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Factors associated with self-reported health among New Zealand military Veterans: A cross-sectional study

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2
3 **FACTORS ASSOCIATED WITH SELF-REPORTED HEALTH AMONG NEW ZEALAND MILITARY**
4 **VETERANS: A CROSS-SECTIONAL STUDY**
5

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1 **ABSTRACT**

2 **Objective**

3 To identify factors associated with better or poorer self-reported health status in New Zealand
4 military Veterans.

5 **Design**

6 An online cross-sectional survey.

7 **Participants**

8 The total number of eligible Veterans is unknown, but a total of 1,817 Veterans responded,
9 including 1009 serving personnel, providing a 26% response rate from that group.

10 **Study variables**

11 Health status was self-reported using the EQ-5D-5L, which asks about problems across five
12 dimensions (mobility, self-care, usual activities, pain or discomfort, and anxiety or
13 depression), with five levels of severity (e.g. no, slight, moderate, severe or extreme
14 problems). The EQ-5D-5L also contains a visual analogue scale (EQ-VAS), scaled from 0 (worst)
15 to 100 (best) imagined health. Hypothetical relationships with better health were positive
16 social support, sleep and psychological flexibility; with poorer health, exposure to
17 psychological trauma, distress and hazardous drinking.

18 **Results:**

19 The proportion of Veterans reporting 'any problems' compared to 'no problems' with the five
20 EQ-5D dimensions, was similar to those found in the general NZ population, although a higher
21 proportion of Veterans reported problems with mobility, self-care, usual activities and pain or
22 discomfort. Psychological flexibility and better sleep quality were associated with higher EQ-
23 VAS scores; distress was associated with lower EQ-VAS scores.

24 **Conclusion:**

25 In this sample of New Zealand Veterans, psychological flexibility and good sleep are associated
26 with better self-rated health, and distress and poor sleep with diminished health. These
27 factors might be used as sentinel health indicators in assessing Veteran health status. As
28 distress, psychological flexibility and sleep are closely related, cognitive behavioural therapy
29 encompassing these domains may be useful in improving the health of New Zealand Veterans.

30 **Keywords:**

31 Self-rated health, EQ-5D, Veterans, deployment, military, risk factors.

32 **Strengths and limitations of this study**

- 33 • Many studies of Veterans have focused on adverse outcomes, but we have been able
34 to focus on a holistic measure of 'health'.

- 35 • The study was sufficiently powered to detect important relationships indicating
36 opportunities for intervention.
- 37 • The exact response rate is unknown, and possible bias may be a limitation.
- 38 • The cross-sectional design means that we cannot explore cause and effect
39 relationships.

40 INTRODUCTION

41 The three major events in the military life course are entry to military service, deployment on
42 active service and transition back to civilian life. On entry, soldiers, sailors and air personnel
43 are subject to a selection process to ensure, as far as possible, good physical and mental
44 health, giving rise to the 'healthy soldier effect', with service personnel being, on average,
45 healthier than the general population.[1] However, the physical and psychological stressors
46 of military service have been found to erode this effect.[2]

47 The physical stressors have a particular impact on the lower limb, with load carriage, high
48 intensity training and the design of footwear being implicated in injury causation.[3] A military
49 career increases opportunities for psychological trauma, and post-traumatic stress disorder
50 (PTSD) has been identified as the 'signature injury' of United States service men and women
51 deployed to Afghanistan and Iraq.[4]

52 A focus on adverse health events in the literature[5] means that wellbeing is relatively
53 overlooked. In the long run, military service has been found to have positive effects.[6,7] Good
54 health after service does, however, depend on the success of the 'military civilian transition',
55 a complex process for which models have been developed.[8] Health problems developed in
56 service, difficulty in assuming a post-service identity and many other factors contribute to
57 health and wellbeing outcomes.[8] In New Zealand, military Veterans can only access
58 assistance from New Zealand Veteran's Affairs (NZVA) if they have undertaken 'qualifying
59 operational service' as defined by the Veteran Support Act 2014,[9] and are Veterans in a legal
60 sense. NZVA support some 12,000 Veterans, with an average age of 80 years, 5000 being
61 actively case managed.[10] The majority will have seen operational service in Korea, Borneo,
62 Malaya and Vietnam. Post-Vietnam, smaller numbers deployed on United Nations and other
63 missions, but the tempo of operations rose with the deployment to Bosnia in 1992, and some
64 9,000-10,000 'legal' Veterans deployed between then and the withdrawal of New Zealand
65 troops from Afghanistan in 2021. The Ministerial Veteran's Health Advisory Panel, established

1
2 66 under the Veteran Support Act, are specifically charged with funding research on this
3
4 67 'contemporary Veteran' group.

5
6 68 The aims of this study were to describe self-reported health among these younger Veterans,
7
8 69 and identify factors associated with better or poorer health.

9 70 **Veteran and public involvement**

10 71 The Ministerial Veterans Health Advisory Panel, who fund research into contemporary
11
12 72 Veterans health,[10] commissioned the study and advised on the design. We also formed a
13
14 73 steering group with representatives from the New Zealand Defence Force, New Zealand
15
16 74 Veterans Affairs, the Royal New Zealand Returned and Services Association (RSA)[11] and No
17
18 75 Duff,[12] a charity providing first response support to Veterans and their families. We also
19
20 76 consulted with the Ngāi Tahu Research Consultation Committee in order to assess the
21
22 77 importance of the project to Māori, New Zealand's indigenous population. We undertook to
23
24 78 inform the Veteran community before releasing the results, also to give all Veterans, defined
25
26 79 as anyone who had served in the military, an opportunity to participate.

27 28 80 **METHODS**

29 30 81 **Participants**

31 82 Data were collected via an online survey, a postal version was also available on request. There
32
33 83 is no comprehensive Veteran registry, however In June 2018, a link to the online questionnaire
34
35 84 was sent by email to all currently serving regular and reserve New Zealand Defence Force
36
37 85 (NZDF) members registered on the NZDF email system who were 'legal Veterans', as indicated
38
39 86 by holding the New Zealand Operational Service Medal, numbering 3,874 personnel at that
40
41 87 time. An introductory message and link to the questionnaire were also presented on the NZDF
42
43 88 'intranet landing page', a secure internal webpage from which all regular force personnel can
44
45 89 access relevant work-related content, tools, and resources. Retired military personnel were
46
47 90 invited to participate through posters distributed to reserve units and the 43 local social clubs
48
49 91 identified by the RSA national office to be 'Veteran active.' Paper questionnaires with return
50
51 92 postage envelopes were made available at these sites. Announcements were also made on
52
53 93 military social media pages, and both retired and currently serving personnel were invited to
54
55 94 participate through an announcement on the No Duff website. The questionnaire was
56
57 95 available for completion from June to December 2018. Ethics approval for the study was
58
59 96 obtained from the Northern B Health and Disability Ethics Committee, reference 17NTB118.
60
60 97

1
2 98 **Questionnaire**
3

4 99 *Criterion variable*
5

6 100 Self-rated health status was assessed using the EQ-5D-5L,[13] a short questionnaire asking
7
8 101 about the respondent's health across five dimensions: mobility, self-care, usual activities, pain
9
10 102 or discomfort and anxiety or depression, with response options ranging from (e.g.) 'no
11
12 103 problems', to 'extreme problems'. For each dimension, participants were categorised as
13
14 104 having 'any problems' if they selected any response other than 'no problems'.

15 105 Additionally, the EQ-5D-5L visual analogue scale (EQ-VAS) asks the respondent to mark on a
16
17 106 vertical visual analogue scale (VAS) how good or bad their health is today, where the
18
19 107 endpoints are labelled 'the best health you can imagine' (score of 100) and 'the worst health
20
21 108 you can imagine' (score of 0).

22 109 *Independent variables*
23

24 110 Demographic characteristics included age, sex, ethnicity, service years, and past deployment
25
26 111 on operational service (yes/no). Ethnicity prioritisation was adopted,[14] whereby
27
28 112 participants with multiple responses were assigned to one of the categories, in the order of
29
30 113 Māori, Pacific Peoples, Other and European.

31 114 General psychiatric morbidity was assessed using the 12-item General Health Questionnaire
32
33 115 (GHQ-12),[15] scored using a four point scale (0-3) and summing the 12 items to give a total
34
35 116 score, with higher scores indicating elevated distress.

36
37 117 Social support was measured using the Social Provisions Scale,[16] with responses made on a
38
39 118 four-point Likert-type scale ranging from 1 'strongly disagree' to 4 'strongly agree'. The 24
40
41 119 items can be reduced to six subscales (attachment, social integration, reassurance of worth,
42
43 120 reliable alliance, social guidance, opportunity for nurturance) or summed to create a total
44
45 121 score, with greater scores indicating greater social support.

46 122 Alcohol use was measured using the AUDIT-C,[17] scaled from 0-12. A score of 3+ for women
47
48 123 and 4+ for men indicated potentially hazardous drinking behaviour.

49
50 124 Sleep quality was assessed with the Sleep Condition Indicator (SCI), [18] assessing insomnia as
51
52 125 described in the Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM-V).[19]
53
54 126 The SCI consists of eight items rated from 0-4, the total scores being scaled to a range of 0 to
55
56 127 10, where higher scores represent better sleep.

57 128 Trauma exposure was assessed with the Brief Trauma Scale (BTS),[20] which captures past
58
59 129 exposure to situations that were life threatening or capable of producing serious injury.
60

1
2 130 Psychological flexibility was measured with the 10-item AAQ-II, designed as a measure of
3
4 131 effectiveness in a particular mode of behavioural intervention, Action and Commitment
5
6 132 Therapy (ACT).[21] Items were answered on a 7-point scale, with options ranging from 'never
7
8 133 true' to 'always true'. The items were summed to obtain a total score (possible range 10 to
9
10 134 70), with higher scores indicative of greater psychological flexibility.

11 135 **Statistical analyses**

12
13 136 With respect to the calculation of summed scores, if only one item was missing for a particular
14
15 137 measure then this was imputed with the mean of the remaining items; if more than one item
16
17 138 was missing then the score was set to missing for that participant. Complete case analysis was
18
19 139 used in the remaining analyses. The five dimensions of the EQ-5D-5L were compared to the
20
21 140 NZ population normative values.[22]

22
23 141 Univariate ordinary least-squares linear regression analyses assessed the strength of
24
25 142 relationships between each independent variable and EQ-VAS scores, using robust standard
26
27 143 errors to account for heteroscedasticity and calculating 95% confidence intervals (95% CIs).
28
29 144 Multivariable linear regression was then used to identify the role of the independent variables
30
31 145 while adjusting for each other. None of the social support sub-scales were used in this
32
33 146 multivariable model, instead using the social support total score. The model was built using
34
35 147 backward variable selection with $p < 0.10$ for variable retention, with the exceptions of age,
36
37 148 sex, service years, and deployment status which were retained as adjusting variables
38
39 149 irrespective of p-values.

40 150 **RESULTS**

41
42 151 When the survey went online, invitations were emailed to the 3784 serving Veterans in the
43
44 152 NZDF, resulting in 1009 responses, 26% of that group, added to by 449 retired and 288 non-
45
46 153 deployed Veterans, a total of 1817, 90 of whom completed a paper questionnaire. A total of
47
48 154 1767 (97%) completed the EQ-VAS and were thus included in all the analyses.

49 155 A supplementary table presents the EQ-VAS score according to the sample characteristics.

50
51 156 Figure 1 shows the proportion of EQ-5D-5L dimension responses reporting 'any problem'
52
53 157 severity level other than 'no problems' in comparison to the New Zealand population
54
55 158 normative values.[22]

56 159 **Figure 1 about here**

57
58 160 The results of the univariate analysis are displayed in Table 1. Here, for continuous
59
60 161 characteristics, the regression coefficient (β) represents the change in the mean EQ-VAS

162 associated with one unit increase in the characteristic. For categorical characteristics, β is the
 163 change in mean EQ-VAS scores compared to the referent category.

164 **Table 1: Univariate cross-sectional associations between variables and mean EQ-VAS scores**
 165 **for New Zealand Veterans (N=1,762)**

Characteristic	<i>n</i>	β	95% CIs	<i>p</i> -value
Age*	1762	-0.19	[-0.24, -0.13]	<.01
Sex				
Female	220	Reference	-	
Male	1520	-0.65	[-3.04, 1.73]	.59
Ethnicity				
NZ European	1382	Reference	-	
Māori	245	1.21	[-1.00, 3.42]	
Other	140	-2.95	[-6.26, 0.36]	0.10
Service years*	1670	0.19	[0.11, 0.27]	<.01
Deployment status				
Not deployed	288	Reference	-	
Deployed	1458	5.80	[3.35, 8.25]	<.01
GHQ-12 score*	1765	-1.63	[-1.79, -1.47]	<.01
Social support*				
Attachment	1760	2.02	[1.69, 2.34]	<.01
Social integration	1758	2.45	[2.06, 2.88]	<.01
Reassurance of worth	1756	2.48	[2.11, 2.85]	<.01
Reliable alliance	1760	2.30	[1.91, 2.70]	<.01
Social guidance	1760	2.00	[1.65, 2.35]	<.01
Opportunity for nurturance	1758	0.85	[0.47, 1.23]	<.01
Social support total score	1753	0.52	[0.44, 0.59]	<.01
Psychological flexibility*	1750	0.79	[0.71, 0.87]	<.01
Sleep score*	1747	3.47	[3.11, 3.83]	<.01
AUDIT-C				
Non-hazardous		Reference	-	
Hazardous		0.62	[-1.03, 2.26]	0.46
Exposure to traumatic events				
Not exposed		Reference	-	
Exposed		-5.72	[-7.34, -4.11]	<.01

166 *Scored as continuous variables, coefficient is per unit increase.

167 Of the demographic variables, age was associated with lower EQ-VAS scores, length of
 168 service with higher scores. No relationships were apparent for sex or ethnicity. Positive
 169 coefficients, indicating better health with presence of the characteristic, were present for
 170 dichotomous variables of deployment, where the mean EQ-VAS score for deployed Veterans
 171 was 5.8 VAS units higher (better) than for non-deployed. The largest negative associations

1
2 172 were for exposure to traumatic events, with a mean EQ-VAS score 5.7, lower for those
3
4 173 exposed compared to those not exposed. Distress, as measured by the GHQ-12, had a
5
6 174 negative association with health state. Positive associations with health state were found for
7
8 175 psychological flexibility as measured by the AAQ-II, better sleep scores, and most of the
9
10 176 dimensions of social support, barring 'opportunity for nurturance'.
11
12 177 Table 2 shows the results from two models. The first model is adjusted for the other
13
14 178 characteristics, with 11 variables and 1,557 people providing valid responses for all factors
15
16 179 included in the model. All effect sizes were reduced, and the social support and AUDIT-C
17
18 180 scores were no longer associated, with 11 variables explaining 35% of the variability in the
19
20 181 EQ-VAS.
21
22 182 The final model involved backward variable selection setting a p-value of 0.10, identifying a
23
24 183 smaller subset of variables. Age, sex, service years, and deployment status were retained in
25
26 184 the model irrespective of their p-values, thus adjusting for those variables, using 1,600
27
28 185 complete responses. Social support and AUDIT-C hazardous drinking were not retained in this
29
30 186 final model; other coefficients remaining essentially the same, with a minimal effect on the
31
32 187 overall R^2 .
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188 **Table 2. Multivariable models of associations between variables and mean EQ-VAS scores**
 189 **for New Zealand Veterans**

Characteristic	Adjusted model, N used =1,557			Final model, N used =1,600		
	β	95% CI	p-value	β	95% CI	p-value
Age (years)*	0.17	[-0.23, 1.11]	<0.01	-0.17	[-0.23, -0.12]	<0.01
Sex						
Female	Ref	-	-	Ref	-	-
Male	0.24	[-2.52, 2.03]	0.84	-0.60	[-2.82, 1.63]	0.60
Ethnicity						
NZ European	Ref	-	-	Ref	-	-
Māori	0.29	[-1.70, 2.27]	0.07	0.19	[-1.77, 2.14]	
Other	-3.58	[-6.66, -0.51]		-2.91	[-5.88, 0.06]	0.15
Service years*	0.17	[0.10, 0.25]	<0.01	0.17	[0.10, 0.25]	<0.01
Deployment status						
Not deployed	Ref			Ref	-	
Deployed	2.91	[0.64, 5.18]	<0.05	2.90	[0.65, 5.15]	0.01
GHQ12 score*	-0.87	[-1.09, -0.65]	<0.01	-0.92	[-1.13, -0.71]	<0.01
Social support (SPS score)*	0.01	[-0.07, 0.10]	0.76	-	-	-
Psychological flexibility score (AAQii)*	0.26	[0.15, 0.37]	<0.01	0.24	[0.14, 0.35]	<0.01
Sleep score (SCI), Range 0-10*	1.60	[1.18, 2.02]	<0.01	1.63	[1.22, 2.05]	<0.01
AUDIT_C score						
Non hazardous	Ref			-	-	-
Hazardous	0.41	[-1.00, 1.81]	0.57	-	-	-
Exposure to traumatic events (BTQ)						
Not exposed	Ref			Ref	-	-
Exposed	-1.77	[-3.30, -0.24]	<0.05	-1.81	[-3.32, 0.30]	0.02
			$R^2 = 0.35$			$R^2 = 0.36$

190 *Scored as continuous variables, coefficient is per unit increase.

191 DISCUSSION

192 *Principal findings*

193 In general, Veterans had a similar proportion of 'any problem' responses in the EQ-5D
 194 dimensions as the general population of New Zealand, with evidence of more problems in the
 195 physical domains of mobility, usual activities and pain or discomfort, but no difference in the
 196 psychological domain.

197 Mutual adjustment, with 11 variables in the model, reduced all the effect sizes and explained
 198 35% of the variance, thus leaving 65% which cannot be explained. The final model had 9
 199 variables, explaining 36% of the variance. The results make conceptual sense in that distress
 200 is associated with reduced EQ-VAS, while psychological flexibility is associated with a modest
 201 protective effect. Surprisingly, social support was not identified as an associated factor,
 202 however we may not have measured some support domains valued by Veterans. There are

203 known to be many other influences on health, including 'social wellbeing',[5] financial status,
204 personality and non-deployment related stressors,[23] which we have not measured.

205 *Strengths and weaknesses*

206 Strengths of our study were the relatively large sample size, the inclusion of all Veterans, the
207 assessment of 'health', infrequently investigated in Veteran populations, and the inclusion of
208 New Zealand Veterans with a range of characteristics, including 'deployed' and 'non-
209 deployed' Veterans. As a measure of health, the EQ-5D-5L dimensions and EQ-VAS ask about
210 health on the day that respondents complete the questionnaire, the EQ-VAS end points being,
211 respectively, the 'best' and 'worst' health they can imagine, so it is a holistic measure of health
212 state.[24]

213 The response rate of 27% from serving Veterans, along with the unknown total number of
214 Veterans, raises the question of bias, the direction of which is difficult to assess, as responses
215 may be more likely from either Veterans with good or poor health. We do know that New
216 Zealand Veterans tend to be stoic, so they might underestimate their health concerns.[25] There are
217 also likely to be other personal characteristics that we have not measured. We were however
218 able to adjust for deployment status, which did have a positive association with health state.
219 The cross-sectional design also means that we cannot explore cause and effect, so
220 recommendations for future interventions require additional support from longitudinal
221 studies.

222 *Comparison with other studies*

223 We have previously reported factors associated with post-traumatic stress in this group,[26]
224 using the Military Post Traumatic Stress Checklist (PCL-M). Factors associated with higher PCL-
225 M scores were trauma exposure, older age, male gender, and being of Māori ethnicity. Factors
226 associated with lower PCL-M scores were greater length of service, psychological flexibility,
227 and better quality sleep. Using health as the outcome disclosed that Māori did not have poorer
228 self-reported health compared to non-Māori, that deployment had a positive effect, and in
229 the univariate models, all of the dimensions of social support were associated with improved
230 health. The final model also included good sleep and psychological flexibility, providing most
231 of the explanatory power in the model.

232 No other studies appear to have used the EQ-VAS as an outcome measure for Veteran health.
233 Boehmer et al.[27] examined wellbeing among participants in the 2000 Behavioural Risk
234 Factor Surveillance System describing health-related quality of life (HRQoL) by sex and military
235 status, active duty, reservists Veterans, or no military service. Participants were asked to rate

1
2 236 recent physical health, mental health, and activity limitation. Active duty men were more likely
3
4 237 than men without military service to report 14 or more days of activity limitation, pain, and
5
6 238 not enough rest in the past 30 days. Reserve personnel reported better overall HRQoL than
7
8 239 non-military participants, and no difference was observed between Veterans and persons
9
10 240 with no military service. There are also reports indicating that non-deployed personnel retain
11
12 241 better health than those who have been deployed.[28] Notably, the predominant reason for
13
14 242 medical discharge from the British Armed Forces was musculoskeletal problems.[29]
15
16 243 Diaz Santana et al.[30] carried out a cross-sectional survey of 60,000 U.S. Veterans of
17
18 244 Afghanistan and Iraq, with 20,563 responses. Mental quality of life scores were higher among
19
20 245 the non-deployed group compared to the deployed group, though the deployed group
21
22 246 reported higher physical quality of life scores compared to the non-deployed. Both mental
23
24 247 and physical quality of life were lower among Veterans compared to U.S. population norms.
25
26 248 Both positive and negative consequences of deployment have been described.[7,30] In a study
27
28 249 of Dutch Veterans,[7] two out of three reported a positive effect of deployment on their
29
30 250 quality of life at the time of the survey, this being related to positive feelings such as
31
32 251 satisfaction or comradeship, but a few having emotions such as frustration or shame. As
33
34 252 regards tangible effects,[31] negative consequences included the military 'chain of command',
35
36 253 being away from home, and deterioration of marital/significant other relationships. Positive
37
38 254 influences include improved financial security, self-improvement, and time to reflect.
39
40 255 Sleep difficulties are a common symptom for those with PTSD. McCarthy et al.[32] reported
41
42 256 on the 3,157 U.S. military Veterans enrolled in the National Health and Resilience in Veterans
43
44 257 Study, in which 27.6% reported poor sleep quality. Path analyses revealed significant
45
46 258 associations between poor sleep, severity of PTSD, poorer mental and physical health
47
48 259 functioning and lower overall quality of life.

49 260 Most Veterans do cope well with a military career, and service has a positive effect on
50
51 261 wellbeing. However, Oster et al.[5] emphasise that when things do not go well for Veterans,
52
53 262 their mental, physical and social health is interconnected, so their needs can be complex, and
54
55 263 management requires an integrated approach.

53 264 *Future directions*

55 265 The results suggest that distress, psychological flexibility, and sleep have an important
56
57 266 relationship with self-rated health among Veterans in this study.
58
59 267 Reducing distress through the promotion of psychological flexibility might be possible,
60
268 although our finding here must be subject to caution as several researchers argue that the

1
2 269 AAQ-II may be measuring psychological distress and affect rather than psychological
3
4 270 inflexibility.[33] Psychological flexibility is specifically targeted by ACT, a psychological
5
6 271 intervention described as being in the 'third wave' of behaviour change strategies.[34] The six
7
8 272 core processes of ACT (acceptance, cognitive defusion, being present, self as context, values,
9
10 273 and committed action) aim to increase psychological flexibility, the goal being "to have clients
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12 274 experience the world more directly so that their behavior is more flexible and thus their
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14 275 actions more consistent with the values that they hold." [34] Approaches such as ACT may
15
16 276 therefore improve health state in appropriate subjects. Lang et al. carried out a randomised
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18 277 clinical trial (RCT), comparing ACT with person-centred therapy,[35] showing a general
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20 278 improvement in symptoms of distress across both treatment arms, ACT providing superior
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22 279 improvement in insomnia. The drop-out rate for both therapies was however high, and the
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24 280 two groups did not exhibit any change in psychological flexibility. The authors proposed that
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26 281 future studies should include additional measures of ACT processes to determine which are
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28 282 actually affected by ACT.

283 Sleep in military personnel has been recognised as a 'vital health behaviour' for which policies
284 and guidelines must be developed.[36] Cognitive behavioural therapy for insomnia (CBT-I) is
285 regarded as an effective 'first line' treatment, and a brief intervention has been described for
286 use in Australian general practice.[37] The Lang et al. trial[35] showed CBT-I to be effective,
287 however future studies should include outcome measures that include ACT processes. Our
288 final model showed that distress had a negative association with health, and psychological
289 flexibility had a positive relationship, with sleep most likely related to both of these variables.
290 It would seem important to screen for these conditions prior to transition from the military,
291 as well as among retired Veterans, in order to provide targeted support. Further research is
292 needed to examine the potential of ACT to improve Veterans' wellbeing.

293 Figure 1 Caption.

294 **The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension**
295 **scores compared to the NZ population normative proportions**

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388 DATA SHARING STATEMENT

389 Data from this study is unsuitable for public deposition due to the privacy of participant data.
390 Data are anonymised, but contain information on deployments (including location and
391 duration), which could lead to some participants being identified. Furthermore, the
392 participant information sheet, as required by the Southern Health and Disability Ethics
393 Committee specifically contains the statement that 'all study data would be kept strictly
394 confidential to the research team.' Qualified researchers may apply for data access with the
395 research team at veterans.health@otago.ac.nz and/or hdecs@moh.govt.nz.

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400 COMPETING INTERESTS

401 None declared.

402 CONTRIBUTION

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405 **Methodology:** Amy Richardson, Ari Samaranayaka, Dianne Gardner, Emma H. Wyeth, Sarah
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407 **Project administration:** Amy Richardson

408 **Resources:** Brandon de Graaf

409 **Software:** Brandon de Graaf

410 **Supervision:** Ari Samaranayaka

411 **Validation:** Amy Richardson

412 **Visualization:** Amy Richardson

413 **Writing – original draft:** David McBride. AS, DG, EHW, SD and DS contributed to the re-writes
414 and final draft

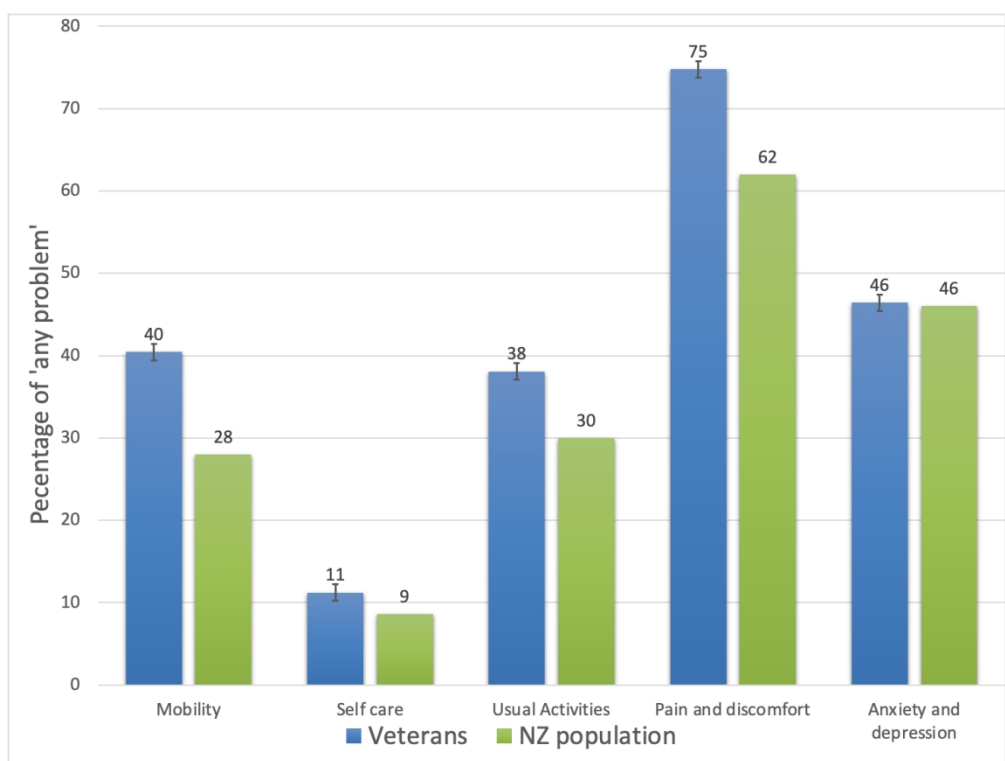
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The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension scores compared to the NZ population normative proportions

123x93mm (300 x 300 DPI)

Supplementary Table: Number of participants and EQ-VAS scores according to sample characteristics

Exposure variable	N(%)	Mean (SD)
All	1767	74.4 (17.1)
Age group (years)		
20-29	136 (7.7)	77.7 (14.4)
30-39	328 (18.6)	77.0 (16.2)
40-49	438 (24.8)	76.1 (14.6)
50-59	350 (19.8)	74.8 (16.6)
60-69	285 (16.1)	71.4 (19.8)
70-79	175 (9.9)	69.4 (19.4)
80+	50 (2.8)	66.2 (20.3)
Missing	5 (0.3)	61.2 (22.1)
Gender		
Female	220 (12.5)	70.3 (17.2)
Male	1520 (86.0)	74.4 (17.2)
Missing	27 (1.5)	75.0 (55.0)
Ethnicity (prioritised)		
NZ European	1382 (78.2)	74.4 (17.1)
Māori	245 (13.9)	75.6 (16.1)
Other	140 (7.9)	71.5 (19.3)
Service years		
0-9	339 (19.2)	69.9 (19.7)
10-19	478 (27.1)	74.5 (17.9)
20-29	530 (30.0)	75.3 (15.9)
30-39	254 (14.4)	76.3 (14.6)
40+	69 (3.9)	75.4 (16.4)
Missing	97 (5.5)	78.8 (14.2)
Deployment (ever)		
No	288 (16.3)	69.5 (19.9)
Yes	1458 (82.5)	75.3 (16.4)
Missing	21 (1.2)	75.6 (14.6)
GHQ12 Score		
0-9	652 (36.9)	82.0 (12.6)
10-19	972 (55.0)	72.3 (16.0)
20-29	123 (7.0)	54.3 (20.3)
30+	18 (1.0)	46.2 (24.4)
Missing	2 (0.1)	-

*sub-scores not used in multivariable models.

Supplementary table contd.

Social support full score		
24-29	0	0 -
30-39	3	(0.2) 66.7 (15.3)
40-49	15	(0.8) 44.5 (22.5)
50-59	97	(5.5) 62.4 (21.8)
60-69	351	(19.9) 69.0 (18.2)
70-79	643	(36.4) 75.1 (15.0)
80-89	409	(23.1) 78.0 (15.0)
90-96	235	(13.3) 81.9 (13.9)
Missing	14	(0.8) 58.1 (25.6)
Social support sub-scores		
Attachment*		
4-7	51	(3.5) 61.4 (23.4)
8-11	516	(29.2) 68.7 (18.0)
12-16	1193	(67.5) 77.5 (15.5)
Missing	7	(0.4) 61.0 (19.7)
Social integration*		
4-7	20	(1.1) 56.2 (25.1)
8-11	429	(24.3) 67.1 (19.4)
12-16	1309	(74.8) 77.1 (15.2)
Missing	9	(0.5) 58.7 (21.5)
Reassurance of worth*		
4-7	37	(2.1) 59.1 (19.5)
8-11	504	(28.5) 69.0 (19.1)
12-16	1215	(68.8) 77.2 (15.2)
Missing	11	(0.6) 62.0 (24.9)
Reliable Alliance*		
4-7	20	(1.1) 49.6 (22.2)
8-11	251	(14.2) 66.9 (20.1)
12-16	1489	(84.3) 76.0 (15.9)
Missing	7	(0.4) 61.0 (19.7)
Guidance sub-score*		
4-7	36	(2.0) 59.2 (22.2)
8-11	387	(21.9) 68.7 (18.9)
12-16	1337	(75.7) 76.6 (15.7)
Missing	7	(0.4) 54.6 (21.6)
Opportunity for nurturance*		
4-7	29	(1.6) 69.3 (18.9)
8-11	413	(23.4) 71.9 (18.8)
12-16	1316	(74.5) 75.4 (16.4)
Missing	9	(0.5) 58.7 (21.5)

Supplementary table, contd.

**Psychological flexibility score
(AAQii score).**

10-19	5	(0.3)	23.2 (13.8)
20-29	40	(2.3)	49.1 (22.1)
30-39	147	(8.3)	63.0 (18.6)
40-49	43	(24.7)	68.5 (16.8)
50-59	664	(37.6)	77.1 (13.9)
60-70	457	(25.9)	82.5 (13.5)
Missing	1	(1.0)	69.6 (20.5)

Sleep Condition Indicator (SCI score)

0 to <2	67	(3.8)	51.2 (22.3)
2 to <4	264	(14.9)	62.2 (19.5)
4 to <6	646	(36.6)	74.3 (14.6)
6 to <8	384	(21.7)	77.6 (14.2)
8 to 10	386	(21.8)	83.5 (12.2)
Missing	20	(1.1)	77.3 (12.8)

AUDIT-C score

Non-hazardous	776	(43.9)	74.0 (17.4)
Hazardous	915	(51.8)	74.6 (16.9)
Missing	76	(4.3)	75.0 (17.0)

**Brief Trauma Questionnaire
(DSM-IV criteria)**

Not exposed	544	(30.8)	78.3 (15.1)
Exposed	1210	(68.5)	72.5 (17.8)
Missing	13	(0.7)	80.6 (8.1)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	Indicate the study's design with a commonly used term in the title or the abstract. Yes, a cross sectional study, p1 title. (b) Provide in the abstract an informative and balanced summary of what was done and what was found Background, results and conclusions, p 1
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Introduction p2.
Objectives	3	State specific objectives, including any prespecified hypotheses p2, lines 59 and 60
Methods		
Study design	4	Present key elements of study design early in the paper p2 line 62 to page 5 line 145
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Participants, page2 line 63- page 3 line 83.
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants page 2 line 64 to page 3, line 68.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Questionnaire, pp 3-5.
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 as above
Bias	9	Describe any efforts to address potential sources of bias Methods, page 3. Lines 76-83.
Study size	10	Explain how the study size was arrived at p5 line 137
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Cases defined through the Multivariable logistic regression with the EQ-Visual analogue scale as the outcome measure, p5 lines 131-136
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Backward elimination process p5 lines 134-135 (b) Describe any methods used to examine subgroups and interactions By multivariable logistic regression, p5 as above (c) Explain how missing data were addressed p4 lines 122-125 (d) If applicable, describe analytical methods taking account of sampling strategy N/A (e) Describe any sensitivity analyses N/A
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 Potentially eligible lines 68-73 p 3 (b) Give reasons for non-participation at each stage N/A (c) Consider use of a flow diagram N/A

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders page 5 et seq, table 1 (b) Indicate number of participants with missing data for each variable of interest ' n used ' columns tables 2 and 3.
Outcome data	15*	Report numbers of outcome events or summary measures as per tables
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Tables, adjusted for age, sex, service years and deployment status. (b) Report category boundaries when continuous variables were categorized. Independent variables, p 3 and 4, EQ-VAS is a continuous scale. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
Discussion		
Key results	18	Summarise key results with reference to study objectives Discussion, p11 first para
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 Discussion lines 215 et seq.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Discussion, p12 lines 230 et seq.
Generalisability	21	Discuss the generalisability (external validity) of the study results p17, line 215 et seq.
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 Funding, p18

*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 www.strobe-statement.org.

BMJ Open

Factors associated with self-reported health among New Zealand military Veterans: A cross-sectional study

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Secondary Subject Heading:	Occupational and environmental medicine, Public health
Keywords:	EPIDEMIOLOGY, OCCUPATIONAL & INDUSTRIAL MEDICINE, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MENTAL HEALTH, Musculoskeletal disorders < ORTHOPAEDIC & TRAUMA SURGERY

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3 **FACTORS ASSOCIATED WITH SELF-REPORTED HEALTH AMONG NEW ZEALAND MILITARY**
4 **VETERANS: A CROSS-SECTIONAL STUDY**
5

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26 2959

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1 **ABSTRACT**

2 **Objective**

3 To identify factors associated with better or poorer self-reported health status in New Zealand
4 military Veterans.

5 **Design**

6 An online cross-sectional survey.

7 **Participants**

8 The participants of interest were the 3,874 currently serving Veterans who had been deployed
9 to a conflict zone, but all Veterans were eligible to participate.

10 **Study variables**

11 Health status was self-reported using the EQ-5D-5L, which asks about problems across five
12 dimensions (mobility, self-care, usual activities, pain or discomfort, and anxiety or
13 depression), with five levels of severity (e.g. no, slight, moderate, severe or extreme
14 problems), also containing a visual analogue scale (EQ-VAS), scaled from 0 (worst) to 100
15 (best) imagined health. Hypothetical relationships with better health were positive social
16 support, sleep and psychological flexibility; with poorer health, exposure to psychological
17 trauma, distress and hazardous drinking.

18 **Results:**

19 The EQ5-D was completed by 1767 Veterans, 1009 serving, a response rate of 26% from that
20 group, with 1767 completing the EQ5-D and entering the analysis, comprising 1458 who had
21 deployed, 288 who had not, and the 21 who did not provide deployment data.

22 A significantly higher proportion of Veterans reported 'any problems' rather than 'no
23 problems' with four EQ-5D dimensions: mobility, self-care, usual activities and pain or
24 discomfort, but no difference in anxiety or depression. Age, length of service, deployment,
25 psychological flexibility and better sleep quality were associated with higher EQ-VAS scores;
26 distress with lower EQ-VAS scores.

27 **Conclusion:**

28 In this sample of New Zealand Veterans, psychological flexibility and good sleep are associated
29 with better self-rated health, and distress and poor sleep with diminished health. These
30 factors might be used as sentinel health indicators in assessing Veteran health status. As
31 distress, psychological flexibility and sleep are closely related, cognitive behavioural therapy
32 encompassing these domains may be useful in improving the health of New Zealand Veterans.

33 **Keywords:**

34 Self-rated health, wellbeing, EQ-5D, Veterans, deployment, military, risk factors.

35 **Strengths and limitations of this study**

- 36 • Many studies of Veterans have focused on adverse outcomes, but we have been able
- 37 to focus on a holistic measure of ‘health’.
- 38 • The study was sufficiently powered to detect important relationships indicating
- 39 opportunities for intervention.
- 40 • The exact response rate is unknown, and bias may be a limitation.
- 41 • The cross-sectional design means that we cannot explore cause and effect
- 42 relationships.

43 **INTRODUCTION**

44 The three major events in the military life course are entry to military service, deployment on
45 active service and transition back to civilian life. On entry, soldiers, sailors and air personnel
46 are subject to a selection process to ensure, as far as possible, good physical and mental
47 health, giving rise to the ‘healthy soldier effect,’ with service personnel being, on average,
48 healthier than the general population.[1] However, the physical and psychological stressors
49 of military service have been found to erode this effect.[2]

50 The physical stressors have a particular impact on the lower limb, with load carriage, high
51 intensity training and the design of footwear being implicated in injury causation.[3] A military
52 career also increases opportunities for psychological trauma, and post-traumatic stress
53 disorder (PTSD) has been identified as the ‘signature injury’ of United States service men and
54 women deployed to Afghanistan and Iraq.[4]

55 A focus on adverse health events in the literature[5] means that wellbeing is relatively
56 overlooked. In the long run, military service has been found to have positive effects.[6,7]
57 Good health after service does, however, depend on the success of the ‘military civilian
58 transition’, a complex process for which models have been developed.[8] Health problems
59 developed in service, difficulty in assuming a post-service identity and many other factors
60 contribute to health and wellbeing outcomes.[8] In New Zealand, military Veterans can only
61 access assistance from New Zealand Veteran’s Affairs (NZVA) if they have undertaken
62 ‘qualifying operational service’ as defined by the Veteran Support Act 2014,[9] thus being
63 Veterans in a legal sense. NZVA support some 12,000 Veterans, with an average age of 80
64 years, 5000 being actively case managed.[10] The majority will have seen operational service
65 in Korea, Borneo, Malaya and Vietnam. Post-Vietnam, smaller numbers deployed on United
66 Nations and other missions, but the tempo of operations rose with the deployment to
67 Bosnia in 1992, and some 9,000-10,000 ‘legal’ Veterans deployed between then and the

1
2 68 withdrawal of New Zealand troops from Afghanistan in 2021. The Ministerial Veteran's
3
4 69 Health Advisory Panel, established under the Veteran Support Act, are specifically charged
5
6 70 with funding research on this 'contemporary Veteran' group, NZVA acknowledging that they
7
8 71 "have had different experiences, and have different needs, compared to the older veterans.
9
10 72 They are likely to have served in a number of deployments during their career, and come to
11
12 73 us with more complex health issues." [10]
13
14 74 The aims of this study were therefore to describe self-reported health among these Veterans,
15
16 75 and identify factors associated with better or poorer health.

17 76 **Veteran and public involvement**

18 77 The Ministerial Veterans Health Advisory Panel, [10] commissioned the study and advised on
19
20 78 the design. We also formed a steering group with representatives from the New Zealand
21
22 79 Defence Force, New Zealand Veterans Affairs, the Royal New Zealand Returned and Services
23
24 80 Association (RSA) [11] and No Duff, [12] a charity providing first response support to Veterans
25
26 81 and their families. We also consulted with the Ngāi Tahu Research Consultation Committee in
27
28 82 order to assess the importance of the project to Māori, New Zealand's indigenous population.
29
30 83 We undertook to inform the Veteran community before releasing the results, to which end a
31
32 84 link to the paper will be posted on the military social media sites where the study was
33
34 85 advertised, and to give all Veterans, defined as anyone who had served in the military, an
35
36 86 opportunity to participate. Participants were not recruited as patients.

37 87 **METHODS**

38 88 **Participants**

39 89 Data were collected via an online survey, a postal version being available on request. There is
40
41 90 no comprehensive Veteran registry, however in July 2018, a link to the online questionnaire
42
43 91 was sent by email to all currently serving regular and reserve New Zealand Defence Force
44
45 92 (NZDF) members registered on the NZDF email system who were 'legal Veterans', as indicated
46
47 93 by holding the New Zealand Operational Service Medal, numbering 3,874 personnel at that
48
49 94 time. An introductory message and link to the questionnaire were also presented on the NZDF
50
51 95 'intranet landing page', a secure internal webpage from which all regular force personnel can
52
53 96 access relevant work-related content, tools, and resources. Retired military personnel were
54
55 97 invited to participate through posters distributed to reserve units and the 43 local social clubs
56
57 98 identified by the RSA national office to be 'Veteran active.' Paper questionnaires with return
58
59 99 postage envelopes were made available at these sites. Announcements were also made on
60
100 100 military social media pages, and both retired and currently serving personnel were invited to

1
2 101 participate through an announcement on the No Duff website. The questionnaire was
3
4 102 available for completion from June to December 2018.

103 **Ethics approval**

7 104 Ethics approval for the study was obtained from the Northern B Health and Disability Ethics
8
9 105 Committee, reference 17NTB118.

106 **Questionnaire**

107 *Criterion variable*

15 108 Self-rated health status was assessed using the EQ-5D-5L,[13] a short questionnaire asking
16
17 109 about the respondent's health across five dimensions: mobility, self-care, usual activities, pain
18
19 110 or discomfort and anxiety or depression, with response options ranging from (e.g.) 'no
20
21 111 problems', to 'extreme problems'. For each dimension, participants were categorised as
22
23 112 having 'any problems' if they selected any response other than 'no problems'.

24 113 Additionally, the EQ-5D-5L visual analogue scale (EQ-VAS) asks the respondent to mark on a
25
26 114 vertical visual analogue scale (VAS) how good or bad their health is today, where the
27
28 115 endpoints are labelled 'the best health you can imagine' (score of 100) and 'the worst health
29
30 116 you can imagine' (score of 0).

117 *Independent variables*

33 118 Demographic characteristics included age, sex, ethnicity, service years, and past deployment
34
35 119 on operational service (yes/no). Ethnicity prioritisation was adopted,[14] whereby
36
37 120 participants with multiple responses were assigned to one of the categories, in the order of
38
39 121 Māori, Pacific Peoples, Other and European.

40 122 General psychiatric morbidity was assessed using the 12-item General Health Questionnaire
41
42 123 (GHQ-12),[15] scored using a four point scale (0-3) and summing the 12 items to give a total
43
44 124 score, with higher scores indicating elevated distress.

46 125 Social support was measured using the Social Provisions Scale,[16] with responses made on a
47
48 126 four-point Likert-type scale ranging from 1 'strongly disagree' to 4 'strongly agree'. The 24
49
50 127 items can be reduced to six subscales (attachment, social integration, reassurance of worth,
51
52 128 reliable alliance, social guidance, opportunity for nurturance) or summed to create a total
53
54 129 score, with greater scores indicating greater social support.

55 130 Alcohol use was measured using the AUDIT-C,[17] scaled from 0-12. A score of 3+ for women
56
57 131 and 4+ for men indicated potentially hazardous drinking behaviour.

58 132 Sleep quality was assessed with the Sleep Condition Indicator (SCI), [18] assessing insomnia as
59
60 133 described in the Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM-V).[19]

1
2 134 The SCI consists of eight items rated from 0-4, the total scores being scaled to a range of 0 to
3
4 135 10, where higher scores represent better sleep.

5 136 Trauma exposure was assessed with the Brief Trauma Scale (BTS),[20] which captures past
6
7 137 exposure to situations that were life threatening or capable of producing serious injury.

8
9 138 Psychological flexibility was measured with the 10-item AAQ-II, designed as a measure of
10
11 139 effectiveness in a particular mode of behavioural intervention, Acceptance and Commitment
12
13 140 Therapy (ACT).[21] Items were answered on a 7-point scale, with options ranging from 'never
14
15 141 true' to 'always true'. The items were summed to obtain a total score (possible range 10 to
16
17 142 70), with higher scores indicative of greater psychological flexibility. The questionnaire is
18
19 143 available as supplementary material.

20 144 **Statistical analyses**

21
22 145 With respect to the calculation of summed scores, if only one item was missing for a particular
23
24 146 measure then this was imputed with the mean of the remaining items; if more than one item
25
26 147 was missing then the score was set to missing for that participant. Complete case analysis was
27
28 148 used in the remaining analyses. The five dimensions of the EQ-5D-5L were compared to the
29
30 149 NZ population normative values.[22]

31
32 150 Z tests were used to compare the EQ5D dimension scores with those of the New Zealand
33
34 151 general population.[22] Univariate ordinary least-squares linear regression analyses assessed
35
36 152 the strength of relationships between each independent variable and EQ-VAS scores, using
37
38 153 robust standard errors to account for heteroscedasticity and calculating 95% confidence
39
40 154 intervals (95% CIs). Multivariable linear regression was then used to identify the role of the
41
42 155 independent variables while adjusting for each other. None of the social support sub-scales
43
44 156 were used in this multivariable model, instead using the social support total score. The model
45
46 157 was built using backward variable selection with $p < 0.10$ for variable retention, with the
47
48 158 exceptions of age, sex, service years, and deployment status which were retained as adjusting
49
50 159 variables irrespective of p-values.

51 160 **RESULTS**

52 161 The EQ-5D was completed by 1767 Veterans, 1009 who were serving (26% of that group), 458
53
54 162 who had retired, 288 who had not deployed, and 21 who did not provide deployment data.

55
56 163 There are no reliable denominator data on retired and non-deployed Veterans in New
57
58 164 Zealand.

59 165 A supplementary table presents the EQ-VAS score according to the sample characteristics.
60

166 Figure 1 shows the proportion of EQ-5D-5L dimension responses reporting 'any problem'
 167 severity level other than 'no problems' in comparison to the New Zealand population
 168 normative values,[22] with table 1 showing the 95% CI's and Z values.

169 **Figure 1 about here**

170 Table 1, Proportion of 'any problem' in EQ-5D domains

Domain	Veterans	NZ population	Z value (p)
	Proportion (95% CI)	Proportion (95% CI)	
Mobility	0.40 (0.38-0.42)	0.28 (0.26-0.30)	8.5 (<.0001)
Self-care	0.11 (0.10-0.12)	0.09 (0.07-0.10)	2.8 (0.03)
Usual activities	0.38 (0.36-0.40)	0.30 (0.28-0.31)	5.6 (<.001)
Pain/discomfort	0.75 (0.73-0.76)	0.62 (0.60-0.63)	9.0 (<.0001)
Anxiety/depression	0.46 (0.44-0.48)	0.46 (0.44-0.48)	0 (1)

171

172 The results of the univariate analysis are displayed in Table 2. Here, for continuous
 173 characteristics, the regression coefficient (β) represents the change in the mean EQ-VAS
 174 associated with one unit increase in the characteristic. For categorical characteristics, β is the
 175 change in mean EQ-VAS scores compared to the referent category.

176

177 **Table 2: Univariate cross-sectional associations between variables and mean EQ-VAS scores**
 178 **for New Zealand Veterans (N=1,762)**

Characteristic	<i>n</i>	β	95% CIs	<i>p</i> -value
Age*	1762	-0.19	[-0.24, -0.13]	<.01
Sex				
Female	220	Reference	-	
Male	1520	-0.65	[-3.04, 1.73]	.59
Ethnicity				
NZ European	1382	Reference	-	
Māori	245	1.21	[-1.00, 3.42]	
Other	140	-2.95	[-6.26, 0.36]	0.10
Service years*	1670	0.19	[0.11, 0.27]	<.01
Deployment status				
Not deployed	288	Reference	-	
Deployed	1458	5.80	[3.35, 8.25]	<.01
GHQ-12 score*	1765	-1.63	[-1.79, -1.47]	<.01
Social support*				
Attachment	1760	2.02	[1.69, 2.34]	<.01
Social integration	1758	2.45	[2.06, 2.88]	<.01
Reassurance of worth	1756	2.48	[2.11, 2.85]	<.01
Reliable alliance	1760	2.30	[1.91, 2.70]	<.01
Social guidance	1760	2.00	[1.65, 2.35]	<.01
Opportunity for nurturance	1758	0.85	[0.47, 1.23]	<.01
Social support total score	1753	0.52	[0.44, 0.59]	<.01
Psychological flexibility*	1750	0.79	[0.71, 0.87]	<.01
Sleep score*	1747	3.47	[3.11, 3.83]	<.01
AUDIT-C				
Non-hazardous		Reference	-	
Hazardous		0.62	[-1.03, 2.26]	0.46
Exposure to traumatic events				
Not exposed	1754	Reference	-	
Exposed		-5.72	[-7.34, -4.11]	<.01

179 *Scored as continuous variables, coefficient is per unit increase.

180 Of the demographic variables, age was associated with lower EQ-VAS scores, length of
 181 service with higher scores. No relationships were apparent for sex or ethnicity. Positive
 182 coefficients, indicating better health with presence of the characteristic, were present for
 183 dichotomous variables of deployment, where the mean EQ-VAS score for deployed Veterans
 184 was 5.8 VAS units higher (better) than for non-deployed. The largest negative associations
 185 were for exposure to traumatic events, with a mean EQ-VAS score 5.7 lower for those
 186 exposed compared to those not exposed. Distress, as measured by the GHQ-12, had a
 187 negative association with health state. Positive associations with health state were found for

1
2 188 psychological flexibility as measured by the AAQ-II, better sleep scores, the total support
3
4 189 scores and the individual dimensions.

5
6 190 Table 3 shows the results from two models. The first model is adjusted for the other
7
8 191 characteristics, with 11 variables and 1,557 people providing valid responses for all factors
9
10 192 included in the model. All effect sizes were reduced, and the social support and AUDIT-C
11
12 193 scores were no longer associated, with 11 variables explaining 35% of the variability in the
13
14 194 EQ-VAS.

15 195 The final model involved backward variable selection setting a p-value of 0.10, identifying a
16
17 196 smaller subset of variables. Age, sex, service years, and deployment status were retained in
18
19 197 the model irrespective of their p-values, thus adjusting for those variables, using 1,600
20
21 198 complete responses. Social support and AUDIT-C hazardous drinking were not retained in
22
23 199 this final model; other coefficients remaining essentially the same, with a minimal effect on
24
25 200 the overall R^2 .

201 **Table 3. Multivariable models of associations between variables and mean EQ-VAS scores**
 202 **for New Zealand Veterans**

Characteristic	Adjusted model, N used =1,557			Final model, N used =1,600		
	β	95% CI	p-value	β	95% CI	p-value
Age (years)*	0.17	[-0.23, 1.11]	<0.01	-0.17	[-0.23, -0.12]	<0.01
Sex						
Female	Ref	-	-	Ref	-	-
Male	0.24	[-2.52, 2.03]	0.84	-0.60	[-2.82, 1.63]	0.60
Ethnicity						
NZ European	Ref	-	-	Ref	-	-
Māori	0.29	[-1.70, 2.27]	0.07	0.19	[-1.77, 2.14]	-
Other	-3.58	[-6.66, -0.51]		-2.91	[-5.88, 0.06]	0.15
Service years*	0.17	[0.10, 0.25]	<0.01	0.17	[0.10, 0.25]	<0.01
Deployment status						
Not deployed	Ref	-	-	Ref	-	-
Deployed	2.91	[0.64, 5.18]	<0.05	2.90	[0.65, 5.15]	0.01
GHQ12 score*	-0.87	[-1.09, -0.65]	<0.01	-0.92	[-1.13, -0.71]	<0.01
Social support (SPS score)*	0.01	[-0.07, 0.10]	0.76	-	-	-
Psychological flexibility score (AAQii)*	0.26	[0.15, 0.37]	<0.01	0.24	[0.14, 0.35]	<0.01
Sleep score (SCI), Range 0-10*	1.60	[1.18, 2.02]	<0.01	1.63	[1.22, 2.05]	<0.01
AUDIT_C score						
Non hazardous	Ref	-	-	-	-	-
Hazardous	0.41	[-1.00, 1.81]	0.57	-	-	-
Exposure to traumatic events (BTQ)						
Not exposed	Ref	-	-	Ref	-	-
Exposed	-1.77	[-3.30, -0.24]	<0.05	-1.81	[-3.32, 0.30]	0.02
			$R^2 = 0.35$			$R^2 = 0.36$

203 *Scored as continuous variables, coefficient is per unit increase.

204 DISCUSSION

205 *Principal findings*

206 With the exception of anxiety or depression, Veterans had a significantly greater proportion
 207 of 'any problem' responses in the EQ-5D dimensions than the general population of New
 208 Zealand.

209 The final model identified variables independently associated with the EQ-VAS score: age,
 210 length of service, deployment, the GHQ score, psychological flexibility, the sleep score and
 211 exposure to traumatic events. The results make conceptual sense in that distress is associated
 212 with reduced EQ-VAS and psychological flexibility with a modest protective effect, however,
 213 and unusually, Social Support was dropped, however the SPS was found to have a significant
 214 correlation with distress, and collinearity was the problem. There are also known to be many

1
2 215 other influences on health, including 'social wellbeing',[5] financial status, personality and
3
4 216 non-deployment related stressors,[23] which we have not measured.

5
6 217 *Strengths and weaknesses*

7 218 Strengths of our study were the relatively large sample size, the inclusion of all Veterans, the
8
9 219 assessment of 'health', infrequently investigated in Veteran populations, and the inclusion of
10
11 220 New Zealand Veterans with a range of characteristics, including 'deployed' and 'non-
12
13 221 deployed' Veterans. As a measure of health, the EQ-5D-5L dimensions and EQ-VAS ask about
14
15 222 health on the day that respondents complete the questionnaire, the EQ-VAS end points being,
16
17 223 respectively, the 'best' and 'worst' health they can imagine, so it is a holistic measure of health
18
19 224 state.[24]

20
21 225 The response rate of 26% from serving Veterans, along with the unknown total number of
22
23 226 Veterans, raises the question of bias, the direction of which is difficult to assess, as
24
25 227 responses may be more likely from either Veterans with good or poor health. The healthy
26
27 228 soldier effect is well known, service having a positive effect on wellbeing, with serving NZ
28
29 229 Veterans having good access to primary health care through the military system, but the
30
31 230 public health care system is the primary pathway to care for all Veterans, who are also
32
33 231 covered by the 'no fault' accident compensation scheme for accidental injuries and
34
35 232 occupational diseases.[25] Deployed Veterans may be at an advantage, but are covered by
36
37 233 NZVA only if their illness or injury is linked to a particular deployment, and the condition is
38
39 234 listed on the 'Statements of Principle' of the Australian Repatriation Medical Authority.[26]
40
41 235 We also know that New Veterans tend to be stoic, so they might underestimate their health
42
43 236 concerns,[27] and there are likely to be other personal characteristics that we have not
44
45 237 measured. We were however able to adjust for deployment status, which did have a positive
46
47 238 association with health state. In the interest of minimising responder burden, we used brief
48
49 239 scales, which might reduce construct validity. Distress, sleep, psychological flexibility and
50
51 240 exposure to traumatic events are likely to be related, so collinearity was difficult to avoid.
52
53 241 The confounding effect was greatest for social support, but our finding does not mean that
54
55 242 social support is of no importance to Veterans. The precision of the other coefficients may
56
57 243 also have been affected. Finally, the cross-sectional design means that we cannot explore
58
59 244 cause and effect, so recommendations for future interventions require additional support
60
245 from longitudinal studies.

246 *Comparison with other studies*

1
2 247 We have previously reported factors associated with post-traumatic stress in this group,[28]
3
4 248 using the Military Post Traumatic Stress Checklist (PCL-M). Factors associated with higher PCL-
5
6 249 M scores were trauma exposure, older age, male gender, and being of Māori ethnicity. Factors
7
8 250 associated with lower PCL-M scores were greater length of service, psychological flexibility,
9
10 251 and better quality sleep. Using health as the outcome disclosed that Māori did not have poorer
11
12 252 self-reported health compared to non-Māori, that deployment had a positive effect, and in
13
14 253 the univariate models, all of the dimensions of social support were associated with improved
15
16 254 health. The final model also included good sleep and psychological flexibility, providing most
17
18 255 of the explanatory power in the model.
19
20 256 No other studies appear to have used the EQ-VAS as an outcome measure for Veteran health.
21
22 257 Boehmer et al.[29] examined wellbeing among participants in the 2000 Behavioural Risk
23
24 258 Factor Surveillance System describing health-related quality of life (HRQoL) by sex and military
25
26 259 status, active duty, reservists Veterans, or no military service. Participants were asked to rate
27
28 260 recent physical health, mental health, and activity limitation. Active duty men were more likely
29
30 261 than men without military service to report 14 or more days of activity limitation, pain, and
31
32 262 not enough rest in the past 30 days, the mobility and pain findings being similar to our sample.
33
34 263 Notably, the predominant reason for medical discharge from the British Armed Forces was
35
36 264 musculoskeletal problems.[30]
37
38 265 Contrary to our finding on deployment, there are reports indicating that non-deployed
39
40 266 personnel retain better health than those who have been deployed,[31] Diaz Santana et al.
41
42 267 having carried out a cross-sectional survey of 60,000 U.S. Veterans of Afghanistan and Iraq,
43
44 268 with 20,563 responses. In contrast to our finding, mental quality of life scores were higher
45
46 269 among the non-deployed group compared to the deployed group, though the deployed group
47
48 270 reported higher physical quality of life scores compared to the non-deployed. Again in
49
50 271 contrast, both mental and physical quality of life were lower among Veterans compared to
51
52 272 U.S. population norms.
53
54 273 Both positive and negative consequences of deployment have been described.[7,32] In a study
55
56 274 of Dutch Veterans,[7] two out of three reported a positive effect of deployment on their
57
58 275 quality of life at the time of the survey, this being related to positive feelings such as
59
60 276 satisfaction or comradeship, but a few having emotions such as frustration or shame. As
277 regards tangible effects,[32] negative consequences included the military 'chain of command',
being away from home, and deterioration of marital/significant other relationships. Positive
influences include improved financial security, self-improvement, and time to reflect.

1
2 280 We found sleep to be associated with better health, but sleep difficulties are a common
3
4 281 symptom for those with PTSD. McCarthy et al.[33] reported on the 3,157 U.S. military
5
6 282 Veterans enrolled in the National Health and Resilience in Veterans Study, in which 27.6%
7
8 283 reported poor sleep quality. Path analyses revealed significant associations between poor
9
10 284 sleep, severity of PTSD, poorer mental and physical health functioning and lower overall
11
12 285 quality of life.

13 286 *Future directions*

14
15 287 The results suggest that distress, psychological flexibility, and sleep have an important
16
17 288 relationship with self-rated health among Veterans in this study.

18
19 289 Reducing distress through the promotion of psychological flexibility might be possible,
20
21 290 although our finding here must be subject to caution as several researchers argue that the
22
23 291 AAQ-II may be measuring psychological distress and affect rather than psychological
24
25 292 inflexibility.[34] Psychological flexibility is specifically targeted by ACT, a psychological
26
27 293 intervention described as being in the ‘third wave’ of behaviour change strategies.[35] The six
28
29 294 core processes of ACT (acceptance, cognitive defusion, being present, self as context, values,
30
31 295 and committed action) aim to increase psychological flexibility, the goal being “to have clients
32
33 296 experience the world more directly so that their behavior is more flexible and thus their
34
35 297 actions more consistent with the values that they hold.”[35] Approaches such as ACT may
36
37 298 therefore improve health state and has been shown to improve pain acceptance and
38
39 299 psychological flexibility [36]. Lang et al. carried out a randomised clinical trial (RCT), comparing
40
41 300 ACT with person-centred therapy,[37] showing a general improvement in symptoms of
42
43 301 distress across both treatment arms, ACT providing superior improvement in insomnia. The
44
45 302 drop-out rate for both therapies was however high, and the two groups did not exhibit any
46
47 303 change in psychological flexibility. The authors proposed that future studies should include
48
49 304 additional measures of ACT processes to determine which are actually affected by ACT.

50
51 305 Sleep in military personnel has been recognised as a ‘vital health behaviour’ for which policies
52
53 306 and guidelines must be developed.[38] Cognitive behavioural therapy for insomnia (CBT-I) is
54
55 307 regarded as an effective ‘first line’ treatment, and a brief intervention has been described for
56
57 308 use in Australian general practice.[39] The Lang et al. trial[37] showed CBT-I to be effective,
58
59 309 however future studies should include outcome measures that include ACT processes. Our
60
310 final model showed that distress had a negative association with health, and psychological
311 flexibility had a positive relationship, with sleep most likely related to both of these variables.
312 It would seem important to screen for these conditions prior to transition from the military,

1
2 313 as well as among retired Veterans, in order to provide targeted support. Further research is
3
4 314 needed to examine the potential of CBT to improve Veterans' wellbeing.

5
6 315 Figure 1 Caption.

7 316 **The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension**
8
9 317 **scores compared to the NZ population normative proportions**

11 318 REFERENCES

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417 **DATA SHARING STATEMENT**

418 Data from this study is unsuitable for public deposition due to the privacy of participant data.
419 Data are anonymised, but contain information on deployments (including location and
420 duration), which could lead to some participants being identified. Furthermore, the
421 participant information sheet, as required by the Southern Health and Disability Ethics
422 Committee specifically contains the statement that 'all study data would be kept strictly
423 confidential to the research team.' Qualified researchers may apply for data access with the
424 research team at veterans.health@otago.ac.nz and/or hdecs@moh.govt.nz.

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430 **COMPETING INTERESTS**

431 None declared.

432 **CONTRIBUTION**

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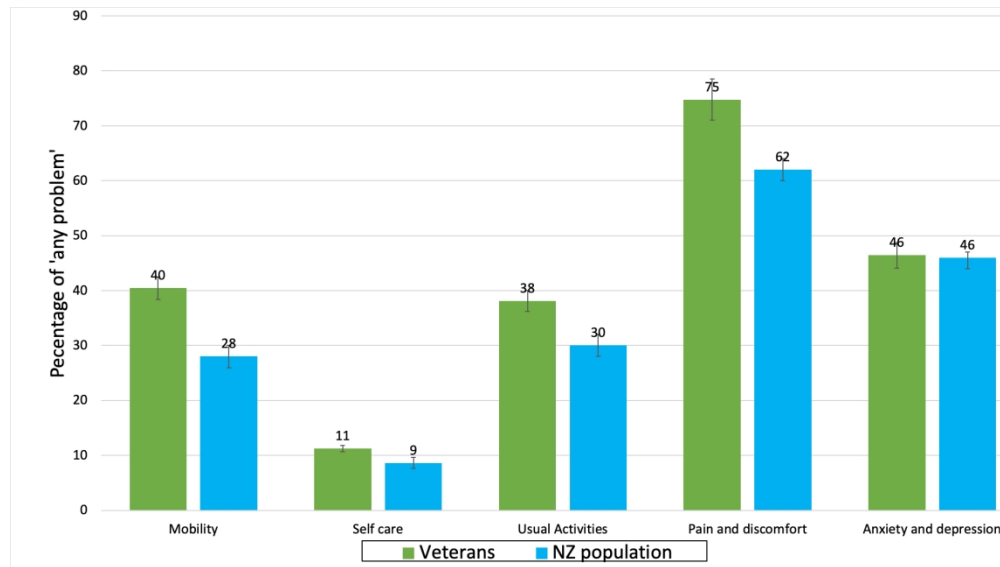
443 **Writing – original draft:** David McBride. AS, DG, EHW, SD and DS contributed to the re-writes
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The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension scores compared to the NZ population normative proportions

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3 **FACTORS ASSOCIATED WITH SELF-REPORTED HEALTH AMONG NEW ZEALAND MILITARY**
4 **VETERANS: A CROSS-SECTIONAL STUDY**
5

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1 **ABSTRACT**

2 **Objective**

3 To identify factors associated with better or poorer self-reported health status in New Zealand
4 military Veterans.

5 **Design**

6 An online cross-sectional survey.

7 **Participants**

8 The participants of interest were the 3,874 currently serving Veterans who had been deployed
9 to a conflict zone, but all Veterans were eligible to participate.

10 **Study variables**

11 Health status was self-reported using the EQ-5D-5L, which asks about problems across five
12 dimensions (mobility, self-care, usual activities, pain or discomfort, and anxiety or
13 depression), with five levels of severity (e.g. no, slight, moderate, severe or extreme
14 problems), also containing a visual analogue scale (EQ-VAS), scaled from 0 (worst) to 100
15 (best) imagined health. Hypothetical relationships with better health were positive social
16 support, sleep and psychological flexibility; with poorer health, exposure to psychological
17 trauma, distress and hazardous drinking.

18 **Results:**

19 The EQ5-D was completed by 1767 Veterans, 1009 serving, a response rate of 26% from that
20 group, with 1767 completing the EQ5-D and entering the analysis, comprising 1458 who had
21 deployed, 288 who had not, and the 21 who did not provide deployment data.

22 A significantly higher proportion of Veterans reported 'any problems' rather than 'no
23 problems' with four EQ-5D dimensions: mobility, self-care, usual activities and pain or
24 discomfort, but no difference in anxiety or depression. Age, length of service, deployment,
25 psychological flexibility and better sleep quality were associated with higher EQ-VAS scores;
26 distress with lower EQ-VAS scores.

27 **Conclusion:**

28 In this sample of New Zealand Veterans, psychological flexibility and good sleep are associated
29 with better self-rated health, and distress and poor sleep with diminished health. These
30 factors might be used as sentinel health indicators in assessing Veteran health status. As
31 distress, psychological flexibility and sleep are closely related, cognitive behavioural therapy
32 encompassing these domains may be useful in improving the health of New Zealand Veterans.

33 **Keywords:**

34 Self-rated health, wellbeing, EQ-5D, Veterans, deployment, military, risk factors.

35 **Strengths and limitations of this study**

- 36 • Many studies of Veterans have focused on adverse outcomes, but we have been able
37 to focus on a holistic measure of 'health'.
- 38 • The study was sufficiently powered to detect important relationships indicating
39 opportunities for intervention.
- 40 • The exact response rate is unknown, and bias may be a limitation.
- 41 • The cross-sectional design means that we cannot explore cause and effect
42 relationships.

43 **INTRODUCTION**

44 The three major events in the military life course are entry to military service, deployment on
45 active service and transition back to civilian life. On entry, soldiers, sailors and air personnel
46 are subject to a selection process to ensure, as far as possible, good physical and mental
47 health, giving rise to the 'healthy soldier effect,' with service personnel being, on average,
48 healthier than the general population.[1] However, the physical and psychological stressors
49 of military service have been found to erode this effect.[2]

50 The physical stressors have a particular impact on the lower limb, with load carriage, high
51 intensity training and the design of footwear being implicated in injury causation.[3] A military
52 career also increases opportunities for psychological trauma, and post-traumatic stress
53 disorder (PTSD) has been identified as the 'signature injury' of United States service men and
54 women deployed to Afghanistan and Iraq.[4]

55 A focus on adverse health events in the literature[5] means that wellbeing is relatively
56 overlooked. In the long run, military service has been found to have positive effects.[6,7]

57 Good health after service does, however, depend on the success of the 'military civilian
58 transition', a complex process for which models have been developed.[8] Health problems
59 developed in service, difficulty in assuming a post-service identity and many other factors
60 contribute to health and wellbeing outcomes.[8] In New Zealand, military Veterans can only
61 access assistance from New Zealand Veteran's Affairs (NZVA) if they have undertaken
62 'qualifying operational service' as defined by the Veteran Support Act 2014,[9] thus being
63 Veterans in a legal sense. NZVA support some 12,000 Veterans, with an average age of 80
64 years, 5000 being actively case managed.[10] The majority will have seen operational service
65 in Korea, Borneo, Malaya and Vietnam. Post-Vietnam, smaller numbers deployed on United
66 Nations and other missions, but the tempo of operations rose with the deployment to
67 Bosnia in 1992, and some 9,000-10,000 'legal' Veterans deployed between then and the

1
2 68 withdrawal of New Zealand troops from Afghanistan in 2021. The Ministerial Veteran's
3
4 69 Health Advisory Panel, established under the Veteran Support Act, are specifically charged
5
6 70 with funding research on this 'contemporary Veteran' group, NZVA acknowledging that they
7
8 71 "have had different experiences, and have different needs, compared to the older veterans.
9
10 72 They are likely to have served in a number of deployments during their career, and come to
11
12 73 us with more complex health issues." [10]

13 74 The aims of this study were therefore to describe self-reported health among these Veterans,
14
15 75 and identify factors associated with better or poorer health.

16 76 **Veteran and public involvement**

17 77 The Ministerial Veterans Health Advisory Panel, [10] commissioned the study and advised on
18
19 78 the design. We also formed a steering group with representatives from the New Zealand
20
21 79 Defence Force, New Zealand Veterans Affairs, the Royal New Zealand Returned and Services
22
23 80 Association (RSA) [11] and No Duff, [12] a charity providing first response support to Veterans
24
25 81 and their families. We also consulted with the Ngāi Tahu Research Consultation Committee in
26
27 82 order to assess the importance of the project to Māori, New Zealand's indigenous population.
28
29 83 We undertook to inform the Veteran community before releasing the results, also to give all
30
31 84 Veterans, defined as anyone who had served in the military, an opportunity to participate.

32 85 **METHODS**

33 86 **Participants**

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35 87 Data were collected via an online survey, a postal version being available on request. There is
36
37 88 no comprehensive Veteran registry, however in July 2018, a link to the online questionnaire
38
39 89 was sent by email to all currently serving regular and reserve New Zealand Defence Force
40
41 90 (NZDF) members registered on the NZDF email system who were 'legal Veterans', as indicated
42
43 91 by holding the New Zealand Operational Service Medal, numbering 3,874 personnel at that
44
45 92 time. An introductory message and link to the questionnaire were also presented on the NZDF
46
47 93 'intranet landing page', a secure internal webpage from which all regular force personnel can
48
49 94 access relevant work-related content, tools, and resources. Retired military personnel were
50
51 95 invited to participate through posters distributed to reserve units and the 43 local social clubs
52
53 96 identified by the RSA national office to be 'Veteran active.' Paper questionnaires with return
54
55 97 postage envelopes were made available at these sites. Announcements were also made on
56
57 98 military social media pages, and both retired and currently serving personnel were invited to
58
59 99 participate through an announcement on the No Duff website. The questionnaire was
60

1
2 100 available for completion from June to December 2018. Ethics approval for the study was
3
4 101 obtained from the Northern B Health and Disability Ethics Committee, reference 17NTB118.

5
6 102 **Questionnaire**

7
8 103 *Criterion variable*

9
10 104 Self-rated health status was assessed using the EQ-5D-5L,[13] a short questionnaire asking
11
12 105 about the respondent's health across five dimensions: mobility, self-care, usual activities, pain
13
14 106 or discomfort and anxiety or depression, with response options ranging from (e.g.) 'no
15
16 107 problems', to 'extreme problems'. For each dimension, participants were categorised as
17
18 108 having 'any problems' if they selected any response other than 'no problems'.

19 109 Additionally, the EQ-5D-5L visual analogue scale (EQ-VAS) asks the respondent to mark on a
20
21 110 vertical visual analogue scale (VAS) how good or bad their health is today, where the
22
23 111 endpoints are labelled 'the best health you can imagine' (score of 100) and 'the worst health
24
25 112 you can imagine' (score of 0).

26 113 *Independent variables*

27
28 114 Demographic characteristics included age, sex, ethnicity, service years, and past deployment
29
30 115 on operational service (yes/no). Ethnicity prioritisation was adopted,[14] whereby
31
32 116 participants with multiple responses were assigned to one of the categories, in the order of
33
34 117 Māori, Pacific Peoples, Other and European.

35 118 General psychiatric morbidity was assessed using the 12-item General Health Questionnaire
36
37 119 (GHQ-12),[15] scored using a four point scale (0-3) and summing the 12 items to give a total
38
39 120 score, with higher scores indicating elevated distress.

40
41 121 Social support was measured using the Social Provisions Scale,[16] with responses made on a
42
43 122 four-point Likert-type scale ranging from 1 'strongly disagree' to 4 'strongly agree'. The 24
44
45 123 items can be reduced to six subscales (attachment, social integration, reassurance of worth,
46
47 124 reliable alliance, social guidance, opportunity for nurturance) or summed to create a total
48
49 125 score, with greater scores indicating greater social support.

50 126 Alcohol use was measured using the AUDIT-C,[17] scaled from 0-12. A score of 3+ for women
51
52 127 and 4+ for men indicated potentially hazardous drinking behaviour.

53 128 Sleep quality was assessed with the Sleep Condition Indicator (SCI), [18] assessing insomnia as
54
55 129 described in the Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM-V).[19]

56
57 130 The SCI consists of eight items rated from 0-4, the total scores being scaled to a range of 0 to
58
59 131 10, where higher scores represent better sleep.

1
2 132 Trauma exposure was assessed with the Brief Trauma Scale (BTS),[20] which captures past
3
4 133 exposure to situations that were life threatening or capable of producing serious injury.
5
6 134 Psychological flexibility was measured with the 10-item AAQ-II, designed as a measure of
7
8 135 effectiveness in a particular mode of behavioural intervention, Acceptance and Commitment
9
10 136 Therapy (ACT).[21] Items were answered on a 7-point scale, with options ranging from 'never
11
12 137 true' to 'always true'. The items were summed to obtain a total score (possible range 10 to
13
14 138 70), with higher scores indicative of greater psychological flexibility.

15 139 **Statistical analyses**

16
17 140 With respect to the calculation of summed scores, if only one item was missing for a particular
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19 141 measure then this was imputed with the mean of the remaining items; if more than one item
20
21 142 was missing then the score was set to missing for that participant. Complete case analysis was
22
23 143 used in the remaining analyses. The five dimensions of the EQ-5D-5L were compared to the
24
25 144 NZ population normative values.[22]
26
27 145 Z tests were used to compare the EQ5D dimension scores with those of the New Zealand
28
29 146 general population.[22] Univariate ordinary least-squares linear regression analyses assessed
30
31 147 the strength of relationships between each independent variable and EQ-VAS scores, using
32
33 148 robust standard errors to account for heteroscedasticity and calculating 95% confidence
34
35 149 intervals (95% CIs). Multivariable linear regression was then used to identify the role of the
36
37 150 independent variables while adjusting for each other. None of the social support sub-scales
38
39 151 were used in this multivariable model, instead using the social support total score. The model
40
41 152 was built using backward variable selection with $p < 0.10$ for variable retention, with the
42
43 153 exceptions of age, sex, service years, and deployment status which were retained as adjusting
44
45 154 variables irrespective of p-values.

45 155 **RESULTS**

46
47 156 The EQ-5D was completed by 1767 Veterans, 1009 who were serving (26% of that group), 458
48
49 157 who had retired, 288 who had not deployed, and 21 who did not provide deployment data.
50
51 158 There are no reliable denominator data on retired and non-deployed Veterans in New
52
53 159 Zealand.
54
55 160 A supplementary table presents the EQ-VAS score according to the sample characteristics.
56
57 161 Figure 1 shows the proportion of EQ-5D-5L dimension responses reporting 'any problem'
58
59 162 severity level other than 'no problems' in comparison to the New Zealand population
60
163 normative values,[22] with table 1 showing the 95% CI's and Z values.

164 **Figure 1 about here**

165 Table 1, Proportion of 'any problem' in EQ-5D domains

Domain	Veterans	NZ population	Z value (p)
	Proportion (95% CI)	Proportion (95% CI)	
Mobility	0.40 (0.38-0.42)	0.28 (0.26-0.30)	8.5 (<.0001)
Self-care	0.11 (0.10-0.12)	0.09 (0.07-0.10)	2.8 (0.03)
Usual activities	0.38 (0.36-0.40)	0.30 (0.28-0.31)	5.6 (<.001)
Pain/discomfort	0.75 (0.73-0.76)	0.62 (0.60-0.63)	9.0 (<.0001)
Anxiety/depression	0.46 (0.44-0.48)	0.46 (0.44-0.48)	0 (1)

166

167 The results of the univariate analysis are displayed in Table 2. Here, for continuous
 168 characteristics, the regression coefficient (β) represents the change in the mean EQ-VAS
 169 associated with one unit increase in the characteristic. For categorical characteristics, β is the
 170 change in mean EQ-VAS scores compared to the referent category.

171

172 **Table 2: Univariate cross-sectional associations between variables and mean EQ-VAS scores**
 173 **for New Zealand Veterans (N=1,762)**

Characteristic	n	β	95% CIs	p-value
Age*	1762	-0.19	[-0.24, -0.13]	<.01
Sex				
Female	220	Reference	-	
Male	1520	-0.65	[-3.04, 1.73]	.59
Ethnicity				
NZ European	1382	Reference	-	
Māori	245	1.21	[-1.00, 3.42]	
Other	140	-2.95	[-6.26, 0.36]	0.10
Service years*	1670	0.19	[0.11, 0.27]	<.01
Deployment status				
Not deployed	288	Reference	-	
Deployed	1458	5.80	[3.35, 8.25]	<.01
GHQ-12 score*	1765	-1.63	[-1.79, -1.47]	<.01
Social support*				
Attachment	1760	2.02	[1.69, 2.34]	<.01
Social integration	1758	2.45	[2.06, 2.88]	<.01
Reassurance of worth	1756	2.48	[2.11, 2.85]	<.01
Reliable alliance	1760	2.30	[1.91, 2.70]	<.01
Social guidance	1760	2.00	[1.65, 2.35]	<.01
Opportunity for nurturance	1758	0.85	[0.47, 1.23]	<.01
Social support total score	1753	0.52	[0.44, 0.59]	<.01
Psychological flexibility*	1750	0.79	[0.71, 0.87]	<.01
Sleep score*	1747	3.47	[3.11, 3.83]	<.01
AUDIT-C				
Non-hazardous		Reference	-	
Hazardous		0.62	[-1.03, 2.26]	0.46
Exposure to traumatic events	1754			
Not exposed		Reference	-	
Exposed		-5.72	[-7.34, -4.11]	<.01

*Scored as continuous variables, coefficient is per unit increase.

175 Of the demographic variables, age was associated with lower EQ-VAS scores, length of
 176 service with higher scores. No relationships were apparent for sex or ethnicity. Positive
 177 coefficients, indicating better health with presence of the characteristic, were present for
 178 dichotomous variables of deployment, where the mean EQ-VAS score for deployed Veterans
 179 was 5.8 VAS units higher (better) than for non-deployed. The largest negative associations
 180 were for exposure to traumatic events, with a mean EQ-VAS score 5.7 lower for those
 181 exposed compared to those not exposed. Distress, as measured by the GHQ-12, had a
 182 negative association with health state. Positive associations with health state were found for

1
2 183 psychological flexibility as measured by the AAQ-II, better sleep scores, the total support
3
4 184 scores and the individual dimensions.

5 185 Table 3 shows the results from two models. The first model is adjusted for the other
6
7 186 characteristics, with 11 variables and 1,557 people providing valid responses for all factors
8
9 187 included in the model. All effect sizes were reduced, and the social support and AUDIT-C
10
11 188 scores were no longer associated, with 11 variables explaining 35% of the variability in the
12
13 189 EQ-VAS.

14
15 190 The final model involved backward variable selection setting a p-value of 0.10, identifying a
16
17 191 smaller subset of variables. Age, sex, service years, and deployment status were retained in
18
19 192 the model irrespective of their p-values, thus adjusting for those variables, using 1,600
20
21 193 complete responses. Social support and AUDIT-C hazardous drinking were not retained in
22
23 194 this final model; other coefficients remaining essentially the same, with a minimal effect on
24
25 195 the overall R^2 .

196 **Table 3. Multivariable models of associations between variables and mean EQ-VAS scores**
 197 **for New Zealand Veterans**

Characteristic	Adjusted model, N used =1,557			Final model, N used =1,600		
	β	95% CI	p-value	β	95% CI	p-value
Age (years)*	0.17	[-0.23, 1.11]	<0.01	-0.17	[-0.23, -0.12]	<0.01
Sex						
Female	Ref	-	-	Ref	-	-
Male	0.24	[-2.52, 2.03]	0.84	-0.60	[-2.82, 1.63]	0.60
Ethnicity						
NZ European	Ref	-	-	Ref	-	-
Māori	0.29	[-1.70, 2.27]	0.07	0.19	[-1.77, 2.14]	-
Other	-3.58	[-6.66, -0.51]		-2.91	[-5.88, 0.06]	0.15
Service years*	0.17	[0.10, 0.25]	<0.01	0.17	[0.10, 0.25]	<0.01
Deployment status						
Not deployed	Ref	-	-	Ref	-	-
Deployed	2.91	[0.64, 5.18]	<0.05	2.90	[0.65, 5.15]	0.01
GHQ12 score*	-0.87	[-1.09, -0.65]	<0.01	-0.92	[-1.13, -0.71]	<0.01
Social support (SPS score)*	0.01	[-0.07, 0.10]	0.76	-	-	-
Psychological flexibility score (AAQii)*	0.26	[0.15, 0.37]	<0.01	0.24	[0.14, 0.35]	<0.01
Sleep score (SCI), Range 0-10*	1.60	[1.18, 2.02]	<0.01	1.63	[1.22, 2.05]	<0.01
AUDIT_C score						
Non hazardous	Ref	-	-	-	-	-
Hazardous	0.41	[-1.00, 1.81]	0.57	-	-	-
Exposure to traumatic events (BTQ)						
Not exposed	Ref	-	-	Ref	-	-
Exposed	-1.77	[-3.30, -0.24]	<0.05	-1.81	[-3.32, 0.30]	0.02
			$R^2 = 0.35$			$R^2 = 0.36$

198 *Scored as continuous variables, coefficient is per unit increase.

199 DISCUSSION

200 *Principal findings*

201 With the exception of anxiety or depression, Veterans had a significantly greater proportion
 202 of 'any problem' responses in the EQ-5D dimensions than the general population of New
 203 Zealand.

204 The final model identified variables independently associated with the EQ-VAS score: age,
 205 length of service, deployment, the GHQ score, psychological flexibility, the sleep score and
 206 exposure to traumatic events. The results make conceptual sense in that distress is associated
 207 with reduced EQ-VAS and psychological flexibility with a modest protective effect, however,
 208 and unusually, Social Support was dropped, however the SPS was found to have a significant
 209 correlation with distress, and collinearity was the problem. There are also known to be many

1
2 210 other influences on health, including 'social wellbeing',[5] financial status, personality and
3
4 211 non-deployment related stressors,[23] which we have not measured.

5
6 212 *Strengths and weaknesses*

7 213 Strengths of our study were the relatively large sample size, the inclusion of all Veterans, the
8
9 214 assessment of 'health', infrequently investigated in Veteran populations, and the inclusion of
10
11 215 New Zealand Veterans with a range of characteristics, including 'deployed' and 'non-
12
13 216 deployed' Veterans. As a measure of health, the EQ-5D-5L dimensions and EQ-VAS ask about
14
15 217 health on the day that respondents complete the questionnaire, the EQ-VAS end points being,
16
17 218 respectively, the 'best' and 'worst' health they can imagine, so it is a holistic measure of health
18
19 219 state.[24]

20
21 220 The response rate of 26% from serving Veterans, along with the unknown total number of
22
23 221 Veterans, raises the question of bias, the direction of which is difficult to assess, as
24
25 222 responses may be more likely from either Veterans with good or poor health. The healthy
26
27 223 soldier effect is well known, service having a positive effect on wellbeing, with serving NZ
28
29 224 Veterans having good access to primary health care through the military system, but the
30
31 225 public health care system is the primary pathway to care for all Veterans, who are also
32
33 226 covered by the 'no fault' accident compensation scheme for accidental injuries and
34
35 227 occupational diseases.[25] Deployed Veterans may be at an advantage, but are covered by
36
37 228 NZVA only if their illness or injury is linked to a particular deployment, and the condition is
38
39 229 listed on the 'Statements of Principle' of the Australian Repatriation Medical Authority.[26]
40
41 230 We also know that New Veterans tend to be stoic, so they might underestimate their health
42
43 231 concerns,[27] and there are likely to be other personal characteristics that we have not
44
45 232 measured. We were however able to adjust for deployment status, which did have a positive
46
47 233 association with health state. In the interest of minimising responder burden, we used brief
48
49 234 scales, which might reduce construct validity. Distress, sleep, psychological flexibility and
50
51 235 exposure to traumatic events are likely to be related, so collinearity was difficult to avoid.
52
53 236 The confounding effect was greatest for social support, but our finding does not mean that
54
55 237 social support is of no importance to Veterans. The precision of the other coefficients may
56
57 238 also have been affected. Finally, the cross-sectional design means that we cannot explore
58
59 239 cause and effect, so recommendations for future interventions require additional support
60
240 from longitudinal studies.

241 *Comparison with other studies*

1
2 242 We have previously reported factors associated with post-traumatic stress in this group,[28]
3
4 243 using the Military Post Traumatic Stress Checklist (PCL-M). Factors associated with higher PCL-
5
6 244 M scores were trauma exposure, older age, male gender, and being of Māori ethnicity. Factors
7
8 245 associated with lower PCL-M scores were greater length of service, psychological flexibility,
9
10 246 and better quality sleep. Using health as the outcome disclosed that Māori did not have poorer
11
12 247 self-reported health compared to non-Māori, that deployment had a positive effect, and in
13
14 248 the univariate models, all of the dimensions of social support were associated with improved
15
16 249 health. The final model also included good sleep and psychological flexibility, providing most
17
18 250 of the explanatory power in the model.
19
20 251 No other studies appear to have used the EQ-VAS as an outcome measure for Veteran health.
21
22 252 Boehmer et al.[29] examined wellbeing among participants in the 2000 Behavioural Risk
23
24 253 Factor Surveillance System describing health-related quality of life (HRQoL) by sex and military
25
26 254 status, active duty, reservists Veterans, or no military service. Participants were asked to rate
27
28 255 recent physical health, mental health, and activity limitation. Active duty men were more likely
29
30 256 than men without military service to report 14 or more days of activity limitation, pain, and
31
32 257 not enough rest in the past 30 days, the mobility and pain findings being similar to our sample.
33
34 258 Notably, the predominant reason for medical discharge from the British Armed Forces was
35
36 259 musculoskeletal problems.[30]
37
38 260 Contrary to our finding on deployment, there are reports indicating that non-deployed
39
40 261 personnel retain better health than those who have been deployed,[31] Diaz Santana et al.
41
42 262 having carried out a cross-sectional survey of 60,000 U.S. Veterans of Afghanistan and Iraq,
43
44 263 with 20,563 responses. In contrast to our finding, mental quality of life scores were higher
45
46 264 among the non-deployed group compared to the deployed group, though the deployed group
47
48 265 reported higher physical quality of life scores compared to the non-deployed. Again in
49
50 266 contrast, both mental and physical quality of life were lower among Veterans compared to
51
52 267 U.S. population norms.
53
54 268 Both positive and negative consequences of deployment have been described.[7,32] In a study
55
56 269 of Dutch Veterans,[7] two out of three reported a positive effect of deployment on their
57
58 270 quality of life at the time of the survey, this being related to positive feelings such as
59
60 271 satisfaction or comradeship, but a few having emotions such as frustration or shame. As
272 regards tangible effects,[32] negative consequences included the military 'chain of command',
273 being away from home, and deterioration of marital/significant other relationships. Positive
274 influences include improved financial security, self-improvement, and time to reflect.

1
2 275 We found sleep to be associated with better health, but sleep difficulties are a common
3
4 276 symptom for those with PTSD. McCarthy et al.[33] reported on the 3,157 U.S. military
5
6 277 Veterans enrolled in the National Health and Resilience in Veterans Study, in which 27.6%
7
8 278 reported poor sleep quality. Path analyses revealed significant associations between poor
9
10 279 sleep, severity of PTSD, poorer mental and physical health functioning and lower overall
11
12 280 quality of life.

13 281 *Future directions*

14
15 282 The results suggest that distress, psychological flexibility, and sleep have an important
16
17 283 relationship with self-rated health among Veterans in this study.

18
19 284 Reducing distress through the promotion of psychological flexibility might be possible,
20
21 285 although our finding here must be subject to caution as several researchers argue that the
22
23 286 AAQ-II may be measuring psychological distress and affect rather than psychological
24
25 287 inflexibility.[34] Psychological flexibility is specifically targeted by ACT, a psychological
26
27 288 intervention described as being in the ‘third wave’ of behaviour change strategies.[35] The six
28
29 289 core processes of ACT (acceptance, cognitive defusion, being present, self as context, values,
30
31 290 and committed action) aim to increase psychological flexibility, the goal being “to have clients
32
33 291 experience the world more directly so that their behavior is more flexible and thus their
34
35 292 actions more consistent with the values that they hold.”[35] Approaches such as ACT may
36
37 293 therefore improve health state and has been shown to improve pain acceptance and
38
39 294 psychological flexibility [36]. Lang et al. carried out a randomised clinical trial (RCT), comparing
40
41 295 ACT with person-centred therapy,[37] showing a general improvement in symptoms of
42
43 296 distress across both treatment arms, ACT providing superior improvement in insomnia. The
44
45 297 drop-out rate for both therapies was however high, and the two groups did not exhibit any
46
47 298 change in psychological flexibility. The authors proposed that future studies should include
48
49 299 additional measures of ACT processes to determine which are actually affected by ACT.

50
51 300 Sleep in military personnel has been recognised as a ‘vital health behaviour’ for which policies
52
53 301 and guidelines must be developed.[38] Cognitive behavioural therapy for insomnia (CBT-I) is
54
55 302 regarded as an effective ‘first line’ treatment, and a brief intervention has been described for
56
57 303 use in Australian general practice.[39] The Lang et al. trial[37] showed CBT-I to be effective,
58
59 304 however future studies should include outcome measures that include ACT processes. Our
60
305 final model showed that distress had a negative association with health, and psychological
306 flexibility had a positive relationship, with sleep most likely related to both of these variables.
307 It would seem important to screen for these conditions prior to transition from the military,

1
2 308 as well as among retired Veterans, in order to provide targeted support. Further research is
3
4 309 needed to examine the potential of CBT to improve Veterans' wellbeing.

5
6 310 Figure 1 Caption.

7 311 **The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension**
8
9 312 **scores compared to the NZ population normative proportions**

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412 DATA SHARING STATEMENT

413 Data from this study is unsuitable for public deposition due to the privacy of participant data.
414 Data are anonymised, but contain information on deployments (including location and
415 duration), which could lead to some participants being identified. Furthermore, the
416 participant information sheet, as required by the Southern Health and Disability Ethics
417 Committee specifically contains the statement that 'all study data would be kept strictly
418 confidential to the research team.' Qualified researchers may apply for data access with the
419 research team at veterans.health@otago.ac.nz and/or hdec@mh.govt.nz.

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424 COMPETING INTERESTS

425 None declared.

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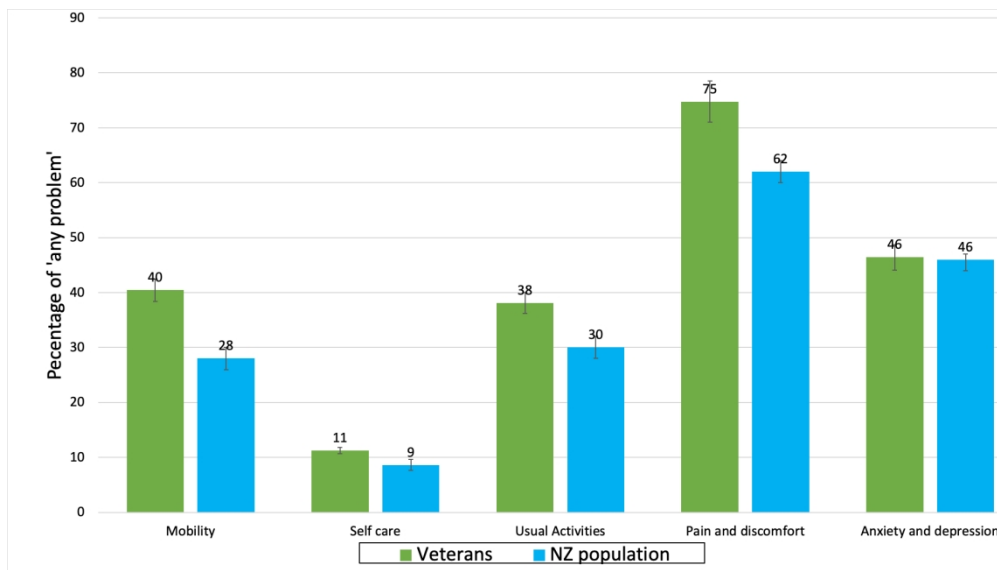
437 **Writing – original draft:** David McBride. AS, DG, EHW, SD and DS contributed to the re-writes
438 and final draft

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1
2 443 Affairs); Mark Compain, Danny Nelson and Richard Terrill (RSA); and NoDuff representatives
3
4 444 Aaron Wood and Lars Millar.
5
6 445 Finally, a thank you to the New Zealand Veterans who took the time and effort to complete a
7
8 446 rather tedious questionnaire. Kia Kaha.
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For peer review only



The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension scores compared to the NZ population normative proportions

338x190mm (144 x 144 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	Indicate the study's design with a commonly used term in the title or the abstract. Yes, a cross sectional study, p1 title. (b) Provide in the abstract an informative and balanced summary of what was done and what was found Background, results and conclusions, p 1
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Introduction p2.
Objectives	3	State specific objectives, including any prespecified hypotheses p2, lines 59 and 60
Methods		
Study design	4	Present key elements of study design early in the paper p2 line 62 to page 5 line 145
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Participants, page2 line 63- page 3 line 83.
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants page 2 line 64 to page 3, line 68.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Questionnaire, pp 3-5.
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 as above
Bias	9	Describe any efforts to address potential sources of bias Methods, page 3. Lines 76-83.
Study size	10	Explain how the study size was arrived at p5 line 137
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Cases defined through the Multivariable logistic regression with the EQ-Visual analogue scale as the outcome measure, p5 lines 131-136
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Backward elimination process p5 lines 134-135 (b) Describe any methods used to examine subgroups and interactions By multivariable logistic regression, p5 as above (c) Explain how missing data were addressed p4 lines 122-125 (d) If applicable, describe analytical methods taking account of sampling strategy N/A (e) Describe any sensitivity analyses N/A
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 Potentially eligible lines 68-73 p 3 (b) Give reasons for non-participation at each stage N/A (c) Consider use of a flow diagram N/A

1 2 3 4 5 6	Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders page 5 et seq, table 1 (b) Indicate number of participants with missing data for each variable of interest ' n used ' columns tables 2 and 3.
7	Outcome data	15*	Report numbers of outcome events or summary measures as per tables
8 9 10 11 12 13 14 15 16 17 18	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Tables, adjusted for age, sex, service years and deployment status. (b) Report category boundaries when continuous variables were categorized. Independent variables, p 3 and 4, EQ-VAS is a continuous scale. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
19 20	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
21	Discussion		
22 23 24	Key results	18	Summarise key results with reference to study objectives Discussion, p11 first para
25 26 27 28	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 Discussion lines 215 et seq.
29 30 31 32	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Discussion, p12 lines 230 et seq.
33 34 35	Generalisability	21	Discuss the generalisability (external validity) of the study results p17, line 215 et seq.
36	Other information		
37 38 39 40	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 Funding, p18

*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 www.strobe-statement.org.

Supplementary Table: Number of participants and EQ-VAS scores according to sample characteristics

Exposure variable	N (%)	Mean (SD)
All	1767	74.4 (17.1)
Age group (years)		
20-29	136 (7.7)	77.7 (14.4)
30-39	328 (18.6)	77.0 (16.2)
40-49	438 (24.8)	76.1 (14.6)
50-59	350 (19.8)	74.8 (16.6)
60-69	285 (16.1)	71.4 (19.8)
70-79	175 (9.9)	69.4 (19.4)
80+	50 (2.8)	66.2 (20.3)
Missing	5 (0.3)	61.2 (22.1)
Gender		
Female	220 (12.5)	75.0 (16.9)
Male	1520 (86.0)	74.4 (17.2)
Missing	27 (1.5)	70.3 (17.2)
Ethnicity (prioritised)		
NZ European	1382 (78.2)	74.4 (17.1)
Māori	245 (13.9)	75.6 (16.1)
Other	140 (7.9)	71.5 (19.3)
Service years		
0-9	339 (19.2)	69.9 (19.7)
10-19	478 (27.1)	74.5 (17.9)
20-29	530 (30.0)	75.3 (15.9)
30-39	254 (14.4)	76.3 (14.6)
40+	69 (3.9)	75.4 (16.4)
Missing	97 (5.5)	78.8 (14.2)
Deployment (ever)		
No	288 (16.3)	69.5 (19.9)
Yes	1458 (82.5)	75.3 (16.4)
Missing	21 (1.2)	75.6 (14.6)
GHQ12 Score		
0-9	652 (36.9)	82.0 (12.6)
10-19	972 (55.0)	72.3 (16.0)
20-29	123 (7.0)	54.3 (20.3)
30+	18 (1.0)	46.2 (24.4)
Missing	2 (0.1)	-

*sub-scores not used in multivariable models.

Supplementary table contd.

Social support full score			
24-29	0	0	-
30-39	3	(0.2)	66.7 (15.3)
40-49	15	(0.8)	44.5 (22.5)
50-59	97	(5.5)	62.4 (21.8)
60-69	351	(19.9)	69.0 (18.2)
70-79	643	(36.4)	75.1 (15.0)
80-89	409	(23.1)	78.0 (15.0)
90-96	235	(13.3)	81.9 (13.9)
Missing	14	(0.8)	58.1 (25.6)
Social support sub-scores			
Attachment*			
4-7	51	(3.5)	61.4 (23.4)
8-11	516	(29.2)	68.7 (18.0)
12-16	1193	(67.5)	77.5 (15.5)
Missing	7	(0.4)	61.0 (19.7)
Social integration*			
4-7	20	(1.1)	56.2 (25.1)
8-11	429	(24.3)	67.1 (19.4)
12-16	1309	(74.8)	77.1 (15.2)
Missing	9	(0.5)	58.7 (21.5)
Reassurance of worth*			
4-7	37	(2.1)	59.1 (19.5)
8-11	504	(28.5)	69.0 (19.1)
12-16	1215	(68.8)	77.2 (15.2)
Missing	11	(0.6)	62.0 (24.9)
Reliable Alliance*			
4-7	20	(1.1)	49.6 (22.2)
8-11	251	(14.2)	66.9 (20.1)
12-16	1489	(84.3)	76.0 (15.9)
Missing	7	(0.4)	61.0 (19.7)
Guidance sub-score*			
4-7	36	(2.0)	59.2 (22.2)
8-11	387	(21.9)	68.7 (18.9)
12-16	1337	(75.7)	76.6 (15.7)
Missing	7	(0.4)	54.6 (21.6)
Opportunity for nurturance*			
4-7	29	(1.6)	69.3 (18.9)
8-11	413	(23.4)	71.9 (18.8)
12-16	1316	(74.5)	75.4 (16.4)
Missing	9	(0.5)	58.7 (21.5)

Supplementary table, contd.

**Psychological flexibility score
(AAQii score).**

10-19	5 (0.3)	23.2 (13.8)
20-29	40 (2.3)	49.1 (22.1)
30-39	147 (8.3)	63.0 (18.6)
40-49	43 (24.7)	68.5 (16.8)
50-59	664 (37.6)	77.1 (13.9)
60-70	457 (25.9)	82.5 (13.5)
Missing	1 (1.0)	69.6 (20.5)

Sleep Condition Indicator (SCI score)

0 to <2	67 (3.8)	51.2 (22.3)
2 to <4	264 (14.9)	62.2 (19.5)
4 to <6	646 (36.6)	74.3 (14.6)
6 to <8	384 (21.7)	77.6 (14.2)
8 to 10	386 (21.8)	83.5 (12.2)
Missing	20 (1.1)	77.3 (12.8)

AUDIT-C score

Non-hazardous	776 (43.9)	74.0 (17.4)
Hazardous	915 (51.8)	74.6 (16.9)
Missing	76 (4.3)	75.0 (17.0)

**Brief Trauma Questionnaire
(DSM-IV criteria)**

Not exposed	544 (30.8)	78.3 (15.1)
Exposed	1210 (68.5)	72.5 (17.8)
Missing	13 (0.7)	80.6 (8.1)

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FACTORS ASSOCIATED WITH SELF-REPORTED HEALTH AMONG NEW ZEALAND MILITARY VETERANS: A CROSS-SECTIONAL STUDY

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1 ABSTRACT

2 Objective

3 To identify factors associated with better or poorer self-reported health status in New Zealand
4 military Veterans.

5 Design

6 An online cross-sectional survey.

7 Participants

8 The participants of interest were the 3,874 currently serving Veterans who had been deployed
9 to a conflict zone, but all Veterans were eligible to participate.

10 Study variables

11 Health status was self-reported using the EQ-5D-5L, which asks about problems across five
12 dimensions (mobility, self-care, usual activities, pain or discomfort, and anxiety or
13 depression), with five levels of severity (e.g. no, slight, moderate, severe or extreme
14 problems), also containing a visual analogue scale (EQ-VAS), scaled from 0 (worst) to 100
15 (best) imagined health. Hypothetical relationships with better health were positive social
16 support, sleep and psychological flexibility; with poorer health, exposure to psychological
17 trauma, distress and hazardous drinking.

18 Results:

19 The EQ5-D was completed by 1767 Veterans, 1009 serving, a response rate of 26% from that
20 group, with 1767 completing the EQ5-D and entering the analysis, comprising 1458 who had
21 deployed, 288 who had not, and the 21 who did not provide deployment data.

22 A significantly higher proportion of Veterans reported 'any problems' rather than 'no
23 problems' with four EQ-5D dimensions: mobility, self-care, usual activities and pain or
24 discomfort, but no difference in anxiety or depression. Age, length of service, deployment,
25 psychological flexibility and better sleep quality were associated with higher EQ-VAS scores;
26 distress with lower EQ-VAS scores.

27 Conclusion:

28 In this sample of New Zealand Veterans, psychological flexibility and good sleep are associated
29 with better self-rated health, and distress and poor sleep with diminished health. These
30 factors might be used as sentinel health indicators in assessing Veteran health status. As
31 distress, psychological flexibility and sleep are closely related, cognitive behavioural therapy
32 encompassing these domains may be useful in improving the health of New Zealand Veterans.

33 Keywords:

34 Self-rated health, wellbeing, EQ-5D, Veterans, deployment, military, risk factors.

35 **Strengths and limitations of this study**

- 36 • Many studies of Veterans have focused on adverse outcomes, but we have been able
37 to focus on a holistic measure of 'health'.
- 38 • The study was sufficiently powered to detect important relationships indicating
39 opportunities for intervention.
- 40 • The exact response rate is unknown, and bias may be a limitation.
- 41 • The cross-sectional design means that we cannot explore cause and effect
42 relationships.

43 **INTRODUCTION**

44 The three major events in the military life course are entry to military service, deployment on
45 active service and transition back to civilian life. On entry, soldiers, sailors and air personnel
46 are subject to a selection process to ensure, as far as possible, good physical and mental
47 health, giving rise to the 'healthy soldier effect,' with service personnel being, on average,
48 healthier than the general population.[1] However, the physical and psychological stressors
49 of military service have been found to erode this effect.[2]

50 The physical stressors have a particular impact on the lower limb, with load carriage, high
51 intensity training and the design of footwear being implicated in injury causation.[3] A military
52 career also increases opportunities for psychological trauma, and post-traumatic stress
53 disorder (PTSD) has been identified as the 'signature injury' of United States service men and
54 women deployed to Afghanistan and Iraq.[4]

55 A focus on adverse health events in the literature[5] means that wellbeing is relatively
56 overlooked. In the long run, military service has been found to have positive effects.[6,7]
57 Good health after service does, however, depend on the success of the 'military civilian
58 transition', a complex process for which models have been developed.[8] Health problems
59 developed in service, difficulty in assuming a post-service identity and many other factors
60 contribute to health and wellbeing outcomes.[8] **In New Zealand, military Veterans can only
61 access assistance from New Zealand Veteran's Affairs (NZVA) if they have undertaken
62 'qualifying operational service' as defined by the Veteran Support Act 2014,[9] thus being
63 Veterans in a legal sense. NZVA support some 12,000 Veterans, with an average age of 80
64 years, 5000 being actively case managed.[10] The majority will have seen operational service
65 in Korea, Borneo, Malaya and Vietnam. Post-Vietnam, smaller numbers deployed on United
66 Nations and other missions, but the tempo of operations rose with the deployment to
67 Bosnia in 1992, and some 9,000-10,000 'legal' Veterans deployed between then and the**

1
2 68 withdrawal of New Zealand troops from Afghanistan in 2021. The Ministerial Veteran's
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4 69 Health Advisory Panel, established under the Veteran Support Act, are specifically charged
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6 70 with funding research on this 'contemporary Veteran' group, NZVA acknowledging that they
7
8 71 "have had different experiences, and have different needs, compared to the older veterans.
9
10 72 They are likely to have served in a number of deployments during their career, and come to
11
12 73 us with more complex health issues." [10]

13 74 The aims of this study were therefore to describe self-reported health among these Veterans,
14
15 75 and identify factors associated with better or poorer health.

16 76 **Veteran and public involvement**

17 77 The Ministerial Veterans Health Advisory Panel, [10] commissioned the study and advised on
18
19 78 the design. We also formed a steering group with representatives from the New Zealand
20
21 79 Defence Force, New Zealand Veterans Affairs, the Royal New Zealand Returned and Services
22
23 80 Association (RSA) [11] and No Duff, [12] a charity providing first response support to Veterans
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25 81 and their families. We also consulted with the Ngāi Tahu Research Consultation Committee in
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27 82 order to assess the importance of the project to Māori, New Zealand's indigenous population.
28
29 83 We undertook to inform the Veteran community before releasing the results, also to give all
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31 84 Veterans, defined as anyone who had served in the military, an opportunity to participate.

32 85 **METHODS**

33 86 **Participants**

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35 87 Data were collected via an online survey, a postal version being available on request. There is
36
37 88 no comprehensive Veteran registry, however in July 2018, a link to the online questionnaire
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39 89 was sent by email to all currently serving regular and reserve New Zealand Defence Force
40
41 90 (NZDF) members registered on the NZDF email system who were 'legal Veterans', as indicated
42
43 91 by holding the New Zealand Operational Service Medal, numbering 3,874 personnel at that
44
45 92 time. An introductory message and link to the questionnaire were also presented on the NZDF
46
47 93 'intranet landing page', a secure internal webpage from which all regular force personnel can
48
49 94 access relevant work-related content, tools, and resources. Retired military personnel were
50
51 95 invited to participate through posters distributed to reserve units and the 43 local social clubs
52
53 96 identified by the RSA national office to be 'Veteran active.' Paper questionnaires with return
54
55 97 postage envelopes were made available at these sites. Announcements were also made on
56
57 98 military social media pages, and both retired and currently serving personnel were invited to
58
59 99 participate through an announcement on the No Duff website. The questionnaire was
60

1
2 100 available for completion from June to December 2018. Ethics approval for the study was
3
4 101 obtained from the Northern B Health and Disability Ethics Committee, reference 17NTB118.

5
6 102 **Questionnaire**

7
8 103 *Criterion variable*

9
10 104 Self-rated health status was assessed using the EQ-5D-5L,[13] a short questionnaire asking
11
12 105 about the respondent's health across five dimensions: mobility, self-care, usual activities, pain
13
14 106 or discomfort and anxiety or depression, with response options ranging from (e.g.) 'no
15
16 107 problems', to 'extreme problems'. For each dimension, participants were categorised as
17
18 108 having 'any problems' if they selected any response other than 'no problems'.

19 109 Additionally, the EQ-5D-5L visual analogue scale (EQ-VAS) asks the respondent to mark on a
20
21 110 vertical visual analogue scale (VAS) how good or bad their health is today, where the
22
23 111 endpoints are labelled 'the best health you can imagine' (score of 100) and 'the worst health
24
25 112 you can imagine' (score of 0).

26 113 *Independent variables*

27
28 114 Demographic characteristics included age, sex, ethnicity, service years, and past deployment
29
30 115 on operational service (yes/no). Ethnicity prioritisation was adopted,[14] whereby
31
32 116 participants with multiple responses were assigned to one of the categories, in the order of
33
34 117 Māori, Pacific Peoples, Other and European.

35 118 General psychiatric morbidity was assessed using the 12-item General Health Questionnaire
36
37 119 (GHQ-12),[15] scored using a four point scale (0-3) and summing the 12 items to give a total
38
39 120 score, with higher scores indicating elevated distress.

40
41 121 Social support was measured using the Social Provisions Scale,[16] with responses made on a
42
43 122 four-point Likert-type scale ranging from 1 'strongly disagree' to 4 'strongly agree'. The 24
44
45 123 items can be reduced to six subscales (attachment, social integration, reassurance of worth,
46
47 124 reliable alliance, social guidance, opportunity for nurturance) or summed to create a total
48
49 125 score, with greater scores indicating greater social support.

50 126 Alcohol use was measured using the AUDIT-C,[17] scaled from 0-12. A score of 3+ for women
51
52 127 and 4+ for men indicated potentially hazardous drinking behaviour.

53 128 Sleep quality was assessed with the Sleep Condition Indicator (SCI), [18] assessing insomnia as
54
55 129 described in the Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM-V).[19]

56
57 130 The SCI consists of eight items rated from 0-4, the total scores being scaled to a range of 0 to
58
59 131 10, where higher scores represent better sleep.

1
2 132 Trauma exposure was assessed with the Brief Trauma Scale (BTS),[20] which captures past
3
4 133 exposure to situations that were life threatening or capable of producing serious injury.
5
6 134 Psychological flexibility was measured with the 10-item AAQ-II, designed as a measure of
7
8 135 effectiveness in a particular mode of behavioural intervention, Acceptance and Commitment
9
10 136 Therapy (ACT).[21] Items were answered on a 7-point scale, with options ranging from 'never
11
12 137 true' to 'always true'. The items were summed to obtain a total score (possible range 10 to
13
14 138 70), with higher scores indicative of greater psychological flexibility.

139 **Statistical analyses**

140 With respect to the calculation of summed scores, if only one item was missing for a particular
141
142 measure then this was imputed with the mean of the remaining items; if more than one item
143
144 was missing then the score was set to missing for that participant. Complete case analysis was
145
146 used in the remaining analyses. The five dimensions of the EQ-5D-5L were compared to the
147
148 NZ population normative values.[22]

149 **Z tests were used to compare the EQ5D dimension scores with those of the New Zealand**
150
151 **general population.**[22] Univariate ordinary least-squares linear regression analyses assessed
152
153 the strength of relationships between each independent variable and EQ-VAS scores, using
154
155 robust standard errors to account for heteroscedasticity and calculating 95% confidence
156
157 intervals (95% CIs). Multivariable linear regression was then used to identify the role of the
158
159 independent variables while adjusting for each other. None of the social support sub-scales
160
161 were used in this multivariable model, instead using the social support total score. The model
162
163 was built using backward variable selection with $p < 0.10$ for variable retention, with the
164
165 exceptions of age, sex, service years, and deployment status which were retained as adjusting
166
167 variables irrespective of p-values.

168 **RESULTS**

169 The EQ-5D was completed by 1767 Veterans, 1009 who were serving (26% of that group), 458
170
171 who had retired, 288 who had not deployed, and 21 who did not provide deployment data.
172
173 There are no reliable denominator data on retired and non-deployed Veterans in New
174
175 Zealand.

176 A supplementary table presents the EQ-VAS score according to the sample characteristics.
177
178 Figure 1 shows the proportion of EQ-5D-5L dimension responses reporting 'any problem'
179
180 severity level other than 'no problems' in comparison to the New Zealand population
181
182 normative values,[22] with table 1 showing the 95% CI's and Z values.

183 **Figure 1 about here**

165 Table 1, Proportion of 'any problem' in EQ-5D domains

Domain	Veterans	NZ population	Z value (p)
	Proportion (95% CI)	Proportion (95% CI)	
Mobility	0.40 (0.38-0.42)	0.28 (0.26-0.30)	8.5 (<.0001)
Self-care	0.11 (0.10-0.12)	0.09 (0.07-0.10)	2.8 (0.03)
Usual activities	0.38 (0.36-0.40)	0.30 (0.28-0.31)	5.6 (<.001)
Pain/discomfort	0.75 (0.73-0.76)	0.62 (0.60-0.63)	9.0 (<.0001)
Anxiety/depression	0.46 (0.44-0.48)	0.46 (0.44-0.48)	0 (1)

166

167 The results of the univariate analysis are displayed in Table 2. Here, for continuous
 168 characteristics, the regression coefficient (β) represents the change in the mean EQ-VAS
 169 associated with one unit increase in the characteristic. For categorical characteristics, β is the
 170 change in mean EQ-VAS scores compared to the referent category.

171

172 **Table 2: Univariate cross-sectional associations between variables and mean EQ-VAS scores**
 173 **for New Zealand Veterans (N=1,762)**

Characteristic	n	β	95% CIs	p-value
Age*	1762	-0.19	[-0.24, -0.13]	<.01
Sex				
Female	220	Reference	-	
Male	1520	-0.65	[-3.04, 1.73]	.59
Ethnicity				
NZ European	1382	Reference	-	
Māori	245	1.21	[-1.00, 3.42]	
Other	140	-2.95	[-6.26, 0.36]	0.10
Service years*	1670	0.19	[0.11, 0.27]	<.01
Deployment status				
Not deployed	288	Reference	-	
Deployed	1458	5.80	[3.35, 8.25]	<.01
GHQ-12 score*	1765	-1.63	[-1.79, -1.47]	<.01
Social support*				
Attachment	1760	2.02	[1.69, 2.34]	<.01
Social integration	1758	2.45	[2.06, 2.88]	<.01
Reassurance of worth	1756	2.48	[2.11, 2.85]	<.01
Reliable alliance	1760	2.30	[1.91, 2.70]	<.01
Social guidance	1760	2.00	[1.65, 2.35]	<.01
Opportunity for nurturance	1758	0.85	[0.47, 1.23]	<.01
Social support total score	1753	0.52	[0.44, 0.59]	<.01
Psychological flexibility*	1750	0.79	[0.71, 0.87]	<.01
Sleep score*	1747	3.47	[3.11, 3.83]	<.01
AUDIT-C				
Non-hazardous		Reference	-	
Hazardous		0.62	[-1.03, 2.26]	0.46
Exposure to traumatic events				
Not exposed	1754	Reference	-	
Exposed		-5.72	[-7.34, -4.11]	<.01

174 *Scored as continuous variables, coefficient is per unit increase.

175 Of the demographic variables, age was associated with lower EQ-VAS scores, length of
 176 service with higher scores. No relationships were apparent for sex or ethnicity. Positive
 177 coefficients, indicating better health with presence of the characteristic, were present for
 178 dichotomous variables of deployment, where the mean EQ-VAS score for deployed Veterans
 179 was 5.8 VAS units higher (better) than for non-deployed. The largest negative associations
 180 were for exposure to traumatic events, with a mean EQ-VAS score 5.7 lower for those
 181 exposed compared to those not exposed. Distress, as measured by the GHQ-12, had a
 182 negative association with health state. Positive associations with health state were found for

1
2 183 psychological flexibility as measured by the AAQ-II, better sleep scores, the total support
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4 184 scores and the individual dimensions.
5
6 185 Table 3 shows the results from two models. The first model is adjusted for the other
7
8 186 characteristics, with 11 variables and 1,557 people providing valid responses for all factors
9
10 187 included in the model. All effect sizes were reduced, and the social support and AUDIT-C
11
12 188 scores were no longer associated, with 11 variables explaining 35% of the variability in the
13
14 189 EQ-VAS.
15
16 190 The final model involved backward variable selection setting a p-value of 0.10, identifying a
17
18 191 smaller subset of variables. Age, sex, service years, and deployment status were retained in
19
20 192 the model irrespective of their p-values, thus adjusting for those variables, using 1,600
21
22 193 complete responses. Social support and AUDIT-C hazardous drinking were not retained in
23
24 194 this final model; other coefficients remaining essentially the same, with a minimal effect on
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196 **Table 3. Multivariable models of associations between variables and mean EQ-VAS scores**
 197 **for New Zealand Veterans**

Characteristic	Adjusted model, N used =1,557			Final model, N used =1,600		
	β	95% CI	p-value	β	95% CI	p-value
Age (years)*	0.17	[-0.23, 1.11]	<0.01	-0.17	[-0.23, -0.12]	<0.01
Sex						
Female	Ref	-	-	Ref	-	-
Male	0.24	[-2.52, 2.03]	0.84	-0.60	[-2.82, 1.63]	0.60
Ethnicity						
NZ European	Ref	-	-	Ref	-	-
Māori	0.29	[-1.70, 2.27]	0.07	0.19	[-1.77, 2.14]	-
Other	-3.58	[-6.66, -0.51]		-2.91	[-5.88, 0.06]	0.15
Service years*	0.17	[0.10, 0.25]	<0.01	0.17	[0.10, 0.25]	<0.01
Deployment status						
Not deployed	Ref	-	-	Ref	-	-
Deployed	2.91	[0.64, 5.18]	<0.05	2.90	[0.65, 5.15]	0.01
GHQ12 score*	-0.87	[-1.09, -0.65]	<0.01	-0.92	[-1.13, -0.71]	<0.01
Social support (SPS score)*	0.01	[-0.07, 0.10]	0.76	-	-	-
Psychological flexibility score (AAQii)*	0.26	[0.15, 0.37]	<0.01	0.24	[0.14, 0.35]	<0.01
Sleep score (SCI), Range 0-10*	1.60	[1.18, 2.02]	<0.01	1.63	[1.22, 2.05]	<0.01
AUDIT_C score						
Non hazardous	Ref	-	-	-	-	-
Hazardous	0.41	[-1.00, 1.81]	0.57	-	-	-
Exposure to traumatic events (BTQ)						
Not exposed	Ref	-	-	Ref	-	-
Exposed	-1.77	[-3.30, -0.24]	<0.05	-1.81	[-3.32, 0.30]	0.02
			$R^2 = 0.35$			$R^2 = 0.36$

198 *Scored as continuous variables, coefficient is per unit increase.

199 DISCUSSION

200 *Principal findings*

201 **With the exception of anxiety or depression, Veterans had a significantly greater proportion**
 202 **of 'any problem' responses in the EQ-5D dimensions than the general population of New**
 203 **Zealand.**

204 The final model identified variables independently associated with the EQ-VAS score: age,
 205 length of service, deployment, the GHQ score, psychological flexibility, the sleep score and
 206 exposure to traumatic events. The results make conceptual sense in that distress is associated
 207 with reduced EQ-VAS and psychological flexibility with a modest protective effect, however,
 208 and unusually, Social Support was dropped, however the SPS was found to have a significant
 209 correlation with distress, and collinearity was the problem. There are also known to be many

1
2 210 other influences on health, including 'social wellbeing',[5] financial status, personality and
3
4 211 non-deployment related stressors,[23] which we have not measured.

5
6 212 *Strengths and weaknesses*

7 213 Strengths of our study were the relatively large sample size, the inclusion of all Veterans, the
8
9 214 assessment of 'health', infrequently investigated in Veteran populations, and the inclusion of
10
11 215 New Zealand Veterans with a range of characteristics, including 'deployed' and 'non-
12
13 216 deployed' Veterans. As a measure of health, the EQ-5D-5L dimensions and EQ-VAS ask about
14
15 217 health on the day that respondents complete the questionnaire, the EQ-VAS end points being,
16
17 218 respectively, the 'best' and 'worst' health they can imagine, so it is a holistic measure of health
18
19 219 state.[24]

20
21 220 The response rate of 26% from serving Veterans, along with the unknown total number of
22
23 221 Veterans, raises the question of bias, the direction of which is difficult to assess, as

24
25 222 responses may be more likely from either Veterans with good or poor health. **The healthy
26
27 223 soldier effect is well known, service having a positive effect on wellbeing, with serving NZ**

28
29 224 **Veterans having good access to primary health care through the military system, but the**
30
31 225 **public health care system is the primary pathway to care for all Veterans, who are also**

32
33 226 **covered by the 'no fault' accident compensation scheme for accidental injuries and**
34
35 227 **occupational diseases.[25] Deployed Veterans may be at an advantage, but are covered by**

36
37 228 **NZVA only if their illness or injury is linked to a particular deployment, and the condition is**
38
39 229 **listed on the 'Statements of Principle' of the Australian Repatriation Medical Authority.[26]**

40
41 230 We also know that New Veterans tend to be stoic, so they might underestimate their health
42
43 231 concerns,[27] and there are likely to be other personal characteristics that we have not

44
45 232 measured. We were however able to adjust for deployment status, which did have a positive
46
47 233 association with health state. **In the interest of minimising responder burden, we used brief**

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49 234 **scales, which might reduce construct validity. Distress, sleep, psychological flexibility and**
50
51 235 **exposure to traumatic events are likely to be related, so collinearity was difficult to avoid.**

52
53 236 **The confounding effect was greatest for social support, but our finding does not mean that**
54
55 237 **social support is of no importance to Veterans.** The precision of the other coefficients may

56
57 238 also have been affected. Finally, the cross-sectional design means that we cannot explore
58
59 239 cause and effect, so recommendations for future interventions require additional support

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240 from longitudinal studies.

241 *Comparison with other studies*

1
2 242 We have previously reported factors associated with post-traumatic stress in this group,[28]
3
4 243 using the Military Post Traumatic Stress Checklist (PCL-M). Factors associated with higher PCL-
5
6 244 M scores were trauma exposure, older age, male gender, and being of Māori ethnicity. Factors
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8 245 associated with lower PCL-M scores were greater length of service, psychological flexibility,
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10 246 and better quality sleep. Using health as the outcome disclosed that Māori did not have poorer
11
12 247 self-reported health compared to non-Māori, that deployment had a positive effect, and in
13
14 248 the univariate models, all of the dimensions of social support were associated with improved
15
16 249 health. The final model also included good sleep and psychological flexibility, providing most
17
18 250 of the explanatory power in the model.
19
20 251 No other studies appear to have used the EQ-VAS as an outcome measure for Veteran health.
21
22 252 Boehmer et al.[29] examined wellbeing among participants in the 2000 Behavioural Risk
23
24 253 Factor Surveillance System describing health-related quality of life (HRQoL) by sex and military
25
26 254 status, active duty, reservists Veterans, or no military service. Participants were asked to rate
27
28 255 recent physical health, mental health, and activity limitation. Active duty men were more likely
29
30 256 than men without military service to report 14 or more days of activity limitation, pain, and
31
32 257 not enough rest in the past 30 days, the mobility and pain findings being similar to our sample.
33
34 258 Notably, the predominant reason for medical discharge from the British Armed Forces was
35
36 259 musculoskeletal problems.[30]
37
38 260 Contrary to our finding on deployment, there are reports indicating that non-deployed
39
40 261 personnel retain better health than those who have been deployed,[31] Diaz Santana et al.
41
42 262 having carried out a cross-sectional survey of 60,000 U.S. Veterans of Afghanistan and Iraq,
43
44 263 with 20,563 responses. In contrast to our finding, mental quality of life scores were higher
45
46 264 among the non-deployed group compared to the deployed group, though the deployed group
47
48 265 reported higher physical quality of life scores compared to the non-deployed. Again in
49
50 266 contrast, both mental and physical quality of life were lower among Veterans compared to
51
52 267 U.S. population norms.
53
54 268 Both positive and negative consequences of deployment have been described.[7,32] In a study
55
56 269 of Dutch Veterans,[7] two out of three reported a positive effect of deployment on their
57
58 270 quality of life at the time of the survey, this being related to positive feelings such as
59
60 271 satisfaction or comradeship, but a few having emotions such as frustration or shame. As
272 regards tangible effects,[32] negative consequences included the military 'chain of command',
273 being away from home, and deterioration of marital/significant other relationships. Positive
274 influences include improved financial security, self-improvement, and time to reflect.

1
2 275 We found sleep to be associated with better health, but sleep difficulties are a common
3
4 276 symptom for those with PTSD. McCarthy et al.[33] reported on the 3,157 U.S. military
5
6 277 Veterans enrolled in the National Health and Resilience in Veterans Study, in which 27.6%
7
8 278 reported poor sleep quality. Path analyses revealed significant associations between poor
9
10 279 sleep, severity of PTSD, poorer mental and physical health functioning and lower overall
11
12 280 quality of life.

13 281 *Future directions*

14
15 282 The results suggest that distress, psychological flexibility, and sleep have an important
16
17 283 relationship with self-rated health among Veterans in this study.

18
19 284 Reducing distress through the promotion of psychological flexibility might be possible,
20
21 285 although our finding here must be subject to caution as several researchers argue that the
22
23 286 AAQ-II may be measuring psychological distress and affect rather than psychological
24
25 287 inflexibility.[34] Psychological flexibility is specifically targeted by ACT, a psychological
26
27 288 intervention described as being in the 'third wave' of behaviour change strategies.[35] The six
28
29 289 core processes of ACT (acceptance, cognitive defusion, being present, self as context, values,
30
31 290 and committed action) aim to increase psychological flexibility, the goal being "to have clients
32
33 291 experience the world more directly so that their behavior is more flexible and thus their
34
35 292 actions more consistent with the values that they hold." [35] Approaches such as ACT may
36
37 293 therefore improve health state and has been shown to improve pain acceptance and
38
39 294 psychological flexibility [36]. Lang et al. carried out a randomised clinical trial (RCT), comparing
40
41 295 ACT with person-centred therapy,[37] showing a general improvement in symptoms of
42
43 296 distress across both treatment arms, ACT providing superior improvement in insomnia. The
44
45 297 drop-out rate for both therapies was however high, and the two groups did not exhibit any
46
47 298 change in psychological flexibility. The authors proposed that future studies should include
48
49 299 additional measures of ACT processes to determine which are actually affected by ACT.

50
51 300 Sleep in military personnel has been recognised as a 'vital health behaviour' for which policies
52
53 301 and guidelines must be developed.[38] Cognitive behavioural therapy for insomnia (CBT-I) is
54
55 302 regarded as an effective 'first line' treatment, and a brief intervention has been described for
56
57 303 use in Australian general practice.[39] The Lang et al. trial[37] showed CBT-I to be effective,
58
59 304 however future studies should include outcome measures that include ACT processes. Our
60
305 final model showed that distress had a negative association with health, and psychological
306 flexibility had a positive relationship, with sleep most likely related to both of these variables.
307 It would seem important to screen for these conditions prior to transition from the military,

1
2 308 as well as among retired Veterans, in order to provide targeted support. Further research is
3
4 309 needed to examine the potential of CBT to improve Veterans' wellbeing.

5
6 310 Figure 1 Caption.

7 311 **The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension**
8
9 312 **scores compared to the NZ population normative proportions**

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412 DATA SHARING STATEMENT

413 Data from this study is unsuitable for public deposition due to the privacy of participant data.
414 Data are anonymised, but contain information on deployments (including location and
415 duration), which could lead to some participants being identified. Furthermore, the
416 participant information sheet, as required by the Southern Health and Disability Ethics
417 Committee specifically contains the statement that 'all study data would be kept strictly
418 confidential to the research team.' Qualified researchers may apply for data access with the
419 research team at veterans.health@otago.ac.nz and/or hdecs@moh.govt.nz.

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424 COMPETING INTERESTS

425 None declared.

426 CONTRIBUTION

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437 **Writing – original draft:** David McBride. AS, DG, EHW, SD and DS contributed to the re-writes
438 and final draft

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446 rather tedious questionnaire. Kia Kaha.

For peer review only



The Psychological and Physical Health and Wellbeing of New Zealand Current and Former Service Personnel

We are researchers from the University of Otago, Massey University and AUT, and we are interested in learning more about ways to help current and former New Zealand service personnel maintain their wellbeing. While many personnel do very well during and after their deployment experiences, some can struggle with physical and mental health problems. We would like to know more about how to help identify when personnel might need extra support.

For this study, we would like to invite you to fill out a questionnaire, which will take about 45 minutes. Participation is completely voluntary and you may withdraw from the study at any time without any risk or disadvantage to you. You are under no obligation to answer all questions presented in it. You may skip any questions that you do not want to answer. All information will be kept confidential, and no material that could identify you will be used in any report on this study.

Please note that the survey is unclassified, and that all information and any comments are at the unclassified level. This survey is being conducted in compliance with DFO 3.14[5] Authority to Conduct Personnel Research.

If you would like more information, please contact David McBride on either 03 479 7208 or 027 253 5451.

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David is a LtCol in the RNZAMC and a reservist, but is carrying out this project in his University capacity. The NZDF will not have access to the data.

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This study is being carried out with the support of Lottery Health and the War Pensions Medical Research Trust Fund. The study has received ethical approval from the Northern B Health and Disability Ethics Committee.

Instructions for completing this survey:

- * Please use Black or Blue pen only to complete this survey
- * When completing Alpha Numeric data collection boxes for optimum accuracy, please print in capital letters and use the number formats and avoid contact with the edge of the box.

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

0	1	2	3	4	5	6	7	8	9
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- * When completing a choice question please colour-in the whole circle.
 - 1 2 3 4
- * If an error is found after a question has been answered please colour-in the correct answer and place a tick next to the correct answer circle.
 - 1 2 3 4 ✓
- * The free text line is a single line for text entry only and will only accommodate text to the size of the line. Any other comments or written information placed anywhere else will be ignored and not captured

SECTION A: PERSONAL DETAILS

ID No

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1. Are you male or female? Male Female

2. What is your date of birth?

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day
month
year

3. Which ethnic group or groups do you belong to ?

New Zealand European

New Zealand Māori

Other (please specify)

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4. What is your service number?

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SECTION B: JOB HISTORY

1. With which branch of the NZDF did you serve?

Navy

Army

Airforce

2. What year did you first join the NZDF?

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year

3. Are you still a serving member of the NZDF ? Yes No

4. How many years did you serve?

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5. What is your current rank or what was your rank when you left the NZDF?

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SECTION C: HEALTH AND WELLBEING

ID No

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C1. HEALTH AND WELLBEING: RECENT HEALTH SYMPTOMS AND MULTI SYMPTOMS ILLNESS

We would like to know about your health in the last six months.

Please indicate whether or not you have suffered any of the following symptoms in the last six months, and if so, please indicate whether your symptoms were mild, moderate, or severe in nature.

Please don't spend too long thinking about each symptom, just provide the first response that comes to mind.

Symptoms: Have you experienced Please colour in the circle if you have this symptom	Are the symptoms Choose one and colour the circle	How long have you had the symptom? Choose one and colour the circle
Loss of concentration <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Feeling distant from others <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Unrefreshed after sleep <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Forgetfulness <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Loss of interest in sex <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Problems with sexual functioning <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Sleeping difficulties <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Avoiding doing things or situations <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months



ID No

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Symptoms: Have you experienced <i>Please colour in the circle if you have this symptom</i>	Are the symptoms <i>Choose one and colour the circle</i>	How long have you had the symptom? <i>Choose one and colour the circle</i>
Fatigue <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Irritability / Outbursts of anger <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Distressing dreams <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Feeling jumpy / easily startled <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Difficulty finding the right word <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Increased sensitivity to noise <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Alcohol intolerance <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Passing urine more often <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Shaking <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Difficulty speaking <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months



ID No

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Symptoms: Have you experienced <i>Please colour in the circle if you have this symptom</i>	Are the symptoms <i>Choose one and colour the circle</i>	How long have you had the symptom? <i>Choose one and colour the circle</i>
Night sweats <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Increased sensitivity to smell <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Loss of or decrease in appetite <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Headaches <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Dizziness or blackouts <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Increased sensitivity to light <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Loss of balance or coordination <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Ringling ears <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Flatulence or burping <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Itchy or painful eyes <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months



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Symptoms: Have you experienced <i>Please colour in the circle if you have this symptom</i>	Are the symptoms <i>Choose one and colour the circle</i>	How long have you had the symptom? <i>Choose one and colour the circle</i>
Double vision <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Loss of sensation in hands / feet <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Constipation <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Persistent cough <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Unintended weight gain >4Kg <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Rapid or pounding heartbeat <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Tingling or burning sensation in hands / feet <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Dry mouth <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Pain in several joints (no swelling or redness) <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Rash or skin irritation <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months



ID No

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Symptoms: Have you experienced <i>Please colour in the circle if you have this symptom</i>	Are the symptoms <i>Choose one and colour the circle</i>	How long have you had the symptom? <i>Choose one and colour the circle</i>
Diarrhoea <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Low back pain <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Skin infections <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Mouth ulcers <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Chest pain <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Toothache <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Stomach cramps <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Nausea <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Stiffness in several joints <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Indigestion <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months



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Symptoms: Have you experienced <i>Please colour in the circle if you have this symptom</i>	Are the symptoms <i>Choose one and colour the circle</i>	How long have you had the symptom? <i>Choose one and colour the circle</i>
Muscle aches or pains <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Wheezing <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Feeling feverish <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Tender / Painful swelling of lymph glands <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Shortness of breath <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months
Sore throat <input type="radio"/>	<input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe	<input type="radio"/> Less than 6 months <input type="radio"/> More than 6 months



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C2. HEALTH AND WELLBEING: POST-TRAUMATIC STRESS

Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, then colour in the circle that indicates how much you have been bothered by that problem in the past month.

	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Repeated, disturbing memories, thoughts, or images of a stressful military experience?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Repeated, disturbing dreams of a stressful military experience?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Suddenly acting or feeling as if a stressful military experience were happening again (as if you were reliving it)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Feeling very upset when something reminded you of a stressful military experience?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of a stressful military experience?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Avoiding thinking about or talking about a stressful military experience or avoiding having feelings related to it?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Avoiding activities or situations because they reminded you of a stressful military experience?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Trouble remembering important parts of a stressful military experience?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Loss of interest in things that you used to enjoy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Feeling distant or cut off from other people?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Feeling emotionally numb or being unable to have loving feelings for those close to you?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Feeling as if your future will somehow be cut short?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Trouble falling or staying asleep?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



ID No

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Not at all A little bit Moderately Quite a bit Extremely

14. Feeling irritable or having angry outbursts? — — — —

15. Having difficulty concentrating? — — — —

16. Being "super alert" or watchful on guard? — — — —

17. Feeling jumpy or easily startled? — — — —

C3. HEALTH AND WELLBEING: SOCIAL SUPPORT

Please indicate to what extent each statement describes your current relationships with other people. So, for example, if you feel a statement is very true of your current relationships, you would respond with a strongly agree. If you feel a statement clearly does not describe your relationships, you would respond with a strongly disagree.

Strongly Disagree Disagree Agree Strongly Agree

1. There are people I can depend on to help me if I really need it. — — —

2. I feel that I do not have close personal relationships with other people. — — —

3. There is no one I can turn to for guidance in times of stress. — — —

4. There are people who depend on me for help. — — —

5. There are people who enjoy the same social activities I do. — — —

6. Other people do not view me as competent. — — —

7. I feel personally responsible for the well-being of another person. — — —

8. I feel part of a group of people who share my attitudes and beliefs. — — —

9. I do not think other people respect my skills and abilities. — — —

10. If something went wrong, no one would come to my assistance. — — —

11. I have close relationships that provide me with a sense of emotional security and well-being. — — —



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60

ID No

Strongly Disagree Disagree Agree Strongly Agree

12. There is someone I could talk to about important decisions in my life. — — —

13. I have relationships where my competence and skill are recognized. — — —

14. There is no one who shares my interests and concerns. — — —

15. There is no one who really relies on me for their well-being. — — —

16. There is a trustworthy person I could turn to for advice if I were having problems. — — —

17. I feel a strong emotional bond with at least one other person. — — —

18. There is no one I can depend on for aid if I really need it. — — —

19. There is no one I feel comfortable talking about problems with. — — —

20. There are people who admire my talents and abilities. — — —

21. I lack a feeling of intimacy with another person. — — —

22. There is no one who likes to do the things I do. — — —

23. There are people who I can count on in an emergency. — — —

24. No one needs me to care for them. — — —



ID No

C4. HEALTH AND WELLBEING: PSYCHOLOGICAL FLEXIBILITY AND COPING

Below you will find a list of statements. Please rate how true each statement is for you by colouring the appropriate circle.



Never True Very Seldom True Seldom True Sometimes True Frequently True Almost Always True Always True

- 1. It's OK if I remember something unpleasant. — — — — — —
- 2. My painful experiences and memories make it difficult for me to live a life that I would value. — — — — — —
- 3. I'm afraid of my feelings. — — — — — —
- 4. I worry about not being able to control my worries and feelings. — — — — — —
- 5. My painful memories prevent me from having a fulfilling life. — — — — — —
- 6. I am in control of my life. — — — — — —
- 7. Emotions cause problems in my life. — — — — — —
- 8. It seems like most people are handling their lives better than I am. — — — — — —
- 9. Worries get in the way of my success. — — — — — —
- 10. My thoughts and feelings get in the way of how I want to live my life. — — — — — —



ID No

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C5. HEALTH AND WELLBEING: GENERAL HEALTH

We would like to know how you have been feeling over the past few weeks.



Please colour in the circle that most closely describes your experience in each question.

Have you recently?

- | | | | | |
|---|-----------------------|-----------------------|-----------------------|----------------------------|
| | Better
than usual | Same as
usual | Less than
usual | Much
less than
usual |
| 1. Been able to concentrate on what you're doing? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- | | | | | |
|--------------------------------|-----------------------|-----------------------|---------------------------|----------------------------|
| | Not at
all | No more
than usual | Rather more
than usual | Much
more than
usual |
| 2. Lost much sleep over worry? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- | | | | | |
|---|-----------------------|-----------------------|---------------------------|-----------------------|
| | More so
than usual | Same as
usual | Less useful
than usual | Much less
useful |
| 3. Felt you were playing a useful part in things? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|
| | More so
than usual | Same as
usual | Less so
than usual | Much less
capable |
| 4. Felt capable of making decisions about things? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- | | | | | |
|----------------------------------|-----------------------|-----------------------|---------------------------|----------------------------|
| | Not at
all | No more
than usual | Rather more
than usual | Much
more than
usual |
| 5. Felt constantly under strain? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- | | | | | |
|--|-----------------------|-----------------------|---------------------------|----------------------------|
| | Not at
all | No more
than usual | Rather more
than usual | Much
more than
usual |
| 6. Felt you couldn't overcome your difficulties? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- | | | | | |
|--|-----------------------|-----------------------|-----------------------|----------------------------|
| | More so
than usual | Same as
usual | Less so
than usual | Much
less than
usual |
| 7. Been able to enjoy your normal day-to-day activities? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
- | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|
| | More so
than usual | Same as
usual | Less so
than usual | Much
less able |
| 8. Been able to face up to your problems? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |



ID No

Not at all No more than usual Rather more than usual Much more than usual

9. Been feeling unhappy and depressed?

— — — — — — — — —

10. Been losing confidence in yourself?

Not at all No more than usual Rather more than usual Much more than usual

— — — — — — — — —

11. Been thinking of yourself as a worthless person?

Not at all No more than usual Rather more than usual Much more than usual

— — — — — — — — —

12. Been feeling reasonably happy, all things considered?

More so than usual About same as usual Less so than usual Much less than usual

— — — — — — — — —

C6. HEALTH AND WELLBEING: GENERAL HEALTH

Under each heading, please colour in the **ONE** circle that best describes your health **TODAY**.

INTELLECTUAL ACTIVITIES

- I have no problems with intellectual activities
- I have slight problems with intellectual activities
- I have moderate problems with intellectual activities
- I have severe problems with intellectual activities
- I am unable to perform intellectual activities



ID No

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C6. HEALTH AND WELLBEING: GENERAL HEALTH

Under each heading, please colour in the **ONE** circle that best describes your health **TODAY**.

**MOBILITY**

- I have no problems in walking about
- I have slight problems in walking about
- I have moderate problems in walking about
- I have severe problems in walking about
- I am unable to walk about

SELFT-CARE

- I have no problems washing or dressing myself
- I have slight problems washing or dressing myself
- I have moderate problems washing or dressing myself
- I have severe problems washing or dressing myself
- I am unable to wash or dress myself

USUAL ACTIVITIES (e.g. work, study, housework, family or leisure activities)

- I have no problems doing my usual activities
- I have slight problems doing my usual activities
- I have moderate problems doing my usual activities
- I have severe problems doing my usual activities
- I am unable to do my usual activities



ID No

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PAIN / DISCOMFORT

- I have no pain or discomfort
- I have slight pain or discomfort
- I have moderate pain or discomfort
- I have severe pain or discomfort
- I have extreme pain or discomfort

ANXIETY / DEPRESSION

- I am not anxious or depressed
- I am slightly anxious or depressed
- I am moderately anxious or depressed
- I am severely anxious or depressed
- I am extremely anxious or depressed



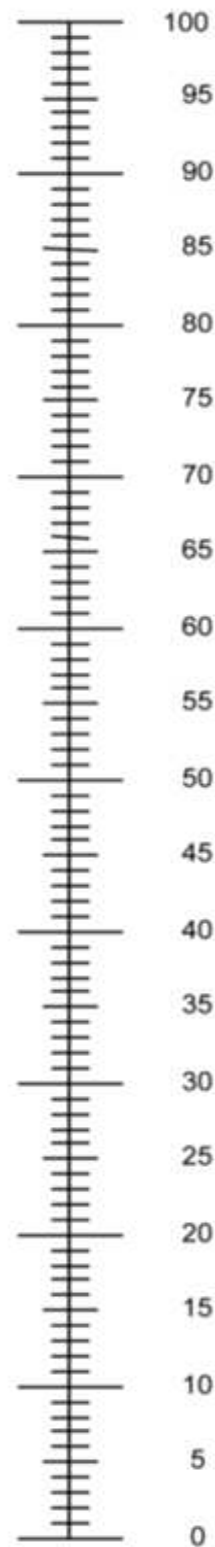
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ID No

- We would like to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine.
- 0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.
- Now, please write the number you marked on the scale in the box below

YOUR HEALTH TODAY =

The best health
you can imagine



The worst health
you can imagine



ID No

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C7. HEALTH AND WELLBEING: SLEEP CONDITION

The following questions relate to your usual sleep condition during the past month only.
For each of the questions, colour in the one best response. Please answer all questions.



Thinking about a typical night in the last month ...

1. How long does it take you to fall asleep?

- 0 - 15 minutes
- 16 - 30 minutes
- 31 - 45 minutes
- 46 - 60 minutes
- ≥ 61 minutes

2. If you then wake up during the night ... how long are you awake for in total? (add all the awakenings up)

- 0 - 15 minutes
- 16 - 30 minutes
- 31 - 45 minutes
- 46 - 60 minutes
- ≥ 61 minutes

3. How many nights a week do you have a problem with your sleep?

- 0 - 1
- 2
- 3
- 4
- 5 - 7

4. How would you rate your sleep quality?

- Very good
- Good
- Average
- Poor
- Very poor



ID No

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Thinking about the past month, to what extent has poor sleep . . .

5. Affected your mood, energy, or relationships?

- Not at all
- A little
- Somewhat
- Much
- Very much

6. Affected your concentration, productivity, or ability to stay awake?

- Not at all
- A little
- Somewhat
- Much
- Very much

7. Troubles you in general?

- Not at all
- A little
- Somewhat
- Much
- Very much

Finally . . .

8. How long have you had a problem with your sleep?

- I don't have a problem / < 1 mo
- 1 - 2 mo
- 3 - 6 mo
- 7 - 12 mo
- > 1 year



ID No

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C8. HEALTH AND WELLBEING: ALCOHOL AND DRUG USE

Because alcohol use can affect your health and can interfere with certain medications and treatments, it is important that we ask some questions about your use of alcohol. Your answers will remain confidential so please be honest.

Please colour in **one** circle that best describes your answer to each question.

1. How often do you have a drink containing alcohol?

- Never
- Monthly or less
- 2 - 4 times a month
- 2 - 3 times a week
- 4 or more times a week

2. How many standard drinks containing alcohol do you have on a typical day?

- 1 or 2
- 3 or 4
- 5 or 6
- 7, 8 to 9
- 10 or more

3. How often do you have six or more drinks on one occasion?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily



ID No


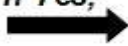
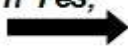
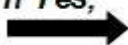

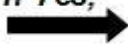

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C9. HEALTH AND WELLBEING: TRAUMATIC EXPOSURE

The following questions ask about events that may be extraordinarily stressful or disturbing for almost everyone. Please colour in the "Yes" or "No" circle to report what has happened to you.

If you answer "Yes" for an event, please answer any additional questions that are listed on the right side of the page to report: (1) whether you thought your life was in danger or you might be seriously injured; and (2) whether you were seriously injured.

If you answer "No" for an event, go on to the next event.

Event	Has this ever happened to you?	If the event happened, did you think your life was in danger or you might be seriously injured?	If the event happened, were you seriously injured?
1. Have you ever served in a war zone, or have you ever served in a noncombat job that exposed you to war-related casualties (for example, as a medic or on graves registration duty)?	<input type="radio"/> No <input type="radio"/> Yes	If Yes,  <input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> Yes
2. Have you ever been in a serious car accident, or a serious accident at work or somewhere else?	<input type="radio"/> No <input type="radio"/> Yes	If Yes,  <input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> Yes
3. Have you ever been in a major natural or technological disaster, such as fire, tornado, hurricane, flood, earthquake, or chemical spill?	<input type="radio"/> No <input type="radio"/> Yes	If Yes,  <input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> Yes
4. Have you ever had a life-threatening illness such as cancer, a heart attack, leukemia, AIDS, multiple sclerosis, etc?	<input type="radio"/> No <input type="radio"/> Yes	If Yes,  <input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> Yes
5. Before age 18, were you ever physically punished or beaten by a parent, caretaker, or teacher so that: you were very frightened; or you thought you would be injured; or you received bruises, cuts, welts, lumps or other injuries?	<input type="radio"/> No <input type="radio"/> Yes	If Yes,  <input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> Yes
6. Not including any punishments or beatings you already reported in Question 5 , have you ever been attacked, beaten or mugged by anyone, including friends, family members or strangers?	<input type="radio"/> No <input type="radio"/> Yes	If Yes,  <input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> Yes
7. Has anyone ever made or pressured you into having some type of unwanted sexual contact? Note: By sexual contact we mean any contact between someone else and your private parts or between you and someone else's private parts.	<input type="radio"/> No <input type="radio"/> Yes	If Yes,  <input type="radio"/> No <input type="radio"/> Yes	<input type="radio"/> No <input type="radio"/> Yes

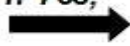
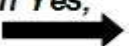


ID No

The following questions ask about events that may be extraordinarily stressful or disturbing for almost everyone. Please colour in the "Yes" or "No" circle to report what has happened to you.

If you answer "Yes" for an event, please answer any additional questions that are listed on the right side of the page to report: (1) whether you thought your life was in danger or you might be seriously injured; and (2) whether you were seriously injured.

If you answer "No" for an event, go on to the next event.

Event	Has this ever happened to you?	If the event happened, did you think your life was in danger or you might be seriously injured?	If the event happened, were you seriously injured?
8. Have you ever been in any other situation in which you were seriously injured, or have you ever been in any other situation in which you feared you might be seriously injured or killed?	<input type="radio"/> No <input type="radio"/> Yes	If Yes, 	<input type="radio"/> No <input type="radio"/> Yes
9. Has a close family member or friend died violently, for example, in a serious car crash, mugging, or attack?	<input type="radio"/> No <input type="radio"/> Yes	If Yes, 	<input type="radio"/> No <input type="radio"/> Yes
10. Have you ever witnessed a situation in which someone was seriously injured or killed, or have you ever witnessed a situation in which you feared someone would be seriously injured or killed?	<input type="radio"/> No <input type="radio"/> Yes		
Note: Do not answer "YES" for any event you already reported in Questions 1-9.			



ID No

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SECTION D: DEPLOYMENTS

D1. Have you been on active deployment (war or peacekeeping)? This doesn't include training exercises or goodwill visits (flying the flag).

Yes

No ***If No, then GO TO SECTION E***

D2. In the table below please write where you were actively deployed and the year in which you were deployed. Remember that this doesn't include training exercises or goodwill visits (flying the flag).

Deployment / mission:

Year of Deployment:

	Deployment / mission:	Year of Deployment:				
1.		<table border="1"><tr><td></td><td></td><td></td><td></td></tr></table>				
2.		<table border="1"><tr><td></td><td></td><td></td><td></td></tr></table>				
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6.		<table border="1"><tr><td></td><td></td><td></td><td></td></tr></table>				
7.		<table border="1"><tr><td></td><td></td><td></td><td></td></tr></table>				



ID No

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SECTION E: FINAL PERSONAL DETAILS

1. What is your current marital status?

- Married Widowed
- De facto relationship Single, never married
- Separated Other (please specify)
- Divorced

--

2. Which category best describes the highest educational qualification you have completed?

- No qualifications
- Secondary school
- University degree or equivalent
- Other post-secondary school qualification

3. What is your current occupation?

- Paid employment full-time Retired
- Paid employment part-time / casual Not working
- Volunteer / community work Unemployed
- Student Other (please specify)
- Home duties

--

4. What is your total annual income (before tax)?

- \$20,000 or less
- \$20,001 - \$30,000
- \$30,001 - \$50,000
- \$50,001 - \$70,000
- \$70,001 - \$100,000
- \$100,001 or more
- Unsure



Supplementary Table: Number of participants and EQ-VAS scores according to sample characteristics

Exposure variable	N (%)	Mean (SD)
All	1767	74.4 (17.1)
Age group (years)		
20-29	136 (7.7)	77.7 (14.4)
30-39	328 (18.6)	77.0 (16.2)
40-49	438 (24.8)	76.1 (14.6)
50-59	350 (19.8)	74.8 (16.6)
60-69	285 (16.1)	71.4 (19.8)
70-79	175 (9.9)	69.4 (19.4)
80+	50 (2.8)	66.2 (20.3)
Missing	5 (0.3)	61.2 (22.1)
Gender		
Female	220 (12.5)	<u>75.0</u> (16.9)
Male	1520 (86.0)	74.4 (17.2)
Missing	27 (1.5)	<u>70.3</u> (17.2)
Ethnicity (prioritised)		
NZ European	1382 (78.2)	74.4 (17.1)
Māori	245 (13.9)	75.6 (16.1)
Other	140 (7.9)	71.5 (19.3)
Service years		
0-9	339 (19.2)	69.9 (19.7)
10-19	478 (27.1)	74.5 (17.9)
20-29	530 (30.0)	75.3 (15.9)
30-39	254 (14.4)	76.3 (14.6)
40+	69 (3.9)	75.4 (16.4)
Missing	97 (5.5)	78.8 (14.2)
Deployment (ever)		
No	288 (16.3)	69.5 (19.9)
Yes	1458 (82.5)	75.3 (16.4)
Missing	21 (1.2)	75.6 (14.6)
GHQ12 Score		
0-9	652 (36.9)	82.0 (12.6)
10-19	972 (55.0)	72.3 (16.0)
20-29	123 (7.0)	54.3 (20.3)
30+	18 (1.0)	46.2 (24.4)
Missing	2 (0.1)	-

*sub-scores not used in multivariable models.

Supplementary table contd.

Social support full score		
24-29	0	0 -
30-39	3	(0.2) 66.7 (15.3)
40-49	15	(0.8) 44.5 (22.5)
50-59	97	(5.5) 62.4 (21.8)
60-69	351	(19.9) 69.0 (18.2)
70-79	643	(36.4) 75.1 (15.0)
80-89	409	(23.1) 78.0 (15.0)
90-96	235	(13.3) 81.9 (13.9)
Missing	14	(0.8) 58.1 (25.6)
Social support sub-scores		
Attachment*		
4-7	51	(3.5) 61.4 (23.4)
8-11	516	(29.2) 68.7 (18.0)
12-16	1193	(67.5) 77.5 (15.5)
Missing	7	(0.4) 61.0 (19.7)
Social integration*		
4-7	20	(1.1) 56.2 (25.1)
8-11	429	(24.3) 67.1 (19.4)
12-16	1309	(74.8) 77.1 (15.2)
Missing	9	(0.5) 58.7 (21.5)
Reassurance of worth*		
4-7	37	(2.1) 59.1 (19.5)
8-11	504	(28.5) 69.0 (19.1)
12-16	1215	(68.8) 77.2 (15.2)
Missing	11	(0.6) 62.0 (24.9)
Reliable Alliance*		
4-7	20	(1.1) 49.6 (22.2)
8-11	251	(14.2) 66.9 (20.1)
12-16	1489	(84.3) 76.0 (15.9)
Missing	7	(0.4) 61.0 (19.7)
Guidance sub-score*		
4-7	36	(2.0) 59.2 (22.2)
8-11	387	(21.9) 68.7 (18.9)
12-16	1337	(75.7) 76.6 (15.7)
Missing	7	(0.4) 54.6 (21.6)
Opportunity for nurturance*		
4-7	29	(1.6) 69.3 (18.9)
8-11	413	(23.4) 71.9 (18.8)
12-16	1316	(74.5) 75.4 (16.4)
Missing	9	(0.5) 58.7 (21.5)

Supplementary table, contd.

**Psychological flexibility score
(AAQii score).**

10-19	5 (0.3)	23.2 (13.8)
20-29	40 (2.3)	49.1 (22.1)
30-39	147 (8.3)	63.0 (18.6)
40-49	43 (24.7)	68.5 (16.8)
50-59	664 (37.6)	77.1 (13.9)
60-70	457 (25.9)	82.5 (13.5)
Missing	1 (1.0)	69.6 (20.5)

Sleep Condition Indicator (SCI score)

0 to <2	67 (3.8)	51.2 (22.3)
2 to <4	264 (14.9)	62.2 (19.5)
4 to <6	646 (36.6)	74.3 (14.6)
6 to <8	384 (21.7)	77.6 (14.2)
8 to 10	386 (21.8)	83.5 (12.2)
Missing	20 (1.1)	77.3 (12.8)

AUDIT-C score

Non-hazardous	776 (43.9)	74.0 (17.4)
Hazardous	915 (51.8)	74.6 (16.9)
Missing	76 (4.3)	75.0 (17.0)

**Brief Trauma Questionnaire
(DSM-IV criteria)**

Not exposed	544 (30.8)	78.3 (15.1)
Exposed	1210 (68.5)	72.5 (17.8)
Missing	13 (0.7)	80.6 (8.1)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	Indicate the study's design with a commonly used term in the title or the abstract. Yes, a cross sectional study, p1 title. (b) Provide in the abstract an informative and balanced summary of what was done and what was found Background, results and conclusions, p 1
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Introduction p2.
Objectives	3	State specific objectives, including any prespecified hypotheses p2, lines 59 and 60
Methods		
Study design	4	Present key elements of study design early in the paper p2 line 62 to page 5 line 145
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Participants, page2 line 63-page 3 line 83.
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants page 2 line 64 to page 3, line 68.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Questionnaire, pp 3-5.
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 as above
Bias	9	Describe any efforts to address potential sources of bias Methods, page 3. Lines 76-83.
Study size	10	Explain how the study size was arrived at p5 line 137
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Cases defined through the Multivariable logistic regression with the EQ-Visual analogue scale as the outcome measure, p5 lines 131-136
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Backward elimination process p5 lines 134-135 (b) Describe any methods used to examine subgroups and interactions By multivariable logistic regression, p5 as above (c) Explain how missing data were addressed p4 lines 122-125 (d) If applicable, describe analytical methods taking account of sampling strategy N/A (e) Describe any sensitivity analyses N/A
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 Potentially eligible lines 68-73 p 3 (b) Give reasons for non-participation at each stage N/A (c) Consider use of a flow diagram N/A

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders page 5 et seq, table 1 (b) Indicate number of participants with missing data for each variable of interest ' n used ' columns tables 2 and 3.
Outcome data	15*	Report numbers of outcome events or summary measures as per tables
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Tables, adjusted for age, sex, service years and deployment status. (b) Report category boundaries when continuous variables were categorized. Independent variables, p 3 and 4, EQ-VAS is a continuous scale. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
Discussion		
Key results	18	Summarise key results with reference to study objectives Discussion, p11 first para
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 Discussion lines 215 et seq.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Discussion, p12 lines 230 et seq.
Generalisability	21	Discuss the generalisability (external validity) of the study results p17, line 215 et seq.
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 Funding, p18

*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 www.strobe-statement.org.

BMJ Open

Factors associated with self-reported health among New Zealand military veterans: a cross-sectional study.

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-056916.R2
Article Type:	Original research
Date Submitted by the Author:	18-Apr-2022
Complete List of Authors:	McBride, David; University of Otago Dunedin School of Medicine, Department of Preventive and Social Medicine Samaranayaka, Ariyapala; University of Otago Division of Health Sciences, Biostatistics Centre Richardson, Amy; University of Otago Dunedin School of Medicine, Preventive and Social Medicine Gardner, D; Massey University, Department of Psychology Shepherd, Daniel; Auckland University of Technology, Health Sciences Wyeth, Emma; University of Otago, Ngāi Tahu Māori Health Research Unit de Graaf, Brandon; University of Otago Dunedin School of Medicine, Injury Prevention Research Unit Derrett, Sarah; University of Otago Dunedin School of Medicine, Preventive and Social Medicine
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Occupational and environmental medicine, Public health
Keywords:	EPIDEMIOLOGY, OCCUPATIONAL & INDUSTRIAL MEDICINE, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MENTAL HEALTH, Musculoskeletal disorders < ORTHOPAEDIC & TRAUMA SURGERY

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1
2
3 1 **FACTORS ASSOCIATED WITH SELF-REPORTED HEALTH AMONG NEW ZEALAND**
4
5 2 **MILITARY VETERANS: A CROSS-SECTIONAL STUDY**

6
7 3 David McBride,¹ Ari Samaranayaka², Amy Richardson,¹ Dianne Gardner,³ Daniel Shepherd,⁴
8
9 4 Emma H. Wyeth⁵, Brandon deGraaf,⁶ Sarah Derrett.¹

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28
29 14 **Keywords:**

30
31 15 Military Medicine

32
33 16 Quality of Life

34
35 17 Risk Factors

36
37 18 Protective Factors

38
39 19 Point Prevalence

40
41 20 **Word count**

42
43 21 3132

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56
57 28

1
2 29 **ABSTRACT**
3

4 30 **Objective**

5 31 To identify factors associated with better or poorer self-reported health status in New Zealand
6
7 32 military Veterans.

8
9 33 **Design**

10 34 A cross-sectional survey.

11
12 35 **Participants**

13 36 The participants of interest were the 3,874 currently serving Veterans who had been deployed
14
15 37 to a conflict zone, but all Veterans were eligible to participate.

16
17 38 **Study variables**

18 39 The EQ-5D-5L, asking about problems across five dimensions (mobility, self-care, usual
19
20 40 activities, pain or discomfort, and anxiety or depression), with five levels of severity (e.g. no,
21
22 41 slight, moderate, severe or extreme problems), also containing a visual analogue scale (EQ-
23
24 42 VAS), scaled from 0 (worst) to 100 (best) imagined health, assessed health status. Hypothetical
25
26 43 relationships with better health were positive social support, sleep and psychological
27
28 44 flexibility; with poorer health, post-traumatic stress, exposure to psychological trauma,
29
30 45 distress and hazardous drinking.

31
32 46 **Results:**

33 47 The EQ5-D was completed by 1767 Veterans, 1009 serving, a response rate of 26% from that
34
35 48 group, 1767 completing the EQ5-D, 1458 who had deployed, 288 who had not, and the 21
36
37 49 who did not provide deployment data. Of these 247 were not used in the analysis due to
38
39 50 missing values in one or more variables, leaving 1,520 for analysis.

40 51 A significantly higher proportion of Veterans reported 'any problems' rather than 'no
41
42 52 problems' with four EQ-5D dimensions: mobility, self-care, usual activities and pain or
43
44 53 discomfort, but no difference in anxiety or depression. Age, length of service, deployment,
45
46 54 psychological flexibility and better sleep quality were associated with higher EQ-VAS scores;
47
48 55 distress with lower EQ-VAS scores.

49
50 56 **Conclusion:**

51 57 In this sample of New Zealand Veterans, psychological flexibility and good sleep are associated
52
53 58 with better self-rated health, and distress and poor sleep with diminished health. These
54
55 59 factors might be used as sentinel health indicators in assessing Veteran health status, and
56
57 60 cognitive behavioural therapy encompassing these domains may be useful in improving the
58
59 61 health of New Zealand Veterans.
60

1
2 **62 Keywords:**

3
4 63 Self-rated health, wellbeing, EQ-5D, Veterans, deployment, military, risk factors.

5
6 **64 Strengths and limitations of this study**

- 7
8
9 65 • Many studies of Veterans have focused on adverse outcomes, but we have been able
10
11 66 to focus on a holistic measure of 'health'.
12
13 67 • The study was sufficiently powered to detect important relationships indicating
14
15 68 opportunities for intervention.
16
17 69 • The exact response rate is unknown, and sampling bias may be a limitation.
18
19 70 • The cross-sectional design means that we cannot explore cause and effect
20
21 71 relationships.

22
23 **72 INTRODUCTION**

24
25 73 The three major events in the military life course are entry to military service, deployment on
26
27 74 active service and transition back to civilian life. On entry, soldiers, sailors and air personnel
28
29 75 are subject to a selection process to ensure, as far as possible, good physical and mental
30
31 76 health, giving rise to the 'healthy soldier effect,' with service personnel being, on average,
32
33 77 healthier than the general population.[1] However, the physical and psychological stressors
34
35 78 of military service have been found to erode this effect.[2]

36
37 79 The physical stressors have a particular impact on the lower limb, with load carriage, high
38
39 80 intensity training and the design of footwear being implicated in injury causation.[3] A military
40
41 81 career also increases opportunities for psychological trauma, and post-traumatic stress
42
43 82 disorder (PTSD) has been identified as the 'signature injury' of United States service men and
44
45 83 women deployed to Afghanistan and Iraq.[4]

46
47 84 A focus on adverse health events in the literature[5] means that wellbeing is relatively
48
49 85 overlooked. In the long run, military service has been found to have positive effects.[6,7]
50
51 86 Good health after service does, however, depend on the success of the 'military civilian
52
53 87 transition', a complex process for which models have been developed.[8] Health problems
54
55 88 developed in service, difficulty in assuming a post-service identity and many other factors
56
57 89 contribute to health and wellbeing outcomes.[8] In New Zealand, military Veterans can only
58
59 90 access assistance from New Zealand Veteran's Affairs (NZVA) if they have undertaken
60
61 91 'qualifying operational service' as defined by the Veteran Support Act 2014,[9] thus being
62
63 92 Veterans in a legal sense. NZVA support some 12,000 Veterans, with an average age of 80
64
65 93 years, 5000 being actively case managed.[10] The majority will have seen operational service
66
67 94 in Korea, Borneo, Malaya and Vietnam. Post-Vietnam, smaller numbers deployed on United

1
2 95 Nations and other missions, but the tempo of operations rose with the deployment to
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4 96 Bosnia in 1992, and some 9,000-10,000 'legal' Veterans deployed between then and the
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6 97 withdrawal of New Zealand troops from Afghanistan in 2021. The Ministerial Veteran's
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8 98 Health Advisory Panel, established under the Veteran Support Act, are specifically charged
9
10 99 with funding research on this 'contemporary Veteran' group, NZVA acknowledging that they
11
12 100 "have had different experiences, and have different needs, compared to the older veterans.
13
14 101 They are likely to have served in a number of deployments during their career, and come to
15
16 102 us with more complex health issues." [10]

17 103 The aims of this study were therefore to describe self-reported health among these Veterans,
18
19 104 and identify factors associated with better or poorer health.

20 105 **Veteran and public involvement**

21 106 The Ministerial Veterans Health Advisory Panel, [10] commissioned the study and advised on
22
23 107 the design. We also formed a steering group with representatives from the New Zealand
24
25 108 Defence Force, New Zealand Veterans Affairs, the Royal New Zealand Returned and Services
26
27 109 Association (RSA) [11] and No Duff, [12] a charity providing first response support to Veterans
28
29 110 and their families. We also consulted with the Ngāi Tahu Research Consultation Committee in
30
31 111 order to assess the importance of the project to Māori, New Zealand's indigenous population.
32
33 112 During consultation we undertook to inform the Veteran community before releasing the
34
35 113 results, to which end a link to the paper will be posted on the military social media sites where
36
37 114 the study was advertised, and to give all NZ Veterans, defined as anyone who had served in
38
39 115 the military, an opportunity to participate. Participants were not recruited as patients.

40 116 **METHODS**

41 117 **Participants**

42
43 118 Potential participants were currently serving Veterans, as indicated by holding the New
44
45 119 Zealand Operational Service Medal at the time of the survey, a total of 3,874 personnel at that
46
47 120 time; retired 'legal' Veterans in the community; and Veterans who had served, but had not
48
49 121 deployed to a conflict. Data were collected via an online survey, a postal version being
50
51 122 available on request. There is no comprehensive Veteran registry, however in July 2018, a link
52
53 123 to the online questionnaire was sent by email to the 3,874 currently serving regular and
54
55 124 reserve New Zealand Defence Force (NZDF) members registered on the NZDF email system
56
57 125 who were 'legal Veterans', as indicated by holding the New Zealand Operational Service
58
59 126 Medal. An introductory message and link to the questionnaire were also presented on the
60
127 NZDF 'intranet landing page', a secure internal webpage from which all regular force

1
2 128 personnel can access relevant work-related content, tools, and resources. Retired military
3
4 129 personnel were invited to participate through posters distributed to reserve units and the 43
5
6 130 local social clubs identified by the RSA national office to be 'Veteran active.' Paper
7
8 131 questionnaires with return postage envelopes were made available at these sites.
9
10 132 Announcements were also made on military social media pages, and both retired and
11
12 133 currently serving personnel were invited to participate through an announcement on the No
13
14 134 Duff website. The questionnaire was available for completion from June to December 2018.

15 135 **Ethics approval**

16 136 Ethics approval for the study was obtained from the Northern B Health and Disability Ethics
17
18 137 Committee, reference 17NTB118.

19 138 **Questionnaire**

20 139 *Criterion variable*

21
22 140 Self-rated health status was assessed using the EQ-5D-5L,[13] a short questionnaire asking
23
24 141 about the respondent's health across five dimensions: mobility, self-care, usual activities, pain
25
26 142 or discomfort and anxiety or depression, with response options ranging from (e.g.) 'no
27
28 143 problems', to 'extreme problems'. For each dimension, participants were categorised as
29
30 144 having 'any problems' if they selected any response other than 'no problems'.

31
32 145 Additionally, the EQ-5D-5L visual analogue scale (EQ-VAS) asks the respondent to mark on a
33
34 146 vertical visual analogue scale (VAS) how good or bad their health is today, where the
35
36 147 endpoints are labelled 'the best health you can imagine' (score of 100) and 'the worst health
37
38 148 you can imagine' (score of 0).

39 149 *Independent variables*

40
41 150 Demographic characteristics included age, sex, ethnicity, service years, and past deployment
42
43 151 on operational service (yes/no). Ethnicity prioritisation was adopted,[14] whereby
44
45 152 participants with multiple responses were assigned to one of the categories, in the order of
46
47 153 Māori, Pacific Peoples, Other and European.

48
49 154 Symptoms of PTS were assessed using the post-traumatic stress disorder (PTSD) checklist –
50
51 155 military version (PCL-M). The PCL-M includes 17 items that ask about DSM-IV symptoms of
52
53 156 PTS related to stressful military experiences, with response options ranging from 1 'Not at all'
54
55 157 to 5 'Extremely' (33). A total symptom severity score is calculated by summing responses to
56
57 158 each option (range = 17 – 85). While scores of 30-35 indicate significant PTS symptomology
58
59 159 and probable cases of PTSD, scores of ≥ 45 indicate a presumptive PTSD diagnosis. [15]

1
2 160 General psychiatric morbidity was assessed using the 12-item General Health Questionnaire
3
4 161 (GHQ-12),[16] scored using a four point scale (0-3) and summing the 12 items to give a total
5
6 162 score, with higher scores indicating elevated distress.

7 163 Social support was measured using the Social Provisions Scale,[17] with responses made on a
8
9 164 four-point Likert-type scale ranging from 1 'strongly disagree' to 4 'strongly agree'. The 24
10
11 165 items can be reduced to six subscales (attachment, social integration, reassurance of worth,
12
13 166 reliable alliance, social guidance and opportunity for nurturance) or summed to create a total
14
15 167 score, with greater scores indicating greater social support.

16 168 Alcohol use was measured using the AUDIT-C,[18] scaled from 0-12. A score of 3+ for women
17
18 169 and 4+ for men indicated potentially hazardous drinking behaviour.

19
20 170 Sleep quality was assessed with the Sleep Condition Indicator (SCI), [19] assessing insomnia as
21
22 171 described in the Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM-V).[20]
23
24 172 The SCI consists of eight items rated from 0-4, the total scores being scaled to a range of 0 to
25
26 173 10, where higher scores represent better sleep.

27 174 Trauma exposure was assessed with the Brief Trauma Scale (BTS),[21] which captures past
28
29 175 exposure to situations that were life threatening or capable of producing serious injury.

30
31 176 Psychological flexibility was measured with the 10-item AAQ-II, designed as a measure of
32
33 177 effectiveness in a particular mode of behavioural intervention, Acceptance and Commitment
34
35 178 Therapy (ACT).[22] Items were answered on a 7-point scale, with options ranging from 'never
36
37 179 true' to 'always true'. The items were summed to obtain a total score (possible range 10 to
38
39 180 70), with higher scores indicative of greater psychological flexibility. The questionnaire is
40
41 181 available as supplementary material.

42 182 **Statistical analyses**

43
44 183 With respect to the calculation of summed scores, if only one item was missing for a particular
45
46 184 measure then this was imputed with the mean of the remaining items; if more than one item
47
48 185 was missing then the score was set to missing for that participant. Complete case analysis was
49
50 186 used in the remaining analyses. Z tests were used to compare the five dimensions of the EQ-
51
52 187 5D-5L to the NZ population normative values.[23]

53 188 Univariate ordinary least-squares linear regression analyses assessed the strength of
54
55 189 relationships between each independent variable and EQ-VAS scores, using robust standard
56
57 190 errors to account for heteroscedasticity and calculating 95% confidence intervals (95% CIs).
58
59 191 Multivariable linear regression was then used to identify the role of the independent variables
60
192 while adjusting for each other. None of the social support sub-scales were used in this

1
2 193 multivariable model, instead using the social support total score. The model was built using
3
4 194 backward variable selection with $p < 0.10$ for variable retention, with the exceptions of age,
5
6 195 sex, service years, and deployment status which were retained as adjusting variables
7
8 196 irrespective of p-values. Cronbach's α , (C_α) reported in Table 2, was used to assess the
9
10 197 internal consistency of the scales used.[24] A value of alpha greater than 0.7 is considered
11
12 198 adequate.[25] Collinearity was assessed by calculating the Pearson correlation coefficient (r);
13
14 199 if $0 < r < 1$ there is a positive linear trend.

200 RESULTS

201 The EQ-5D was completed by 1767 Veterans, 1009 who were serving (26% of that group), 458
202 who had retired, 288 who had not deployed, and 21 who did not provide deployment data.

203 There are no reliable denominator data on retired and non-deployed Veterans in New
204 Zealand.

205 To facilitate a complete case analysis, 247 replies were not used due to missing values in one
206 or more variables, the final sample including 1520 individuals.

207 A supplementary table presents the EQ-VAS score according to the sample characteristics.

208 Figure 1 shows the proportion of EQ-5D-5L dimension responses reporting 'any problem'
209 severity level other than 'no problems' in comparison to the New Zealand population
210 normative values,[23] with Table 1 showing the 95% CI's and Z values.

211 Figure 1 about here

212 Table 1, Proportion of 'any problem' in EQ-5D domains

Domain	Veterans	NZ population	Z value (p)
	Proportion (95% CI)	Proportion (95% CI)	
Mobility	0.40 (0.38-0.43)	0.28 (0.26-0.30)	8.5 (<.0001)
Self-care	0.11 (0.10-0.13)	0.09 (0.07-0.10)	2.8 (0.03)
Usual activities	0.38 (0.35-0.40)	0.30 (0.28-0.31)	5.6 (<.001)
Pain/discomfort	0.75 (0.73-0.77)	0.62 (0.60-0.63)	9.0 (<.0001)
Anxiety/depression	0.47 (0.44-0.49)	0.46 (0.44-0.48)	0 (1.0)

213

214 The results of the univariate analysis are displayed in Table 2. Here, for continuous
215 characteristics, the regression coefficient (β) represents the change in the mean EQ-VAS
216 associated with one unit increase in the characteristic. For categorical characteristics, β is the
217 change in mean EQ-VAS scores compared to the referent category.

218 **Table 2: Univariate cross-sectional associations between variables and mean EQ-VAS scores**
 219 **for New Zealand Veterans (N=1,520)**

Characteristic	C_{α}	n	β	95% CIs	p -value
Age*	-	1520	-0.18	[-0.24, -0.12]	<0.01
Sex					
Female	-	189	Ref		
Male	-	1331	-0.15	[-2.76, 2.46]	0.91
Ethnicity	-				
NZ European	-	1193	Ref		0.13
Māori	-	214	0.82	[-1.56, 3.19]	
Other	-	113	-3.55	[-7.33, 0.23]	
Service years*	-	1520	0.19	[0.11, 0.28]	<0.01
Deployment status	-				
Not deployed	-	242	ref		
Deployed	-	1278	6.56	[3.85, 9.26]	<0.01
GHQ-12 score*	0.89	1520	-1.63	[-1.81, -1.46]	<0.01
Social support*		1520	2.05	[1.70, 2.41]	<0.01
Attachment	0.81	1520	2.47	[2.02, 2.92]	<0.01
Social integration	0.79	1520	2.49	[2.08, 2.91]	<0.01
Reassurance of worth	0.77	1520	2.39	[1.97, 2.82]	<0.01
Reliable alliance	0.81	1520	2.01	[1.63, 2.39]	<0.01
Social guidance	0.84	1520	0.83	[0.40, 1.25]	<0.01
Opportunity for nurturance	0.75	1520	0.53	[0.44, 0.61]	<0.01
Social support total score	-	1520	0.80	[0.71, 0.88]	<0.01
Psychological flexibility*	0.93	1520	3.56	[3.18, 3.95]	<0.01
Sleep score*	0.87				<0.01
AUDIT-C	0.67	707	Ref		
Non-hazardous		813	0.71	[-1.04, 2.45]	0.43
Hazardous					
Exposure to traumatic events	-				
Not exposed		454	Ref		
Exposed		1066	-5.62	[-7.39, 3.86]	<0.01
PTSD (PCL-M Score)*		1520	-0.67	[-0.75, -0.60]	<0.01

*Scored as continuous variables, coefficient is per unit increase

220
 221
 222 Of the demographic variables, age was associated with lower EQ-VAS scores, length of service
 223 with higher scores. No relationships were apparent for sex or ethnicity. Positive coefficients,
 224 indicating better health with presence of the characteristic, were present for dichotomous
 225 variables of deployment, where the mean EQ-VAS score for deployed Veterans was 6.56 VAS
 226 units higher (better) than for non-deployed. The largest negative associations were for
 227 exposure to traumatic events, with a mean EQ-VAS score 5.62 lower for those exposed
 228 compared to those not exposed. Distress, as measured by the GHQ-12, had a negative
 229 association with health state, as did PTSD as measured by the PCL-M. Positive associations

1
2 230 with health state were found for psychological flexibility as measured by the AAQ-II, better
3
4 231 sleep scores, the total support scores and the individual dimensions.
5
6 232 Table 3 shows the results from two multivariable models. The first model is adjusted for the
7
8 233 other characteristics, with 12 variables included in the model. All effect sizes were reduced,
9
10 234 and the social support and AUDIT-C scores were no longer associated.
11
12 235 The final model involved backward variable selection setting a p-value of 0.10, identifying a
13
14 236 smaller subset of variables. Age, sex, service years, and deployment status were retained in
15
16 237 the model irrespective of their p-values, thus adjusting for those variables. Social support
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18 238 and AUDIT-C hazardous drinking were not retained in this final model; other coefficients
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20 239 remaining essentially the same.
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Table 3. Multivariable models of associations between variables and mean EQ-VAS scores for New Zealand Veterans

Characteristic	Adjusted model, N =1,520			Final model, N =1,520		
	β	95% CI	p-value	β	95% CI	p-value
Age (years)*	-0.15	[-0.21, -0.10]	<0.01	-0.16	[-0.22, -0.10]	<0.01
Sex						
Female	Ref			Ref		
Male	0.06	[-0.23, 2.35]	0.96	0.02	[-2.27, 2.30]	0.99
Ethnicity						
NZ European	Ref		0.03	Ref		0.03
Māori	0.53	[-1.46, 2.53]		0.55	[-1.44, 2.54]	
Other	-4.04	[-7.12, -0.95]		-4.07	[-7.16, -0.99]	
Service years*	0.16	[0.09, 0.24]	<0.01	0.17	[0.09, 0.24]	<0.01
Deployment status						
Not deployed	Ref			Ref		
Deployed	3.33	[1.00, 5.67]	0.01	3.36	[1.03, 5.70]	0.01
GHQ12 score*	-0.83	[-1.06, -0.61]	<0.01	-0.84	[-1.06, -0.62]	<0.01
Social support (SPS score)*	0.02	[-0.07, 0.11]	0.65	-	- -	-
Psychological flexibility score (AAQii)*	0.18	[0.06, 0.31]	0.01	0.19	[0.07, 0.31]	<0.01
Sleep score (SCI), Range 0-10*	1.41	[0.95, 1.88]	<0.01	1.41	[0.95, 1.87]	<0.01

244 Table 3, continued

AUDIT_C score							
Non hazardous	Ref						
Hazardous	0.37	[-1.05, 1.79]	0.61	-	-	-	-
Exposure to traumatic events (BTQ)							
Not exposed	Ref			Ref			
Exposed	-1.46	[-3.02, 0.11]	0.07	-1.45	[-3.02, 0.12]	0.07	
PTSD (PCL-M Score)*							
	-0.14	[-0.25, -0.04]	0.01	-0.15	[-0.25, -0.04]	0.01	

*Scored as continuous variables, coefficient is per unit increase.

246 **DISCUSSION**

247 *Principal findings*

248 With the exception of anxiety or depression, Veterans had a significantly greater proportion
249 of 'any problem' responses in the EQ-5D dimensions than the general population of New
250 Zealand.

251 The final model identified variables independently associated with the EQ-VAS score: age,
252 length of service, deployment, the GHQ score, psychological flexibility, the sleep score and
253 exposure to traumatic events. The results make conceptual sense in that distress is associated
254 with reduced EQ-VAS, and psychological flexibility may have a modest protective effect. Age
255 had a negative association, length of service being positive, most likely due to the 'healthy
256 soldier' effect.[1] Unusually, Social Support was dropped, however the SPS was found to
257 correlate significantly with GHQ12 ($r=0.47$), AAQii ($r=0.56$), and SCI scores ($r=0.36$), suggesting
258 collinearity. There are known to be many other influences on health, including 'social
259 wellbeing',[5] financial status, personality and non-deployment related stressors,[26] which
260 we have not measured.

261 *Strengths and weaknesses*

262 Strengths of our study were the relatively large sample size, the inclusion of all Veterans, the
263 assessment of 'health', infrequently investigated in Veteran populations, and the inclusion of
264 New Zealand Veterans with a range of characteristics, including 'deployed' and 'non-
265 deployed' Veterans. As a measure of health, the EQ-5D-5L dimensions and EQ-VAS ask about
266 health on the day that respondents complete the questionnaire, the EQ-VAS end points being,
267 respectively, the 'best' and 'worst' health they can imagine, so it is a holistic measure of health
268 state.[27]

269 The response rate of 26% from serving Veterans, along with the unknown total number of
270 Veterans, raises the question of bias, the direction of which is difficult to assess, as
271 responses may be more likely from either Veterans with good or poor health. The healthy
272 soldier effect is well known, service having a positive effect on wellbeing, with serving NZ
273 Veterans having good access to primary health care through the military system, but the
274 public health care system is the primary pathway to care for all Veterans, who are also
275 covered by the 'no fault' accident compensation scheme for accidental injuries and
276 occupational diseases.[28] Deployed Veterans may be at an advantage, but are covered by
277 NZVA only if their illness or injury is linked to a particular deployment, and the condition is
278 listed on the 'Statements of Principle' of the Australian Repatriation Medical Authority.[29]

1
2 279 We also know that New Veterans tend to be stoic, so they might underestimate their health
3
4 280 concerns,[30] and there are likely to be other personal characteristics that we have not
5
6 281 measured. We were however able to adjust for deployment status, which did have a positive
7
8 282 association with health state. In the interest of minimising responder burden, we used brief
9
10 283 scales, which might reduce construct validity. Distress, sleep, psychological flexibility and
11
12 284 exposure to traumatic events are likely to be related, so collinearity was difficult to avoid.
13
14 285 The confounding effect was greatest for social support, but our finding does not mean that
15
16 286 social support is of no importance to Veterans. The precision of the other coefficients may
17
18 287 also have been affected. Finally, the cross-sectional design means that we cannot explore
19
20 288 cause and effect, so recommendations for future interventions require additional support
21
22 289 from longitudinal studies.

22 290 *Comparison with other studies*

23
24 291 We have previously reported factors associated with post-traumatic stress in this group,[31]
25
26 292 using the Military Post Traumatic Stress Checklist (PCL-M). Factors associated with higher PCL-
27
28 293 M scores were trauma exposure, older age, male gender, and being of Māori ethnicity. Factors
29
30 294 associated with lower PCL-M scores were greater length of service, psychological flexibility,
31
32 295 and better quality sleep. Using health as the outcome disclosed that Māori did not have poorer
33
34 296 self-reported health compared to non-Māori, that deployment had a positive effect, and in
35
36 297 the univariate models, all of the dimensions of social support were associated with improved
37
38 298 health. The final model also included good sleep and psychological flexibility, providing most
39
40 299 of the explanatory power in the model.

41 300 No other studies appear to have used the EQ-VAS as an outcome measure for Veteran health.
42
43 301 Boehmer et al.[32] examined wellbeing among participants in the 2000 Behavioural Risk
44
45 302 Factor Surveillance System describing health-related quality of life (HRQoL) by sex and military
46
47 303 status, active duty, reservists Veterans, or no military service. Participants were asked to rate
48
49 304 recent physical health, mental health, and activity limitation. Active duty men were more likely
50
51 305 than men without military service to report 14 or more days of activity limitation, pain, and
52
53 306 not enough rest in the past 30 days, the mobility and pain findings being similar to our sample.
54
55 307 Notably, the predominant reason for medical discharge from the British Armed Forces was
56
57 308 musculoskeletal problems.[33]

57 309 Contrary to our finding on deployment, there are reports indicating that non-deployed
58
59 310 personnel retain better health than those who have been deployed. Diaz Santana et al.[34]
60
311 having carried out a cross-sectional survey of 60,000 U.S. Veterans of Afghanistan and Iraq,

1
2 312 with 20,563 responses. In contrast to our finding, mental quality of life scores were higher
3
4 313 among the non-deployed group compared to the deployed group, though the deployed group
5
6 314 reported higher physical quality of life scores compared to the non-deployed. Again in
7
8 315 contrast, both mental and physical quality of life were lower among Veterans compared to
9
10 316 U.S. population norms.

11 317 Both positive and negative consequences of deployment have been described.[7,35] In a study
12
13 318 of Dutch Veterans,[7] two out of three reported a positive effect of deployment on their
14
15 319 quality of life at the time of the survey, this being related to positive feelings such as
16
17 320 satisfaction or comradeship, but a few having emotions such as frustration or shame. As
18
19 321 regards tangible effects,[35] negative consequences included the military 'chain of command',
20
21 322 being away from home, and deterioration of marital/significant other relationships. Positive
22
23 323 influences include improved financial security, self-improvement, and time to reflect.

24 324 We found sleep to be associated with better health, but sleep difficulties are a common
25
26 325 symptom for those with PTSD. McCarthy et al.[36] reported on the 3,157 U.S. military
27
28 326 Veterans enrolled in the National Health and Resilience in Veterans Study, in which 27.6%
29
30 327 reported poor sleep quality. Path analyses revealed significant associations between poor
31
32 328 sleep, severity of PTSD, poorer mental and physical health functioning and lower overall
33
34 329 quality of life.

35 330 *Future directions*

36
37 331 The results suggest that distress, psychological flexibility, and sleep have an important
38
39 332 relationship with self-rated health among Veterans in this study.

40
41 333 Reducing distress through the promotion of psychological flexibility might be possible,
42
43 334 although our finding here must be subject to caution as several researchers argue that the
44
45 335 AAQ-II may be measuring psychological distress and affect rather than psychological
46
47 336 inflexibility.[37]

48 337 Sleep in military personnel has been recognised as a 'vital health behaviour' for which policies
49
50 338 and guidelines must be developed.[38] Cognitive behavioural therapy for insomnia (CBT-I) is
51
52 339 regarded as an effective 'first line' treatment, and a brief intervention has been described for
53
54 340 use in Australian general practice.[39]. Our final model showed that distress had a negative
55
56 341 association with health, and psychological flexibility had a positive relationship, with sleep
57
58 342 most likely related to both of these variables. It would seem important to screen for these
59
60 343 conditions prior to transition from the military, as well as among retired Veterans, in order to

1
2 344 provide targeted support. Further research is needed to examine the potential of cognitive
3
4 345 behavioural therapy to improve Veterans' wellbeing.
5
6 346

7
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1
2 444 **DATA SHARING STATEMENT**
3

4 445 Data from this study is unsuitable for public deposition due to the privacy of participant data.
5
6 446 Data are anonymised, but contain information on deployments (including location and
7
8 447 duration), which could lead to some participants being identified. Furthermore, the
9
10 448 participant information sheet, as required by the Southern Health and Disability Ethics
11
12 449 Committee specifically contains the statement that 'all study data would be kept strictly
13
14 450 confidential to the research team.' Qualified researchers may apply for data access with the
15
16 451 research team at veterans.health@otago.ac.nz and/or hdecs@moh.govt.nz.

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26
27 457 **COMPETING INTERESTS**

28
29 458 None declared.

30
31 459 **CONTRIBUTION**

32
33 460 All the authors have made substantial contributions to the conception or design of the work;
34
35 461 or the acquisition, analysis, or interpretation of data for the work; AND
36
37 462 Drafting the work or revising it critically for important intellectual content; AND
38
39 463 Final approval of the version to be published; AND
40
41 464 Agreement to be accountable for all aspects of the work in ensuring that questions related to
42
43 465 the accuracy or integrity of any part of the work are appropriately investigated and resolved.

44
45 466 **Specific responsibilities**

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47 467 **Investigation:** Amy Richardson, Emma H. Wyeth, Sarah Derrett, Daniel Shepherd, David
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59 473 **Software:** Brandon de Graaf.

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4 476 **Visualization:** Amy Richardson.

5 477 **Writing – original draft:** David McBride. AS, DG, EHW, SD and DS contributed to the re-writes
6
7 478 and final draft.
8
9

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24
25 487 Figure 1 Caption.

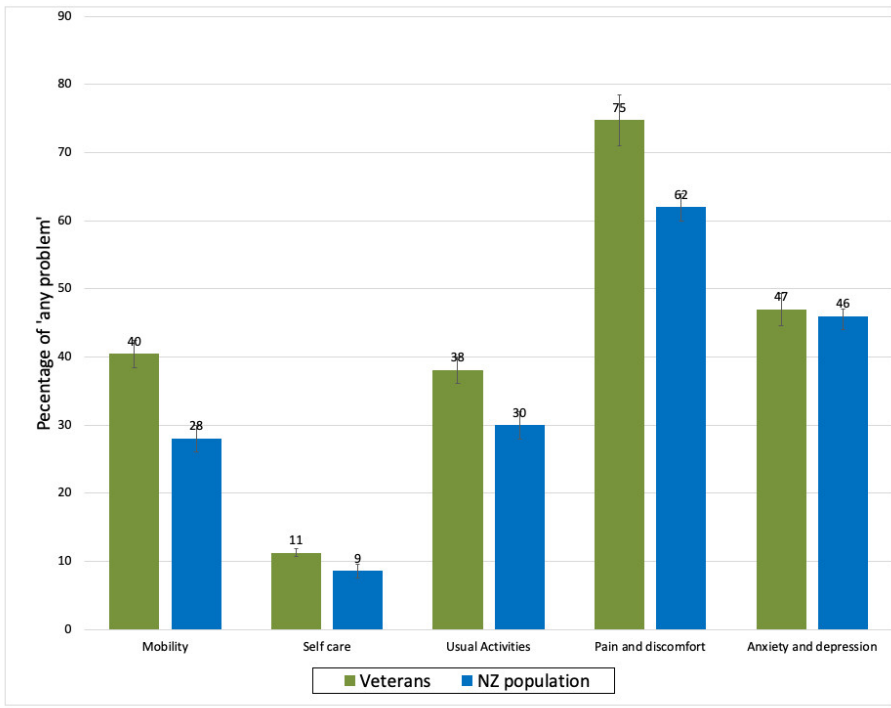
26 488 **The proportion of Veterans reporting ‘any problem’ with each of the EQ-5D-5L dimension**
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28 489 **scores compared to the NZ population normative proportions**

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The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension scores compared to the NZ population normative proportions

86x65mm (300 x 300 DPI)

Supplementary Table: Number of participants and EQ-VAS scores according to sample characteristics

Exposure variable	N (%)	Mean (SD)
All	1767	74.4 (17.1)
Age group (years)		
20-29	136 (7.7)	77.7 (14.4)
30-39	328 (18.6)	77.0 (16.2)
40-49	438 (24.8)	76.1 (14.6)
50-59	350 (19.8)	74.8 (16.6)
60-69	285 (16.1)	71.4 (19.8)
70-79	175 (9.9)	69.4 (19.4)
80+	50 (2.8)	66.2 (20.3)
Missing	5 (0.3)	61.2 (22.1)
Gender		
Female	220 (12.5)	75.0 (16.9)
Male	1520 (86.0)	74.4 (17.2)
Missing	27 (1.5)	70.3 (17.2)
Ethnicity (prioritised)		
NZ European	1382 (78.2)	74.4 (17.1)
Māori	245 (13.9)	75.6 (16.1)
Other	140 (7.9)	71.5 (19.3)
Service years		
0-9	339 (19.2)	69.9 (19.7)
10-19	478 (27.1)	74.5 (17.9)
20-29	530 (30.0)	75.3 (15.9)
30-39	254 (14.4)	76.3 (14.6)
40+	69 (3.9)	75.4 (16.4)
Missing	97 (5.5)	78.8 (14.2)
Deployment (ever)		
No	288 (16.3)	69.5 (19.9)
Yes	1458 (82.5)	75.3 (16.4)
Missing	21 (1.2)	75.6 (14.6)
GHQ12 Score		
0-9	652 (36.9)	82.0 (12.6)
10-19	972 (55.0)	72.3 (16.0)
20-29	123 (7.0)	54.3 (20.3)
30+	18 (1.0)	46.2 (24.4)
Missing	2 (0.1)	-

*sub-scores not used in multivariable models.

Supplementary table contd.

Social support full score		
24-29	0	0 -
30-39	3	(0.2) 66.7 (15.3)
40-49	15	(0.8) 44.5 (22.5)
50-59	97	(5.5) 62.4 (21.8)
60-69	351	(19.9) 69.0 (18.2)
70-79	643	(36.4) 75.1 (15.0)
80-89	409	(23.1) 78.0 (15.0)
90-96	235	(13.3) 81.9 (13.9)
Missing	14	(0.8) 58.1 (25.6)
Social support sub-scores		
Attachment*		
4-7	51	(3.5) 61.4 (23.4)
8-11	516	(29.2) 68.7 (18.0)
12-16	1193	(67.5) 77.5 (15.5)
Missing	7	(0.4) 61.0 (19.7)
Social integration*		
4-7	20	(1.1) 56.2 (25.1)
8-11	429	(24.3) 67.1 (19.4)
12-16	1309	(74.8) 77.1 (15.2)
Missing	9	(0.5) 58.7 (21.5)
Reassurance of worth*		
4-7	37	(2.1) 59.1 (19.5)
8-11	504	(28.5) 69.0 (19.1)
12-16	1215	(68.8) 77.2 (15.2)
Missing	11	(0.6) 62.0 (24.9)
Reliable Alliance*		
4-7	20	(1.1) 49.6 (22.2)
8-11	251	(14.2) 66.9 (20.1)
12-16	1489	(84.3) 76.0 (15.9)
Missing	7	(0.4) 61.0 (19.7)
Guidance sub-score*		
4-7	36	(2.0) 59.2 (22.2)
8-11	387	(21.9) 68.7 (18.9)
12-16	1337	(75.7) 76.6 (15.7)
Missing	7	(0.4) 54.6 (21.6)
Opportunity for nurturance*		
4-7	29	(1.6) 69.3 (18.9)
8-11	413	(23.4) 71.9 (18.8)
12-16	1316	(74.5) 75.4 (16.4)
Missing	9	(0.5) 58.7 (21.5)

Supplementary table, contd.

**Psychological flexibility score
(AAQii score).**

10-19	5	(0.3)	23.2 (13.8)
20-29	40	(2.3)	49.1 (22.1)
30-39	147	(8.3)	63.0 (18.6)
40-49	43	(24.7)	68.5 (16.8)
50-59	664	(37.6)	77.1 (13.9)
60-70	457	(25.9)	82.5 (13.5)
Missing	1	(1.0)	69.6 (20.5)

Sleep Condition Indicator (SCI score)

0 to <2	67	(3.8)	51.2 (22.3)
2 to <4	264	(14.9)	62.2 (19.5)
4 to <6	646	(36.6)	74.3 (14.6)
6 to <8	384	(21.7)	77.6 (14.2)
8 to 10	386	(21.8)	83.5 (12.2)
Missing	20	(1.1)	77.3 (12.8)

AUDIT-C score

Non-hazardous	776	(43.9)	74.0 (17.4)
Hazardous	915	(51.8)	74.6 (16.9)
Missing	76	(4.3)	75.0 (17.0)

**Brief Trauma Questionnaire
(DSM-IV criteria)**

Not exposed	544	(30.8)	78.3 (15.1)
Exposed	1210	(68.5)	72.5 (17.8)
Missing	13	(0.7)	80.6 (8.1)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	Indicate the study's design with a commonly used term in the title or the abstract. Yes, a cross sectional study, p1 title. (b) Provide in the abstract an informative and balanced summary of what was done and what was found Background, results and conclusions, p 1
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Introduction p2.
Objectives	3	State specific objectives, including any prespecified hypotheses p2, lines 59 and 60
Methods		
Study design	4	Present key elements of study design early in the paper p2 line 62 to page 5 line 145
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Participants, page2 line 63- page 3 line 83.
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants page 2 line 64 to page 3, line 68.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Questionnaire, pp 3-5.
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 as above
Bias	9	Describe any efforts to address potential sources of bias Methods, page 3. Lines 76-83.
Study size	10	Explain how the study size was arrived at p5 line 137
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Cases defined through the Multivariable logistic regression with the EQ-Visual analogue scale as the outcome measure, p5 lines 131-136
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Backward elimination process p5 lines 134-135 (b) Describe any methods used to examine subgroups and interactions By multivariable logistic regression, p5 as above (c) Explain how missing data were addressed p4 lines 122-125 (d) If applicable, describe analytical methods taking account of sampling strategy N/A (e) Describe any sensitivity analyses N/A
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 Potentially eligible lines 68-73 p 3 (b) Give reasons for non-participation at each stage N/A (c) Consider use of a flow diagram N/A

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders page 5 et seq, table 1 (b) Indicate number of participants with missing data for each variable of interest ' n used ' columns tables 2 and 3.
Outcome data	15*	Report numbers of outcome events or summary measures as per tables
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Tables, adjusted for age, sex, service years and deployment status. (b) Report category boundaries when continuous variables were categorized. Independent variables, p 3 and 4, EQ-VAS is a continuous scale. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
Discussion		
Key results	18	Summarise key results with reference to study objectives Discussion, p11 first para
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 Discussion lines 215 et seq.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Discussion, p12 lines 230 et seq.
Generalisability	21	Discuss the generalisability (external validity) of the study results p17, line 215 et seq.
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 Funding, p18

*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 www.strobe-statement.org.

BMJ Open

Factors associated with self-reported health among New Zealand military veterans: a cross-sectional study.

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-056916.R3
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2
3 1 **FACTORS ASSOCIATED WITH SELF-REPORTED HEALTH AMONG NEW ZEALAND**
4
5 2 **MILITARY VETERANS: A CROSS-SECTIONAL STUDY**

6
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28
29 14 **Keywords:**

30
31 15 Military Medicine

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33 16 Quality of Life

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35 17 Risk Factors

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37 18 Protective Factors

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39 19 Point Prevalence

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43 21 3132

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1
2 29 **ABSTRACT**
3

4 30 **Objective**

5 31 To identify factors associated with better or poorer self-reported health status in New Zealand
6
7 32 military Veterans.

8
9 33 **Design**

10 34 A cross-sectional survey.

11
12 35 **Participants**

13 36 The participants of interest were the 3,874 currently serving Veterans who had been deployed
14
15 37 to a conflict zone, but all Veterans were eligible to participate.

16
17 38 **Study variables**

18 39 The EQ-5D-5L, asking about problems across five dimensions (mobility, self-care, usual
19
20 40 activities, pain or discomfort, and anxiety or depression), with five levels of severity (e.g. no,
21
22 41 slight, moderate, severe or extreme problems), also containing a visual analogue scale (EQ-
23
24 42 VAS), scaled from 0 (worst) to 100 (best) imagined health, assessed health status. Hypothetical
25
26 43 relationships with better health were positive social support, sleep and psychological
27
28 44 flexibility; with poorer health, post-traumatic stress, exposure to psychological trauma,
29
30 45 distress and hazardous drinking.

31
32 46 **Results:**

33 47 The EQ5-D was completed by 1767 Veterans, 1009 serving, a response rate of 26% from that
34
35 48 group, 1767 completing the EQ5-D, 1458 who had deployed, 288 who had not, and the 21
36
37 49 who did not provide deployment data. Of these 247 were not used in the analysis due to
38
39 50 missing values in one or more variables, leaving 1,520 for analysis.

40 51 A significantly higher proportion of Veterans reported 'any problems' rather than 'no
41
42 52 problems' with four EQ-5D dimensions: mobility, self-care, usual activities and pain or
43
44 53 discomfort, but no difference in anxiety or depression. Age, length of service, deployment,
45
46 54 psychological flexibility and better sleep quality were associated with higher EQ-VAS scores;
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48 55 distress with lower EQ-VAS scores.

49
50 56 **Conclusion:**

51 57 In this sample of New Zealand Veterans, psychological flexibility and good sleep are associated
52
53 58 with better self-rated health, and distress and poor sleep with diminished health. These
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55 59 factors might be used as sentinel health indicators in assessing Veteran health status, and
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57 60 cognitive behavioural therapy encompassing these domains may be useful in improving the
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59 61 health of New Zealand Veterans.
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62 **Keywords:**

63 Self-rated health, wellbeing, EQ-5D, Veterans, deployment, military, risk factors.

64 **Strengths and limitations of this study**

- 65 • Many studies of Veterans have focused on adverse outcomes, but we have been able
66 to focus on a holistic measure of 'health'.
- 67 • The study was sufficiently powered to detect important relationships indicating
68 opportunities for intervention.
- 69 • The exact response rate is unknown, and sampling bias may be a limitation.
- 70 • The cross-sectional design means that we cannot explore cause and effect
71 relationships.

72 **INTRODUCTION**

73 The three major events in the military life course are entry to military service, deployment on
74 active service and transition back to civilian life. On entry, soldiers, sailors and air personnel
75 are subject to a selection process to ensure, as far as possible, good physical and mental
76 health, giving rise to the 'healthy soldier effect,' with service personnel being, on average,
77 healthier than the general population.[1] However, the physical and psychological stressors
78 of military service have been found to erode this effect.[2]

79 The physical stressors have a particular impact on the lower limb, with load carriage, high
80 intensity training and the design of footwear being implicated in injury causation.[3] A military
81 career also increases opportunities for psychological trauma, and post-traumatic stress
82 disorder (PTSD) has been identified as the 'signature injury' of United States service men and
83 women deployed to Afghanistan and Iraq.[4]

84 A focus on adverse health events in the literature[5] means that wellbeing is relatively
85 overlooked. In the long run, military service has been found to have positive effects.[6,7]
86 Good health after service does, however, depend on the success of the 'military civilian
87 transition', a complex process for which models have been developed.[8] Health problems
88 developed in service, difficulty in assuming a post-service identity and many other factors
89 contribute to health and wellbeing outcomes.[8] In New Zealand, military Veterans can only
90 access assistance from New Zealand Veteran's Affairs (NZVA) if they have undertaken
91 'qualifying operational service' as defined by the Veteran Support Act 2014,[9] thus being
92 Veterans in a legal sense. NZVA support some 12,000 Veterans, with an average age of 80
93 years, 5000 being actively case managed.[10] The majority will have seen operational service
94 in Korea, Borneo, Malaya and Vietnam. Post-Vietnam, smaller numbers deployed on United

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2 95 Nations and other missions, but the tempo of operations rose with the deployment to
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4 96 Bosnia in 1992, and some 9,000-10,000 'legal' Veterans deployed between then and the
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6 97 withdrawal of New Zealand troops from Afghanistan in 2021. The Ministerial Veteran's
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8 98 Health Advisory Panel, established under the Veteran Support Act, are specifically charged
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10 99 with funding research on this 'contemporary Veteran' group, NZVA acknowledging that they
11
12 100 "have had different experiences, and have different needs, compared to the older veterans.
13
14 101 They are likely to have served in a number of deployments during their career, and come to
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16 102 us with more complex health issues." [10]

17 103 The aims of this study were therefore to describe self-reported health among these Veterans,
18
19 104 and identify factors associated with better or poorer health.

20 105 **Veteran and public involvement**

21 106 The Ministerial Veterans Health Advisory Panel, [10] commissioned the study and advised on
22
23 107 the design. We also formed a steering group with representatives from the New Zealand
24
25 108 Defence Force, New Zealand Veterans Affairs, the Royal New Zealand Returned and Services
26
27 109 Association (RSA) [11] and No Duff, [12] a charity providing first response support to Veterans
28
29 110 and their families. We also consulted with the Ngāi Tahu Research Consultation Committee in
30
31 111 order to assess the importance of the project to Māori, New Zealand's indigenous population.
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33 112 During consultation we undertook to inform the Veteran community before releasing the
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35 113 results, to which end a link to the paper will be posted on the military social media sites where
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37 114 the study was advertised, and to give all NZ Veterans, defined as anyone who had served in
38
39 115 the military, an opportunity to participate. Participants were not recruited as patients.

40 116 **METHODS**

41 117 **Participants**

42
43 118 Potential participants were currently serving Veterans, as indicated by holding the New
44
45 119 Zealand Operational Service Medal at the time of the survey, a total of 3,874 personnel at that
46
47 120 time; retired 'legal' Veterans in the community; and Veterans who had served, but had not
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49 121 deployed to a conflict. Data were collected via an online survey, a postal version being
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51 122 available on request. There is no comprehensive Veteran registry, however in July 2018, a link
52
53 123 to the online questionnaire was sent by email to the 3,874 currently serving regular and
54
55 124 reserve New Zealand Defence Force (NZDF) members registered on the NZDF email system
56
57 125 who were 'legal Veterans', as indicated by holding the New Zealand Operational Service
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59 126 Medal. An introductory message and link to the questionnaire were also presented on the
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127 NZDF 'intranet landing page', a secure internal webpage from which all regular force

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2 128 personnel can access relevant work-related content, tools, and resources. Retired military
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4 129 personnel were invited to participate through posters distributed to reserve units and the 43
5
6 130 local social clubs identified by the RSA national office to be 'Veteran active.' Paper
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8 131 questionnaires with return postage envelopes were made available at these sites.
9
10 132 Announcements were also made on military social media pages, and both retired and
11
12 133 currently serving personnel were invited to participate through an announcement on the No
13
14 134 Duff website. The questionnaire was available for completion from June to December 2018.

15 135 **Ethics approval**

16 136 Ethics approval for the study was obtained from the Northern B Health and Disability Ethics
17
18 137 Committee, reference 17NTB118.

19 138 **Questionnaire**

20 139 *Criterion variable*

21
22 140 Self-rated health status was assessed using the EQ-5D-5L,[13] a short questionnaire asking
23
24 141 about the respondent's health across five dimensions: mobility, self-care, usual activities, pain
25
26 142 or discomfort and anxiety or depression, with response options ranging from (e.g.) 'no
27
28 143 problems', to 'extreme problems'. For each dimension, participants were categorised as
29
30 144 having 'any problems' if they selected any response other than 'no problems'.

31
32 145 Additionally, the EQ-5D-5L visual analogue scale (EQ-VAS) asks the respondent to mark on a
33
34 146 vertical visual analogue scale (VAS) how good or bad their health is today, where the
35
36 147 endpoints are labelled 'the best health you can imagine' (score of 100) and 'the worst health
37
38 148 you can imagine' (score of 0).

39 149 *Independent variables*

40
41 150 Demographic characteristics included age, sex, ethnicity, service years, and past deployment
42
43 151 on operational service (yes/no). Ethnicity prioritisation was adopted,[14] whereby
44
45 152 participants with multiple responses were assigned to one of the categories, in the order of
46
47 153 Māori, Pacific Peoples, Other and European.

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49 154 Symptoms of PTS were assessed using the post-traumatic stress disorder (PTSD) checklist –
50
51 155 military version (PCL-M). The PCL-M includes 17 items that ask about DSM-IV symptoms of
52
53 156 PTS related to stressful military experiences, with response options ranging from 1 'Not at all'
54
55 157 to 5 'Extremely' (33). A total symptom severity score is calculated by summing responses to
56
57 158 each option (range = 17 – 85). While scores of 30-35 indicate significant PTS symptomology
58
59 159 and probable cases of PTSD, scores of ≥ 45 indicate a presumptive PTSD diagnosis. [15]
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1
2 160 General psychiatric morbidity was assessed using the 12-item General Health Questionnaire
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4 161 (GHQ-12),[16] scored using a four point scale (0-3) and summing the 12 items to give a total
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6 162 score, with higher scores indicating elevated distress.

7 163 Social support was measured using the Social Provisions Scale,[17] with responses made on a
8
9 164 four-point Likert-type scale ranging from 1 'strongly disagree' to 4 'strongly agree'. The 24
10
11 165 items can be reduced to six subscales (attachment, social integration, reassurance of worth,
12
13 166 reliable alliance, social guidance and opportunity for nurturance) or summed to create a total
14
15 167 score, with greater scores indicating greater social support.

16 168 Alcohol use was measured using the AUDIT-C,[18] scaled from 0-12. A score of 3+ for women
17
18 169 and 4+ for men indicated potentially hazardous drinking behaviour.

19
20 170 Sleep quality was assessed with the Sleep Condition Indicator (SCI), [19] assessing insomnia as
21
22 171 described in the Diagnostic and Statistical Manual of Mental Disorders version 5 (DSM-V).[20]
23
24 172 The SCI consists of eight items rated from 0-4, the total scores being scaled to a range of 0 to
25
26 173 10, where higher scores represent better sleep.

27 174 Trauma exposure was assessed with the Brief Trauma Scale (BTS),[21] which captures past
28
29 175 exposure to situations that were life threatening or capable of producing serious injury.

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31 176 Psychological flexibility was measured with the 10-item AAQ-II, designed as a measure of
32
33 177 effectiveness in a particular mode of behavioural intervention, Acceptance and Commitment
34
35 178 Therapy (ACT).[22] Items were answered on a 7-point scale, with options ranging from 'never
36
37 179 true' to 'always true'. The items were summed to obtain a total score (possible range 10 to
38
39 180 70), with higher scores indicative of greater psychological flexibility.

40 181 **Statistical analyses**

41
42 182 With respect to the calculation of summed scores, if only one item was missing for a particular
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44 183 measure then this was imputed with the mean of the remaining items; if more than one item
45
46 184 was missing then the score was set to missing for that participant. Complete case analysis was
47
48 185 used in the remaining analyses. Z tests were used to compare the five dimensions of the EQ-
49
50 186 5D-5L to the NZ population normative values.[23]

51 187 Univariate ordinary least-squares linear regression analyses assessed the strength of
52
53 188 relationships between each independent variable and EQ-VAS scores, using robust standard
54
55 189 errors to account for heteroscedasticity and calculating 95% confidence intervals (95% CIs).

56
57 190 Multivariable linear regression was then used to identify the role of the independent variables
58
59 191 while adjusting for each other. None of the social support sub-scales were used in this
60
192 multivariable model, instead using the social support total score. The model was built using

backward variable selection with $p < 0.10$ for variable retention, with the exceptions of age, sex, service years, and deployment status which were retained as adjusting variables irrespective of p -values. Cronbach's α , (C_α) was used to assess the internal consistency of the scales used.[24] A value of alpha greater than 0.7 is considered adequate.[25] Collinearity was assessed by calculating the Pearson correlation coefficient (r); if $0 < r < 1$ there is a positive linear trend.

RESULTS

The EQ-5D was completed by 1767 Veterans, 1009 who were serving (26% of that group), 458 who had retired, 288 who had not deployed, and 21 who did not provide deployment data.

There are no reliable denominator data on retired and non-deployed Veterans in New Zealand.

To facilitate a complete case analysis, 247 replies were not used due to missing values in one or more variables, the final sample including 1520 individuals.

A supplementary table presents the EQ-VAS score according to the sample characteristics.

Figure 1 shows the proportion of EQ-5D-5L dimension responses reporting 'any problem' severity level other than 'no problems' in comparison to the New Zealand population normative values,[23] with Table 1 showing the 95% CI's and Z values.

Figure 1 about here

Table 1, Proportion of 'any problem' in EQ-5D domains

Domain	Veterans	NZ population	Z value (p)
	Proportion (95% CI)	Proportion (95% CI)	
Mobility	0.40 (0.38-0.43)	0.28 (0.26-0.30)	8.5 (<.0001)
Self-care	0.11 (0.10-0.13)	0.09 (0.07-0.10)	2.8 (0.03)
Usual activities	0.38 (0.35-0.40)	0.30 (0.28-0.31)	5.6 (<.001)
Pain/discomfort	0.75 (0.73-0.77)	0.62 (0.60-0.63)	9.0 (<.0001)
Anxiety/depression	0.47 (0.44-0.49)	0.46 (0.44-0.48)	0 (1.0)

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The results of the univariate analysis are displayed in Table 2. Here, for continuous characteristics, the regression coefficient (β) represents the change in the mean EQ-VAS associated with one unit increase in the characteristic. For categorical characteristics, β is the change in mean EQ-VAS scores compared to the referent category.

217 **Table 2: Univariate cross-sectional associations between variables and mean EQ-VAS scores**
 218 **for New Zealand Veterans (N=1,520)**

Characteristic	C_{α}^*	<i>n</i>	β	95% CIs	<i>p</i> -value
Age**	-	1520	-0.18	[-0.24, -0.12]	<0.01
Sex					
Female	-	189	Ref		
Male	-	1331	-0.15	[-2.76, 2.46]	0.91
Ethnicity	-				
NZ European	-	1193	Ref		0.13
Māori	-	214	0.82	[-1.56, 3.19]	
Other	-	113	-3.55	[-7.33, 0.23]	
Service years*	-	1520	0.19	[0.11, 0.28]	<0.01
Deployment status	-				
Not deployed	-	242	ref		
Deployed	-	1278	6.56	[3.85, 9.26]	<0.01
GHQ-12 score*	0.89	1520	-1.63	[-1.81, -1.46]	<0.01
Social support*		1520	2.05	[1.70, 2.41]	<0.01
Attachment	0.81	1520	2.47	[2.02, 2.92]	<0.01
Social integration	0.79	1520	2.49	[2.08, 2.91]	<0.01
Reassurance of worth	0.77	1520	2.39	[1.97, 2.82]	<0.01
Reliable alliance	0.81	1520	2.01	[1.63, 2.39]	<0.01
Social guidance	0.84	1520	0.83	[0.40, 1.25]	<0.01
Opportunity for nurturance	0.75	1520	0.53	[0.44, 0.61]	<0.01
Social support total score	-	1520	0.80	[0.71, 0.88]	<0.01
Psychological flexibility*	0.93	1520	3.56	[3.18, 3.95]	<0.01
Sleep score*	0.87				<0.01
AUDIT-C	0.67	707	Ref		
Non-hazardous		813	0.71	[-1.04, 2.45]	0.43
Hazardous					
Exposure to traumatic events	-				
Not exposed		454	Ref		
Exposed		1066	-5.62	[-7.39, 3.86]	<0.01
PTSD (PCL-M Score)*		1520	-0.67	[-0.75, -0.60]	<0.01

*Cronbach's α

**Scored as continuous variables, coefficient is per unit increase

Of the demographic variables, age was associated with lower EQ-VAS scores, length of service with higher scores. No relationships were apparent for sex or ethnicity. Positive coefficients, indicating better health with presence of the characteristic, were present for dichotomous variables of deployment, where the mean EQ-VAS score for deployed Veterans was 6.56 VAS units higher (better) than for non-deployed. The largest negative associations were for exposure to traumatic events, with a mean EQ-VAS score 5.62 lower for those exposed compared to those not exposed. Distress, as measured by the GHQ-12, had a negative

1
2 229 association with health state, as did PTSD as measured by the PCL-M. Positive associations
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4 230 with health state were found for psychological flexibility as measured by the AAQ-II, better
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6 231 sleep scores, the total support scores and the individual dimensions.

7 232 Table 3 shows the results from two multivariable models. The first model is adjusted for the
8
9 233 other characteristics, with 12 variables included in the model. All effect sizes were reduced,
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11 234 and the social support and AUDIT-C scores were no longer associated.

12
13 235 The final model involved backward variable selection setting a p-value of 0.10, identifying a
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15 236 smaller subset of variables. Age, sex, service years, and deployment status were retained in
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17 237 the model irrespective of their p-values, thus adjusting for those variables. Social support
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19 238 and AUDIT-C hazardous drinking were not retained in this final model; other coefficients
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21 239 remaining essentially the same.
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Table 3. Multivariable models of associations between variables and mean EQ-VAS scores for New Zealand Veterans

Characteristic	Adjusted model, N =1,520			Final model, N =1,520		
	β	95% CI	p-value	β	95% CI	p-value
Age (years)*	-0.15	[-0.21, -0.10]	<0.01	-0.16	[-0.22, -0.10]	<0.01
Sex						
Female	Ref			Ref		
Male	0.06	[-0.23, 2.35]	0.96	0.02	[-2.27, 2.30]	0.99
Ethnicity						
NZ European	Ref		0.03	Ref		0.03
Māori	0.53	[-1.46, 2.53]		0.55	[-1.44, 2.54]	
Other	-4.04	[-7.12, -0.95]		-4.07	[-7.16, -0.99]	
Service years*	0.16	[0.09, 0.24]	<0.01	0.17	[0.09, 0.24]	<0.01
Deployment status						
Not deployed	Ref			Ref		
Deployed	3.33	[1.00, 5.67]	0.01	3.36	[1.03, 5.70]	0.01
GHQ12 score*	-0.83	[-1.06, -0.61]	<0.01	-0.84	[-1.06, -0.62]	<0.01
Social support (SPS score)*	0.02	[-0.07, 0.11]	0.65	-	-	-
Psychological flexibility score (AAQii)*	0.18	[0.06, 0.31]	0.01	0.19	[0.07, 0.31]	<0.01
Sleep score (SCI), Range 0-10*	1.41	[0.95, 1.88]	<0.01	1.41	[0.95, 1.87]	<0.01

244 Table 3, continued

AUDIT_C score							
Non hazardous	Ref						
Hazardous	0.37	[-1.05, 1.79]	0.61	-	-	-	-
Exposure to traumatic events (BTQ)							
Not exposed	Ref			Ref			
Exposed	-1.46	[-3.02, 0.11]	0.07	-1.45	[-3.02, 0.12]	0.07	
PTSD (PCL-M Score)*							
	-0.14	[-0.25, -0.04]	0.01	-0.15	[-0.25, -0.04]	0.01	

*Scored as continuous variables, coefficient is per unit increase.

246 **DISCUSSION**

247 *Principal findings*

248 With the exception of anxiety or depression, Veterans had a significantly greater proportion
249 of 'any problem' responses in the EQ-5D dimensions than the general population of New
250 Zealand.

251 The final model identified variables independently associated with the EQ-VAS score: age,
252 length of service, deployment, the GHQ score, psychological flexibility, the sleep score and
253 exposure to traumatic events. The results make conceptual sense in that distress is associated
254 with reduced EQ-VAS, and psychological flexibility may have a modest protective effect. Age
255 had a negative association, length of service being positive, most likely due to the 'healthy
256 soldier' effect.[1] Unusually, Social Support was dropped, however the SPS was found to
257 correlate significantly with GHQ12 ($r=0.47$), AAQii ($r=0.56$), and SCI scores ($r=0.36$), suggesting
258 collinearity. There are known to be many other influences on health, including 'social
259 wellbeing',[5] financial status, personality and non-deployment related stressors,[26] which
260 we have not measured.

261 *Strengths and weaknesses*

262 Strengths of our study were the relatively large sample size, the inclusion of all Veterans, the
263 assessment of 'health', infrequently investigated in Veteran populations, and the inclusion of
264 New Zealand Veterans with a range of characteristics, including 'deployed' and 'non-
265 deployed' Veterans. As a measure of health, the EQ-5D-5L dimensions and EQ-VAS ask about
266 health on the day that respondents complete the questionnaire, the EQ-VAS end points being,
267 respectively, the 'best' and 'worst' health they can imagine, so it is a holistic measure of health
268 state.[27]

269 The response rate of 26% from serving Veterans, along with the unknown total number of
270 Veterans, raises the question of bias, the direction of which is difficult to assess, as
271 responses may be more likely from either Veterans with good or poor health. The healthy
272 soldier effect is well known, service having a positive effect on wellbeing, with serving NZ
273 Veterans having good access to primary health care through the military system, but the
274 public health care system is the primary pathway to care for all Veterans, who are also
275 covered by the 'no fault' accident compensation scheme for accidental injuries and
276 occupational diseases.[28] Deployed Veterans may be at an advantage, but are covered by
277 NZVA only if their illness or injury is linked to a particular deployment, and the condition is
278 listed on the 'Statements of Principle' of the Australian Repatriation Medical Authority.[29]

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2 279 We also know that New Veterans tend to be stoic, so they might underestimate their health
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4 280 concerns,[30] and there are likely to be other personal characteristics that we have not
5
6 281 measured. We were however able to adjust for deployment status, which did have a positive
7
8 282 association with health state. In the interest of minimising responder burden, we used brief
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10 283 scales, which might reduce construct validity. Distress, sleep, psychological flexibility and
11
12 284 exposure to traumatic events are likely to be related, so collinearity was difficult to avoid.
13
14 285 The confounding effect was greatest for social support, but our finding does not mean that
15
16 286 social support is of no importance to Veterans. The precision of the other coefficients may
17
18 287 also have been affected. Finally, the cross-sectional design means that we cannot explore
19
20 288 cause and effect, so recommendations for future interventions require additional support
21
22 289 from longitudinal studies.

22 290 *Comparison with other studies*

23
24 291 We have previously reported factors associated with post-traumatic stress in this group,[31]
25
26 292 using the Military Post Traumatic Stress Checklist (PCL-M). Factors associated with higher PCL-
27
28 293 M scores were trauma exposure, older age, male gender, and being of Māori ethnicity. Factors
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30 294 associated with lower PCL-M scores were greater length of service, psychological flexibility,
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32 295 and better quality sleep. Using health as the outcome disclosed that Māori did not have poorer
33
34 296 self-reported health compared to non-Māori, that deployment had a positive effect, and in
35
36 297 the univariate models, all of the dimensions of social support were associated with improved
37
38 298 health. The final model also included good sleep and psychological flexibility, providing most
39
40 299 of the explanatory power in the model.

41 300 No other studies appear to have used the EQ-VAS as an outcome measure for Veteran health.
42
43 301 Boehmer et al.[32] examined wellbeing among participants in the 2000 Behavioural Risk
44
45 302 Factor Surveillance System describing health-related quality of life (HRQoL) by sex and military
46
47 303 status, active duty, reservists Veterans, or no military service. Participants were asked to rate
48
49 304 recent physical health, mental health, and activity limitation. Active duty men were more likely
50
51 305 than men without military service to report 14 or more days of activity limitation, pain, and
52
53 306 not enough rest in the past 30 days, the mobility and pain findings being similar to our sample.
54
55 307 Notably, the predominant reason for medical discharge from the British Armed Forces was
56
57 308 musculoskeletal problems.[33]

57 309 Contrary to our finding on deployment, there are reports indicating that non-deployed
58
59 310 personnel retain better health than those who have been deployed. Diaz Santana et al.[34]
60
311 having carried out a cross-sectional survey of 60,000 U.S. Veterans of Afghanistan and Iraq,

1
2 312 with 20,563 responses. In contrast to our finding, mental quality of life scores were higher
3
4 313 among the non-deployed group compared to the deployed group, though the deployed group
5
6 314 reported higher physical quality of life scores compared to the non-deployed. Again in
7
8 315 contrast, both mental and physical quality of life were lower among Veterans compared to
9
10 316 U.S. population norms.

11 317 Both positive and negative consequences of deployment have been described.[7,35] In a study
12
13 318 of Dutch Veterans,[7] two out of three reported a positive effect of deployment on their
14
15 319 quality of life at the time of the survey, this being related to positive feelings such as
16
17 320 satisfaction or comradeship, but a few having emotions such as frustration or shame. As
18
19 321 regards tangible effects,[35] negative consequences included the military 'chain of command',
20
21 322 being away from home, and deterioration of marital/significant other relationships. Positive
22
23 323 influences include improved financial security, self-improvement, and time to reflect.

24 324 We found sleep to be associated with better health, but sleep difficulties are a common
25
26 325 symptom for those with PTSD. McCarthy et al.[36] reported on the 3,157 U.S. military
27
28 326 Veterans enrolled in the National Health and Resilience in Veterans Study, in which 27.6%
29
30 327 reported poor sleep quality. Path analyses revealed significant associations between poor
31
32 328 sleep, severity of PTSD, poorer mental and physical health functioning and lower overall
33
34 329 quality of life.

35 330 *Future directions*

36
37 331 The results suggest that distress, psychological flexibility, and sleep have an important
38
39 332 relationship with self-rated health among Veterans in this study.

40
41 333 Reducing distress through the promotion of psychological flexibility might be possible,
42
43 334 although our finding here must be subject to caution as several researchers argue that the
44
45 335 AAQ-II may be measuring psychological distress and affect rather than psychological
46
47 336 inflexibility.[37]

48 337 Sleep in military personnel has been recognised as a 'vital health behaviour' for which policies
49
50 338 and guidelines must be developed.[38] Cognitive behavioural therapy for insomnia (CBT-I) is
51
52 339 regarded as an effective 'first line' treatment, and a brief intervention has been described for
53
54 340 use in Australian general practice.[39]. Our final model showed that distress had a negative
55
56 341 association with health, and psychological flexibility had a positive relationship, with sleep
57
58 342 most likely related to both of these variables. It would seem important to screen for these
59
60 343 conditions prior to transition from the military, as well as among retired Veterans, in order to

1
2 344 provide targeted support. Further research is needed to examine the potential of cognitive
3
4 345 behavioural therapy to improve Veterans' wellbeing.
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7
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444 **DATA SHARING STATEMENT**

445 Data from this study is unsuitable for public deposition due to the privacy of participant data.
446 Data are anonymised, but contain information on deployments (including location and
447 duration), which could lead to some participants being identified. Furthermore, the
448 participant information sheet, as required by the Southern Health and Disability Ethics
449 Committee specifically contains the statement that 'all study data would be kept strictly
450 confidential to the research team.' Some instruments used in the survey may be copyright.
451 Qualified researchers may apply for data access and a copy of the survey by contacting the
452 research team at veterans.health@otago.ac.nz and/or hdec@mh.govt.nz.

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458 **COMPETING INTERESTS**

459 None declared.

460 **CONTRIBUTION**

461 All the authors have made substantial contributions to the conception or design of the work;
462 or the acquisition, analysis, or interpretation of data for the work; AND
463 Drafting the work or revising it critically for important intellectual content; AND
464 Final approval of the version to be published; AND
465 Agreement to be accountable for all aspects of the work in ensuring that questions related to
466 the accuracy or integrity of any part of the work are appropriately investigated and resolved.

467 **Specific responsibilities**

468 **Investigation:** Amy Richardson, Emma H. Wyeth, Sarah Derrett, Daniel Shepherd, David
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471 Derrett, David McBride, Daniel Shepherd.

472 **Project administration:** Amy Richardson.

473 **Resources:** Brandon de Graaf.

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4 476 **Validation:** Amy Richardson.
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6 477 **Visualization:** Amy Richardson.
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8 478 **Writing – original draft:** David McBride. AS, DG, EHW, SD and DS contributed to the re-writes
9 and final draft.
10

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25 487 rather tedious questionnaire. Kia Kaha.

26 488 Figure 1 Caption.

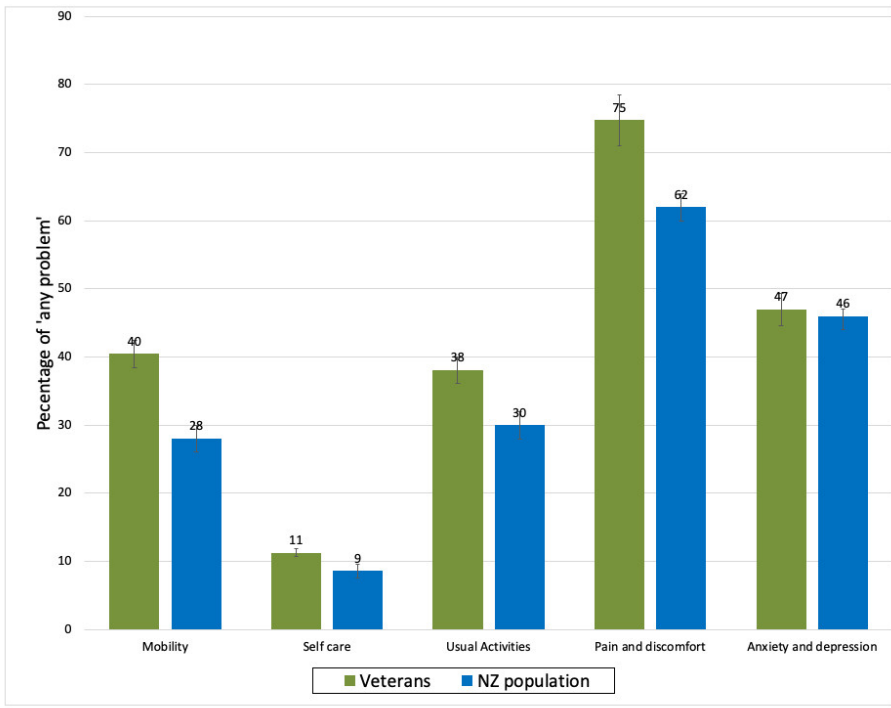
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28 489 **The proportion of Veterans reporting ‘any problem’ with each of the EQ-5D-5L dimension**
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30 490 **scores compared to the NZ population normative proportions**
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The proportion of Veterans reporting 'any problem' with each of the EQ-5D-5L dimension scores compared to the NZ population normative proportions

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Supplementary Table: Number of participants and EQ-VAS scores according to sample characteristics

Exposure variable	N (%)	Mean (SD)
All	1767	74.4 (17.1)
Age group (years)		
20-29	136 (7.7)	77.7 (14.4)
30-39	328 (18.6)	77.0 (16.2)
40-49	438 (24.8)	76.1 (14.6)
50-59	350 (19.8)	74.8 (16.6)
60-69	285 (16.1)	71.4 (19.8)
70-79	175 (9.9)	69.4 (19.4)
80+	50 (2.8)	66.2 (20.3)
Missing	5 (0.3)	61.2 (22.1)
Gender		
Female	220 (12.5)	75.0 (16.9)
Male	1520 (86.0)	74.4 (17.2)
Missing	27 (1.5)	70.3 (17.2)
Ethnicity (prioritised)		
NZ European	1382 (78.2)	74.4 (17.1)
Māori	245 (13.9)	75.6 (16.1)
Other	140 (7.9)	71.5 (19.3)
Service years		
0-9	339 (19.2)	69.9 (19.7)
10-19	478 (27.1)	74.5 (17.9)
20-29	530 (30.0)	75.3 (15.9)
30-39	254 (14.4)	76.3 (14.6)
40+	69 (3.9)	75.4 (16.4)
Missing	97 (5.5)	78.8 (14.2)
Deployment (ever)		
No	288 (16.3)	69.5 (19.9)
Yes	1458 (82.5)	75.3 (16.4)
Missing	21 (1.2)	75.6 (14.6)
GHQ12 Score		
0-9	652 (36.9)	82.0 (12.6)
10-19	972 (55.0)	72.3 (16.0)
20-29	123 (7.0)	54.3 (20.3)
30+	18 (1.0)	46.2 (24.4)
Missing	2 (0.1)	-

*sub-scores not used in multivariable models.

Supplementary table contd.

Social support full score		
24-29	0	0 -
30-39	3	(0.2) 66.7 (15.3)
40-49	15	(0.8) 44.5 (22.5)
50-59	97	(5.5) 62.4 (21.8)
60-69	351	(19.9) 69.0 (18.2)
70-79	643	(36.4) 75.1 (15.0)
80-89	409	(23.1) 78.0 (15.0)
90-96	235	(13.3) 81.9 (13.9)
Missing	14	(0.8) 58.1 (25.6)
Social support sub-scores		
Attachment*		
4-7	51	(3.5) 61.4 (23.4)
8-11	516	(29.2) 68.7 (18.0)
12-16	1193	(67.5) 77.5 (15.5)
Missing	7	(0.4) 61.0 (19.7)
Social integration*		
4-7	20	(1.1) 56.2 (25.1)
8-11	429	(24.3) 67.1 (19.4)
12-16	1309	(74.8) 77.1 (15.2)
Missing	9	(0.5) 58.7 (21.5)
Reassurance of worth*		
4-7	37	(2.1) 59.1 (19.5)
8-11	504	(28.5) 69.0 (19.1)
12-16	1215	(68.8) 77.2 (15.2)
Missing	11	(0.6) 62.0 (24.9)
Reliable Alliance*		
4-7	20	(1.1) 49.6 (22.2)
8-11	251	(14.2) 66.9 (20.1)
12-16	1489	(84.3) 76.0 (15.9)
Missing	7	(0.4) 61.0 (19.7)
Guidance sub-score*		
4-7	36	(2.0) 59.2 (22.2)
8-11	387	(21.9) 68.7 (18.9)
12-16	1337	(75.7) 76.6 (15.7)
Missing	7	(0.4) 54.6 (21.6)
Opportunity for nurturance*		
4-7	29	(1.6) 69.3 (18.9)
8-11	413	(23.4) 71.9 (18.8)
12-16	1316	(74.5) 75.4 (16.4)
Missing	9	(0.5) 58.7 (21.5)

Supplementary table, contd.

**Psychological flexibility score
(AAQii score).**

10-19	5	(0.3)	23.2 (13.8)
20-29	40	(2.3)	49.1 (22.1)
30-39	147	(8.3)	63.0 (18.6)
40-49	43	(24.7)	68.5 (16.8)
50-59	664	(37.6)	77.1 (13.9)
60-70	457	(25.9)	82.5 (13.5)
Missing	1	(1.0)	69.6 (20.5)

Sleep Condition Indicator (SCI score)

0 to <2	67	(3.8)	51.2 (22.3)
2 to <4	264	(14.9)	62.2 (19.5)
4 to <6	646	(36.6)	74.3 (14.6)
6 to <8	384	(21.7)	77.6 (14.2)
8 to 10	386	(21.8)	83.5 (12.2)
Missing	20	(1.1)	77.3 (12.8)

AUDIT-C score

Non-hazardous	776	(43.9)	74.0 (17.4)
Hazardous	915	(51.8)	74.6 (16.9)
Missing	76	(4.3)	75.0 (17.0)

**Brief Trauma Questionnaire
(DSM-IV criteria)**

Not exposed	544	(30.8)	78.3 (15.1)
Exposed	1210	(68.5)	72.5 (17.8)
Missing	13	(0.7)	80.6 (8.1)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation
Title and abstract	1	Indicate the study's design with a commonly used term in the title or the abstract. Yes, a cross sectional study, p1 title. (b) Provide in the abstract an informative and balanced summary of what was done and what was found Background, results and conclusions, p 1
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported Introduction p2.
Objectives	3	State specific objectives, including any prespecified hypotheses p2, lines 59 and 60
Methods		
Study design	4	Present key elements of study design early in the paper p2 line 62 to page 5 line 145
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection Participants, page2 line 63- page 3 line 83.
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants page 2 line 64 to page 3, line 68.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable Questionnaire, pp 3-5.
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 as above
Bias	9	Describe any efforts to address potential sources of bias Methods, page 3. Lines 76-83.
Study size	10	Explain how the study size was arrived at p5 line 137
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why Cases defined through the Multivariable logistic regression with the EQ-Visual analogue scale as the outcome measure, p5 lines 131-136
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding Backward elimination process p5 lines 134-135 (b) Describe any methods used to examine subgroups and interactions By multivariable logistic regression, p5 as above (c) Explain how missing data were addressed p4 lines 122-125 (d) If applicable, describe analytical methods taking account of sampling strategy N/A (e) Describe any sensitivity analyses N/A
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 Potentially eligible lines 68-73 p 3 (b) Give reasons for non-participation at each stage N/A (c) Consider use of a flow diagram N/A

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders page 5 et seq, table 1 (b) Indicate number of participants with missing data for each variable of interest ' n used ' columns tables 2 and 3.
Outcome data	15*	Report numbers of outcome events or summary measures as per tables
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included Tables, adjusted for age, sex, service years and deployment status. (b) Report category boundaries when continuous variables were categorized. Independent variables, p 3 and 4, EQ-VAS is a continuous scale. (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses N/A
Discussion		
Key results	18	Summarise key results with reference to study objectives Discussion, p11 first para
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 Discussion lines 215 et seq.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence Discussion, p12 lines 230 et seq.
Generalisability	21	Discuss the generalisability (external validity) of the study results p17, line 215 et seq.
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 Funding, p18

*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 www.strobe-statement.org.