Original Article

Mental Health States of Soldiers with Histories of Corona Virus Disease 2019 Infection in Taiwan: A Comparison Study with Non-infected Soldiers

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Abstract

Objectives: According to the most recent studies on the mental health impacts of coronavirus disease 2019 (COVID-19), psychological effects are salient in the community, but they are not obvious in the military population. In the study, we intended to examine mental health state and suicide ideation among soldiers with past histories of COVID-19 and to compare them with non-infected controls. **Methods:** We recruited 193 active-duty military personnel from northern Taiwan and collected their responses of a series of copies of the questionnaire, i.e., Beck's Depression Inventory for depression, Beck's Anxiety Inventory for anxiety, Davidson Trauma Scale for symptoms of posttramatic stress disorder (PTSD), Pittsburgh Sleep Quality Index for sleep disturbance and sleep dissatisfaction, and Five-item Brief Symptom Rating Scale for suicide ideation. **Results:** Among our samples, about 58.5% (113/193) reported a past history of COVID-19 infection (infected group) at least once. More than 85% had vaccinated in more than two doses. The infected soldier group presented themselves significantly higher magnitude (1.92 ± 0.54) of impacts on their lives than noninfected control group (1.72 ± 0.66, $p < 0.05$). The discrepancy in life impact between infected and non-infected groups was significantly more salient in male soldiers ($p < 0.05$) comparing with female. In male soldiers, most mental health states were higher in the non-infected group than the infected group but nonsignificant. **Conclusion:** This study shows the common and differences in mental health states and suicide ideation between COVID-19 infected and non-infected soldiers in Taiwan and genders. In line with the findings of current studies, our results showed nonsignificant differences between male and female groups in the military population although significant differences among the community population. Further studies with larger sample sizes and more details are needed to confirm our assumption.

Key words: coronavirus disease 2019, mental health state, soldiers, suicide ideation
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Introduction

Currently, the coronavirus disease 2019 (COVID-19) pandemic has shown a dramatic impact on people's lives, resulting in increased social isolation, economic recession, and a sense of powerlessness (https://www.mentalhealth.va.gov/docs/data-sheets/2020/2020-National-Veteran-Suicide-Prevention-Annual-Report-11-2020-508.pdf) [1]. A substantial rise in depression and anxiety exists in the general public during the COVID-19 pandemic [2]. Depression and anxiety are also accompanied by a possible increase in deaths using suicides [1,3]. Previous surveys of people infected with COVID-19 have shown a high prevalence of mental disorders, including depression [4], anxiety [5], and posttraumatic stress disorder (PTSD) [6]. As an example, a study of 402 adult survivors of COVID-19 showed that 28% meet the PTSD diagnostic threshold, 31% the depression diagnostic threshold, and 42% the anxiety diagnostic threshold after one month [6].

Pandemics and disasters have disproportionately affected poor and vulnerable populations, both physically and

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psychologically [7]. During the 2003 severe acute respiratory syndrome outbreak in Hong Kong, suicides increased by 13.9% over those in the previous year (https://csrp.hku.hk/statistics/), especially a remarkable increase was found among older adults [8]. A study has shown 72 suicide cases related to COVID-19 in India [9] and revealed the suicide causalities are fear of COVID-19 infection, followed by the financial crisis, loneliness, social boycott, and pressure to be a quarantine, COVID-19 positive, COVID-19 work-related stress, being unable to come back home due to lockdown, unavailability of alcohol [9]. Furthermore, the suicide rate in high-income countries has been observed relatively stable during the COVID-19 pandemic [10].

The military population has been considered a highly vulnerable group to the negative mental health effects of the pandemic due to stressful events such as combat deployments, depression, and substance use [11]. But the findings of a population-based prospective cohort study among 3078 US military veterans showed that the rates of suicide ideation and suicide attempts do not significantly increase from pre-pandemic to peripandemic at the population level [12].

In this study, we intended to examine how COVID-19 affects military personnel in mental health and suicide ideation, and the differences between infect- and non-infected soldier groups.

Methods

Study participants and study procedures

With the approval of the institutional review board at the Tri-Service General Hospital, National Defense Medical Center in Taipei, Taiwan (TSGHIRB protocol number = C202205022 and date of approval = May 17, 2022), all study participants needed to sign informed consents. In this study, we recruited 193 active-duty military personnel from northern Taiwan. All participants attended a series of military mental health education programs in military camps in northern Taiwan between May 2022 to July 2022. Only three soldiers refused to participate or were ineligible due to personal reasons.

Measures

Study participants filled out an anonymous questionnaire about their current personal feeling about the psychological impact on their lives during the COVID-19 pandemic (one question with four-point Likert scales, 03 points, from no influence to severe influence) and psychiatric states, i.e., Beck's Anxiety Inventory (BAI-II) was used to assess subject's anxiety state, Beck's Depression Inventory (BDI-II) for subject's depression state, Davidson Trauma Scale (DTS) for subject's current state of posttraumatic stress disorder. Sleep quality was measured using Pittsburgh Sleep Quality Index (PSQI) with disturbance scores and self-rated dissatisfaction with sleep quality. Individual suicide ideation was assessed using the Five-item Brief Symptom Rating Scale (BSRS-5) and the sixth extended question of it.

Beck's anxiety inventory

BAI was also developed by Beck et al., [13]. It is a self-reported tool with 21 four-point Likert scale (03 points) questions. The BAI can be used with individuals 1780 years old and was found to be a useful screening instrument to detect the presence of a current anxiety disorder [14]. Subjects are to answer questions according to their feelings of the previous one week (including the day of assessment). The Chinese version of the BAI-C has been shown to have substantial internal consistency, reliability, and stability of the outpatient population in Taiwan [15].

Beck's depression inventory

The BDI, the second edition (BDI-II), is a self-report 21-item instrument, evaluating the presence and severity of depressive symptoms listed in *the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition* during the past two weeks. Each item is scored from 0 for "not at all" to 3 for "almost always" [16]. The Chinese version of the BDI-II has been shown to have substantial internal consistency, reliability, and stability of the military population in Taiwan [17].

Davidson trauma scale

The DTS is a 17-item self-report copy of questionnaire of the general severity of PTSD and intensity of specific symptoms, developed for trauma survivors. Respondents are first asked to record "The trauma that is most disturbing to you." Next, respondents are asked to read each of the 17 items, and "Consider how often in the last week the symptom troubled you and how severe it was." The measure includes a total score and scores for four subscales (re-experiencing, avoidance, numbing, and arousal). The instrument is used to assess the worst symptoms lifetime. Scores can also be calculated for each of the four PTSD sub-symptoms [18]. The Chinese version of DTS was introduced in 2000 with good reliability and validity [19].

Pittsburgh sleep quality index

The PSQI developed by Buysse and his coworkers in 1989 [20], is a common scale used for self-assessment of sleep quality into "poor" from "good" sleep by measuring seven areas of sleep quality [21], i.e., sleep efficiency, sleep latency, average sleep disturbance per week, hours of actual sleep, subjective sleep quality, daytime dysfunction, and use of sleeping medication per week. Each component is scored 0 to 3 points with a maximal possible score of 21. Higher scores indicate poorer sleep quality. In general, a PSQI score lower than 5 means excellent sleep quality. In 2005, a Chinese version of the PSQI was developed by Tsai et al. [22], showing overall good reliability.

Five-item brief symptom rating scale

BSRS-5 is originally designed as a screen tool for psychiatric illness screening in non-psychiatric health settings [23]. Besides five symptom items of anxiety, depression, hostility, interpersonal sensitivity /inferiority, and insomnia, the modified BSRS-5 by adding the sixth item of current suicide

ideation has been used for an effective screening instrument for suicide ideation [24]. In this study, we summarized responders' rating scores. From 0 to 4 indicates none to extreme severity level of the first five items as an index of suicide risk, and the score of the sixth item as suicide ideation (zero for negative and others for positive symptom).

Statistical analysis

The descriptive statistical analyses and the comparisons of demographic characteristics between samples from the army and navy or genders were done using *t*-test for continuous variables and a Chi-squared test for dichotomous or categorical variables. For the four-point Liker's scale of participants' reports about their feeling of psychological impact on their lives, we treated it as a categorical variable first and then arbitrarily as a continuous variable to facilitate our comparing analyses between infected/non-infected groups and genders. The differences between groups were calculated using an independent *t*-test.

We used Statistical Package for Social Science software version 24 for Windows (SPSS Inc., Chicago, Illinois, USA) to compute all study variables. The differences between the groups were considered as significant if *p*-values were smaller than 0.05.

Results

In this study, 193 active duty soldiers in northern Taiwan participated in this study. Most of them (89.12%) were male. Their age were aged in a range from 19 to 37.5 (mean ± standard deviation = 24.78 ± 4.75) years. Table 1 presents the comparisons of demographic characteristics, psychological impacts of their lives and states of vaccination of samples according their past history of COVID-19 infection.

Due to the limited sample size for those who infected more than once ($n = 3$), we divided our sample into only two groups (infected or post-COVID group and non-infected or never COVID group). Table 2 shows the differences in demographics, mental health states between the two groups.

Table 3 presents the gender differences in demographics and mental health states among our samples. Table 4 compares the infected and non-infected groups within each sex.

Discussion

In this study, about 58.5% (113/193) of our military samples reported past history of COVID-19 infection at least once. More than 85% of recruited soldiers had vaccinated more than twice. More than 60% of soldiers reported severe psychological impact of life during the COVID-19 pandemic period (Table 1).

After we treated the psychological life impact as a continuous variable and dividing samples into infected and non-infected groups, there are no differences in many fields of mental health states between the two groups. But the infected soldier group presented a significantly higher magnitude (1.92 ± 0.54) of psychological impacts on their lives than the non-infected group (1.72 ± 0.66, $p < 0.05$). Contrary to expectations, noninfected group presented higher mean scores of anxiety, depression, PTSD symptoms, sleep disturbance, sleep dissatisfaction, BSRS total score, and suicidal ideation than the infected group although none of their discrepancies reached the significant threshold (Table 2).

Our findings, although contradict some community studies [3-6] that the infected population suffered from higher levels of mental health adversities [4-6], indirectly support the findings of a prospective cohort study among US military veterans that the rates of suicide ideation and suicide attempts did not significantly increase from pre-pandemic to peri-pandemic at the population level [12]. That is, even though the military population can be a highly vulnerable group to the negative mental health effects of the pandemic [11], the psychological impact of COVID-19 on the lives of military population was not as salient as community population.

Regarding the sex difference among our samples, the only difference is that the male soldiers presented significantly

Table 1. Demographic characteristics of samples (soldiers in active service) with or without past histories of corona virus disease 2019 infection ($n = 193$)

	Never COVID-19 infection ($n = 80$), *n* (%)	Once COVID-19 infection ($n = 110$), *n* (%)	Twice or more COVID-19 infection ($n = 3$), *n* (%)
Male sex	70 (87.50)	99 (90.00)	3 (100)
Age (mean ± SD)	25.36 ± 5.16	24.43 ± 4.45	21.97 ± 2.12
Self-reported psychological impact of life during the pandemic***			
No	1 (1.25)	0	0
Slight	28 (35.00)	20 (18.18)	1 (33.33)
Severe	42 (52.50)	77 (70.00)	0
Collapsed	8 (10.00)	11 (10.00)	1 (33.33)
Others (refused to answer)	1 (1.25)	2 (1.82)	1 (33.33)
Vaccination for COVID			
Never vaccinated	6 (7.50)	1 (0.91)	0
Vaccinated once	0	2 (1.82)	0
Vaccinated twice	6 (7.50)	9 (8.18)	0
Vaccinated more than twice	68 (85.00)	99 (90.00)	3 (100)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ with Chi-square test.

SD, standard deviation; COVID-19, with history of coronavirus disease. COVID-19, corona virus disease 2019

Table 2. The comparisons of mental health sates of non-infected soldiers (without past histories of corona virus disease 2019 infection) and infected soldiers (with one or more past histories of corona virus disease 2019 infection)

	Mean ± SD	
	Noninfected soldiers (n = 80)	Infected soldiers (n = 113)
Male sex, n (%)	70 (87.50)	102 (90.27)
Age (years)	25.36 ± 5.16	24.37 ± 4.42
Psychological impact of life	1.72 ± 0.66	1.92 ± 0.54*
Mental health states		
Anxiety (BAI-II)	24.44 ± 6.13	23.50 ± 5.27
Depression (BDI-II)	4.80 ± 7.72	3.74 ± 6.50
PTSD (DTS)	11.96 ± 14.19	10.63 ± 15.46
PSQI_sleep disturbance	4.31 ± 4.55	4.31 ± 3.78
PSQI_sleep dissatisfaction	0.69 ± 0.87	0.69 ± 0.79
BSRS_total	1.98 ± 3.70	1.21 ± 2.49
Suicidal ideation	0.10 ± 0.41	0.03 ± 0.16

*p < 0.05 calculated using independent t-test
BAI-II, Beck Anxiety Inventory, the second edition; BDI-II, The Beck Depression Inventory, the second edition; PTSD, symptoms of posttraumatic stress disorder; DTS, Davidson Trauma Scale; PSQI, Pittsburgh Sleep Quality Index; BSRS; Five-item Brief Symptom Rating Scale; SD, standard deviation

Table 3. The comparisons of mental health sates and past histories of corona virus disease 2019 infection of male and female soldiers (n = 190)

	Mean ± SD	
	Male soldiers (n = 172)	Female soldiers (n = 18)
COVID-19 infected, n (%)	102 (59.30)	9 (50.00)
Age (years)	24.87 ± 5.12	24.75 ± 4.75
Psychological impact of life	2.00 ± 0.50	1.82 ± 0.61
Mental health states		
Anxiety (BAI-II)	26.56 ± 6.96	23.67 ± 5.49*
Depression (BDI-II)	6.33 ± 8.52	4.05 ± 6.90
PTSD (DTS)	14.78 ± 12.16	10.9 ± 15.34
PSQI_sleep disturbance	4.94 ± 3.92	4.19 ± 4.08
PSQI_sleep dissatisfaction	0.89 ± 0.90	0.67 ± 0.82
BSRS_total	2.83 ± 3.75	1.42 ± 2.99
Suicidal ideation	0.06 ± 0.24	0.06 ± 0.30

*p < 0.05 calculated using independent t-test
BAI-II, Beck Anxiety Inventory, the second edition; BDI-II, The Beck Depression Inventory, the second edition; PTSD, symptoms of posttraumatic stress disorder; DTS, Davidson Trauma Scale; PSQI, Pittsburgh Sleep Quality Index; BSRS; Five-item Brief Symptom Rating Scale; SD, standard deviation

higher anxiety mean scores (26.56 ± 6.96) than female soldiers (23.67 ± 5.49, p < 0.05). Similar trends were also found in depression, PTSD symptoms, sleep disturbance, sleep dissatisfaction, and BSRS total score but none of them reached any significant threshold (Table 3).

In that, the discrepancy in life impact between infected and non-infected groups becomes significantly more salient in male soldiers (p < 0.05) comparing with female soldiers (Table 4). In detail, in male soldiers, most mental health states were higher in noninfected group than the infected group although did not reach a significant threshold. On the other hand, in female soldiers, the mental health states were higher in the infected group than in the infected group but did not reach any significance.

Therefore, we suggest that the study findings compel us consider that the discrepancy between military and community populations in COVID-19 impacts on mental health may be primarily or partially due to gender differences mentioned above.

Study limitations

In this study, the mental health states of Taiwanese active duty personnel with and without past history of COVID-19 infection were compared in the first time. Our findings provided a first-step understanding about their similarities and differences in anxiety, depression, PTSD symptoms, and sleep problems. Nevertheless, as a cross-sectional survey study, this study has seven limitations:

- This study has limited sample size (N = 193). Many similar trends and discrepancies existed between infected and non-infected groups in female soldiers.
- In this study, only BDI and the sixth item of BSRS were used to measure the suicide ideation of participants. Some other instruments specific to suicidality are warranted for further evaluation in future studies.
- Cut-off points of each scale were not used in this study due to the good power for sensitivity and specificity are unavailable for the military population so far. We believe the cross-sectional scores of participants are not appropriated to be classified by the cut-off points from other populations.
- We assumed that the labeling effects of COVID-19 infection could cause a higher psychological impact of life of soldiers although lacking support from previous evidence. The specific characteristics of the female soldier population might be totally different from that of the female civilian and male populations. Therefore, to tell the true discrepancies between infected and non-infected female soldiers is difficult due to the limited sample size. Further studies with a greater number of female soldiers are needed.
- As a result of the anonymous strategy in this study, we did not collect information of the duration between last COVID-19 infection and self-administration of questionnaire, as well as their last vaccination. We cannot examine the impact of infection on the lives of infected soldiers over time.
- We did not address the possible adverse effects of vaccination and nor where or not these effects interacted with COVID-19 infection.
- There is the major concern that neither self-reported past histories nor anonymous responses to copies of questionnaire are as accurate as clinical diagnoses. Thus, further chronological studies with diagnosed patients in practice are needed to fill this knowledge gap.

Table 4. Comparisons of mental health states of soldiers without and with past histories of corona virus disease 2019 infection by sex

	Male soldiers		Female soldiers	
	Non-infected group (n = 70)	Infected group (n = 102)	Non-infected group n = 9	Infected group n = 9
Age, years	25.13 ± 5.16	24.48 ± 4.45	26.73 ± 5.29	23.22 ± 4.63
Psychological impact of life	1.70 ± 0.67	1.91 ± 0.56*	1.88 ± 0.64	2.11 ± 0.33
Mental health states				
Anxiety (BAI-II)	24.33 ± 6.09	23.23 ± 5.02	25.67 ± 6.95	27.44 ± 7.26
Depression (BDI-II)	4.87 ± 7.81	3.48 ± 6.18	4.78 ± 7.74	7.89 ± 9.43
PTSD (DTS)	11.76 ± 14.76	10.37 ± 15.73	14.56 ± 10.41	15.00 ± 14.35
PSQI_sleep disturbance	4.26 ± 4.66	4.14 ± 3.64	4.67 ± 4.06	5.22 ± 3.99
PSQI_sleep dissatisfaction	0.66 ± 0.87	0.68 ± 0.79	0.89 ± 0.93	0.89 ± 0.93
BSRS_total	1.93 ± 3.68	1.08 ± 2.36	2.56 ± 4.16	3.11 ± 3.52
Suicidal ideation	0.10 ± 0.42	0.03 ± 0.17	0.11 ± 0.33	0 ± 0

*$p < 0.05$ calculated by independent t- test

Non-infected group, samples without past histories of COIVD-19 infection; Infected soldiers, samples with one or more past histories of COVID-19 infection.

BAI-II, Beck Anxiety Inventory, the second edition; BDI-II, The Beck Depression Inventory, the second edition; PTSD, symptoms of post-traumatic stress disorder; DTS, Davidson Trauma Scale; PSQI, Pittsburgh Sleep Quality Index; BSRS; Five-item Brief Symptom Rating Scale

Study summary

Based on anonymous self-reported responses from 193 active duty soldiers in Taiwan, our study showed that about 60% of our samples had a past history of COVID-19 infection at least once. And 85% of them had been vaccinated. In a series of mental health states, the only difference between infected and non-infected soldiers is the more adverse impact on lives reported by infected soldiers, especially among male soldiers than non-infected soldiers. That is non-infected male soldiers reported higher levels of these mental health states although the difference was nonsignificant. The results of this study provide a first glimpse into how COVID-19 infection affects soldiers' mental health. Further studies with larger sample size and further clinical assessments were needed.

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Conflicts of Interest

Dr. Yueh-Ming Tai, an editorial board member at *Taiwanese Journal of Psychiatry* (Taipei), had no rôle in the peer review process of or decision to publish this article. The other authors declared no conflicts of interest in writing this paper.

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