Brief Report

Risk Factors of Psychiatric Hospitalization of Military Service Persons in Taiwan: Preliminary Results from Unsupervised Clustering Techniques

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Abstract

Background: To understand the discrepancies of the use of mental health providers among different military ranks and/or compulsory/voluntary military services especially of the psychiatry admission during active services. **Methods:** We collected military medical records of one military psychiatry teaching hospital of north Taiwan from 2012 to 2015. All 3,513 samples were divided into three groups ─ enlisted females (EFs), enlisted males, and drafted males (DMs). The outcome measurement was the time period from the date of enlisted or drafted to the first psychiatric admission (E-A period). After comparing baseline characteristics and E-A period among three groups, we applied unsupervised clustering techniques, exhaustive Chi-squared automatic interaction detector, to cluster samples based on their military ranks and compulsory/voluntary service. **Results:** In general, the EF group showed the longest E-A period and the DM group the shortest. The most common diagnosis was major depression followed by anxiety or other nonpsychiatric disorders. The privates and recruits showed shorter E-A periods, and the younger enlistment age of officers showed the longer E-A period if we clustered based on military ranks. Those who entered army due to obligation showed shorter E-A period and those males who enlisted voluntarily at age over 22.5 years also showed shorter E-A period. **Conclusion:** This study demonstrates potential clusters associating with psychiatry admission in military. But, we caution that the findings here should be treated as preliminary.

Key words: compulsory service, military mental health, psychiatric admission, voluntary service
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Introduction

When a military serviceman/servicewoman has a psychiatric hospitalization, it is quite different from a general civilian has a similar one. He/She has not only to face the consequence of a possible military discharge but also to develop a self-stigma (or internalized stigma) as being perceived as weak and shameful [1]. One 2002 study from the United States on active duty marines and soldiers who met the criteria for one or more mental illnesses described that about half of them report remarkable guilty feeling if they sought help [2]. A military study from the United Kingdom on about 3,000 personnel indicated that stigmatization against those who have received care for mental illnesses, impacts their seeking help from mental health providers [3]. Studies on Taiwanese military mental health have shown the different prevalences of psychiatric diagnoses between soldiers and civilians [4].

Sufficient evidence is still lacking about what kind of factors impact the military hospitalization due to mental illnesses. Therefore, we did data-based unsupervised clustering analyses to address this issue. With exhaustive Chi-squared automatic interaction detector (CHAID) decision tree analysis, we intended to classify military psychiatric inpatients based on their military service time periods from enlistment to the first time of psychiatric admission (E-A period).

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Methods

This is a retrospective chart review study. The experimental protocol was approved by the institutional review board at the Tri-Service General Hospital, National Defense Medical Center in Taipei, Taiwan without the need of obtaining informed consents from the study participants.

Study participants

The sample comprised totally 3,513 military psychiatric inpatients in one military psychiatry teaching hospital in north Taiwan from year 2012 to 2015. Those inpatients had three main groups: (a) the all-male privates and recruits for compulsory military services (drafted males, [DMs] group, $n = 2,004$); (b) the male service persons for voluntary military service (enlisted males, group, $n = 1,409$); and (c) the female voluntary service women (enlisted females, [EFs] group, $n = 100$).

Measures

Enlistment-first admission time period

We defined the "enlistment-first admission time period (E-A period)" as the time period from the date of samples' enlistment to the date of their first psychiatry admission in the registry. For those who used to be hospitalized twice or more in this hospital, we used only the first-admission sociodemographic data, military ranks, diagnoses, and the date.

Exhaustive Chi-squared automatic interaction detector analysis

Differing from supervised classifications, unsupervised clustering method is a kind of data-based modeling to discover outcome measurement, like E-A period in this study [5]. This method is linked to the potential factors, especially when nonlinear relationships between them are encountered [5]. The exhaustive CHAID algorithm, a kind of unsupervised clustering, builds a decision tree by means of repeated partitions of each subset into two or more child nodes, beginning with the full database [6]. This method has been widely used in many medical fields to predict pulmonary embolism [7], to stage a cancer [8], to help a clinical decision [9], and to promote suicide prevention [10].

Statistical analysis

The descriptive analyses were used to present demographic characteristics of three groups. Then, we compared parameters between groups with analysis of variance for continuous variables, and with Chi-square test for categorical variables. To determine the potential risk factors of outcome variable (E-A period), we applied the Poisson linear regression model, and the further exhaustive CHAID analysis with 10-fold cross-validation. We computed all study variables with Statistical Package for Social Science software version 22 (SPSS Inc., Chicago, Illinois, USA). The differences between groups were considered significant if p-values were smaller than 0.05.

Results

Table 1 lists characteristics of our psychiatric hospitalization active-service military personnel from 2012 to 2015. Table 2 represents their military characteristics, namely ranks, being deployed or not, types of military service, and psychiatry diagnoses. Table 3 shows the result of the Poisson regression models to predict E-A periods of our samples.

Using the exhaustive CHAID algorithm, Figure 1 shows the result based on military ranks and Figure 2 is based on samples' voluntary or compulsory services (Tables 1-3 and Figures 1 and 2).

Table 1. Characteristics of psychiatry admission active-service military personnel from 2012 to 2015

	M±SD			Statistic
	EFs ($n = 100$)	EMs ($n = 1409$)	DMs ($n = 2004$)	
Age of enlistment or draft (A)	22.31 ± 3.43	21.31 ± 3	21.51 ± 2.37	EF > EM, DM
Age of first psychiatry admission (B)	25.44 ± 3.16	23.91± 3.61	21.79 ± 2.43	EF > EM > DM
Months of military service before first admission (B−A)	37.55 ± 34.1	31.12 ± 41.89	3.25 ± 8.01	EF > EM > DM
Education levels, *n* (%)***				
Elementary school	0	11 (0.71)	44 (2.20)	
Junior high school	0	130 (9.23)	414 (20.66)	
Senior high school	26 (26)	414 (29.38)	742 (37.03)	
University	55 (55)	677 (48.05)	665 (33.18)	
College	14 (14)	154 (10.93)	90 (4.49)	
Master degree or higher	5 (5)	23 (1.56)	47 (2.35)	
Marriage status, *n* (%)***				
Single	91 (91)	1,343 (95.32)	1,981 (98.85)	
Married	8 (8)	64 (4.54)	21 (1.05)	
Divorced	1 (1)	2 (0.14)	2 (0.10)	

*$p < 0.05$; **$p < 0.01$, ***$p < 0.01$ using ANOVA or Fisher's exact test when appropriate (N = 3513).
Due to combined compulsory and voluntary military services in Taiwan, only young males has the obligation to be drafted. Both males and females present in the Taiwanese army for voluntary military service.
M, mean; SD, standard deviation; EFs, enlisted females; EMs, enlisted males, DMs, drafted males; ANOVA, analysis of variance

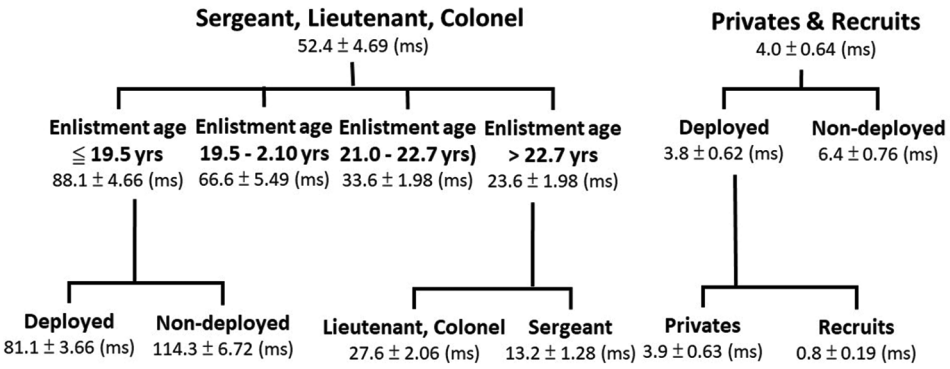

Figure 1. The result of the unsupervised classification (exhaustive CHAID decision tree) based on military ranks for samples' mean period of time (month ± standard error) from enlistment to the first psychiatry admission. ms, months; yrs, years.

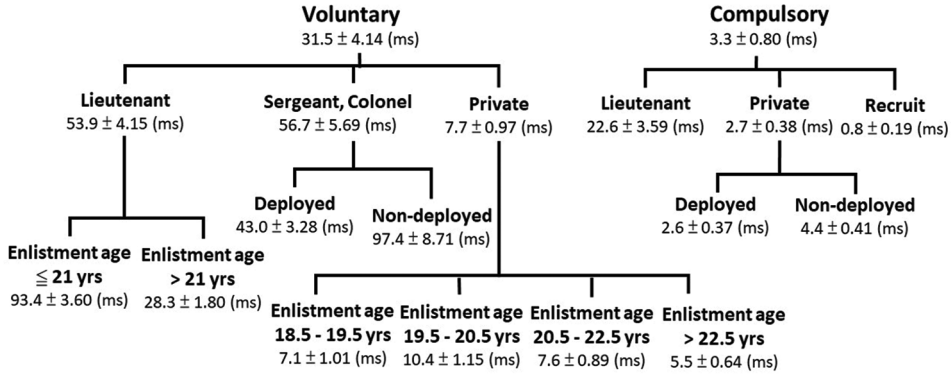

Figure 2. The result of the unsupervised classification (exhaustive CHAID decision tree) based on voluntary/compulsory service for samples' mean period of time (month ± standard error) from enlistment to the first psychiatric admission. ms, months.

Discussion

Our study demonstrated the results of applying unsupervised decision tree algorithm, exhaustive CHAID, to categorize military psychiatry patients in predicting how long in average their E-A periods will be. In our Taiwanese service men/women, the DMs who entered the army due to obligation had shortest average E-A period (about three months, Table 1). Otherwise, the EFs who entered army voluntarily showed the eldest mean age at enlistment (about 22 years old) and the longest E-A period (Table 1).

The majority (> 90%) of psychiatry diagnoses in service persons were major depression and nonpsychotic disorders (Table 2). According to the current military mental health screen assessment regulation, the diagnosis, or category, of *neurosis* consists of anxiety disorders and some other nonpsychotic mental illnesses, for example, to include obsessive-compulsive disorder, phobia, and dysthymia. This is partially in line with a previous survey of British military psychiatry hospitalization in 2007 [11]. In that survey, the most common psychiatry problem for admission is depression, followed by alcohol-related problems [11]. In our study, about one percent of service persons were diagnosed as schizophrenia or bipolar disorder. The diagnoses of intellectual disability and organic mental disorders were still represented in male group, especially among DMs. We once assumed that this results from the discrepancy in the mental health between the service persons of voluntary and compulsory military service. But, the results of our Poisson regression model (Table 3) revealed that either psychiatry diagnosis or type of military service (voluntary/compulsory) did not significantly associated with E-A period after excluding interactions of other variables. Instead, the military ranks and the age of enlistment (or draft) were significantly associated ($p < 0.001$).

The main finding of this article is that although Table 3 showed the statistical correlation relationships between some risk factors and the outcome variable in the Poisson linear regression models, what we are interested is the data-based nonsupervised insights instead of the hypotheses-based results. Thus, we took some of significant risk factors in Table 3 into the decision tree analysis (CHAID) and produced (Figures 1 and 2). Our study shed light on how practically classify (or cluster) military active service persons by their military service types and genders in terms of the average time of period to be psychiatry hospitalization (E-A period). The results of unsupervised clustering analyses revealed that the deployed recruits showed the shortest E-A period (0.8 ± 0.19 months). The longest E-A period (114.3 ± 6.72 months) was observed among nondeployed officer who enlisted in army before the age of 19.5 years. The E-A period seemed generally lower

Table 2. The military characteristics and psychiatry diagnoses of psychiatry admission active-service personnel†

	EFs	EMs	DMs
Military ranks***			
Colonel	0 (0)	15 (1.06)	0 (0)
Lieutenant	49 (49.00)	472 (33.5)	18 (0.90)
Sergeant	36 (36.00)	192 (13.63)	43 (2.15)
Private	15 (15.00)	730 (51.81)	1,848 (92.22)
Recruit	0 (0)	0 (0)	95 (4.74)
Deployed	72 (72.00)	1,170 (83.04)	1,865 (93.06)
Type of military service***			
Army	69 (69.00)	987 (70.05)	1,680 (83.83)
Navy	8 (8.00)	137 (9.72)	176 (8.78)
Air force	3 (3.00)	81 (5.75)	41 (2.05)
Sea patrol	1 (1.00)	31 (2.2)	39 (1.95)
Military police	6 (6.00)	54 (3.83)	31 (1.55)
Unified logistics	2 (2.00)	44 (3.12)	16 (0.80)
Armed forces reserve	4 (4.00)	13 (0.92)	0 (0)
MND office	7 (7.00)	62 (4.33)	21 (1.05)
Psychiatry diagnosis§			
Major depression	90 (90.00)	1,257 (89.21)	1,669 (83.28)
Other nonpsychotic disorder	9 (9.00)	107 (7.59)	234 (11.68)
Schizophrenia	0 (0)	14 (0.99)	18 (0.90)
Bipolar disorder	1 (1.00)	15 (1.06)	15 (0.75)
Intellectual disability	0 (0)	3 (0.21)	13 (0.65)
Organic mental disorder (substance related)	0 (0)	0 (0)	5 (0.25)
Organic mental disorder (nonsubstance related)	0 (0)	3 (0.21)	2 (0.10)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.01$ using ANOVA or Chi-square test when appropriate ($n = 3513$);
†Data were presented in n (%);
§Comorbidity of 2 or 3 psychiatric disorders existed. ANOVA, analysis of variance; MND, Ministry of National Defense of Taiwan; EFs, enlisted females; EMs, enlisted males, DMs, drafted males

among privates, and recruits can be due to their shorter service periods. Besides, an inverse proportional trend was found between enlistment age and E-A period among the groups other than privates or recruits (Figure 1). If we performed the unsupervised classification based on the voluntary/compulsory military services of samples (Figure 2), compulsory-service soldiers and officers showed the shorter E-A periods than their counterparts. As the rule of thumb, deployed personnel showed the shorter E-A period than the nondeployed counterparts. Counterintuitively, the inverse proportional trend rule did not perfectively apply the group of voluntary-service privates. Especially, the voluntary-service privates who enlisted over 22.5 years old showed the E-A period as 5.5 ± 0.64 months after their enlistments that was apparently the shortest among all age groups.

Study limitations

The readers are cautioned not to overinterpret the study finding because this study has three limitations:

Table 3. The result of Poisson linear regression model with outcome measurement as months of military service before samples' first psychiatric admission

Y = Months of military service before first psychiatry admission		
X (independent variables)	Wald Chi-square	df
Military ranks	2316.55***	4
Age of military enlistment or draft	1190.24***	1
Education levels	320.82***	7
Marriage status	207.26***	2
Gender	55.23***	2
Deployed	22.38***	1
Psychiatry diagnosis	10.11	8
Type of military service	0.08	1

*$p < 0.05$; **$p < 0.01$; ***$p < 0.01$.
df, degree of freedom

- The study did not have control group, or nonadmission personnel. The absence of this comparative group hinders us to conduct the survival analysis to clarify the causality.
- The previous British survey in 2007 [11] also observed that more women are admitted with depression and more men with alcohol-related disorders. That observation was not seen to our samples due to limited sample size in the female group. But, insights provided in this study still can be generalized to some other good points which are warranting further investigations.
- An essential drawback of decision tree technique is only limited number of variables can be used in the final tree. If one arbitrarily compiles many variables on the final decision tree, it will be too complex to be understood.

Summary

According to the registry of one military psychiatry teaching hospital in Taiwan, those who entered army due to obligation showed the shortest time duration from enlistment to first psychiatric hospitalization, especially who were deployed. For the voluntary service men/women, the elder enlistment age and the status of being deployed is associated with shorter service time periods before psychiatric hospitalization than other groups.

We caution that the findings should be treated as preliminary results due to the nature of this exhaustive CHAID technique. We need some sort of validation for the study results before we recommend the use of the exhaustive CHAID technique.

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Conflicts of Interest

There are no conflicts of interest.

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