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Accident prevention activity and accident experience in the Republic of Korea military

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ABSTRACT

Introduction According to data released by the Korea National Statistical Office, the number of accidents has been decreasing since 2012. However, a considerable number of deaths related to safety accidents (23–46 deaths) are still reported annually. This study aimed to observe the correlation between accident prevention activities in the Republic of Korea (ROK) military and the incidence of safety accidents.

Methods The study used data from the 2014–2015 Military Health Survey and included 13 618 responses (Army: 8414 (61.8%); Navy/Marine: 2262 (16.6%); Air Force: 2942 (21.6%)) from the ROK military personnel. Accident experiences and thoughts on accident prevention activities were self-reported. Multiple logistic regression analysis was used to examine the validity of accident prevention activity and accident experience.

Results Of the 13 618 military personnel who responded, 12.0% reported experiencing safety accidents in the military and 1020 (7.5%) felt that accident prevention activities in the military were insufficient. On logistic regression analysis, we found a significant difference (insufficiency OR=1.56, CI 1.31 to 1.86). In particular, military personnel who belong to the Army and Navy were more likely to think that accident prevention activities were insufficient. In addition, military personnel who experienced falls/slips, crash, and laceration/puncture wound/amputation/penetrating wound accidents were more likely to think accident prevention activities were insufficient.

Conclusions Our study found that accident prevention activities in the military and accident experiences were related. It is necessary for the ROK Ministry of Defense, Army, Navy and Air Force headquarters to re-evaluate their accident prevention systems.

INTRODUCTION

Military personnel can face serious injuries and even fatal injuries,^{1–3} and such accidents, which cause non-combat losses, are factors causing difficulties in maintaining military combat power.^{4–6} Furthermore, in the event of an accidental death, the incident itself may affect the morale of the armed forces or may result in the nation losing confidence in or withdrawing support from the military.⁷

Some safety accidents can be expected or are predictable. However, due to the unexpected nature of the majority of safety accidents, they are generally difficult to predict. Such accidents can be prevented by identifying and modifying risk factors or possibilities of accidents,^{8–11} accident prevention activity (education and safety inspections), and continuous efforts to prevent such incidents.^{12–14}

Key messages

- ▶ This study confirmed the association between military accident prevention activities and the safety accident experience.
- ▶ It is necessary re-check each military's accident prevention system.

However, despite efforts to prevent accidents, safety accidents in the armed forces continue to occur, prompting us to ask whether the military's accident prevention activity is sufficient.

According to data released by the Korea National Statistical Office, 46 military personnel died due to safety accidents in 2010. The number of accidents has been decreasing since 2012. However, a considerable number of deaths related to safety accidents (23–46 deaths) are still reported annually,¹⁵ although these data only report the number of deaths and not the number of non-fatal safety accidents that occur in an individual's military life. Based on these data, we investigated whether there was any correlation between accident experience in the military and accident prevention activity.

METHODS

Study participants

Data for our study population were obtained from the 2014–2015 Military Health Survey (MHS), a cross-sectional, military sample survey conducted by the School of Military Medicine designed to obtain military health determinants. This survey was based on a self-report questionnaire. The MHS was developed based on the Korea National Health and Nutrition Examination Survey (KNHANES) and was designed to determine the health status of the Republic of Korea (ROK) military personnel. The KNHANES is an ongoing surveillance system in the ROK that assesses the health and nutritional status of Koreans, monitors trends in health risk factors and the prevalence of major chronic diseases, and provides data for the development and evaluation of health policies and programmes in Korea.¹⁶ Similarly, the MHS collects data on military personnel's general characteristics, health behaviours, injuries, safety consciousness, social support, disease and medical service use, as well as characteristics that only apply to female military personnel. To represent the entire population of the ROK military personnel, the MHS uses stratified random sampling. Specifically, MHS sampling considers military personnel's sex, rank, service type and



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working area. Raw data were obtained from the Korean Military Medical School with the dean's approval. Since the 2014 MHS is an anonymous, self-administered survey, individual responses cannot be linked to specific personnel or medical records. A total of 14 244 survey participants provided data during the two years of the study (officers and warrant officers: 1914; non-commissioned officers (NCOs): 3604; enlisted soldiers: 8726). We identified respondents who had responded to the following two items: accident experience during the past year and accident prevention activity (n=14 164). We excluded participants who did not respond to questions on sex (n=10), educational level (n=142), branch (n=28), rank (n=150), service classification (n=88) and smoking (n=128). Finally, data from 13 618 personnel (officers and warrant officers: 1812; NCOs: 3406;

enlisted soldiers: 8400) were obtained and analysed as a representative sample.

Variables

The main dependent variable in this study was accident experience in the previous one year, marked as either 'yes' or 'no' in the MHS. We conducted the study after excluding missing data on accident experience from our study population. The variable of interest was accident prevention activity, which we investigated through the MHS by asking 'Is there sufficient education and efforts to prevent accidents within the unit?' with the following possible answers: 'definitely yes', 'mostly', 'neutral', 'mostly not' and 'not at all'. We classified participants who responded

Table 1 General characteristics of the study (Military Health Survey 2014–2015)

Variable	Experience of accident						P value
	Total		Yes		No		
	n	%	n	%	n	%	
Accident prevention activity							<0.0001
Sufficient	8184	60.1	860	10.5	7324	89.5	
Neutral	4414	32.4	582	13.2	3832	86.8	
Insufficient	1020	7.5	194	19	826	81	
Sex							0.0002
Male	13 224	97.1	1612	12.2	11 612	87.8	
Female	394	2.9	24	6.1	370	93.9	
Marital status							<0.0001
Married	1648	12.1	102	6.2	1546	93.8	
Once married (divorced, separated, bereaved)	312	2.3	18	5.8	294	94.2	
Unmarried	11 658	85.6	1516	13	10 142	87	
Educational level							0.2982
High school or lower	2508	18.4	286	11.4	2222	88.6	
College or higher	11 110	81.6	1350	12.2	9760	87.9	
Military type							<0.0001
Army	8414	61.8	1120	13.3	7294	86.7	
Navy/Marine	2262	16.6	242	10.7	2020	89.3	
Air Force	2942	21.6	274	9.3	2668	90.7	
Branch							0.2282
Combat	8808	64.7	1080	12.3	7728	87.7	
Non-combat	4810	35.3	556	11.6	4254	88.4	
Rank							<0.0001
Warrant officer and commissioned officer (W1–O6)	1812	13.3	74	4.1	1738	95.9	
Non-commissioned officer (E5–E9)	3406	25	214	6.3	3192	93.7	
Enlisted soldier (E3–E4)	4008	29.4	714	17.8	3294	82.2	
Enlisted soldier (E1–E2)	4392	32.3	634	14.4	3758	85.6	
Working area							<0.0001
Forward area	9014	66.2	1192	13.2	7822	86.8	
Rear area	4604	33.8	444	9.6	4160	90.4	
Service classification							<0.0001
Long-term military service	2950	21.7	160	5.4	2790	94.6	
Short-term military service	10 668	78.3	1476	13.8	9192	86.2	
Working type							0.2284
Day work	6752	49.6	834	12.4	5918	87.7	
Shift work	6866	50.4	802	11.7	6064	88.3	
Smoking							<0.0001
Current smoker	5966	43.8	608	10.2	5358	89.8	
Former smoker	848	6.2	120	14.2	728	85.9	
Non-smoker	6804	50	908	13.4	5896	86.7	
Total	13 618	100	1636	12	11 982	88	

'definitely yes' or 'mostly' as the group who felt that accident prevention education and efforts were sufficient. People who responded with 'neutral' were classified as the neutral group. The remaining respondents were classified as the group that considers accident prevention education and efforts to be insufficient. Several covariates were also assessed, including sociodemographic, military-related and health-related characteristics. Sociodemographic characteristics included sex (male, female), marital status (married, once married (divorced, separated, bereaved), unmarried) and educational level (high school or lower, college or higher). Military-related characteristics included military type (Army, Navy/Marine, Air Force), branch (combat, technique/administration, special), rank (warrant officer and commissioned officer (W1–O6), NCO (E5–E9), enlisted soldier (E3–E4), enlisted soldier (E1–E2)), working area (forward, rear), service classification (long-term military service, short-term military service), working type (day work, shift work) and smoking (current smoker, former smoker, non-smoker).

Statistical analysis

χ^2 test and logistic regression analysis were used to analyse the association between accident prevention activity and accident experience. χ^2 test was used to examine significant differences in accident experience, depending on the accident prevention activity. Multiple logistic regression analysis was used to determine OR and 95% CI. Subgroup analysis was performed according to accident experience, accident prevention activity, sex, marital status, educational level, military type, branch, working area, service classification, working type and smoking. We conducted a subgroup analysis of dependent variables to analyse the perception of accident prevention activity according to the type of accident. Statistical analyses were performed using SAS V.9.4 software. Significance level was set at $p < 0.05$.

RESULTS

Our sample included 13 618 military personnel (Army: 8414 (61.8%); Navy/Marine: 2262 (16.6%); Air Force: 2942 (21.6%)). According to our analysis, military personnel generally thought there were enough military accident prevention activities. Out of a total of 13 618 military personnel, 8184 (60.1%) thought they had sufficient accident prevention activities in the military, 4414 (32.4%) were found to be neutral, and 1020 (7.5%) thought accident prevention activities were insufficient (Table 1).

Table 2 shows the correlation between accident experience and accident prevention activity through multiple logistic regression analysis. Compared with the group who thought accident prevention activities were sufficient, the groups who considered accident prevention activities to be neutral and insufficient were more likely to have experienced accidents (Table 2).

Table 3 shows the results of a subgroup analysis of sex, marital status, educational level, military type, branch, working area, service classification and working type. In terms of educational level, those who were educated below high school and had experienced an accident were more likely to think that accident prevention activities in the military were neutral or insufficient (Table 3). In terms of military type, Army and Navy personnel who had experienced accidents considered accident prevention activities to be insufficient (Table 3). Additionally, military personnel that belonged to a combat branch are more likely to consider accident prevention activities to be insufficient (Table 3).

Figure 1 shows the results of the dependent variable subgroup analysis. This figure shows the accident prevention activity

Table 2 Factors associated with experience of accident and accident prevention activity (Military Health Survey 2014–2015)

Variables	Experience of accident
	Adjusted OR (95% CI)
Accident prevention activity	
Sufficient	1.00
Neutral	1.12 (0.99 to 1.25)
Insufficient	1.56 (1.31 to 1.86)
Sex	
Male	0.75 (0.48 to 1.16)
Female	1.00
Marital status	
Married	1.00
Once married (divorced, separated, bereaved)	0.96 (0.57 to 1.61)
Unmarried	0.78 (0.57 to 1.07)
Educational level	
High school or lower	1.00
College or higher	1.16 (1.01 to 1.33)
Military type	
Army	1.00
Navy/Marine	1.02 (0.85 to 1.22)
Air Force	0.92 (0.76 to 1.11)
Branch	
Combat	1.00
Non-combat	1.06 (0.94 to 1.21)
Rank	
Warrant officer and commissioned officer (W1–O6)	1.00
Non-commissioned officer (E5–E9)	1.55 (1.17 to 2.05)
Enlisted soldier (E3–E4)	4.87 (3.62 to 6.54)
Enlisted soldier (E1–E2)	3.85 (2.86 to 5.18)
Working area	
Forward area	1.07 (0.92 to 1.25)
Rear area	1.00
Service classification	
Long-term military service	1.00
Short-term military service	1.20 (0.89 to 1.63)
Working type	
Day work	0.90 (0.81 to 1.01)
Shift work	1.00
Smoking	
Current smoker	1.00
Former smoker	1.43 (1.15 to 1.77)
Non-smoker	1.40 (1.25 to 1.57)

according to accident type. In most accident types, accident prevention activity was considered insufficient. In particular, military personnel who had suffered from falls/slips, crash, and laceration/puncture wound/amputation/penetrating wound were more likely to consider accident prevention activities to be insufficient, at a statistically significant level.

DISCUSSION

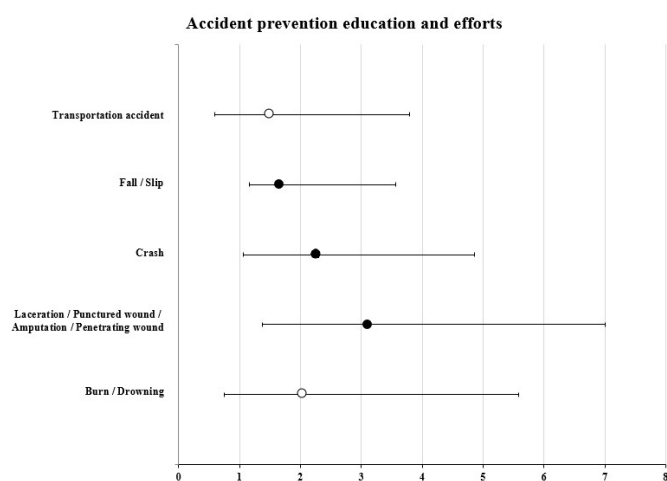
According to our research, the Korean government and the Ministry of National Defense need to revisit their safety education systems to ensure the safety of military personnel. First, the government needs to review the current safety management system. The system accounting for safety accidents is included in the Korean military policies. However, over the past decade, deaths caused by safety accidents in the military have been

Table 3 Subgroup analysis of experience of accident and accident prevention activity by covariate

Variable	Experience of accident		
	Sufficient	Neutral	Insufficient
	OR	OR (95% CI)	OR (95% CI)
Sex			
Male	1.00	1.11 (0.99 to 1.25)	1.57 (1.32 to 1.88)
Female	1.00	1.30 (0.50 to 3.40)	<0.001 (<0.001 to >999.999)
Marital status			
Married	1.00	0.90 (0.54 to 1.51)	0.90 (0.54 to 1.51)
Once married (divorced, separated, bereaved)	1.00	0.21 (0.04 to 1.17)	<0.001 (<0.001 to >999.999)
Unmarried	1.00	1.14 (1.01 to 1.29)	1.61 (1.35 to 1.93)
Educational level			
High school or lower	1.00	1.64 (1.25 to 2.16)	2.20 (1.46 to 3.33)
College or higher	1.00	1.02 (0.90 to 1.16)	1.46 (1.20 to 1.78)
Military type			
Army	1.00	1.07 (0.93 to 1.23)	1.62 (1.31 to 1.99)
Navy/Marine	1.00	1.88 (1.39 to 2.53)	2.25 (1.36 to 3.73)
Air Force	1.00	0.84 (0.64 to 1.12)	0.94 (0.59 to 1.50)
Branch			
Combat	1.00	1.09 (0.95 to 1.26)	1.75 (1.42 to 2.14)
Non-combat	1.00	1.17 (0.96 to 1.42)	1.13 (0.79 to 1.61)
Working area			
Forward area	1.00	1.15 (1.01 to 1.32)	1.73 (1.42 to 2.12)
Rear area	1.00	1.01 (0.81 to 1.27)	1.10 (0.76 to 1.60)
Service classification			
Long-term military service	1.00	0.74 (0.49 to 1.13)	1.11 (0.52 to 2.36)
Short-term military service	1.00	1.16 (1.03 to 1.31)	1.61 (1.34 to 1.93)
Working type			
Day work	1.00	0.97 (0.83 to 1.14)	1.44 (1.12 to 1.85)
Shift work	1.00	1.29 (1.09 to 1.52)	1.70 (1.33 to 2.18)
Smoking			
Current smoker	1.00	1.12 (0.93 to 1.35)	1.68 (1.27 to 2.23)
Former smoker	1.00	0.99 (0.65 to 1.52)	1.81 (0.094 to 3.48)
Non-smoker	1.00	1.12 (0.96 to 1.31)	1.44 (1.13 to 1.84)

approximately one-third of all annual deaths.¹⁵ This suggests Korean military policy reform. Second, preventive actions should be reinforced. Although there are numerous risk factors for safety accidents, some accidents could be prevented if the prevention activities are strengthened. An army is an organisation managed by schedules. In almost every mission, the personnel are warned

in advance and are aware of which mission they will be assigned to. If proper safety education and guidelines are provided prior to the next mission, fewer accidents are likely to occur. In addition, enhanced field monitoring conducted by administrations could play a role in contributing to fewer safety accidents. Third, it is necessary to train each unit's safety training specialist. To date, ROK military safety activities are mostly carried out by the officers of each unit. However, these officers are sometimes overloaded on duty as they are assigned multiple tasks aside from being in charge of safety activities. Also, some officers may not have expertise in the field, and therefore well-trained safety instructors are needed to deal exclusively with on-field monitoring. Fourth, the ongoing safety work in the military needs full review. Safety-related work is primarily managed by commissioned officers; however, they do not spend much time on the field. In most cases, they spend most of their time doing administrative work. On the other hand, it is usually the NCOs who are out on the field. Increased communication between commissioned and non-commissioned officers will enable commissioned officers to construct better plans that reflect NCOs' concerns with regard to on-field safety issues. Furthermore, if administrative work can be simplified, commissioned officers will be less occupied and will be able to spend more time out on the field with NCOs.

**Figure 1** Accident prevention activity according to accident type.

Our research has some limitations. First, we asked whether or not soldiers had experienced accidents in the past year. However, the MHS used self-report questionnaires, thus recall bias may have occurred. Operation logs, which record and track accident history, could have been a more suitable source of data, but the military did not allow use of logs for security reasons. Second, this study is unable to explain the causal relationship between accident prevention activities and accidents in the military because this was conducted using a cross-sectional design. The findings of our study would have been more valid if we had used a longitudinal design, but this was not possible due to data limitations.

Our study identified trends between accident prevention activities and accident experiences in the military. This study suggests indepth review of current accident prevention activities to make up for deficiencies.

CONCLUSION

Our study found that accident prevention activities in the military and accident experiences were related. It is necessary for the ROK Ministry of Defense, Army, Navy and Air Force headquarters to re-evaluate their accident prevention systems.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval The institutional review board of the ROK AFMC provided formal ethics approval for the MHS data sets (IRB approval number AFMC-14-IRB-004, AFMC-15060-IRB-15-049).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available.

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