

## **Determining Levels of Search and Rescue Team's Knowledge on Avalanche Search and Rescue**

**Nahsan Kaya<sup>1</sup>, Ezgi Atalay<sup>2</sup>, Melike Demir Doğan<sup>3</sup>**

### **Abstract**

Avalanches kill more than 150 people every year, although no one knows the exact figure. Additionally, the mortality rate in avalanche incidents may reach up to 70% due to factors such as the lack of knowledge, experience, and organization of search and rescue personnel. This cross-sectional study was conducted to determine the awareness on avalanche and the level of knowledge on search and rescue among personnel who respond to avalanche incidents and participate in search and rescue activities. The sample consisted of 304 individuals who agreed to participate in the study between June and July 2021. Data were collected using an information form on socio-demographic characteristics and a survey prepared by the researchers upon the relevant literature review. It was found that while 65.8% of the participants were female, 34.2% were male. Their mean age was  $29.69 \pm 8.50$  years. The rate of those participating in search and rescue activities in case of a disaster was 44.1%. The participants had a moderate level of knowledge on avalanche search and rescue as well as on-site medical management of avalanche victims. Those who participated in search and rescue activities in case of a disaster had a higher level of knowledge on avalanche search and rescue than those who did not. Those who were trained on avalanche search and rescue (preparedness, response) had higher levels of knowledge on avalanche search and rescue and on-site medical management of avalanche victims when compared to those who were not. As a consequence, it was determined that participation in search and rescue activities in a disaster increased the personnel's level knowledge. Also, the related training elevated the levels of knowledge on both avalanche search and rescue and on-site medical management of avalanche victims.

**Keywords:** Avalanche, Knowledge Level, Search and Rescue, Training

### **1. INTRODUCTION**

Natural disasters cause people to lose their lives and properties on a massive scale. Every year, avalanches, one of these natural disasters, cause the deaths of residents, mountaineers, transportation and electricity employees, military personnel, and sportsmen, particularly in mountainous areas (Ayuso et al., 2015). In recent years, there has been an increase in avalanche incidents as a result of the increasing interest in winter and outdoor sports. (Rauch et al., 2021). Although avalanche incidents tend to occur during the winter months, it is seen that they occur in every month of the year (İliklerden et al., 2021).

<sup>1</sup> Lecturer, Kutahya Health Sciences University, Department of Medical Services and Techniques, Kutahya, Turkey  
Corresponding author e-mail: [nahsankaya0229@gmail.com](mailto:nahsankaya0229@gmail.com) ORCID: <https://orcid.org/0000-0003-4933-2738>

<sup>2</sup> Lecturer, Bolu Abant İzzet Baysal University, Department of First and Emergency Assistance, Bolu, Turkey  
e-mail: [ezgiatalay@ibu.edu.tr](mailto:ezgiatalay@ibu.edu.tr) ORCID: <https://orcid.org/0000-0002-7404-4351>

<sup>3</sup> Associate Professor, Gümüşhane University, Department of Nursing, Faculty of Health Sciences, Gümüşhane, Turkey  
e-mail: [melekdm@gmail.com](mailto:melekdm@gmail.com) ORCID: <https://orcid.org/0000-0001-7051-2202>

Avalanches kill more than 150 people every year, although no one knows the exact figure. (Bejiga et al., 2017). Around 100 deaths in Europe are attributed to avalanches. Avalanches killed an average of 25 people/year in Switzerland between 1937 and 2015, 26 people/year in Austria between 1969 and 2015, 27 people/year in France between 1970 and 2015, and 20 people/year in Italy between 1970 and 2015 (Techel et al., 2016).

Although avalanches in Turkey frequently occur in the Eastern Anatolia Region and the Eastern Black Sea Region, they may also take place in the other regions. The fatalities in avalanche incidents in Turkey took place mostly between 1991 and 1992, resulting in death of 328 people. Avalanches killed 135 individuals between 1992 and 1993 (Gürer, 2002). The recent worst avalanche disaster in Turkey occurred in Van-Bahçesaray in 2020. During the search and rescue activities carried out to rescue the victims of the first avalanche, a second avalanche hit. 42 people, including military personnel, died and 84 people got injured as a consequence of the incident (Avşın and Çakı 2021). Each avalanche incident affects an average of four individuals (Hohlrieder et al., 2006). Even though avalanche has a relatively low rate among leading causes of death worldwide, the mortality rate associated with avalanches is reported to be 23% (Kornhall et al., 2005). However, depending on factors such as getting entirely buried in the snow (about 2 meters) and the lack of knowledge, experience, and organization of search and rescue personnel, the mortality rate may reach up to 70% (Harvey and Zweifel 2008).

In addition, increasing climate change causes avalanches of different frequencies and types that affect the survival rates of individuals (Strapazzon, et al., 2021). The rate of analysis for avalanche survival was approximately 50% for fully buried avalanche victims and <5% for partially or unburied victims (Brugger et al., 2021). Trauma is the leading cause of death in approximately 20-30% of victims, although asphyxia (about 70%) is the most common cause of death in fully buried victims according to survival curves from Austria, Canada, and Switzerland. Hypothermia is the main cause of death in only about 1% of fully buried avalanche victims (Strapazzon et al., 2021; Rauch et al., 2021).

Search and rescue personnel involved in avalanche rescue activities face logistical and medical challenges. The survival rate of avalanche victims decreases, given that search and rescue teams take an average of 45 minutes to arrive at the scene and often have to conduct extensive searches in dangerous terrain (Strapazzon et al., 2021).

In consideration of the aforesaid, the aim of this study is to determine the awareness on avalanche and the level of knowledge on search and rescue among personnel who respond to avalanche incidents and participate in search and rescue activities.

## **2. MATERIALS AND METHODS**

### **2. 1. Setting and Participants**

This cross-sectional study was conducted to determine the awareness on avalanche and the level of knowledge on search and rescue among personnel who would respond to avalanche incidents and participate in search and rescue activities. The population was composed of 850 individuals who participated in the search and rescue operations that were carried out by the ANDA Kardeş Vefa Association.

The Anda Kardeş Vefa Association was founded in 2016 to provide humanitarian aid. The headquarters of the association is located in Ankara, and accommodates a total of forty official representatives in Turkey. The association operates in 17 centers with over 900 members in total. It collaborates with Disaster and Emergency Management Presidency (AFAD), which is Turkey's

official authority on disasters, in order to respond to natural disasters. More than four hundred members of the Association have successfully completed the Training on the Disaster Awareness Trainer that was provided by AFAD. These trainers have continued their efforts to raise awareness of thousands of people in different regions of Turkey through disaster preparedness trainings (URL 1).

The sample size was determined to be 265 people through random sampling with finite population at a confidence interval of 95%, and the sample consisted of 304 people who agreed to participate in the study among the search and rescue members of the ANDA Kardeş Vefa Association. The data were gathered between June and July 2021.

## **2. 2. Measures and instruments**

The data were collected using an information form on socio-demographic characteristics and a survey which was prepared by the researchers upon the relevant literature review and contains questions on the knowledge level of the search and rescue personnel about avalanche search and rescue as well as on-site medical management of avalanche victims.

The information form for socio-demographic characteristics: It consists of fourteen questions on socio-demographic characteristics of the participants such as age, gender, height, weight, profession, avalanche search and rescue, and first aid.

The survey: It consists of eight questions on the Level of Knowledge on Avalanche Search and Rescue that are answered as Correct (1 point), Incorrect (0 point), and I don't know (0 point) as well as fourteen questions on the on-site medical management of avalanche victims that are answered as Correct (1 point), Incorrect (0 point), and I don't know (0 point).

## **2. 3. Ethical Considerations**

For the study, approval was obtained from the Scientific Research and Publication Ethics Committee of Gümüşhane University (approval no: 2021/4 & date: 09/06/2021). Permission was obtained from the ANDA Kardeş Vefa Association.

## **2. 4. Statistical analysis**

Means, median, frequencies, and percentage as descriptive statistics were used to show the socio-demographic characteristics. The data were compared by using t test, Mann-Whitney U Test, Pearson's Correlation and Spearman's Correlation for all statistical analyses and a 2-sided p value of < 0.05 was considered as statistically significant.

## **3. FINDINGS**

Findings of the present study indicated that 65.8% of the participants were female, 34.2% were male, and 68.8% were single. Their mean age was  $29.69 \pm 8.50$ . It was found that 39.1 % had a bachelor's degree. While 4.3 % were healthcare professionals, the remaining 95.7 % were members of other professions. Their average duration of working actively in the association was  $18.39 \pm 17.08$  months. The rate of those participating in search and rescue activities in case of a disaster was 44.1 %. The rate of people participating in search and rescue activities in case of an avalanche, on the other hand, was 4.9%.

Moreover, 44.7% of the participants stated that they were trained on avalanche search and rescue (preparedness, response) and 64.8% stated that they had knowledge about the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios. The rate of those who were trained on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined was 27%, and the rate of those who

were trained on the general risk concept of snow and avalanches or the planning of risk management was 39.8%, and rate of those who were trained on the first aid was 74% (Table 1).

Table 1. Socio-demographic characteristics of the participants

	n	%
<b>Gender</b>		
Female	200	65.8
Male	104	34.2
<b>Marital Status</b>		
Married	95	31.3
Single	209	68.8
<b>Educational Level</b>		
Primary School	9	3
Secondary School	12	3.9
High School	81	26.6
Associate Degree	74	24.3
Bachelor's Degree	119	39.1
Master's Degree	9	3
<b>Profession</b>		
Healthcare personnel	13	4.3
Members of Other professions	291	95.7
<b>How long have you been actively working within the association?</b>		
<b>Have you participated in search and rescue activities within the association in case of a disaster?</b>		
Yes	134	44.1
No	170	55.9
<b>Have you participated in search and rescue activities within the association in case of an avalanche?</b>		
Yes	15	4.9
No	289	95.1
<b>Have you been trained on avalanche search and rescue (preparedness, response)?</b>		
Yes	136	44.7
No	168	55.3

### Determining Levels of Search and Rescue Team's Knowledge on Avalanche Search and Rescue

<b>Are you knowledgeable with inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios?</b>		
Yes	197	64.8
No	107	35.2
<b>Have you been trained on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined?</b>		
Yes	82	27
No	222	7
<b>Have you been trained on the general risk concept of snow and avalanche or the planning of risk management?</b>		
Yes	121	39.8
No	183	60.2
<b>Have you been trained on first aid?</b>		
Yes	225	74
No	79	25

Table 2 shows the percentage values of the participants' answers to questions about the level of knowledge on avalanche search and rescue (Table 2). Table 3 shows the percentage values of their answers to questions about the on-site medical management of avalanche victims (Table 3).

The mean correct answer of the questions on the level of knowledge on avalanche search and rescue was  $4.21 \pm 1.94$ . The mean correct answer of the questions on the on-site medical management of avalanche victims was  $7.83 \pm 3.18$ . When the mean correct answers of the questions about the level of knowledge on avalanche search and rescue were compared in terms of gender, a statistically significant correlation was observed ( $t=3.55$ ;  $p < 0.001$ ). Females had a higher level of knowledge on avalanche search and rescue compared to their male counterparts. When the mean correct answers of the questions on the level of knowledge on avalanche search and rescue were compared in terms of marital status, a statistically significant correlation was observed ( $t=2.01$ ;  $p=0.04$ ). Married people had a higher level of knowledge on avalanche search and rescue compared to their single counterparts (Table 4).

When the participation in search and rescue activities in case of any disaster and the mean correct answers of the questions about the level of knowledge on avalanche search and rescue were compared, a statistically significant correlation was determined ( $t=2.13$ ;  $p= 0.03$ ). Those who participated in search and rescue operations within the body of the association in case of a disaster had a higher level of knowledge on avalanche search and rescue than those who did not. A statistically significant correlation was determined between the status of being trained on avalanche search and rescue (preparedness, response) and the mean correct answers of the questions about the level of knowledge on avalanche search and rescue ( $Z=-6.12$ ;  $p < 0.001$ ). Those who were trained on avalanche search and rescue (preparedness, response) had higher levels of knowledge on avalanche search and rescue than those who were not. When status of being trained on avalanche search and rescue (preparedness, response) and the mean correct answers of the questions about the level of knowledge on on-site medical management of avalanche victims were compared, a statistically significant correlation was identified ( $Z=-5.60$ ;  $p < 0.001$ ). Those who were trained on avalanche search and rescue (preparedness, response) had higher levels of

knowledge on on-site medical management of avalanche victims compared to those who were not (Table 4).

Table 2. Questions on the Level of Knowledge on Avalanche Search and Rescue

	Correct		Incorrect		I do not know	
	n	%	n	%	n	%
1. In case of an avalanche, field scanning begins by determining its location, appointment of an observer, rough observation, and identification of escape routes.	261	86.1	2	0.7	40	13.2
2. After the location is identified, it is ensured that the transmitter scanning and probing procedures are followed and the identified victim is rescued by shoveling out.	208	68.6	25	8.3	70	23.1
3. Radio communication is not permitted in an avalanche zone.	58	19.2	168	55.6	76	25.2
4. Detectors should be kept at least 20 cm away from other electrical and metal objects in transmitter mode and at least 50 cm away in receiver mode.	116	38.9	25	8.4	157	52.7
5. The metal rods to be used for probing must be one meter.	75	24.8	116	38.4	111	36.8
6. Shoveling should begin 1.5 meters below the victim in the area marked with the probe.	154	51.2	21	7	126	41.9
7. Snow must be shoveled upward.	126	42.1	70	23.4	103	34.4
8. Avalanche rescue dogs can be used to sniff up and identify the buried victims.	179	59.5	49	16.3	73	24.3

Table 3. Questions on on-site medical management of avalanche victims

	Correct		Incorrect		I do not know	
	n	%	n	%	n	%
1. The first thing you should do when you reach a disaster victim is to keep the airway clear.	277	91.1	7	2.3	20	6.6
2. The airway may be utilized to provide the airway patency.	155	51.0	37	12.2	112	36.8
3. The body temperature of the victim must be checked.	279	91.8	4	1.3	21	6.9
4. Body temperature in hypothermia stage I is 32-35 °C. The victim is conscious but suffers from tremors.	192	63.2	36	11.8	76	25
5. Body temperature of the victim must be maintained with a thermal blanket when he/she is transported to the trauma board.	270	88.8	5	1.6	29	9.5
6. Body temperature in hypothermia stage II is 28-32 °C. The victim begins to have an impaired consciousness and the tremors stop.	177	58.2	19	6.3	108	35.5

## Determining Levels of Search and Rescue Team's Knowledge on Avalanche Search and Rescue

7. Lethal Asphyxia (deprivation of oxygen) is rarely seen among avalanche victims.	58	19.1	127	41.8	119	39.1
8. Body temperature in hypothermia stage III is 24-28 °C. The victim is fully conscious.	55	18.1	136	44.7	113	37.2
9. A neck collar must be used for the reached disaster victim against the risk of trauma.	245	80.6	18	5.9	41	13.5
10. Body temperature in hypothermia stage IV is 24°C. The victim has no vital signs.	160	52.6	21	6.9	123	40.5
11. If you reach a disaster victim who is not breathing and has no visible fatal injury, he is regarded as dead.	46	15.1	184	60.5	74	24.3
12. If you reach a disaster victim who is conscious but has tremors, you must change his clothes and keep his body temperature stable.	236	77.6	19	6.3	49	16.1
13. If you reach a disaster victim who is unconscious but breathing, you must have the victim drink hot, sweet liquids.	62	20.4	174	57.2	68	22.4
14. If you reach a disaster victim who is not breathing and has a visible fatal injury, you must start CPR.	125	41.1	39	12.8	140	46.1

When status of having the knowledge about the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios and the mean correct answers of the questions about the level of knowledge on avalanche search and rescue were compared, a statistically significant correlation was identified between them ( $Z=-6.94$ ;  $p<0.001$ ). Those who had knowledge about the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios had higher knowledge levels on avalanche search and rescue than those who did not. When status of having the knowledge about the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios and the mean of correct answers to the questions about the on-site medical management of avalanche victims were compared, a statistically significant correlation was identified ( $Z=-3.77$ ;  $p<0.001$ ). Those who were knowledgeable with the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios had higher level of knowledge on on-site medical management of avalanche victims than those who did not (Table 4).

When the status of receiving the training on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined was compared with the mean correct answers of the questions on the level of knowledge on avalanche search and rescue, a statistically significant correlation was determined between them ( $Z=-4.70$ ;  $p<0.001$ ). Those who were trained on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined had higher knowledge levels on avalanche search and rescue than those who were not. When status of receiving the training on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined was compared with the mean correct answers of the questions about the on-site medical management of avalanche victims, a statistically significant correlation was found ( $Z=-3.47$ ;  $p=0.001$ ). Those who were trained on this issue had higher levels of knowledge on on-site medical management of avalanche victims than level of those who were not (Table 4).

When the status of receiving the training on general risk concept of snow and avalanche or the planning of risk management was compared with the mean of correct answers to the questions about the knowledge level on avalanche search and rescue, a statistically significant correlation was found between them ( $Z=-4.62$ ;  $p<0.001$ ). Those, who were trained on this issue, had a higher

level of knowledge on avalanche search and rescue than those who were not. When status of receiving the training on general risk concept of snow and avalanche or the planning of risk management was compared with the mean correct answers of the questions on the on-site medical management of avalanche victims, a statistically significant correlation was identified between ( $Z=-5.03$ ;  $p< 0.001$ ). Those, who were trained on this issue, had higher levels of knowledge on on-site medical management of avalanche victims compared to those who were not (Table 4).

Table 4. Comparison of the participants' levels of knowledge on search-rescue and response with their socio-demographic characteristics

	The mean correct answers of the questions on the level of knowledge on avalanche search and rescue.		The mean correct answers of the questions on on-site medical management of avalanche victims	
	mean±sd	P	mean±sd	p
<b>Gender</b>				
Female	4.50±1.90	< 0.001*	7.98±3.11	0.24*
Male	3.66±1.85		7.53±3.32	
<b>Marital Status</b>				
Married	4.55±1.87	0.04*	8.17±3.14	0.20*
Single	4.06±1.95		7.67±3.20	
<b>Have you participated in search and rescue activities within the association in case of a disaster?</b>				
Yes	4.49±1.83	0.03*	7.93±3.07	0.62*
No	4.00±2.00		7.75±3.28	
<b>Have you participated in search and rescue activities within the association in case of an avalanche?</b>				
Yes	4.93±1.09	0.14*	7.66±2.41	0.83*
No	4.18±1.96		7.84±3.22	
<b>Have you been trained on avalanche search and rescue (preparedness. response)?</b>				
Yes	4.99±1.41	< 0.001**	9.03±2.28	< 0.001**
No	3.58±2.08		6.85±3.47	
<b>Do you have knowledge on inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios?</b>				
Yes	4.82±1.62	< 0.001**	8.38±2.87	< 0.001**
No	3.12±1.99		6.82±3.46	

## Determining Levels of Search and Rescue Team's Knowledge on Avalanche Search and Rescue

<b>Have you been trained on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined?</b>				
Yes	5.12±1.44	< 0.001**	8.93±2.37	0.001**
No	3.89±1.99		7.42±3.35	
<b>Have you been trained on the general risk concept of snow and avalanche or the planning of risk management?</b>				
Yes	4.84±1.57	< 0.001**	8.99±2.38	< 0.001**
No	3.82±2.04		7.06±3.41	
<b>Have you been trained on first aid?</b>				
Yes	4.48±1.77	< 0.001**	8.27±2.93	< 0.001**
No	3.46±2.17		6.56±3.55	

\*t-test, \*\*Mann-Whitney U test

When the status of receiving the training on first aid was compared with the mean correct answers of the questions on the level of knowledge on avalanche search and rescue, a statistically significant correlation was identified ( $Z=-3.84$ ;  $p< 0.001$ ). Those, who were trained on first aid, had higher levels of knowledge on avalanche search and rescue than those who were not. When status of receiving the training on first aid was compared with the mean correct answers of the questions about the on-site medical management of avalanche victims, a statistically significant correlation was identified ( $Z=-3.75$ ;  $p< 0.001$ ). Those who were trained on first aid had higher levels of knowledge on on-site medical management of avalanche victims than those who were not (Table 4).

When the mean correct answers of the questions about the level of knowledge on avalanche search and rescue were compared with age, a statistically significant correlation was identified ( $r=0.12$ ;  $p=0.03$ ). When the mean correct answers of the questions on the on-site medical management of avalanche victims was compared with age, a statistically significant correlation was found between them ( $r=0.12$ ;  $p=0.02$ ). As age of the participants increased, the level of knowledge on the on-site medical management of avalanche victims and the level of knowledge on avalanche search and rescue increased. When the mean correct answers of the questions about the level of knowledge on avalanche search and rescue and the on-site medical management of avalanche victims were compared, a statistically significant correlation was determined between them ( $r=0.64$ ;  $p<0.001$ ). As the participants' level of knowledge on avalanche search and rescue increased, their level of knowledge on the on-site medical management of avalanche victims also increased.

## 4. DISCUSSION

Today, search and rescue and emergency personnel are involved in the first stages of responses to avalanche incidents. Search and rescue teams of non-governmental organizations can also respond to these incidents. Besides, security forces are on duty to assist search and rescue teams, since they are often deployed in mountainous terrains. It is important for all personnel, who work in terrains with high avalanche risk and respond to avalanche incidents, to be highly skilled in search and rescue and medical management (Lied, 1988; Harvey and Zweifel 2008; Kornhall and

Martens-Nielsen 2016). However, individual practical solutions, activities, ideas and resource supply of team members should be simply understood and efficiently applied at the organizational level. Many factors (weather conditions, dangerous terrain, major injury, casualties, inadequate equipment, and insufficient number of staff members) may affect search and rescue members on the incident site. When these factors are combined with the lack of experience of search and rescue personnel, the effect of these factors intensifies (Denton and Patrol 1994). This study revealed that the rate of the participants involved in search and rescue activities in case of a disaster was 44.1%. The rate of those participating in search and rescue activities in case of an avalanche, on the other hand, was 4.9%. 44.7% of the participants stated that they were trained on avalanche search and rescue (preparedness, response) and 64.8% stated that they had knowledge about the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios. The rate of those who were trained on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined was 27%. The rate of those who were trained on the general risk concept of snow and avalanches or the planning of risk management was 39.8%. The rate of those who were trained on the first aid was 74%. However, the mean correct answers of the questions on the level of knowledge on avalanche search and rescue were at moderate level. The mean correct answers of the questions on the on-site medical management of avalanche victims were at moderate level. This might be associated with the low participation rate of individuals in the avalanche search and rescue activities.

When the mean correct answers of the questions about the level of knowledge on avalanche search and rescue were compared with gender, it was determined that females had a higher level of knowledge on avalanche search and rescue than their male counterparts. There is no study in the literature on the correlation between gender and the level of knowledge on avalanche search and rescue. However, no significant difference was observed between knowledge levels of disaster medicine and gender in studies conducted to determine the general knowledge level of healthcare professionals on disaster (Güner, 2016). Likewise, a study on the knowledge, attitude, and preparedness for practice among students receiving training on disaster medicine and preparedness at the university revealed no significant difference in knowledge, attitude, and preparedness to practice based on gender (Al-Ziftawi et al., 2021). The major cause for this difference between gender and the knowledge level on avalanche search and rescue could not be found in the literature review. However, it is believed that this difference may be understood by assessing gender and training times for avalanche search and rescue together.

The present study indicated that married ones had a higher level of knowledge on avalanche search and rescue than their single counterparts. There has been no study in the literature on the correlation of knowledge level on avalanche search and rescue with gender and marital status. In a previous study, the level of married healthcare professionals' knowledge on earthquake was found to be significantly higher than the level of single ones (Çelebi and Uçku 2017). Likewise, it is considered that the significantly high knowledge level of married people is associated with the fact that they married at advanced ages, and thus their experience and knowledge increased progressively.

It was observed that those who participated in search and rescue activities in case of a disaster had a higher level of knowledge on avalanche search and rescue than those who did not. The studies aiming to determine the general knowledge level of healthcare professionals on disaster reported that those who had taken part in a disaster before had higher knowledge levels on disaster medicine than those who had not, and this difference between the two groups was statistically significant (Güner, 2016). Furthermore, a study conducted to assess the disaster knowledge skills and preparedness levels of nurses reported that the participants who were experienced in disaster responses and trained on disaster management had higher levels of

knowledge on disaster management than those who were not experienced in disaster responses and not trained on disaster management (Hasan et al., 2021). These results are compatible with results of the present study and search and rescue experience elevates knowledge level and highlights the importance of experience in search and rescue.

It was observed that those who were trained on avalanche search and rescue (preparedness, response) had higher levels of knowledge on avalanche search and rescue than those who were not. Those who were trained on avalanche search and rescue (preparedness, response) had higher levels of knowledge on on-site medical management of avalanche victims than those who were not. In their study, Strapazzon et al., (2018) reported that avalanche training raised the awareness on avalanche search and rescue and level of knowledge on this subject. Second rescuers were trained on rescue by Genswein and Eide (2008). The rescuers practiced what they had learnt from the field training. Their rescue skills and efficiency improved with this training and practice. These findings are compatible with findings of the present study, demonstrating that the training is critical.

Since avalanche zones are mountainous and rugged terrains, they are often ineligible for resource access (Van Tilburg, 2017). Therefore, one-on-one drills in the region are important. Indeed, this study revealed that those who had knowledge about the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios had higher levels of knowledge on avalanche search and rescue than those who did not. Those who had knowledge about the inspection in mountainous terrain, drills in rough terrain, and avalanche scenarios had higher levels of knowledge on on-site medical management of avalanche victims than those who did not.

The collective assessment of information on local weather, topography, snow, and avalanche conditions is thought to allow avalanche risk assessment and lower the possibility of adverse events. The activities associated with the transport and rescue stages should maintain the continuity of risk assessments (Lunde and Njå 2019). This study revealed that those who were trained on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined had higher levels of knowledge on avalanche search and rescue than those who were not. Those who were trained on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined had higher levels of knowledge on on-site medical management of avalanche victims than those who were not. Those, who were trained on the general risk concept of snow and avalanches or the planning of risk management, had higher knowledge levels on avalanche search and rescue than those who were not. Those who were trained on the general risk concept of snow and avalanche or the planning of risk management, had higher levels of knowledge on on-site medical management of avalanche victims than those who were not. As a result, it is considered that closing the gaps in training on how the stability and inclination of deposited snow are affected by meteorological parameters and how these parameters might be determined would allow the related personnel to realize a more effective response.

After determining location of avalanche victims and shoveling them out, the first practice is to deliver first aid. The first aider's primary responsibility is to open the respiratory tract and avoid hypothermia. The high level of knowledge on the search and rescue personnel about the vital functions of the disaster victims allows them to realize an effective response by anticipating the first aid procedures in the field (Michahelles et al., 2003). In this study, it was determined that those who were trained on first aid had higher levels of knowledge on avalanche search and rescue than those who were not. Those who were trained on first aid had higher knowledge levels on on-site medical management of avalanche victims than those who were not. As a result, it is considered that raising the level of search and rescue personnel's knowledge on first aid would make search - rescue and response more effective in future avalanche incidents.

It was determined that as age of the participants increased, their level of knowledge on the on-site medical management of avalanche victims and avalanche search and rescue increased. As the level of knowledge on avalanche search and rescue elevated, the level of knowledge on the on-site medical management of avalanche victims also elevated. A study that investigated the knowledge levels of disaster medicine reported, contrary to our study that knowledge levels decreased with increasing age (Güner, 2016). Likewise, young participants were found to have higher levels of knowledge than older participants in a study on the knowledge, attitude, and preparedness for practice of students receiving health education on disaster medicine and preparedness at the university (Al-Ziftawi et al., 2021). Based on these findings, it was considered that the skills and knowledge of personnel who were working within the association for a long time improved with the responses in the field. It is believed that the inclusion of disaster management courses in the curricula was effective in high knowledge level, attitude, and preparedness for the practice among young people.

## 5. CONCLUSION

Findings of this study revealed that those who participated in search and rescue activities within the association in case of a disaster had a higher level of knowledge about search and rescue than those who did not. Also the trainings raised the knowledge level on both the avalanche search and rescue and the on-site medical management of avalanche victims. It is thought that it would be effective to organize the training programs in order to raise the knowledge level of the search and rescue personnel in avalanches. Acknowledgements: Not applicable.

Author contributions: Study concept and design (all authors); questionnaire design (all authors); acquisition of data (all authors); analysis of data (all authors); drafting of manuscript (all authors); revision of manuscript (all authors); approval of final manuscript (all authors).

*Financial/Material Support: None.*

*Disclosures: None.*

## REFERENCES

- Al-Ziftawi, N.H., Elamin, F. M., Ibrahim, M. I. M. (2021). Assessment of knowledge, attitudes, and readiness to practice regarding disaster medicine and preparedness among university health students. *Disaster Medicine and Public Health Preparedness* 15:3, 316-324. <https://doi.org/10.1017/dmp.2019.157>
- Avşın, N., Çakı, D.T. (2021). Çatak-Bahçesaray (Van) karayolu üzerindeki çığa duyarlı alanların belirlenmesi. *Jeomorfolojik Araştırmalar Dergisi* 7:30-47. <https://doi.org/10.46453/jader.911574>
- Ayuso, N., Cuchí, J.A., Lera, F., Villarroel, J.L. (2015). A deep insight into avalanche transceivers for optimizing rescue. *Cold Regions Science and Technology* 111:80-94. <https://doi.org/10.1016/j.coldregions.2014.12.005>
- Bejiga, M.B., Zeggada, A., Nouffidj, A., Melgani, F. (2017). A convolutional neural network approach for assisting avalanche search and rescue operations with UAV imagery. *Remote Sensing* 9:2, 100. <https://doi.org/10.3390/rs90201000>
- Brugger, H., Strapazzon, G., and Zafren, K. (2021). "Avalanche accidents" in Mountain emergency medicine. eds. H. Brugger, K. Zafren, L. Festi, P. Paal, and G. Strapazzon (Milan, Italy: EDRA S.p.A.), 223–251.
- Çelebi, İ., Uçku, Ş. (2017). Kayseri ili 112 acil sağlık hizmetlerinde görev yapan sağlık personelinin deprem

bilgi düzeyi ve etkileyen etmenler. Hastane Öncesi Dergisi 2:2, 91-103. <https://dergipark.org.tr/en/pub/hod/issue/31941/351631>

Denton, G., Patrol, B. M. N. S. (1994). The human experience of avalanche rescue. In Proceedings of the International Snow Science Workshop, Snowbird, UT pp. 431-438 <https://arc.lib.montana.edu/snow-science/objects/issw-1994-431-438.pdf>. Accessed 20 June 2021

Genswein, M., Eide, R. (2008). The efficiency of companion rescuers with minimal training. In Proceedings Whistler 2008 International Snow Science Workshop September 21-27, 2008 (pp. 581-590) [http://www.issw2008.com/papers/P\\_8214.pdf](http://www.issw2008.com/papers/P_8214.pdf). Accessed 11 June 2021

Güner, Y. (2016). Çanakkale ili 112 acil sağlık hizmetleri istasyonlarında çalışan personelin afet tıbbi konusundaki bilgi düzeyleri Yüksek Lisans Tezi, Sağlık Bilimleri Enstitüsü, Pamukkale Üniversitesi

Gürer, İ. (2002). Türkiye'de yerleşim yerlerine yönelik kar ve çığ problemleri. Türkiye Mühendislik Haberleri, 420:4, 147-154.

Harvey, S., Zweifel, B. (2008). New trends of recreational avalanche accidents in Switzerland. In: Campbell C, Conger S, editors. International Snow Science Workshop 2008: Proceedings of international snow science workshop. <http://www.slf.ch/praevention/lawinenunfaelle/unfallstatistik/paperissw08.pdf>. Accessed 21 June 2021

Hasan, M. K., Younos, T. B., Farid, Z. I. (2021). Nurses' knowledge, skills and preparedness for disaster management of a Megapolis: Implications for nursing disaster education. Nurse Education Today 107:105122. <https://doi.org/10.1016/j.nedt.2021.105122>

Hohlrieder, M., Mair, P., Wuertl, W., Brugger, H. (2005). The impact of avalanche transceivers on mortality from avalanche accidents. High Altitude Medicine & Biology 6:1, 72-77. <https://doi.org/10.1089/ham.2005.6.72>

İliklerden, D. M., Kalaycı, T., & Karacaoglu, İ. C. (2021). The evaluation of traumas of victims in Avalanche disasters in Van province, Turkey on February 4-5, 2020. Eastern Journal of Medicine, 26(3), 465-469. <https://doi.org/10.5505/ejm.2021.86244>

Kornhall, D. K., Martens-Nielsen, J. (2016). The prehospital management of avalanche victims. BMJ Military Health 162:6, 406-412. <http://dx.doi.org/10.1136/jramc-2015-000441>

Lied, K. (1988). The avalanche accident at Vassdalen. Norway 5 March 1986. Cold Regions Science and Technology 15:2, 137-150. [https://doi.org/10.1016/0165-232X\(88\)90060-2](https://doi.org/10.1016/0165-232X(88)90060-2)

Lunde, A., Njå, O. (2019). Rescue performance in Norwegian road related avalanche incidents. Cold regions science and technology 165:102774. <https://doi.org/10.1016/j.coldregions.2019.04.011>

Michahelles, F., Matter, P., Schmidt, A., Schiele, B. (2003). Applying wearable sensors to avalanche rescue. Computers & Graphics 27:6, 839-847. <https://doi.org/10.1016/j.cag.2003.08.008>

Rauch, S., Strapazzon, G., & Brugger, H. (2021). On-Site Medical Management of Avalanche Victims—A Narrative Review. International Journal of Environmental Research and Public Health, 18(19), 10234. <https://doi.org/10.3390/ijerph181910234>

Strapazzon, G., Migliaccio, D., Fontana, D., Stawinoga, A. E., Milani, M., Brugger, H. (2018). Knowledge of the avalanche victim resuscitation checklist and utility of a standardized lecture in Italy. Wilderness & environmental medicine 29:1, 56-60. <https://doi.org/10.1016/j.wem.2017.08.007>

Strapazzon, G., Schweizer, J., Chiambretti, I., Brodmann Maeder, M., Brugger, H., & Zafren, K. (2021). Effects of climate change on avalanche accidents and survival. Frontiers in physiology, 12, 639433. <https://doi.org/10.3389/fphys.2021.639433>

Techel, F., Jarry, F., Kronthaler, G., Mitterer, S., Nairz, P., Pavšek, M., Darms, G. (2016). Avalanche Fatalities

in the European Alps: LongTermTrends and Statistics. *Geographica Helvetica* 71:2, 147-159.  
<https://doi.org/10.5194/gh-71-147-2016>

URL 1, <https://anda.org.tr/hakkimizda/> . Accessed 21 June 2022.

Van Tilburg, C., Grissom, C. K., Zafren, K., McIntosh, S., Radwin, M. I., Paal, P. et al. (2017). Wilderness medical society practice guidelines for prevention and management of avalanche and nonavalanche snow burial accidents. *Wilderness & Environmental Medicine* 28:1, 23-42. <https://doi.org/10.1016/j.wem.2016.10.004>