Journal of Complementary Medicine Research, ISSN: 2146-8397 Vol. 15, No. 1, 2024(pp. 65-70)

RESEARCH ARTICLE WWW.JOCMR.COM

Applications to Emergency Medical Services from Schools: a Retrospective Study

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ABSTRACT

Aim and Background: Children spend a significant part of the day in school. During this time, injuries or any illness are likely to occur that may require emergency medical care. The aim of this study is to examine the epidemiological characteristics associated with the reasons for applications to emergency medical services from schools and with the conceptual framework of school health.

Methods: This retrospective study conducted with province emergency medical services (EMS) data. 4043 cases that applications to EMS from school between 2014-2019 were determined and analyzed. The scope of this research was reviewed patient characteristics, time, and season of the emergency medical service application, diagnostic type, triage, and interventions.

Results: The mean age was 14.0±3.20, 58.7% were female, and 52.8% were transferred to the hospital by ambulance. Most of the applications were caused by non-traumatic reasons. The reason for application varied according to gender and age ($p<0.001$). While 5-12-year-old students applied mostly due to trauma; female and 13-18 year-old students applied frequently due to non-traumatic reasons ($p<0.001$).

Conclusions: The findings of this study are thought to contribute to the development of school health strategies. The strategies should focus on the specific age and gender groups and medical health conditions, especially mental health. However, there is a need for further research into identifying risk factors to better understand the underlying mechanisms and potential interactions with other factors.

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How to cite this article: Meral B, Bulut K H (2024), Applications to Emergency Medical Services from Schools: a Retrospective Study. Journal of Complementary Medicine Research, Vol. 15, No. 1, 2024 (pp. 65-70).

KEYWORDS:
anxiety,
children,
emergency medical services,
nursing,
school

ARTICLE HISTORY:
Received: Oct 07, 2023
Accepted: Nov 10, 2023
Published: Dec 13, 2023

DOI:
10.5455/jcmr.2024.15.01.11

INTRODUCTION

Children spend most of their time at school until adulthood and they face many emergencies situations (1,2). School health services are very important, but it may remain in the background, especially in developing countries where there are no school health nurses, as in our country (3,4). Even so, schools must be prepared to prevent and effectively manage medical emergencies, regardless of the availability of a healthcare professional (3,5). In this respect, prevention strategies and recommendations to be developed should primarily focus on specific risk factors and etiology.

Accidents and injuries in schools are among the leading emergencies and lead to serious morbidity and mortality in children as well as limitations in students' daily activities, decrease in school attendance and academic success, psychosocial distress in both children and families, impaired quality of life, the activation of emergency medical services (EMS), increased pediatric emergency department (PED) visits and health care expenses (6,7). Studies have reported that 21-44% of children applications to the PED due to school-related injuries (8,9).

Many medical conditions including complications of chronic health conditions, attacks, unexpected acute illness, behavioral crises, psychosomatic complaints could occur in school that may require emergency services admission (9,10). In a study, more than half of the nurses reported that at least 10 students applied to the school nurse weekly and activated more than 10 EMS in the previous academic year (11). Olympia et al. (2005) stated most of the school nurses experienced a life-threatening situation and activated EMS in the previous academic year (12). Another reason of applied to the PED increasing mental health problems among pediatric population (13,14). Also, existing research has documented an increase in mental health visits and diagnoses during the school year (10, 14-17).

Previous studies focused on the prevalence and consequences of school accidents and injuries, however, information on certain risk factors associated with applications to EMS from school for both traumatic and non-traumatic children remain limited. This is one of the most important obstacles to defining strategies and intervention plans to be applied for managing emergencies due to chronic diseases and preventing trauma-related injuries in schools (9). In this sense, to contribute to developing prevention strategies to improve school health, the present study aims to determine the epidemiological characteristics associated with the reasons for applications to emergency medical services from schools.

MATERIALS AND METHODS

This study was a retrospective study designed to evaluate the applications of schools and dormitories to the provincial ambulance services between September 2014-May 2019. All applications to the provincial ambulance service between the stated years were examined by the researchers. Data from 4043 cases who were applications to EMS and were 5 to 18 years of age were included. The cases were divided into two age groups according to the school types (elementary/middle school, and high school) of the students. In the current study, patient characteristics, time, and season of the EMS application, diagnostic type, triage, and interventions were examined. In addition, according to the International Classification of Diseases-10 (ICD-10) diagnostic group in the system, these cases were grouped as traumatic and non-traumatic causes. Traumatic causes were grouped as falls, injuries (open wound, superficial injury), crush/sprain/fracture/dislocation, assault/push/impact, head trauma and others. Non-traumatic causes were grouped as pain (abdominal pain, dysmenorrhea, pelvic pain, headache, undefined type of pain), cardiovascular diseases (chest pain, angina pectoris, palpitations, hypotension, hypertension), respiratory diseases (asthma, shortness of breath, sore throat, nasal bleeding), psychiatric diseases (anxiety disorder, conversion, suicide), poisoning (food poisoning, drug side effect-related poisoning), nausea-vomiting, nervous system diseases (epilepsy, convulsions, dizziness), syncope, gastrointestinal diseases (diarrhea, gastroenteritis) and others (infectious diseases, fever, hypoglycemia, hyperglycemia).

The male gender and low age groups could be considered as risk factors for falling/trauma (6,20-22). It is recommended to evaluate the injuries within the scope of emergency health services according to age, gender, and type of injury (23). In this context, applications made due to trauma and non-traumatic causes were evaluated according to age and gender in this study and it was examined whether or not there was any difference between the groups.

Statistical Analysis

The study data were analyzed using SPSS version 21. While continuous data were presented as means and standard deviations, minimum-maximum, categorical data were shown as number and percentage. The Chi-square test (x2) was used to determine the associations and differences between the groups. In the Chi-square test, the most frequently used effect size coefficient Phi for 2x2 tables and Cramer's V values for tables larger than 2x2 were used. This coefficient ranged from 0 to 1 and was evaluated as 0.10/small effect, 0.30/medium effect, and 0.50/high effect (24). A value of p less than 0.05 was accepted as statistically significant.

RESULTS

The applications to EMS were between 2014-2019 years, with percentages of 6.1%, 17.2%, 21.8%, 24.1%, and 30.8%, respectively (Figure 1). More than half of the children (58.7%) were female students, and the mean age was 14.03±3.20 years. It was found that the applications to EMS were mostly made in spring (35.2%) and between 12:00-16:00 (50.1%). According to the diagnoses of the EMS team, 62.1% of the applications were due to non-traumatic reasons, and 52.8% were transferred to the hospital by ambulance (Table 1). The causes of applications to EMS according to gender and age groups were shown in Table 2. A statistically significant difference was found between the causes of application to the EMS and the gender and age groups ($p<0.001$).

The applications of the students to the EMS due to non-traumatic reasons with gender and age groups were a statistically significant difference ($p<0.001$) (Table 3). The most frequent non-traumatic reasons for female students to apply to the EMS were psychiatric diseases, pain, and syncope (39.1%, 15.1%, 13.3%, respectively). The application reasons of the male students were psychiatric diseases (22.5%), syncope (16.6%), and pain (16.5%). The most frequent non-traumatic reason in the age group of 5-12 years was syncope (18.4%) whereas age between 13-18 years was psychiatric diseases (38.8%).

The causes of applications to EMS due to trauma according to gender and age groups were shown in Table 4. The applications of the students to the EMS due to trauma and gender was no significant difference ($p>0.05$). The most common reasons of trauma in students between the ages of 13-18 were fall, crush/sprain/fracture/dislocation and head trauma, whereas between 5-12 years were fall, head trauma and crush/sprain/fracture, respectively ($p<0.001$).

DISCUSSION

This study shows that most of the applications from schools to EMS were made in spring, between 12:00-16:00, and half of the applications were transferred to the hospital. Also, key findings from this study provide an understanding of the reasons and associated factors for applications to EMS from schools. These findings confirm that most of the applications were for psychiatric diseases, and the reasons for application were significantly associated with gender and age groups.

Consistent with the literature, the present study revealed applications to EMS were mostly made in the afternoon (25,26). It is thought that this may be caused by the leisure time activities of the students during lunchtime or the crowds during the exchange of students who are receiving education either in the morning and at noon. In this study, almost half of the patients and casualties were transferred to a hospital. In contrast to this study reported that the number of children transported to the PED was quite low (23,27,28). The difference between the studies may be associated with study designs, the presence of school health nurses, and the health policies of the countries.

There are various reasons from injury to unexpected major illnesses, or complications of chronic health conditions of applications to EMS from schools. Approximately 25% of school children have one of the chronic health problems (9).

Consistent with previous studies, our findings indicated that applications due to non-traumatic reasons were more frequent than traumas (28,29). In the previous studies reported that the most commonly seen health problems students were seizures, asthma, Type-1 diabetes, and psychiatric emergency (5,11,30). Findings of the present study revealed that the application to EMS due to non-traumatic reasons were psychiatric diseases and psychosomatic conditions including pain and syncope rather than chronic health problems. Psychosomatic complaints such as headache and abdominal pain could be associated with increased stress, depression and anxiety (31). While recent studies indicated that childrens' mental health problems and the applications to the PED due to mental health problems have increased, this finding emphasizes that children need psychosocial support (32,33).

Injuries are among the top public health problems facing children (6,21). In the present study, as in others (34-36), falls constituted approximately half of the traumas, but precise data about the intentional injuries related to violence and bullying in schools could not be obtained. In a study conducted in the same region, it was reported that assault was in third place among the accident types causing school injuries after crushes and falls (2). However, the relationship between unintentional injuries and various factors such as being bullied, engaging in physical fights, loneliness, psychological distress, hyperactivity, or conduct problems in children and adolescents is well established (6,22). Thus, creating a safe school climate is an excessively needed and essential target for injury prevention efforts. Nevertheless, a safe school climate needs to involve not only the physical school environment, but also the emotional and psychological environment. In that vein, there is a need to address mental health status of students such as aggressive behaviors and bullying among schoolchildren within the scope of school health.

Male students applied to EMS more frequently due to trauma, while female students applied mostly due to non-traumatic reasons. These findings correspond with the results of other studies demonstrating male students were mostly risky to trauma related injury compared to girls (8,20,22,37). This difference between gender could be related to the more aggressive and violent nature of activities in which boys are taking part as compared to girls (2,20,23). Similarly, the frequency of trauma in children may vary according to their age characteristics. Consistent with the literature highlighting school accidents are more frequent in low-age groups, our findings revealed the majority of children applied due to traumas/injuries were between 5-12 years of age (1,8,20,37). This may be associated with not only the developing cognitive and behavioral skills of children, but also with the fact that children in this age group are more curious and unaware of the dangers. Also, this is believed to be caused by the lack of physical control, such as clumsiness seen at the beginning of adolescence (1,6).

Study Limitations

The present study has some limitations which need to be pointed out. Firstly, since the data used in the study are records of EMS, they may not reflect all emergencies in schools such as accidents, injuries, and illnesses. Secondly, one of the most important limitations of this retrospective study is that the data did not clearly reveal how traumatic injuries occur and injury severity. Since it was not explicitly stated, it was grouped as falls, injury (open wound, superficial injury), crush/sprain/fracture/dislocation, assault/pushing/crush, head trauma, and others. Another important limitation was that the results of a great majority of cases were not reported in the records. In addition, the absence of the accident place (classroom, yard, etc.) in the record system is an important obstacle especially in determining where the injuries occur frequently.

CONCLUSION

The most common reasons for applications to EMS from schools are psychiatric diseases and falls, and the reasons for applications are associated with age groups and gender. This study highlights the need to develop various strategies to prevent falls and take precautions, especially in schools providing education to children in the age group of 5-12 years. Also, the findings point to the necessity not to neglect the mental health of students in schools, follow up with validated scales psychosocially, integrate strategies to promote mental health into school health practices, and plan necessary interventions.

Ethical Considerations

This study was performed within ethical standards in accordance with the Declaration of Helsinki. It was approved by the Ethical Commission of the Karadeniz Technical University Faculty of Medicine (approval number: 24237859-716).

Informed Consent

Consent has been obtained from the relevant institution.

Authorship Contributions

Concept: H.K.B., B.M., Design: H.K.B., B.M., Data Collection: B.M., H.K.B., Analysis or Interpretation: B.M., H.K.B., Literature Search: B.M., H.K.B, Writing: B.M., H.K.B

Conflict of Interest

No potential conflict of interest was reported by the authors.

Financial Disclosure

The authors declared that this study received no financial support.

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Table 1. Distribution of the applications made to the EMS and socio-demographic characteristics of the patients (N=4043)

Characteristics	**Mean±Sd**	**Min.-Max.**
Age	14.03±3.20	5-18
Age group (year)	**n**	**%**
5-12	1183	29.3
13-18	2860	70.7
Gender		
Female	2374	58.7
Male	1669	41.3
School Type		
Primary School	1782	44.1
High School	2173	53.7
School Dormitory	87	2.2
School location		
City center	1830	45.3
District	2213	54.7
Season		

Fall	1341	33.2
Winter	1200	29.6
Spring	1418	35.1
Summer	84	2.1
Hour		
08-12	1661	41.1
12-16	2025	50.1
16-20	230	5.7
20-24	97	2.4
24-08	30	0.7
Triage		
Green	1278	29.2
Yellow	1435	35.5
Red	1430	35.3
Consequences		
Transfer to hospital	2138	52.8
On-site intervention	109	2.7
Rejection of transfer	205	5.1
Unspecified	1591	39.4
Diagnostic group		
Trauma	1534	37.9
Non-traumatic causes	2509	62.1

Table 2. Comparison of the causes of applications to the EMS according to gender and age (N=4043)

	Non-traumatic causes (2509)		**Trauma (1534)**		**Statistical analysis**	
Gender (n)	**n**	**%**	**n**	**%**	**X^2; p**	**Phi**
Female (2374)	1842	73.4	532	34.7	589.25; **<0.001**	0.382
Male (1669)	667	26.6	1002	65.3		
Age group (n)						
5-12 (1183)	412	16.4	771	50.3	526.66; **<0.001**	0.361
13-18 (2860)	2097	83.6	763	49.7		

Table 3. Comparison of applications to EMS due to non-traumatic reasons

Non-traumatic causes	**Gender**				**Age group**				**Total**	
	Female		**Male**		**5-12 years**		**13-18 years**			
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Psychiatric diseases*	720	39.1	150	22.5	56	13.6	814	38.8	870	34.7
Pain	279	15.1	110	16.5	60	14.6	329	15.7	389	15.5
Syncope*	245	13.3	111	16.6	76	18.4	280	13.4	356	14.2
Respiratory system diseases	118	6.4	56	8.4	37	9.0	137	6.5	174	6.9
Nervous system diseases	117	6.4	57	8.5	47	11.4	127	6.1	174	6.9
Cardiovascular diseases *	115	6.2	70	10.5	29	7.0	156	7.4	185	7.4
Nausea-Vomiting	93	5.0	32	4.8	14	3.4	111	5.3	125	5.0
Poisoning	75	4.1	24	3.6	63	15.3	36	1.7	99	3.9
Gastrointestinal diseases *	39	2.1	24	3.6	9	2.2	54	2.6	63	2.5
Other*	41	2.2	33	4.9	21	5.1	53	2.5	74	2.9
Total	**1842**	**73.4**	**667**	**26.6**	**261**	**10.4**	**2248**	**89.6**	**2509**	**100.0**
Statistical analysis	X^2= 78.449; **p<0.001;** Cramer's V=0.177				X^2= 220.509; **p<0.001;** Cramer's V= 0.321					

*Adjusted Residual= ≥+2, ≤-2

Table 4. Comparison of applications to the EMS due to trauma

Trauma	Gender				Age group				Total	
	Female		Male		5-12 years		13-18 years			
	n	%	n	%	n	%	n	%	n	%
Falls*	212	39.8	435	43.4	351	45.5	296	38.8	647	42.2
Crush, sprain, fracture, dislocation*	140	26.3	213	21.3	131	17.0	222	29.1	353	23.0
Head trauma*	90	16.9	197	19.7	176	22.8	111	14.5	287	18.7
Open wound*	52	9.8	78	7.8	47	6.1	83	10.9	130	8.5
Assault, pushing, crush	28	5.3	63	6.3	52	6.7	39	5.1	91	5.9
Other	10	1.9	16	1.6	14	1.8	12	1.6	26	1.7
Total	**532**	**100**	**1002**	**100**	**771**	**100**	**763**	**100**	**1534**	**100**
Statistical analysis	X^2= 8.710; p= 0.121				X^2= 55.333; **p<0.001** Cramer's V=0.189					

**Adjusted Residual= ≥+2, ≤-2 (for age)*

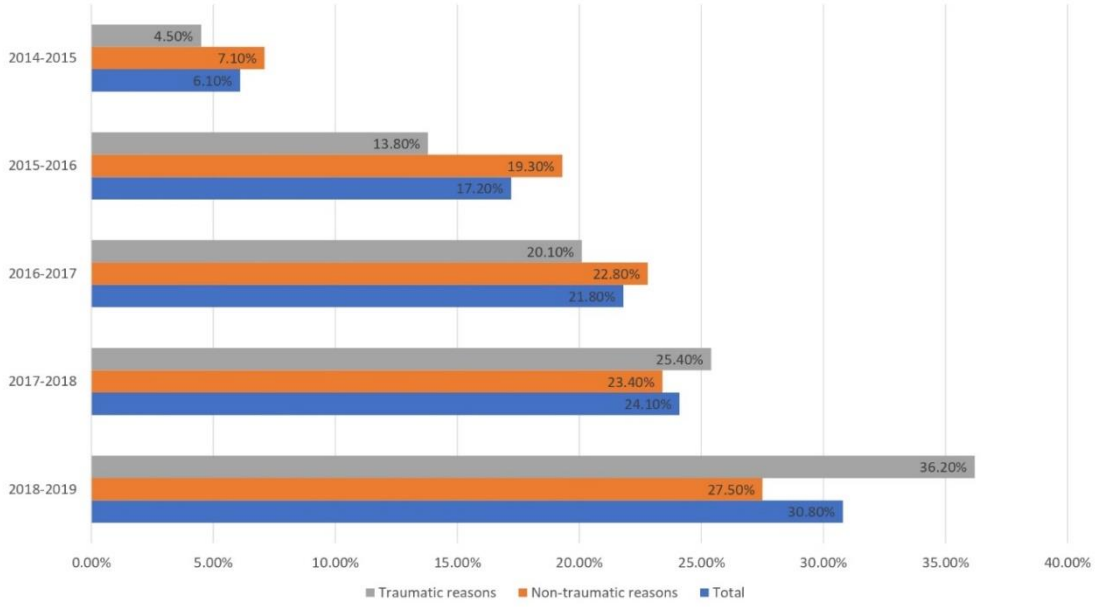

Figure 1. Distribution of the reasons of the applications of the schools to the emergency health services by years