

# Evaluation of pediatric patients referred from the secondary care state hospital emergency department

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## ABSTRACT

**Aims:** Determining the profiles of pediatric patients who need to be referred from the emergency department is important in terms of taking the necessary precautions during the referral process and providing care opportunities. This study aimed to examine the characteristics of pediatric patients who applied to our hospital's emergency department and were referred to other hospitals.

**Methods:** A total of 4870 children aged 0-17 years who presented to the emergency department of our secondary regional hospital and were referred to other hospitals over a five-year period were included in the study.

**Results:** The median age of the patients was 7 (min-max 0-17) years, and 2809 (57.7%) were male. The highest referral rate during the day was between the hours of 16-24 (46.6%). A total of 66.5% of referrals were made to tertiary care hospitals, and 92.8% were to the emergency department. The most common cause for referral was the lack of relevant branch and/or specialist (68.8%). The most common preliminary diagnosis or findings in referred children were convulsion (11.4%), acute appendicitis (9.0%) and abdominal pain (6.2%). In the 14-17 age group, the rate of those referred due to convulsions, trauma, burns and ileus was significantly lower than the other groups, while the rate of those referred due to drug poisoning, traffic accident, chest pain, pneumothorax, sharp object injuries and electric shock was significantly higher ( $p<0.05$ ). The rate of those referred due to fever, chemical exposure, ileus, foreign body aspiration or ingestion, respiratory failure, acute gastroenteritis and gastrointestinal hemorrhage was significantly higher in the 0-3 age group compared to other groups ( $p<0.05$ ). In cases such as drug poisoning, soft tissue injury, fall, fever, trauma, traffic accident, burn, foreign body aspiration or ingestion, pneumothorax, fracture and head trauma, the rates of patients referred to the tertiary care were significantly higher than those referred to the secondary care ( $p<0.05$ ).

**Conclusion:** The findings obtained from this study has showed that the most frequently referred cases in pediatric patients are acute appendicitis, convulsion and abdominal pain, that the majority of referrals are made to tertiary care hospitals and especially emergency services, that the absence of a relevant branch or specialist physician is the most common reason for referrals, that the patients' preliminary diagnoses, patient age and time of admission significantly direct the referral characteristics.

**Keywords:** Child, referral, secondary care hospital

## INTRODUCTION

Pediatric patients brought to the emergency department for non-urgent reasons prevent a significant portion of the staff, time and effort that would be devoted to other emergency patients. The applications of these patients should be prevented as much as possible or they should be directed to general outpatient clinics without delay.<sup>1-4</sup> However, the rapid, comprehensive and most appropriate approach given by experienced physicians and healthcare personnel to children brought for urgent reasons is life-saving and also reduces

the risk of morbidity and complications that may develop.<sup>2,3</sup> However, in most hospitals, there is no child health and disease specialist or emergency medicine specialist in the emergency department, or the available facilities do not allow providing the most appropriate approach to the patient.<sup>1-4</sup> In these cases, after the necessary first intervention, the patient must be treated as quickly as possible. It is necessary to be referred from the emergency department to a higher or more comprehensive health institution with treatment options.<sup>3-5</sup>

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In hospitals in small settlements, there is often no separate pediatric emergency unit due to the lack of specialist physicians, equipment and facilities, and a significant portion of pediatric patients in emergency situations need to be referred.<sup>1,2</sup> While referrals from second-level hospitals are generally expected to be to tertiary care hospitals, referrals from such small-scale hospitals are not available. Some of the referrals can be made to another secondary care hospital in a larger settlement nearby. When following this path, it is generally taken into consideration which hospital is closest to the specialist physician or the necessary care unit, which is suitable for the patient's preliminary diagnosis. Although the majority of such referrals are to general hospitals, some of them may be to branch hospitals such as children's hospitals, mental health hospitals or chest hospitals. However, the highest referral rate generally belongs to tertiary care hospitals.<sup>1,2,6,7</sup>

Our aim in this study was to examine the reasons for referral of patients who were thought to require special treatment from a secondary care hospital and to investigate the appropriateness of the referral requirement.

## METHODS

### Selection of Patients

In this study, the data of a total of 21826 patients who applied to the emergency department and were referred to other hospitals between January 2019 and December 2023 were retrospectively examined. Among the patients, 4870 children between the ages of 0-17 were included in the study. The data of these patients were obtained by scanning hospital records. Patients aged 18 and over, patients who were transferred back to the institution they came from, and patients who were transferred to a department within the hospital were not included in the study. For referred pediatric patients, the yearly periods to be used in the evaluation were determined as April-September and October-March, referral time intervals were 08-16, 16-24 and 24-08, and age groups were 0-3, 4-8, 9-13 and 14-17. The study was carried out with the permission of the Samsun University Clinical Researches Ethics Committee (Date: 03.01.2024, Decision No: 2024/1/4). Since this is a retrospective study, informed consent forms are not required. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

### Statistical Analysis

The sample size in the study was calculated by power analysis using G-Power (version 3.1.9.6, Franz Faul, Universitat Kiel, Germany). Effect size 0.1; Type 1 error was taken as 0.05 and test power as 0.95, and the total required sample size was determined as at least 1979.

All statistical analyzes in the study were performed using SPSS 25.0 software (IBM SPSS, Chicago, IL, USA). Comparisons between groups in terms of categorical variables were made with the Chi-square test. The results were evaluated within the 95% confidence interval and p values <0.05 were considered significant. Bonferroni correction was made where necessary.

## RESULTS

The median age of the patients was 7 (min-max: 0-17), 2809 (57.7%) were male, and 1652 (33.9%) were in the 0-3 age group. The highest referral rate during the day was between

the hours of 16-24 (46.6%). A total of 66.5% of referrals were made to tertiary care hospitals. The most frequently referred hospitals were the university hospital (55.1%), children's hospital (30.9%) and training and research hospital (11.4%), and these constituted a total of 97.4% of all referrals. A total of 92.8% of referrals were made to the emergency department. The most common cause for referral was the lack of relevant branch and/or specialist (68.8%) (Table 1).

**Table 1. Distribution of pediatric patients referred from the emergency department according to age**

	n	%
<b>n</b>	<b>4870</b>	<b>100</b>
<b>Gender</b>		
Male	2809	57.7
Female	2061	42.3
<b>Age (years)</b>		
0-3	1652	33.9
4-8	1224	25.1
9-13	1005	20.6
14-17	989	20.3
<b>Year admitted</b>		
2019	1266	26.0
2020	1177	24.2
2021	952	19.5
2022	860	17.7
2023	615	12.6
<b>Referred period</b>		
April-september	2507	51.5
October-march	2363	48.5
<b>Referred hour</b>		
08-16	1815	37.3
16-24	2269	46.6
24-08	786	16.1
<b>Referred level</b>		
Secondary care	1631	33.5
Tertiary care	3239	66.5
<b>Referred hospital</b>		
University hospital	2683	55.1
Children's hospital	1504	30.9
Training and research hospital	556	11.4
Private hospital	54	1.1
State hospital	44	0.9
Mental health hospital	21	0.4
Chest diseases hospital	8	0.2
<b>Referred unit</b>		
Emergency room	4519	92.8
Clinics	351	7.2
<b>Cause of referral</b>		
Lack of relevant department or branch specialist	3350	68.8
Advanced testing and treatment	1348	27.7
Bed occupancy	133	2.7
Other	39	0.8

In the distribution of patients referred from our hospital, 22.3% were children, and the rates of pediatric patients referred in 2019 and 2020 were significantly higher compared to other years, and the rate of pediatric patients referred in 2023 was significantly lower ( $p < 0.001$ ). In the study; The rates of patients referred to tertiary care hospitals in 2020 and 2023 were significantly higher than in 2021 and 2022 ( $p < 0.001$ ) (Table 2).

**Table 2. Distribution of patients by years and hospital level**

P	Total patients referred		Pediatric patients referred		Secondary care		Tertiary care		P
	n	%	n	%	n	%	n	%	
p									<0.001
2019	4511	28.1	1266	28.1	426	33.6	840	66.4	0.89
2020	4017	29.3	1177	29.3	350	29.7	827	70.3	0.002
2021	4315	22.1	952	22.1	392	41.2	560	58.8	<0.001
2022	4601	18.7	860	18.7	329	38.3	531	61.7	0.001
2023	4382	14.0	615	14.0	134	21.8	481	78.2	<0.001
Total	21826	22.3	4870	22.3	1631		3239		

The most common preliminary diagnosis or findings in referred children were convulsion (11.4%), acute appendicitis (9.0%), abdominal pain (6.2%), drug poisoning (5.8%) and soft tissue injury (% was 4.8). In the 14-17 age group, the rate of those referred due to convulsion, trauma and ileus was significantly lower compared to other groups, while the rate of those referred due to drug poisoning, traffic accident, chest pain, pneumothorax, sharp object injury and electric shock was significantly higher ( $p < 0.05$  for each). The rate of those referred due to acute appendicitis and anxiety disorder was found to be significantly higher in the 9-13 and 14-17 age groups compared to the other groups ( $p < 0.05$  for both). The rate of those referred due to fever, chemical exposure, ileus, foreign body aspiration or ingestion, respiratory failure, acute gastroenteritis and gastrointestinal hemorrhage was significantly higher in the 0-3 age group compared to other groups ( $p < 0.05$  for each). In this group, the rate of those referred due to acute appendicitis, traffic accident, diabetes mellitus, fracture, arrhythmia and electric shock was found to be significantly lower than the other groups ( $p < 0.05$  for each) (Table 3).

Referral rates to secondary care hospitals were found to be significantly higher in cases of acute appendicitis, abdominal pain, nausea and vomiting, chemical exposure, respiratory tract infection, ileus, acute gastroenteritis and testicular torsion ( $p < 0.05$  for each). In cases such as drug poisoning, soft tissue injury, fall, fever, trauma, traffic accident, burn, foreign body aspiration or ingestion, pneumothorax, fracture and head trauma, the rates of patients referred to the tertiary care were significantly higher than those referred to the secondary care (each for  $p < 0.05$ ) (Table 4).

In the period between April and September, the rates of those referred to tertiary care, those with drug poisoning and falls were significantly higher compared to the October - March period, while the rates of those referred to children's hospitals, acute appendicitis, soft tissue injuries and traffic accident cases were significantly lower ( $p < 0.05$  for each) (Table 5).

Among those referred in the 8-16 hour period during the day, the rate of children in the 0-3 age group was significantly higher than other age groups, and the rates of 9-13 and 14-17 age groups were found to be significantly higher in the

**Table 3. Distribution of referred patients according to preliminary diagnosis or findings**

	Total		Age groups (years)								P
			0-3		4-8		9-13		14-17		
	n	%	n	%	n	%	n	%	n	%	
Convulsion	556	11.4	209	12.7	167	13.6	144	14.3	36	3.6	<0.001
Acute appendicitis	439	9	8	0.5	104	8.5	177	17.6	150	15.2	<0.001
Stomach ache	302	6.2	52	3.1	75	6.1	94	9.4	81	8.2	<0.001
Drug poisoning	282	5.8	118	7.1	38	3.1	20	2.0	106	10.7	<0.001
Soft tissue injury	232	4.8	74	4.5	81	6.6	39	3.9	38	3.8	0.004
Fall	194	4	72	4.4	74	6.0	28	2.8	20	2.0	<0.001
Fever	191	3.9	124	7.5	40	3.3	17	1.7	10	1.0	<0.001
Nausea and vomiting	179	3.7	68	4.1	43	3.5	43	4.3	25	2.5	0.127
Chemical exposure	172	3.5	129	7.8	27	2.2	10	1.0	6	0.6	<0.001
Respiratory tract infection	167	3.4	101	6.1	47	3.8	10	1.0	9	0.9	<0.001
Trauma	162	3.3	53	3.2	55	4.5	35	3.5	19	1.9	0.01
Ileus	156	3.2	83	5.0	46	3.8	24	2.4	3	0.3	<0.001
Traffic accident	153	3.1	23	1.4	48	3.9	28	2.8	54	5.5	<0.001
Burn	104	2.1	64	3.9	29	2.4	7	0.7	4	0.4	<0.001
Foreign body aspiration or ingestion	94	1.9	50	3.0	14	1.1	18	1.8	12	1.2	0.001
Respiratory failure	91	1.9	66	4.0	13	1.1	6	0.6	6	0.6	<0.001
Diabetes mellitus	73	1.5	4	0.2	26	2.1	20	2.0	23	2.3	<0.001
Chest pain	67	1.4	3	0.2	10	0.8	8	0.8	46	4.7	<0.001
Syncope	63	1.3	19	1.2	18	1.5	13	1.3	13	1.3	0.903
Pneumothorax	49	1	0	0.0	0	0.0	0	0.0	49	5.0	<0.001
Fracture	46	0.9	4	0.2	22	1.8	13	1.3	7	0.7	0.004
Acute gastroenteritis	46	0.9	26	1.6	7	0.6	10	1.0	3	0.3	<0.001
Gastrointestinal hemorrhage	38	0.8	21	1.3	5	0.4	4	0.4	8	0.8	0.026
Testicular torsion	37	0.8	12	0.7	13	1.1	4	0.4	8	0.8	0.35
Bleeding disorder	36	0.7	17	1.0	11	0.9	4	0.4	4	0.4	0.217
Head injury	36	0.7	16	1.0	11	0.9	6	0.6	3	0.3	0.143
Falling from high	35	0.7	20	1.2	0	0.0	5	0.5	10	1.0	<0.001
Anxiety disorder	35	0.7	0	0.0	0	0.0	15	1.5	20	2.0	0.001
Gunshot wound	34	0.7	11	0.7	7	0.6	4	0.4	12	1.2	0.145
Bleeding	33	0.7	8	0.5	19	1.6	2	0.2	4	0.4	<0.001
Anemia	33	0.7	8	0.5	0	0.0	18	1.8	7	0.7	<0.001
Cerebral palsy	31	0.6	2	0.1	27	2.2	2	0.2	0	0.0	<0.001
Hyperglycemia	28	0.6	2	0.1	3	0.2	15	1.5	8	0.8	<0.001
Single finger amputation	27	0.6	9	0.5	4	0.3	8	0.8	6	0.6	0.519
Sharps injury	24	0.5	0	0.0	2	0.2	3	0.3	19	1.9	0.029
Arrhythmia	24	0.5	2	0.1	11	0.9	5	0.5	6	0.6	<0.001
Electric shock	20	0.4	2	0.1	6	0.5	3	0.3	9	0.9	0.019
Foreign body in eye	19	0.4	9	0.5	4	0.3	6	0.6	0	0.0	0.106
Other	562	11.5	163	9.9	117	9.6	137	13.6	145	14.7	<0.001

**Table 4. Distribution of preliminary diagnoses according to the referral step**

	Secondary care		Tertiary care		p
	n	%	n	%	
Convulsion	172	10.5	384	11.9	0.175
Acute appendicitis	394	24.2	45	1.4	<0.001
Stomach ache	214	13.1	88	2.7	<0.001
Drug poisoning	21	1.3	261	8.1	<0.001
Soft tissue injury	20	1.2	212	6.5	<0.001
Fall	15	0.9	179	5.5	<0.001
Fever	40	2.5	151	4.7	<0.001
Nausea and vomiting	105	6.4	74	2.3	<0.001
Chemical exposure	75	4.6	97	3.0	0.004
Respiratory tract infection	80	4.9	87	2.7	<0.001
Trauma	20	1.2	142	4.4	<0.001
Ileus	129	7.9	27	0.8	<0.001
Traffic accident	2	0.1	151	4.7	<0.001
Burn	2	0.1	102	3.1	<0.001
Foreign body aspiration-ingestion	20	1.2	74	2.3	0.011
Respiratory failure	24	1.5	67	2.1	0.147
Diabetes mellitus	19	1.2	54	1.7	0.173
Chest pain	22	1.3	45	1.4	0.909
Syncope	18	1.1	45	1.4	0.405
Pneumothorax	6	0.4	43	1.3	0.002
Acute gastroenteritis	23	1.4	23	0.7	0.017
Fracture	0	0.0	46	1.4	<0.001
Gastrointestinal hemorrhage	12	0.7	26	0.8	0.802
Testicular torsion	25	1.5	12	0.4	<0.001
Head injury	0	0.0	36	1.1	<0.001
Bleeding disorder	0	0.0	36	1.1	<0.001
Anxiety disorder	16	1.0	19	0.6	0.124
Falling from high	2	0.1	33	1.0	<0.001
Gunshot wound	0	0.0	34	1.0	<0.001
Anemia	0	0.0	33	1.0	<0.001
Bleeding	16	1.0	17	0.5	0.067
Cerebral palsy	0	0.0	31	1.0	<0.001
Hyperglycemia	14	0.9	14	0.4	0.063
Single finger amputation	0	0.0	27	0.8	<0.001
Arrhythmia	12	0.7	12	0.4	0.087
Sharps injury	2	0.1	22	0.7	0.009
Electric shock	4	0.2	16	0.5	0.200
Foreign body in eye	0	0.0	19	0.6	0.006
Other	107	6.6	455	14.0	<0.001
Total	1631	100	3239	100	

24-08 hour period ( $p<0.001$ ). The rate of referral to tertiary care hospitals between the hours of 16-24 was significantly higher than other time periods ( $p<0.001$ ). The rate of referral to emergency services between 8-16 period was found to be significantly higher than other time periods ( $p<0.001$ ). The rate of those referred due to the absence of a relevant branch

or specialist physician between 24-08 was significantly higher than other time periods, and the rate of those requiring further examination and treatment was significantly lower ( $p<0.001$ ) (Table 5).

The rate of those referred due to convulsions and acute appendicitis between the hours of 24-08 was significantly higher compared to other time periods, while the rates of those referred due to soft tissue injuries, falls and trauma were significantly lower ( $p<0.05$  for each).

Between the hours of 8-16, the rate of those referred due to abdominal pain, fever, nausea and vomiting was significantly higher compared to other periods, while the rate of those referred due to traffic accident was significantly lower ( $p<0.05$  for each). The rate of those referred due to drug poisoning between the hours of 16-24 was significantly higher compared to other periods ( $p<0.05$  for each) (Table 5).

## DISCUSSION

The characteristics of pediatric patients who are brought to the emergency department and transferred to a hospital with more facilities after first aid vary depending on many factors.<sup>1-3</sup> In this study, the relationship between many factors regarding pediatric patients referred from the emergency department has been demonstrated.

The coronavirus disease 2019 (COVID-19) pandemic had a significant impact on pediatric patient referrals in 2020 and 2021.<sup>8,9</sup> In the present study, 22.3% of all referred patients in total were children, and the rates of pediatric patients referred in 2019 and 2020 were similar to other years. It was found that the rate of pediatric patients referred in 2023 was significantly higher than the previous year. In addition, the rates of patients referred to tertiary care hospitals in 2020 and 2023 were found to be significantly higher than in 2021 and 2022. These findings may indicate that during the COVID-19 pandemic, the impact of which was felt intensely in 2021 and 2022, various reasons such as the increase in the density of hospitals due to COVID-19, the reduction of routine patient admissions and planned operations, and the public not going to hospitals unless necessary, affected pediatric patient referral rates.

Although some criteria are suggested for the referral of pediatric patients who apply to the emergency department, there is variability in practices.<sup>10,11</sup> Urkin et al.<sup>10</sup> reported that 32% of pediatric patients were referred due to urgent further examination. Ezhumalai et al.<sup>11</sup> reported that one of the most common reasons for referral was consultation with the relevant specialist physician, with a rate of 40.5%. In the present study, the most common reason for referral was found to be the absence of the relevant branch and/or specialist, and other common reasons were the purpose of further examination, bed occupancy, and lack of the relevant imaging method. These findings show that the lack of branch and specialist medicine or relevant special units in small-scale hospitals is the main factor in referrals. In addition, although there is a specialist physician, reasons such as not having sufficient facilities to provide treatment to the relevant patient or limited accessibility to the specialist physician may also have increased the number of such referrals. In the present study, it was observed that 92.8% of referrals were made to emergency rooms. This finding shows that referral cases mostly involve real urgency. In addition, the idea that the referred emergency



Table 5. Distribution of some variables according to the shipping period and the shipping time of the day												
	Referred period				P	Referred hour						P
	April-september		October-march			08-16		16-24		24-08		
	n	%	n	%		n	%	n	%	n	%	
n	2507		2363			1815		2269		786		
Gender					0.522							0.562
Male	1435	57.2	1374	58.1		1036	57.1	1327	58.5	446	56.7	
Female	1072	42.8	989	41.9		779	42.9	942	41.5	340	43.3	
Age (years)					0.073							<0.001
0-3	840	33.5	812	34.4		694	38.2	726	32.0	232	29.5	<0.001
4-8	651	26.0	573	24.2		438	24.1	632	27.9	154	19.6	<0.001
9-13	487	19.4	518	21.9		343	18.9	447	19.7	215	27.4	<0.001
14-17	529	21.1	460	19.5		340	18.7	464	20.4	185	23.5	0.019
Referred level					<0.001							<0.001
Secondary care	729	29.1	902	38.2		682	37.6	363	28.0	313	39.8	
Tertiary care	1778	70.9	1461	61.8		1133	62.4	1633	72.0	473	60.2	
Referred hospital					<0.001							<0.001
University hospital	1459	58.2	1224	51.8	<0.001	937	51.6	1324	58.4	422	53.7	<0.001
Children's hospital	685	27.3	819	34.7	<0.001	633	34.9	578	25.5	293	37.3	<0.001
Training and research hospital	319	12.7	237	10.0	0.003	196	10.8	309	13.6	51	6.5	<0.001
Private hospital	24	1.0	30	1.3	0.298	24	1.3	18	0.8	12	1.5	0.131
State hospital	8	0.3	36	1.5	<0.001	17	0.9	22	1.0	5	0.6	0.761
Mental health hospital	12	0.5	9	0.4	0.271	2	0.1	16	0.7	3	0.4	0.015
Chest diseases hospital	0	0.0	8	0.3	0.015	6	0.3	2	0.1	0	0.0	0.184
Referred unit					0.556							<0.001
Emergency room	2321	92.6	2198	93.0		1734	95.5	2067	91.1	718	91.3	
Clinics	186	7.4	165	7.0		81	4.5	202	8.9	68	8.7	
Reason for referral					0.098							<0.001
Lack of relevant department or branch specialist	1763	70.3	1587	67.2		1260	69.4	1506	66.4	584	74.3	<0.001
Advanced testing and treatment	664	26.5	684	28.9		504	27.8	675	29.7	169	21.5	<0.001
Bed occupancy	63	2.5	70	3.0		35	1.9	71	3.1	27	3.4	0.027
Other	17	0.7	22	0.9		16	0.9	17	0.7	6	0.8	0.888
Preliminary diagnoses												
Convulsion	284	11.3	272	11.5	0.841	174	9.6	258	11.4	124	15.8	<0.001
Acute appendicitis	190	7.6	230	9.7	0.007	124	6.8	168	7.4	128	16.3	<0.001
Stomach ache	144	5.7	158	6.7	0.173	155	8.5	98	4.3	49	6.2	<0.001
Soft tissue injury	115	4.6	167	7.1	<0.001	87	4.8	140	6.2	5	0.6	<0.001
Drug poisoning	146	5.8	86	3.6	<0.001	76	4.2	161	7.1	45	5.7	<0.001
Fall	141	5.6	53	2.2	<0.001	82	4.5	99	4.4	13	1.7	0.001
Traffic accident	86	3.4	105	4.4	<0.001	40	2.2	82	3.6	31	3.9	0.014
Trauma	78	3.1	101	4.3	<0.001	69	3.8	88	3.9	5	0.6	<0.001
Fever	114	4.5	58	2.5	0.069	100	5.5	62	2.7	29	3.7	<0.001
Chemical exposure	107	4.3	55	2.3	<0.001	66	3.6	85	3.7	21	2.7	0.355
Nausea and vomiting	127	5.1	26	1.1	0.031	110	6.1	44	1.9	25	3.2	<0.001
Respiratory tract infection	23	0.9	92	3.9	<0.001	48	2.6	46	2.0	21	2.7	0.357
Fracture	24	1.0	22	0.9	0.925	13	0.7	28	1.2	5	0.6	0.146

service will be responsible for referral to the relevant branch or specialist physician may have increased the frequency of referral to the emergency department.

The time when pediatric patients are brought to the hospital is important in terms of approach to the patient and prognosis.<sup>12,13</sup> In the present study, it was found that the highest referral rate during the day was made between the hours of 16-24 (46.6%). In addition, referral rates to both tertiary care hospitals and emergency departments between the hours of 16-24 were found to be significantly higher compared to other time periods. These findings may be due to the increase in the number of pediatric patients brought to the emergency department and requiring referral during the time period when it is more difficult to reach specialist physicians after working hours but social life continues. This may also be due to the fact that patients brought during working hours tend to go to outpatient clinics rather than the emergency department, but this may mean that the cases in question are not urgent. However, in the study, the rate of children aged 0-3 among those referred in the 8-16 time period was found to be significantly higher than other age groups, and in the 24-08 time period, the rates of age groups over 13 years of age were found to be significantly higher. These findings may have been caused by the fact that children who were old enough to be cared for by their mothers or a caregiver were brought to the emergency department during working hours. The fact that referral rates in older age groups occur after midnight may be due to the fact that hospital facilities are at their lowest level at that time rather than the increase in the number of patients.

The rate of patients referred between 24-08 due to the absence of a relevant branch or specialist physician was found to be significantly higher compared to other time periods, and the rate of patients referred due to advanced examination and treatment was found to be significantly lower. Although referral rates are higher between late working hours and midnight, the main reason for referral after midnight may be that the possibility of further examination is much less at that time than after working hours. For this reason, there was a significant decrease in referrals for further examination after midnight, and accordingly, the other reason, which was the lack of a relevant physician or branch, may have become more prominent.

In the present study, it was observed that the rate of those referred due to convulsions and acute appendicitis between the hours of 24-08 was significantly higher compared to other time periods. The main reason for this may be that these cases are unexpected, sudden and emergency situations, and that the cases are of such severity that they need to be referred urgently, rather than the increase in the number of such patients at those hours. The rate of those referred due to abdominal pain, fever, nausea and vomiting between the hours of 8-16 and the proportion of those referred due to drug poisoning between the hours of 16-24 was found to be significantly higher compared to other periods. The rate of those referred due to traffic accidents was found to be significantly lower between the hours of 8-16 compared to other groups. It is expected that the frequency of traffic accidents will be lower during working hours when the child is at school or when young children are with a caregiver at home. Drug poisoning may be caused by the time period when the child who is at home after school hours is more likely to take medication.

Pediatric patients brought to the emergency departments of small-scale secondary care hospitals are most frequently referred to tertiary care hospitals or second-level children's hospitals.<sup>1,2,6,7</sup> In the present study, 66.5% of the referrals were made to tertiary care hospitals. The most frequently referred hospital types are university hospitals (55.1%), children's hospitals (30.9%) and training and research hospitals (11.4%), and these hospitals accounted for 97.4% of the total referral cases. These findings show that emergency pediatric cases are most frequently referred to large or superior health centers where the number of specialist physicians and facilities are greater. However, it has been determined that some cases in critical condition are referred to nearby public or private hospitals in order to avoid wasting time, and some cases are referred to branch hospitals.

In the present study, the most common preliminary diagnosis or findings in referred children were convulsion (11.4%), acute appendicitis (9.0%), abdominal pain (6.2%), drug poisoning (5.8%) and soft tissue injury (4.8%). These findings suggest that these diseases are at a higher frequency and that the patient may have been presented with a referral condition. In the present study, referral rates to secondary care hospitals were found to be significantly higher in cases of acute appendicitis, abdominal pain, nausea and vomiting, chemical exposure, respiratory tract infection, ileus, acute gastroenteritis and testicular torsion. This may be due to the fact that some of these cases may have been presented with a clinical condition serious enough to require urgent referral to the nearest large institution, while some may have resulted from the thought that extensive examination was not necessary. In the present study, it was observed that the rates of patients referred to the third step were significantly higher than those referred to the second step in cases such as drug poisoning, soft tissue injury, fall, fever, trauma, traffic accident, burn, foreign body aspiration or ingestion, pneumothorax, fracture and head trauma. These findings may indicate that these cases are likely to be in a clinical situation that will require extensive and advanced intervention rather than being a case of urgency regardless of the step of referral.

In the present study, the rate of those referred to tertiary care in the period between april and september was found to be significantly higher compared to the period between october and march, and the rate of those referred to the children's hospital was found to be significantly lower. This may be due to the increase in the frequency of cases requiring referral to larger hospitals, rather than advanced and comprehensive intervention, especially during the school period. In the present study, the rates of drug poisoning and falls in the period between april and september were found to be significantly higher compared to the period between october and march, while the rates of acute appendicitis, soft tissue injuries and traffic accidents were significantly lower. This may be due to seasonal and social conditions, such as traffic congestion during the cold season and when work-school life increases, and the increase in the frequency of falls due to children spending more time outdoors during the summer holiday period.

Acute appendicitis is one of the most common surgical emergencies in children.<sup>14</sup> It has been stated that in cases of appendicitis in children, patients under the age of 5 should be referred to pediatric surgery, and those who are older should be referred to pediatric or general surgery.<sup>14,15</sup> It has been reported that 68% of these cases are operated on by general surgeons.<sup>16,17</sup>

In the present study, acute appendicitis was one of the most frequently referred cases from the emergency department. It has been observed that these cases are more frequently referred to secondary care hospitals, especially in the October-March period and between 24-08 hours. This supports the fact that the frequency of acute appendicitis shows such a temporal change. One reason for this is that the increase in respiratory tract infections in this period is included in the etiology of appendicitis, and in the present study, the rate of respiratory tract infections is higher in the October-March period. In addition, it may be due to the increased awareness of the patient's situation by his family in these time periods or the fact that intervention opportunities in the hospital are more limited in those periods. In the study, the rate of those referred due to acute appendicitis was found to be significantly higher in the 9-13 and 14-17 age groups compared to other groups, and significantly lower in the 0-3 age group. This may be related to the age at which acute appendicitis occurs.

Abdominal pain is a common reason for admission to the emergency department in children of all ages.<sup>18,19</sup> Olympia et al.<sup>18</sup> reported that the most frequently referred cases from the emergency department in children were abdominal pain cases with a rate of 18%, but the rate of unnecessary referral in these cases was higher than other reasons. In their study in Canada, Reiner et al.<sup>19</sup> reported that the rate of abdominal pain among pediatric patients coming from the referral emergency department to the regional pediatric emergency department was 5.1%. Abdominal pain was seen in 6.2% of the children referred in the present study. In the study, it was determined that referrals due to abdominal pain were at least in the 0-3 age range, abdominal pain cases were significantly referred to secondary care hospitals, and referrals due to abdominal pain were higher, especially during working hours, compared to other time periods. These findings may indicate that cases of abdominal pain are common, especially from the age at which this complaint can be expressed, and that they are most likely brought to the hospital during school hours or during the time period of the caregiver. These findings may also indicate that abdominal pain cases are more often referred to secondary care with the thought that they will not require further examination.

Convulsion is among the most common reasons for admission to the emergency department in children and can be a cause of significant morbidity.<sup>20</sup> In the present study, the most frequent referral rate was seen in convulsion cases. Additionally, it was found that the rate of patients referred due to convulsions was significantly lower in the 14-17 age group compared to other groups. In terms of referral rates of convulsion cases, no difference was detected in terms of seasonal and daytime periods and referral steps. These findings generally show that convulsions are common in all ages except older children and that no difference is taken into consideration when referring cases.

Bone fractures are a common cause of emergency admission in children. Although intervention in the emergency room is often sufficient in fracture cases, specialist intervention is required in many cases. In some cases, advanced intervention may be required.<sup>18,19,21,22</sup> Ramasu et al.<sup>22</sup> showed that 30% of pediatric fracture cases presenting to the emergency department were referred unnecessarily. In their study in Canada, Reiner et al.<sup>19</sup> reported that the rate of fracture cases among pediatric patients referred to the regional pediatric emergency department from other emergency services was 15.8%. Olympia et al.<sup>18</sup> reported

this rate as 12%. In the present study, fracture cases constituted 0.9% of all referred children. These inconsistencies arise from the difference in population and hospital size between studies and show the difference between the referral criteria of small-scale hospitals and large-scale hospitals. In the present study, it was determined that all referred fracture cases were sent to tertiary care hospitals. This finding shows that advanced and comprehensive intervention is required in all fracture cases that can be referred. The study also found that referred fracture cases did not vary according to seasonality and daytime. In addition, it was observed that the rate of cases referred due to fracture was significantly lower in the 0-3 age group and significantly higher in the 4-8 age group compared to other groups. This may be due to the fact that younger children experience fewer fractures due to their bone structure, and most likely because children in the 4-8 age group are much more active.

Although fever is very common in children, it can be an indicator of some very serious emergency situations, and in cases of feverish children, rapid intervention and differential diagnosis must be made.<sup>10,23</sup> Urkin et al.<sup>10</sup> reported that 12% of referred pediatric patients were referred due to fever, which required immediate intervention. Olympia et al.<sup>18</sup> reported that fever cases constituted 9% of referred children. Evans et al.<sup>24</sup> reported this rate as 4.6%. In their study in Canada, Reiner et al.<sup>19</sup> reported the infection rate as 4% among pediatric patients who came from the referral emergency department to the regional pediatric emergency department. In the present study, those referred due to fever constituted 3.9% of all patients. In the present study, the rate of those referred due to fever was found to be significantly higher in the 0-3 age group compared to other groups. It was also found that the rate of referral to tertiary care hospitals due to fever was significantly higher. These findings show that these cases are referred to higher centers and at a higher rate due to the fever seen in younger children and the fact that infants are faced with many serious infections during the development of immunity.

It has been shown that the referral status in children brought to the emergency department is significantly related to the child's age.<sup>25</sup> In the present study, the rate of those referred due to drug poisoning, traffic accidents, sharp object injuries and electric shock was found to be significantly higher in the 14-17 group. The rate of people referred due to anxiety disorders was found to be significantly higher in the 9-13 and 14-17 age groups compared to other groups. This is related to the fact that these findings and preliminary diagnoses are seen mostly in older children. In the present study, the rate of those referred due to chemical exposure, ileus, foreign body aspiration or ingestion, respiratory failure, acute gastroenteritis and gastrointestinal hemorrhage was found to be significantly higher in the 0-3 age group compared to other groups. This is related to the fact that these findings and preliminary diagnoses are seen mostly in young children. Similarly, the rate of those referred due to traffic accidents, diabetes mellitus, arrhythmia and electric shock, which are not common in young children, was found to be significantly lower than other groups.

### Limitations

The fact that our hospital's facilities and specialist physician diversity change rapidly over time and that this cannot be clearly distinguished, and that pediatric patient referrals depend on both the patient, the physician's condition at that



moment, and many different factors during the day, have made analysis difficult. However, the fact that the present study was conducted on a number of nearly five thousand patients, which is rare in the literature, may have minimized the possibility of errors in the analysis. In the present study, since mortality data on referred children was not available, an analysis could not be made in this regard.

## CONCLUSION

The findings obtained from this study, which is one of the rare studies in the literature as far as we can reach, has showed that the most frequently referred cases in pediatric patients are acute appendicitis, convulsion and abdominal pain, that the majority of referrals are made to tertiary care hospitals and especially emergency services, that the lack of a relevant branch or specialist physician is the most common reason for referrals, and that the preliminary diagnosis of the patients, the patient's age and the time of admission significantly direct the referral characteristics.

## ETHICAL DECLARATIONS

### Ethics Committee Approval

The study was carried out with the permission of the Samsun University Clinical Researches Ethics Committee (Date: 03.01.2024, Decision No: 2024/1/4).

### Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

### Referee Evaluation Process

Externally peer-reviewed.

### Conflict of Interest Statement

The authors have no conflicts of interest to declare.

### Financial Disclosure

The authors declared that this study has received no financial support.

### Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

## REFERENCES

- van Veen M, ten Wolde F, Poley MJ, et al. Referral of nonurgent children from the emergency department to general practice: compliance and cost savings. *Eur J Emerg Med.* 2012;19(1):14-19. doi:10.1097/MEJ.0b013e32834727d4
- Ellbrant J, Åkeson J, Åkeson PK. Pediatric emergency department management benefits from appropriate early redirection of nonurgent visits. *Pediatr Emerg Care.* 2015;31(2):95-100. doi:10.1097/PEC.0000000000000348
- Cheek JA, Braitberg G, Craig S, West A. Why do children present to emergency departments? Exploring motivators and measures of presentation appropriateness for children presenting to a paediatric emergency department. *J Paediatr Child Health.* 2017;53(5):451-457. doi:10.1111/jpc.13482
- Chamberlain JM, Krug S, Shaw KN. Emergency care for children in the United States. *Health Aff (Millwood).* 2013;32(12):2109-2115. doi:10.1377/hlthaff.2013.0871
- Treleaven E, Pham TN, Le DN, Brooks TN, Le HT, Partridge JC. Referral patterns, delays, and equity in access to advanced paediatric emergency care in Vietnam. *Int J Equity Health.* 2017;16(1):215. doi:10.1186/s12939-017-0703-y
- Bucak IH, Almisi H, Benli S, Geyik M, Turgut M. An evaluation of patients brought to the pediatric emergency department by ambulance. *Pediatr Emerg Intensive Care Med.* 2020;7:62-68.
- Temizkan RC, Büyük N, Kilicaslan Ö, Ankarali H, Kocabay K. Characteristics of patients visiting the pediatric emergency department of a medical faculty hospital. *Anatol Clin.* 2019;24(2):122-131.
- Muhammad H, Magetsari R, Rukmoyo T, et al. Impacts of COVID-19 pandemic on pediatric fractures: a 4-year evaluation of epidemiology and delayed treatment from prepandemic to pandemic period at a tertiary referral hospital. *Ann Med Surg (Lond).* 2023;85(9):4300-4306. doi:10.1097/MS9.0000000000001073
- Monzani A, Ragazzoni L, Della Corte F, Rabbone I, Franc JM. COVID-19 pandemic: perspective from Italian Pediatric Emergency Physicians. *Disaster Med Public Health Prep.* 2020;14(5):648-651. doi:10.1017/dmp.2020.198
- Urkin J, Segal I, Barak N, Press J. Referral criteria from community clinics to pediatric emergency departments. *Scientific World J.* 2008;8:350-356. doi:10.1100/tsw.2008.38
- Ezhumalai G, Jayashree M, Nallasamy K, Bansal A, Bharti B. Referrals to a pediatric emergency department of a tertiary care teaching hospital before and after introduction of a referral education module-a quality improvement study. *BMC Health Serv Res.* 2020;20(1):761. doi:10.1186/s12913-020-05649-w
- McCrorry MC, Gower EW, Simpson SL, Nakagawa TA, Mou SS, Morris PE. Off-hours admission to pediatric intensive care and mortality. *Pediatrics.* 2014;134(5):e1345-e1353. doi:10.1542/peds.2014-1071
- Williams V, Jaiswal N, Chauhan A, Pradhan P, Jayashree M, Singh M. Time of pediatric intensive care unit admission and mortality: a systematic review and meta-analysis. *J Pediatr Intensive Care.* 2020;9(1):1-11. doi:10.1055/s-0039-3399581
- Hodges MM, Burlew CC, Acker SN, et al. Pediatric appendicitis: Is referral to a regional pediatric center necessary?. *J Trauma Acute Care Surg.* 2018; 84(4):636-641. doi:10.1097/TA.0000000000001787
- Surgical Advisory Panel. American Academy of Pediatrics. Guidelines for referral to pediatric surgical specialists. *Pediatrics.* 2002;110(1 Pt 1):187-191.
- Somme S, Bronsert M, Morrato E, Ziegler M. Frequency and variety of inpatient pediatric surgical procedures in the United States. *Pediatrics.* 2013;132(6):e1466-e1472. doi:10.1542/peds.2013-1243
- Kokoska ER, Minkes RK, Silen ML, et al. Effect of pediatric surgical practice on the treatment of children with appendicitis. *Pediatrics.* 2001; 107(6):1298-1301. doi:10.1542/peds.107.6.1298
- Olympia RP, Wilkinson R, Dunnick J, Dougherty BJ, Zauner D. Pediatric referrals to an emergency department from urgent care centers. *Pediatr Emerg Care.* 2018;34(12):872-877. doi:10.1097/PEC.0000000000000955
- Reiner E, Ahmadi A, Grafstein E, Doan Q. Outcomes from referrals and unscheduled visits from community emergency departments to a regional pediatric emergency department in Canada. *Pediatr Emerg Care.* 2019; 35(3):185-189. doi:10.1097/PEC.0000000000001013
- Sidhu R, Velayudam K, Barnes G. Pediatric seizures. *Pediatr Rev.* 2013; 34(8):333-342. doi:10.1542/pir.34-8-333
- Walsh LR, Nuzzi LC, Taghinia AH, Labow BI. Presentation and referral patterns in pediatric closed hand fractures. *Hand (NY).* 2023;18(2):288-293. doi:10.1177/15589447211008590
- Ramasubbu B, McNamara R, Deiratany S, Okafor I. An evaluation of the accuracy and necessity of fracture clinic referrals in a busy pediatric emergency department. *Pediatr Emerg Care.* 2016;32(2):69-70. doi:10.1097/PEC.0000000000000473
- van Ierland Y, Elshout G, Moll HA, et al. Use of alarm features in referral of febrile children to the emergency department: an observational study. *Br J Gen Pract.* 2014;64(618):e1-e9. doi:10.3399/bjgp14X676393
- Evans JM, Dayal P, Hallam DL, et al. Illness severity of children admitted to the PICU from referring emergency departments. *Hosp Pediatr.* 2018;8(7): 404-409. doi:10.1542/hpeds.2017-0201
- Palleiko BA, Lynn JV, Achkar AH, Hart-Johnson T, Perry MA, Blackwood RA. Sociodemographic factors associated with adherence to referrals from the pediatric emergency department. *J Emerg Med.* 2020;58(4):594-602. doi:10.1016/j.jemermed.2019.11.023