

What Has Changed in Injury-Related Presentations During COVID-19 Pandemic? A Single-Center Experience from a Pediatric Emergency Department

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What is already known on this topic?

- After the pandemic, there was a significant decrease in the total patient volume.
- The pandemic has a great impact on accident-related applications in children. Although children were protected from respiratory infections, they spent more time at home and faced different risks.

What this study adds on this topic?

- The pandemic has a great impact on accident-related applications in children.
- There are significant changes in the reasons for admission and the triage level of the patients.

ABSTRACT

Objective: The coronavirus disease 2019 pandemic affected the healthcare systems worldwide. In this study, we aimed to examine the impact of the coronavirus disease 2019 pandemic on injury-related visits.

Materials and Methods: We conducted a retrospective analysis of 7648 injury-related pediatric emergency department visits between March 11 and June 30, 2018, 2019, and 2020, and compared the total number of visits, triage levels, distributions of injury mechanisms, and admission rates during the pandemic in 2020 to the same period in 2018 and 2019.

Results: In the first 4 months of the pandemic, there was a 69.5% drop in all pediatric emergency department visits compared to the previous 2 years. Despite this decrease, the proportion of injury-related pediatric emergency department visits increased from 14% to 20.9% in 2020 ($P < .001$). There was a 3.8% increase in the frequencies of patients with high triage acuity levels (T1, T2, and T3) and a 3.8% decrease in patients with low triage acuity levels ($P < .001$). The domestic injury rate increased from 40% to 60% during the pandemic period ($P < .001$). Hospitalization rates increased from 6% to 11.5% and admission to intensive care units increased from 0.9% to 3.3%. The differences were statistically significant ($P < .001$). Visits due to burn increased from 2.7% to 5.2% ($P < .001$), poisoning from 3.4% to 5.5% ($P < .001$), bicycle accidents from 3.3% to 6.8% ($P < .001$), while injuries due to motor vehicle accidents decreased from 2.6% to 1.3% ($P = .004$) and sports injuries decreased from 8% to 2.1% ($P < .001$).

Conclusion: This study revealed that despite the significant decrease in total pediatric emergency department visits, percentages of injury-related visits increased during the pandemic.

Keywords: COVID-19, injury, pediatric emergency department

INTRODUCTION

In the last period of 2019, a new virus, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), emerged in China and spread throughout the world in a short while causing coronavirus disease 2019 (COVID-19).¹ The World Health Organization declared the outbreak a Public Health Emergency of International Concern on January 30, 2020, and a pandemic on March 11, 2020.² The first case with COVID-19 in Turkey was also officially announced on March 11, 2020, by the government authorities. However, the devastating effects of the COVID-19 pandemic are still ongoing. In Turkey, more than 5 million people were affected by the disease up to date. Turkey responded to the pandemic by taking serious measures such as school closures, closures of public gathering places, shelter-in-place orders for non-essential

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workers, quarantine, and lockdown to prevent the spread of the disease. Meanwhile, significant changes were also made in the healthcare system to safely manage patients with and without COVID-19. Elective surgeries were postponed and preventive medical care was deferred. Pediatric emergency departments (PED) became the main source of healthcare service provider for children. However, people's healthcare-seeking behaviors also changed. To date, there have been many reports showing a sharp decline in PED visits, particularly with low triage levels, and delayed hospital visits even in more severe cases from different parts of the world.³⁻⁶ There were also changes in the distribution of reasons patients visited PED during this period. The most significant change was observed in the frequencies of patients with respiratory tract infections, which was reported to be reduced by 70%. A substantial decrease was also observed in the frequency of encounters with injuries and poisonings.⁷ Delaroche et al⁷ reported a 34.6% decrease in diagnostic codes related to injuries and a 20.2% decrease in diagnostic codes related to poisoning. The Centers for Disease Control and Prevention reported that exposure calls related to cleaners and disinfectant increased of 20.4% and 16.4% during January and March 2020 (45,550), compared to January-March 2019(37,822) and January-March 2018 (39,122), respectively.

There are now many studies on the COVID-19 pandemic; however, the impact of the pandemic on hospital admission reasons other than COVID-19 has been demonstrated by fewer studies.⁵ Studies examining injury-related admissions during the COVID-19 period are quite limited.^{8,9} This study aimed to examine the changes in admission rates of patients with injury-related reasons during the pandemic compared to the same period of 2018 and 2019.

MATERIALS AND METHODS

Study Design, Subjects, and Setting

We conducted a retrospective, cohort study at a single center. Our institution is a high volume academic center where average 70 000 PED visits occurred annually in the pre-pandemic period. All patients arriving at the PED are directed to the triage area where the first assessment of a patient is carried out by a pediatric emergency nurse with more than 10 years of experience and senior residents in pediatrics. Chief complaints and vital signs are recorded during triage and a triage code is assigned to the patient by a standardized process. We have been using a modified version of the Canadian Triage Acuity System where patients who need to be seen immediately are coded as T1, resuscitation, patients who need to be seen in 15 minutes as T2, emergent, patients who need to be seen in 30 minutes as T3, urgent, patients who need to be seen in 60 minutes as T4, less urgent, and patients who need to be seen in 120 minutes as T5, non-urgent cases. Shortly after the declaration of the pandemic, an additional code "C1" was added to identify and isolate the patients with positive or suspected COVID-19. If any patient with a C1 code had an injury-related reason, these patients received standard care in an isolated single room and were included in the study.

In order for us to compare the presentation characteristics of PED visits during the pandemic period to the pre-pandemic

period, we constituted 2 groups: the study group and the control group. The study group consisted of patients who visited the PED for injury-related reasons from March 11, 2020, to June 30, 2020, and the control group consisted of patients who visited the PED for the same reasons during the same period of the previous 2 years (March 11-June 30, 2018 and 2019). Patients who left without being seen, left against medical advice, or were older than 18 years were excluded.

This study was approved by Hacettepe University Ethics Committee (GO 21-57) and the Ministry of Health Scientific Committee (2020-12-04T12_50_18) and complies with the Declaration of Helsinki.

Data Collection

Data were extracted from patient charts and electronic health records. Based on the medical record, patients with a diagnosis between S0, superficial head injury, and T14.9, injury unspecified according to the International Classification of Diseases-10 (ICD-10) diagnosis code, were included in the study. The collected data included age, sex, time to enter the emergency department, level of evaluation, type of arrival, hospitalization, operation need, injury mechanism, and primary discharge diagnoses. Changes in the total number of visits, injury-related visits, demographic data of the patients, and frequency of specific injury-related PED visits were compared between groups. Specific injury-related visits were classified based on the data from the literature.³

Statistical Analysis

Statistical analyses were performed with International Business Machines Statistical Package for Social Sciences 22.0 (IBM SPSS Corp.; Armonk, NY, USA) package program. Data were presented as mean \pm standard deviation, median (interquartile range (IQR)), or percentages, whenever appropriate. Variables were investigated using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov) to determine whether they were normally distributed. Numerical measurements were presented with mean and standard deviation or medians with IQR based on distribution and qualitative data with numbers and percentages. The Mann-Whitney *U* test was performed to detect differences between 2 independent groups for continuous variables. For categorical variables, a chi-square test or Fisher's exact test was performed. A *P*-value below .05 was considered statistically significant.

RESULTS

Basic Characteristics

In total, 51 257 visits occurred during the analyzed period between March 11 and June 30, 2018, 2019, and 2020. Among all, 7648 visits were injury-related. The mean age of all the patients included in the study was 8.9 years and 60.7% were male. The mean age decreased significantly during the pandemic (6 years vs. 9 years, *P* < .001).

Following the official announcement of the pandemic and the first case from Turkey on March 11, 2020, there has been a sharp decline in the total number of PED visits. During the first 4 months of the pandemic, there was a 69.6% decrease in comparison with the same term of the previous 2 years (*P* < .001). Figure 1 demonstrates changes in the total number of PED

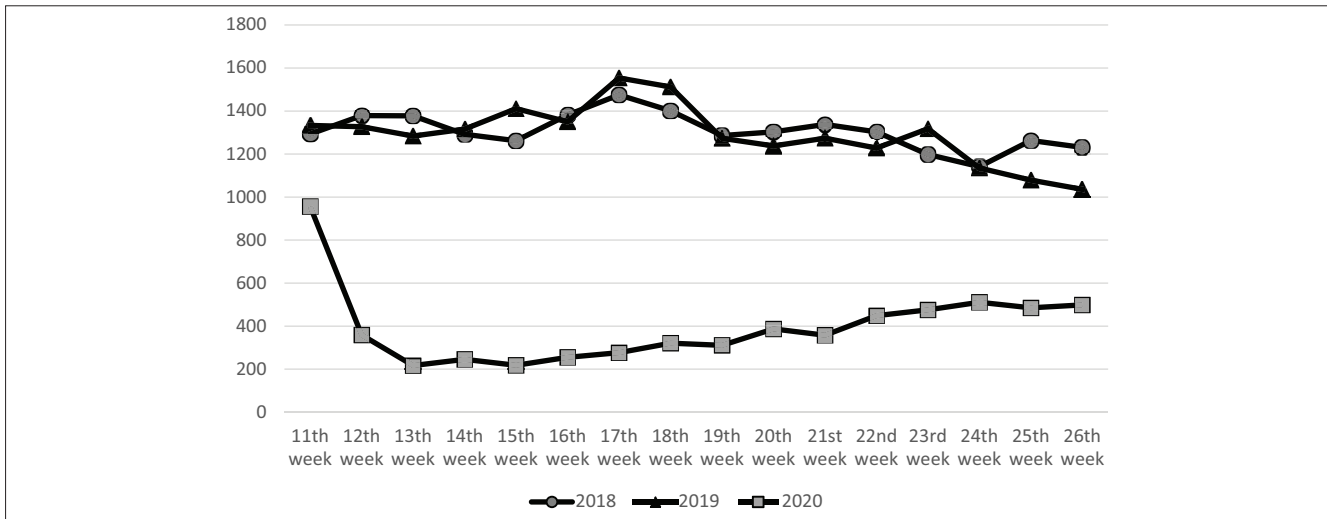


Figure 1. Weekly visit count to pediatric emergency department from 2018 through 2020.

visits during the study period. In the pre-pandemic period, a total of 44 487 visits existed, whereas 6770 visits occurred in the pandemic period. Figure 2 shows changes in injury-related PED visits. In the pre-pandemic period, a total of 6229 visits were injury-related whereas 1419 visits were made due to injury-related complaints in the pandemic period. There was a rapid decline followed by a gradual increase in the number of patients with injury-related complaints at the beginning of the pandemic in 2020. Although the proportion of patients with injury-related visits to the PED was 14% in the previous 2 years, at the beginning of the pandemic, this proportion increased to 20.9% ($P < .001$). There was a 3.8% increase in the frequencies of patients with high triage acuity levels (T1, T2, and T3) and a 3.8% decrease in patients with low levels of triage acuity levels ($P < .001$). No statistically significant difference was found in the sex distribution of the patients who visited the PED before and in the pandemic period under interest (male 60% vs. female 40% ($P = .79$)). During the pandemic period, the percentage of patients who came to the PED via ground ambulance increased

significantly from 13.3% to 32.4% ($P < .001$). In addition, when the triage levels of the patients who arrived at the PED by ambulance were examined, we found that the rate of referral by ambulance was 5.3% in the previous 2 years and 22.6% in 2020. The domestic injury rate increased from 40% to 60% during the pandemic period ($P < .001$). Hospitalization rates increased from 6% to 11.5% and intensive care unit admission rates increased from 0.9% to 3.3%. Differences were statistically significant ($P < .001$ for both). However, no statistically significant difference was found in the rate of surgical need, 3.1% vs. 4.2% ($P = .089$). A comparison of PED visits between pandemic and pre-pandemic periods is detailed in Table 1.

Changes in the Distribution of Injury Mechanisms

Significant changes in the distribution of injury mechanisms were detected. Visits due to burn increased from 2.7% to 5.2% ($P < .001$), poisoning from 3.4% to 5.5% ($P < .001$), bicycle accidents from 3.3% to 6.8% ($P < .001$), while injuries due to assault decreased from 2.6% to 1.3% ($P = .004$) and sports injuries from

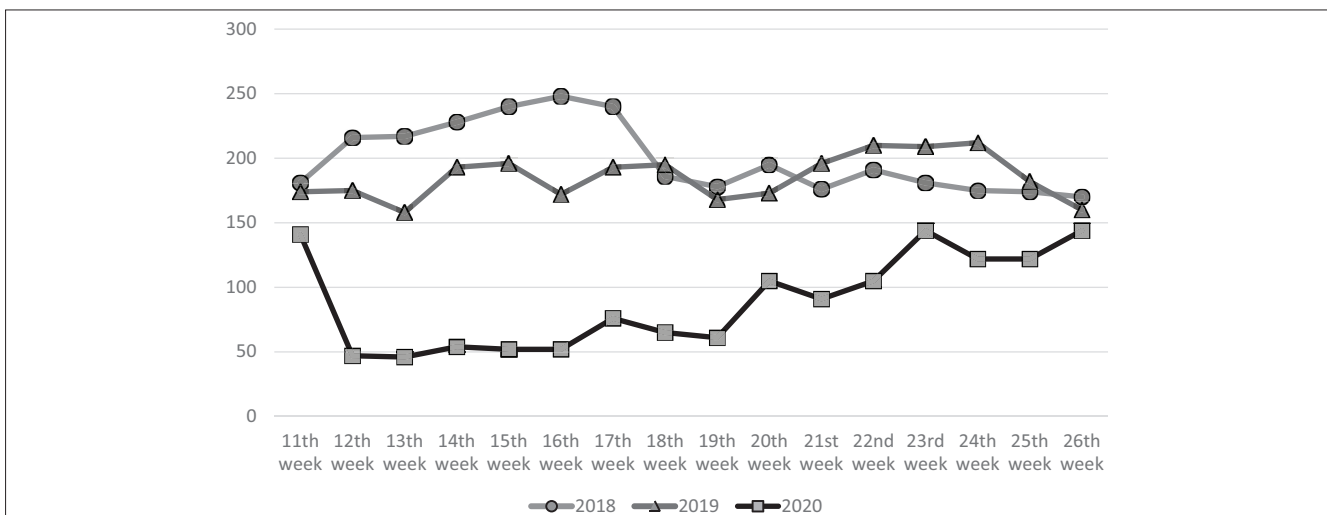


Figure 2. Weekly visit injury-related count to pediatric emergency department from 2018 through 2020.

Table 1. Demographic and Clinical Characteristics of Injury-Related Pediatric Emergency Department Visits

	March 11 to June 30, 2018-2019 (n = 6229) 2-Year Average (n = 3114)	March 11-June 30, 2020 (n = 1419)	Percent Change	P
Time interval of admission, n (%)				<.001^a
08:00 AM to 03:59 PM	1102 (35.3)	414 (29)		
04:00 AM to 11:59 PM	1754 (56.3)	844 (59)		
12:00 AM to 07:59 AM	259 (8.2)	161 (11)		
Age, years (IQR)	9 (4-14)	6 (3-11)		<.001^b
Sex, n (%)				.709 ^a
Male	1895 (60.8)	856 (60)	-0.8	
Female	1221 (39.2)	563 (40)	0.8	
Triage level, n (%)				<.001^a
High acuity (T1, T2, T3)	893 (28.6)	460 (32.4)	3.8	
Low acuity (T4 and T5)	2223 (71.4)	959 (67.6)	-3.8	
Via ambulance, n (%)	415 (13.3)	460 (32.4)	19.1	<.001^a
Home accidents, n (%)	1219 (40)	839 (59)	19	<.001^a
Hospitalization, n (%)	193 (6)	164 (11.5)	5.5	<.001^a
Pediatric ward, n (%)	8 (0.4)	20 (1.4)	0.8	<.001^a
Surgery ward, n (%)	156 (4.8)	97 (6.8)	2	.006^a
Intensive care unit, n (%)	28 (0.9)	47 (3.3)	2.4	<.001^a
Surgical intervention, n (%)	98 (3.1)	61 (4.2)	1.1	.089 ^a

The values which p value less than 0.05 are marked in bold.
^aChi-square test was used.
^bMann-Whitney U test was used.

8% to 2.1% ($P < .001$). Changes in the proportions of visits due to falls, road traffic accidents, foreign body aspirations, and foreign body ingestions did not reach significance. There were no visits due to firearm injuries or drowning during the pandemic

period. Changes in the distribution of injury mechanisms are detailed in Table 2.

DISCUSSION

In this study, we demonstrated an increase in injury-related PED visits despite the fact that the total number of patients significantly decreased during the first 4 months of the pandemic compared to the pre-pandemic period. This finding is similar to the findings of Claudet et al.⁸ In their study, they reported increased rates of domestic injuries among all trauma cases during the pandemic (from 40% to 74%). They argued that quarantine might have shifted the usual accident sites to the home and caused more serious accidental injuries and more cases with poorer prognosis such as more falls from height and admissions to intensive care units. In contrast to this finding, Delaroché et al⁷ reported a decrease in injury- and poisoning-related PED visits during the pandemic compared to the preceding 2 years.

When the admission times of the patients were evaluated, it was observed that there was an increase in admissions during the pandemic period. De Laroche et al⁷ evaluated admission hours in a similar way in their study.⁷ No differences were found in the application rates.

In this study, we also found that the proportion of patients with high acuity triage levels was higher and the proportion of patients with low acuity levels was lower in 2020 compared to the previous 2 years. In our country, there always has been a high demand for PED. Furthermore, shortly after the official declaration of the COVID-19 pandemic, elective surgeries were postponed and out-patient clinics were closed so PEDs became the only healthcare supplier at the beginning of the pandemic. However, both overall and non-emergent visits to the PED decreased. This might be due to parents' hesitancy to seek medical care due to fears of SARS-CoV-2 exposure risk at the hospitals. The increased proportions of patients with higher acuity levels might be related to the unsafe environment outside of schools, more exposure to risky activities, and less supervision of parents due to working

Table 2. Distribution of Injury-Related Admission Reasons Among Groups

Mechanism	March 11 to June 30, 2018-2019 2-Year Average n (%)	March 11-June 30 2020 n (%)	Percent Change (%)	Difference Between the Number of Patients Admitted (n)	P
Burn	84 (2.7)	75 (5.2)	-10.7	-9	<.001^a
Drowning	3 (0.08)	0 (0)	-100	-3	.286 ^a
Fall	1149 (36.8)	533 (37.5)	-53.6	-616	.645 ^a
Traffic accident	154 (4.9)	87 (6.1)	-43.1	-67	.064 ^a
Poisoning	213 (3.4)	78 (5.5)	-26.4	-135	<.001^a
Assault	107 (2.6)	19 (1.3)	-77.1	-88	.004^a
Firearm	5 (0.1)	0 (0)	-100	-5	.131 ^a
Bike accident	105 (3.3)	97 (6.8)	-7.6	-8	<.001^a
Sports accident	252 (8)	31 (2.1)	-87.6	-221	<.001^a
Foreign body aspiration	83 (2.6)	61 (4.2)	-26.5	-22	.071 ^a
Foreign body ingestion	33 (1)	31 (2.1)	-6	-2	.062 ^a

The values which p value less than 0.05 are marked in bold.
^aChi-square test was used.

online during the pandemic. In their study Chaiyachati et al⁴ also found similar results and reported an increased proportion of patients with high acuity levels (T1, T2, and T3) (from 49.6% to 56%) in 2020. They argued that children's shifted environments after the stay-at-home orders present different and mostly preventable threats to child health.⁴ Another study conducted in an emergency department in Turkey reported a decreased number of emergency department visits during the pandemic when compared to the previous year, which supports our findings. They concluded that a decrease in the number of presentations of non-emergent complaints resulted in a decrease in unnecessary patient burden. They also demonstrated increased morbidity and mortality rates which they linked with patients' avoidance of seeking medical attention.¹¹

During the pandemic, the proportions of patients that arrived at the PED via ground ambulance were higher than it was in the previous years. There may be several reasons to explain this finding. First, since elective surgeries were postponed, surgical units were able to admit more trauma patients so the Provincial Ambulance Service Command and Control Center referred more patients. Second, due to quarantine, particularly during the lockdown, patients may have seen the safest and fastest way to come to the hospital as via ambulance. No study addressing this issue has been found in the literature.

Domestic injuries always maintain their importance among accidental injuries in children. The increased frequency of domestic injuries stressed the fact that the environment outside of school could be unsafe for children. This increase might also be explained by less parental supervision due to parents working online during the pandemic. Claudet et al⁶ emphasized that it was a paradox that children who spent more time at home with their family were being watched twice as much and still were exposed to more trauma. Further studies are needed to better understand this paradox.

Hospitalization rates are among other important issues that changed during the pandemic. In our study, we observed that there was an increase in both total hospitalizations and admissions to intensive care units. Similarly, DeLaroche et al⁷ reported increased rates of hospitalization in their study in which they analyzed the combined data from 27 children's hospitals. This finding might be due to the increase in the rate of patients with higher triage levels. We also found that there was an increase in surgical rates. Similarly, Hernigou et al⁹ stated that although the total number decreased, the operation rates increased. Similarly, Claudet et al⁶ noted that the incidence of serious fractures requiring surgery showed an increasing trend.

An important effect of the pandemic was observed in the distributions of injury mechanisms. The percentage of patients who had burns during the pandemic period among all patients increased significantly compared to the pre-pandemic period. Almost all of the burns occurred at home, which addresses unsafe environments in homes 1 more time. It has been observed that the number of burn cases increased as the time spent by children at home increased. We have observed this clearly in presentations, especially during quarantine periods. For emergency physicians, especially intubation indications in facial burns and fluid support therapy in extensive burns

can be challenging. Therefore, emergency physicians should increase their knowledge and skills in burn management in the new period. There is not much information in the literature on this subject. Claudet et al⁶ compared the percentages of patients who presented with burn during the pandemic with the pre-pandemic period and did not find a difference in the proportion of presentation.

Percentages of visits due to poisoning were found to be significantly increased in our study. Similar observations were reported by the Centers for Disease Control and Prevention (CDC). An increase in cases of poisoning, particularly with cleaning agents and hand disinfectants, has been reported in another paper.¹² In the literature, a significant increase in calls to the poison center has been reported at the beginning of the pandemic.^{2,7}

Bicycle accidents were also found to be increased in percentage. In our country, at the beginning of the pandemic, schools were closed and a curfew was imposed on people under 20 years in order to control the spread of the disease. However, bicycle injuries were found to increase in proportion during the pandemic, meaning non-compliance with restrictions. We are unaware of any study regarding the change in the percentages of bicycle injuries during the pandemic.

In our study, the most notable decrease was seen in visits related to assault-related injuries and sports accidents. At first glance, this reduction in assault-related injuries seems to be different from similar studies in the literature. Three of the reviewed articles examined hospital data, which showed an increase in physical intimate partner violence and physical child abuse injuries, compared to the 3 years prior.¹³⁻¹⁵ We thought there were different factors affecting this situation. First of all, the methods of these studies differ. For instance, it is an expected result to see an increase in a study in which domestic violence is questioned. As assault-related injuries, we have included all assaults suffered by the child by a family member or a stranger. Most of these situations occur at school or outside the home. This was the case before the pandemic. Unfortunately, domestic violence is hard to detect. Educators and other family members can help uncover these situations. However, the lockdown and closure of schools during the pandemic period have also eliminated these opportunities.

Visits due to falls, road traffic accidents, foreign body aspirations, and foreign body ingestions showed an increased trend, yet the difference did not reach significance. In their study, Chaiyachati et al⁴ reported that foreign body ingestion was among the 20 most frequent presentation complaints in 2020 for the first time and that it was more than 3 years before. In our study, we observed that there was almost no change in the number of patients with foreign body ingestions. This shows that children who spend more time at home are faced with different threats.

Strengths and Limitations

The main strength of this study is that large data from a high-volume tertiary referral center were analyzed. However, our results reflected a single-center experience, which limits national and international generalizability. Our findings align

with previous studies in the literature suggesting that similar trends were observed throughout the world. As the main focus of this study was to examine changes in injury-related PED visits, we did not study visits made due to other reasons and because a large data were to be analyzed, we were not able to examine the cases in detail by the means of the length of hospital stay, revisit rate, or outcomes.

CONCLUSION

Despite a sharp decline in the total number of patient visits during the pandemic period, there was a significant increase in the proportion of visits related to injuries, particularly burns, poisonings, and bicycle accident cases. Furthermore, proportions of patients with high triage acuity levels among all were increased and this increase was associated with increased rates of hospitalizations and pediatric intensive care unit admissions.

Ethics Committee Approval: This study was approved by Ethics committee of Hacettepe University, (Approval No: GO 21/50; January 2021).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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