

A Prospective Investigation of Factors Influencing Neonatal Visits to a Tertiary Emergency Department

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What is already known on this topic?

- Newborns generally use emergency services for their non-acute needs. Early discharge after birth leaves parents and/or caregivers inadequately trained in baby care.
- In a few studies, it has been stated that if enough training is given for postpartum care, unnecessary admission of newborns to emergency service will decrease.

What this study adds on this topic?

- Newborns use emergency services for primary care. Factors such as being discharged from hospital within the first 24 hours after birth, incomplete/insufficient primary care services, or primary care not being preferred; on the contrary, easy access to emergency services and 24/7 access to a physician increase the number of emergency service admissions of newborns.

ABSTRACT

Objective: Although emergency complaints in newborns are very rare and benign, pediatric emergency department (ED) admissions in Turkey are increasing due to early postpartum discharge and insufficient prenatal care. We aimed to analyze the factors affecting neonatal admissions to ED and to evaluate progress and outcomes following discharge, and hospitalization rates.

Materials and Methods: All neonates aged 28 days or less admitted to the pediatric ED were included prospectively. Demographics, perinatal-maternal features, and social factors were recorded. Complaints, clinical findings and diagnoses, hospitalization referral rates, and readmission frequencies were analyzed.

Results: A total of 2109 neonates were enrolled; the median age was 6 days and 55.7% were males. More than half the newborns (67.5%) visited the ED out of hours, and 99% were non-referral. The frequency of multiparity and cesarean delivery were 48.9% and 57.4%, respectively. The most common complaints were jaundice (66.3%), irritability (9.3%), vomiting (3.4%), and fever (2.6%). While the hospitalization rate was 13%, 12.8% had a serious illness (sepsis, pneumonia, bronchiolitis, etc.). Serious diseases and hospitalization rates were higher among neonates with low birth weight and prematurity ($P < .005$, $P < .001$). Mothers who were primiparous and had their pregnancy at a younger age (<21 years) used EDs frequently for non-serious conditions ($P < .05$, $P < .05$, respectively). Early postpartum discharge, admission out of hours, age ≤ 7 days, residence in proximity to the hospital, and primiparity were significantly associated with readmission to the ED within 24 hours ($P = .001$, $P < .001$, $P < .001$, $P = .014$ and $P < .001$, respectively).

Conclusion: The admission of neonates to family care physicians and sufficient prenatal and postpartum care will prevent unnecessary referrals to ED and increase the physicians' quality of care for serious diseases in neonates.

Keywords: Emergency department, newborn, postpartum care, prematurity, primary health care

INTRODUCTION

Although emergency complaints in newborns are very rare and benign, emergency department (ED) admissions are increasing day by day.¹ Physiological adaptations to extrauterine life in the first 28 days after birth, parents' fears, early postpartum discharge, transfer to a family physician without sufficient training on baby care at the hospital, and home nursing care or emergency services can be shown as the reasons for this increase.² Factors such as the high risk of serious bacterial infection in the neonatal period, the milder/weaker signs of infection, the parents' anxiety, and insufficient experience and/or knowledge are associated

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with ED admissions. As in all age groups, most of the newborns use ED for non-urgent complaints.^{3,4} In the literature, it has been reported that these babies use ED with a frequency of 44-73% with non-emergency complaints, and even almost 90% of these patients are seen by physicians in ED and sent home immediately.^{1,5,6}

Neonatal ED admissions cause anxiety for both parents and physicians. The risk of contact with infected people increases due to the high number of pediatric ED applications and the crowded waiting areas.^{1,7} There is also a need for careful differential diagnosis of any nonspecific symptoms in newborns. However, since physicians working in ED examine a large number of patients, especially outside of the working hours, there is not enough time for this evaluation and sometimes there is a risk of overlooking serious diseases.^{7,8} The primary aim of our study was to investigate the causes of ED admission, urgency, and the relationship between these admissions and epidemiological, sociocultural, and prenatal and postnatal factors. Our secondary aim was to examine the ED evaluations, follow-up, management, hospitalization rates and prognosis, and the factors affecting them.

METHODS

Patient Selection

All patients aged between 0 and 28 days who applied to the pediatric ED were included in the study prospectively for 1 year. Parents were informed about the study, both orally and in writing, and written consent was obtained from those who agreed to participate. Ethics committee approval was given by the scientific research ethics committee of Ege University Faculty of Medicine (No. 17-2/14). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data Collection and Evaluation of Patients

The demographic data (gender, age) of the patients aged between 0 and 28 days who applied to the emergency service, and the month and time (working hours/out of hours) of application to ED were recorded. Maternal age, number of births, distance from the family residence to the hospital, availability of help for the mother, and the duration of hospital stay (days) after delivery were questioned as maternal factors. Birth week of the baby, birth weight, mode of delivery, and type of feed (breast milk/formula) were recorded. Patients' admission to ED (outpatient/ambulance), admission complaint, diagnosis, and results of ED were analyzed. Pneumonia, epileptic seizure, sepsis, urinary tract infection, intracranial hemorrhage, cardiopathy, and brief resolved unexplained event (BRUE) were accepted as "serious disease" in the patients. Other babies with no serious illness were identified as "non-serious conditions." The applications of babies who did not have any features in their physical examination, who did not have serious diseases, and who were evaluated as healthy newborns, were evaluated as "unnecessary use of ED." Parents' residence being less than 10 km away from the hospital was considered to be proximal. Also, the rate of readmission to ED (RDM) within 24 hours was investigated.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 25.0 (IBM SPSS Corp., Armonk, NY, USA). In presenting continuous variables, parametric tests were

Table 1. Demographic Data of the Patients Participating in the Study

Age (days) [median (IQR)]	6.0 (11.0)
Gender (M/F)	1.3/1
Admission time, n (%)	
During working hours	685 (32.5)
Out of hours	1424 (67.5)
Admission period, n (%)	
Winter	557 (26.4)
Spring	692 (32.8)
Summer	366 (17.4)
Fall	494 (23.4)
Admission method, n (%)	
Outpatient	2088 (99.0)
Ambulance	21 (1.0)
Admission Week, n (%)	
1 week (0-7 days)	1196 (56.7)
2 weeks (8-14 days)	443 (21)
3 weeks (15-21 days)	256 (12.1)
4 weeks (22-28 days)	214 (10.1)

M, male; F, female; SD, standard deviation.

expressed as mean \pm standard deviation, non-parametric tests as median (interquartile range, IQR), and categorical variables as numbers and percentages. The compliance of the data to normal distribution was examined using the Kolmogorov-Smirnov test. A simple correlation test was used to evaluate the relationship between the 2 variables. Chi-square analysis was used to examine the differences between categorical variables. A value of $P < .05$ was considered statistically significant in all analyses.

RESULTS

During the study period, 2183 (2.7%) of 79 887 patients, who applied to ED, were newborns. Seventy-four patients were excluded due to the disapproval of their parents. The median age of 2109 newborns in total was 6.0 (IQR 2.0-14.0) days and 55.7% of them were male (Table 1). While more than half the babies (67.5%) admitted out of hours, only 21 (1.0%) patients were brought to ED by ambulance (Table 1). While the detection rate of serious illness was 28.2% (193/685) in babies who were admitted during working hours; this rate was 36.3% (517/1424) in babies admitted out of hours ($P < .001$). When the admission times of the patients were examined, it was seen that the most frequent application was in the months of spring (32.8%) (Table 1). While 56.7% ($n = 1196$) of the patients admitted to ED within the first week (first 7 days) after birth, admissions were 21.0% ($n = 443$) in the second week, 12.1% ($n = 256$) in the third week and 10.1% ($n = 214$) at the fourth week (Table 1). While 72.9% ($n = 1020$) of ED admissions within the first week after birth were found unnecessary, it was observed that the rate of serious disease detection was statistically significantly higher in babies who admitted in the other weeks ($P < .001$, $P = .004$, $P < .001$, and $P < .001$, respectively).

When maternal factors were examined, the median maternal age was 29 years (IQR 7.0), the frequency of multiparity was 48.9%, cesarean section (C/S) delivery was 57.4%, and advanced maternal age (>35 years) was 12.4%. We found that

Table 2. Perinatal, Maternal and Social Characteristics of the Patients

	<i>n</i>
Maternal age (years) [median (min-max)]	29 (16-44)
Parity, <i>n</i> (%)	
Primipara	1078 (51.1)
Multipara	1031 (48.9)
Gestational age, <i>n</i> (%)	
Preterm (<37 weeks)	210 (10.0)
Term	1899 (90.0)
Type of delivery, <i>n</i> (%)	
NSVD	898 (42.6)
C/S	1211 (57.4)
Birth weight, <i>n</i> (%)	
SGA	86 (4.1)
AGA	1998 (94.7)
LGA	25 (1.2)
Living close to the hospital, <i>n</i> (%)	1301 (61.7)
Availability of a helper at home, <i>n</i> (%)	1290 (61.2)
Postpartum hospital stay (days) [median (min-max)]	1.5 (6 s-12 g)

C/S, cesarean section; AGA, appropriate for gestational age; SGA, small for gestational age; LGA, large for gestational age; Max, maximum; Min, minimum; NSVD, normal spontaneous vaginal delivery; d, day; h, hour.

61.7% of the parents lived close to the hospital and 61.2% of them had a helper at home for baby care (Table 2). Moreover, the rate of normal newborn detection was significantly higher in the admission of the parents living close to the hospital ($P < .001$). The median hospital stay of the mother after delivery was 1.5 days (IQR 1.0). It was observed that those with a postpartum hospital stay of < 24 hours mostly used ED for non-serious conditions ($P = .014$). The presence of a parent's helper did not reduce the number of admissions to ED either. It was observed that 210 (10.5%) of the babies included in the study had a gestational week below 37 weeks (preterm). Moreover, when the birth weights of the patients were analyzed, it was found that the majority (94.7%) had normal birth weight (AGA) according to gestational age, 4.1% had low birth weight (<2500 g) and 1.2% had large birth weight (LGA) (Table 2).

The most common complaint of newborns presenting to ED were jaundice (66.3%), followed by restlessness (9.3%) and vomiting (3.4%). Other complaints are shown in Table 3. Discharge diagnoses after the emergency room evaluation were "healthy normal newborn" (69.4%), infantile colic (7.5%), indirect hyperbilirubinemia (6.7%), upper respiratory tract infection (URTI) (6.5%), late hemorrhagic disease of newborn (LHDN) (2.3%), pneumonia (1.9%), sepsis (1.5%), BRUE (0.9%), and other conditions (3.3%) (Table 3). It was observed that a diagnosis of a healthy normal newborn increased statistically significantly with the decreasing age of the baby at admission ($P < .001$, $r = 0.432$). While only 272 (12.9%) newborns were admitted due to serious illness, 13% were hospitalized and sudden infant death occurred in 1 patient (Table 3).

It was observed that mothers younger than 21 years old, primiparous mothers, and parents living close to the hospital frequently used ED for non-serious conditions ($P = .009$, $P = .001$, and $P = .011$, respectively) (Table 4). On the other hand, the

Table 3. Complaints of the Patients Participating in the Study and Their Diagnoses in PED

	<i>n</i>	%
Complaint		
Jaundice	1399	66.3
Unrest	197	9.3
Vomiting	71	3.4
Fever	54	2.6
Blood from the navel	49	2.3
Cough	47	2.2
Inability to feed	42	2.0
Grunt	40	1.9
Bruising	33	1.6
Stuffy/runny nose	32	1.5
Debris	24	1.1
Navel discharge	21	1.0
Other	100	4.7
Diagnosis		
Normal newborn	1464	69.4
Infantile colic	159	7.5
Indirect hyperbilirubinemia	141	6.7
URTI	137	6.5
LHDN	49	2.3
Pneumonia/Bronchiolitis	41	1.9
Sepsis	32	1.5
BRUE	19	0.9
Other	67	3.3

BRUE, brief resolved unexplained event; PED, pediatric emergency department; URTI, upper respiratory tract infection; LHDN, late hemorrhagic disease of the newborn.

rates of serious disease detection and hospitalization rates were significantly higher in small for gestational age (SGA) and preterm babies ($P = .031$, $P < .001$, $P < .001$, and $P = .02$, respectively) (Table 4). The frequency of hospitalization was significantly higher in patients with multiparity, advanced maternal age, and those living far from the hospital ($P = .024$, $P = .001$, and $P = .008$, respectively) (Table 4). While there was no statistically significant difference between the age of the baby, advanced maternal age, SGA, preterm delivery, and detection of BRUE, it was observed that the frequency of BRUE was higher in children whose mothers were multiparous (15/19) ($P = .01$).

The rate of readmission (RDM) of babies in the cohort to the ED within 24 hours was 22% ($n = 463$). It was observed that most of these patients (84.7%) admitted with the same complaints. Patients with significantly higher readmission rates were found to be out of hours applications, early discharge after birth (within the first 24 hours postnatal), early neonatal age (≤ 7 days), residing close to the hospital, and babies of primiparous mothers, respectively ($P = .001$, $P < .001$, $P < .001$, $P = .014$, and $P < .001$) (Table 5). On the other hand, it was observed that the RDM of preterm babies was significantly less in the first 24 hours ($P = .005$) (Table 5).

DISCUSSION

The neonatal period is one that is not only vulnerable but requires constant care, and parents should have sufficient

Table 4. Comparison of Maternal and Postpartum Factors According to Diagnosis and Hospitalization Frequency

	Normal Newborn		Serious Illness		Hospitalization	
	+	-	+	-	+	-
Parity, n (%)						
Primipara	727 (67.4)	351 (32.6)	119 (11)	959 (89)	123 (11.4)	955 (88.6)
Multipara	672 (65.2)	359 (34.8)	153 (14.8)*	878 (85.2)	152 (14.7)*	879 (85.4)
Advanced maternal age, n (%)						
Yes	198 (75.9)	63 (24.1)	52 (19.9)*	209 (80.1)	48 (18.4)*	213 (81.6)
No	1201 (65) [§]	647 (35)	220 (11.9)	1628 (88.1)	227 (12.3)	1621 (87.7)
Residing close to the hospital, n (%)						
Yes	897 (64.5) [§]	393 (35.5)	147 (11.4)	1143 (88.6)*	148 (11.5)	1142 (88.5)
No	502 (61.3)	317 (38.7)	125 (15.3)	694 (84.7)	127 (15.5)*	692 (84.5)
Gestational age, n (%)						
Preterm	142 (67.6)	68 (32.4)	57 (27.4) [§]	153 (72.6)	55 (26.2) [§]	155 (73.8)
Term	1257 (66.2)	642 (33.8)	215 (11.3)	1684 (88.7)	220 (11.6)	1679 (88.4)
Birth weight, n (%)						
SGA	57 (66.3)	29 (33.7)	18 (20.9)*	68 (79.1)	19 (22.1)*	67 (77.9)
AGA	1326 (66.4)	672 (33.6)	253 (13.3)	1745 (86.7)	255 (13.4)	1743 (86.6)
LGA	16 (64)	9 (36)	1 (4)	24 (96)	1 (4)	24 (96)

*P < .05, [§]P < .001.
AGA, appropriate for gestational age; SGA, small for gestational age; LGA, large for gestational age.

knowledge about baby care. The admissions of newborns to ED are increasing day by day due to reasons such as over-sensitive and anxious parents or caregivers, early postpartum discharge, insufficient training on baby care in the postpartum

period, and insufficient primary care support.^{1,2,9} ED physicians become anxious and worried in terms of diagnosis, patient management, and patient skipping, because of the need for a detailed evaluation of every nonspecific symptom in the neonatal period, the high risk of rapid deterioration in a clinical situation, the similar reaction to every situation, and despite all these, the newborn entering a crowded environment that is not suitable.⁷⁻¹⁰ This study showed that, as in all other age groups, newborns use ED due to “complaints without real urgency.”

Table 5. Comparison of Demographic, Maternal, and Postnatal Factors According to Readmission to ED Within the First 24 Hours

	Readmission to ED Within the First 24 Hours		P*
	+	-	
Birth weight, n (%)			
SGA	9 (10.5)	77 (89.5)	
AGA	216 (10.8)	1782 (89.2)	>.05
LGA	2 (8)	23 (92)	
Gestational age, n (%)			
Preterm	11 (5.2)	199 (94.8)	.005
Term	216 (13.4)	1683 (86.6)	
Advanced maternal age, n (%)			
Yes	34 (13)	227 (87)	>.05
No	193 (10.4)	1655 (89.6)	
Parity, n (%)			
Primipara	148 (13.7)	930 (86.3)	<.001
Multipara	79 (7.7)	952 (92.3)	
Admission time, n (%)			
Working hours	51 (7.4)	634 (82.6)	.001
Out of hours	176 (12.4)	1248 (77.6)	
Living close to the hospital, n (%)			
Yes	156 (12.1)	1134 (87.9)	.014
No	71 (8.7)	748 (91.3)	
Age			
≤ 7 days	227 (100)	969 (51.5)	<.001
> 7 days	0 (0)	913 (48.5)	

ED, emergency department; AGA, appropriate for gestational age; SGA, small for gestational age; LGA, large for gestational age.
*p<0.05 was considered significant

The rate of neonatal admission to the ED ranges from 1.3 to 20.4%.^{1,2,11,12} Similar to the literature, the rate of newborn patients in our study was found to be 2.7%. It was observed that this rate increased by almost 50% (1.9%/2.7%) compared to another study conducted in our country in previous years.¹ As shown in questionnaire-based studies, the use of ED for non-emergency situations is mostly related to rapid service delivery. It should not be forgotten that earlier postpartum discharges also contribute to ED admission preference. Considering the distribution of the applications during the day, we observed that, similar to previous studies (62%), more than half of our patients (67.5%) came out of hours.¹³ We think that parents' preference for these hours may be their working patterns rather than the urgency of the baby's complaint of admission. The significantly higher rate of detection of serious illness in babies admitting out of hours can be demonstrated by the fact that while polyclinic applications can be made out of hours, easier access to a neonatal specialist and patients who admit to ED are more during out of hours due to the shorter working hours.

The younger the babies are when admitted to the ED, the greater the possibility that they are normal, healthy newborns. It has been reported that infants less than 14 days of age use the ED more, but these generally do not require urgent care, and their hospitalization rates are lower.^{1,2,3,10,14} In our study group, the age of most patients (77.7%) was ≤ 14 days, and 72.9% of them did not have an emergency. Early postpartum discharge,

inadequate training in postpartum care, and the increased anxiety and fear of parents in this period may explain this situation. In contrast, those older than 14 days had a higher rate of acute serious illness.

In some studies, it has been observed that parents use ED more frequently because of the low maternal age, primiparity, and inadequate postnatal care training.^{5,10} In countries where primary health care services are well planned and implemented, it has been shown that these factors do not affect ED admissions.¹⁰ In this study, it has been shown that factors such as primiparity, young maternal age (<21 years), early discharge (<24 hours), and residing close to the hospital increase admission to ED with “non-emergency complaints.” With these results, it can be interpreted that the lack and/or insufficiency of baby care training in the health institution where the postpartum care took place and the subsequent primary healthcare services may have led parents to ED.

Jaundice and nutritional problems are the most common complaints of newborns admitting to the ED, and emergency/serious illness is found in very few of them.^{11,15,16} Similar to these studies, in our cohort, more than three-quarters of the patients presented with jaundice, restlessness, and vomiting, while most of them (69.4%) were evaluated as normal healthy newborns. It was observed that 87.1% of the patients admitted to ED in non-emergency situations which could have been evaluated in the family health center. In a similar study conducted by Batu et al.¹ in our country, the admission rate of ED for non-emergency reasons was found to be 44.3%, while it was reported that this rate ranged between 49 and 70% globally, and 90% of them were even discharged immediately after being seen by the physician.^{5,17} The higher rate in our country can be explained by the fact that our hospital is in the busiest part of the city and that the families can easily reach the hospital because they reside close to the hospital. As an inevitable consequence of this, the rate of hospitalization (12.9%) was found to be lower than the rates in other studies (17–47%).^{2,10,15,16,18}

Prematurity is a special risk factor in terms of nutritional problems, infections, and neonatal complications.¹⁹ It has been reported that these babies apply to ED for “real emergencies” and their hospitalization rates are higher than for full-term babies.^{1,5,14,19,20} Similar factors were found to be significantly higher in the premature subgroup, which constitutes one-tenth of our study group. It has been reported that babies with SGA, another special group among newborns, have a low admission to ED.¹³ It was observed that babies with SGA, whose representation in our study was also very low (4.1%), used ED in real emergencies or serious illnesses. Premature and SGA babies have high rates of hospitalization after birth and their parents have received adequate training in care, which may explain why these babies use ED less.

It has been reported that the RDM rates of children in the first 72 hours after discharge from ED are between 1.1 and 15.8%.^{21–25} Although RDMs cause an increase in the patient crowd in ED, they are among the indicators of patient care quality.^{21,26} The frequency of readmission is affected by factors such as the health system in practice, the age of the patient, the

sociocultural/economic level, the presence of chronic disease, the time of application, the proximity of the residence to the hospital, and the crowded environment.^{21,27,28} In our study, the RDM rate in the first 24 hours was found to be higher (22%) compared to the literature, and it was observed that most (84.9%) patients admitted with the same complaint. This difference can be explained by various reasons, such as residing close to the hospital, applying out of hours for the first admission, early discharge (<24 hours after birth), early neonatal period (≤ 7 days), and those with a primipara mother, for whom the RDM rate was significantly higher in the first 24 hours. Providing information support to fresh parents with visual and written documents (smartphone applications or educational video contents) about common problems and baby care in the postnatal period (even before) in the hospital where the baby is born, can prevent both unnecessary ED admissions and RDMs. The need for a correct family physician and ED admission preferences should be explained in detail.

Our study is a single-center study and has been conducted in the western-most point of Turkey, and these factors constitute an important limitation in the generalization of the results that we obtained.² Since the non-hospitalized patients cannot be followed up, it is not possible to know whether or not they readmitted to another hospital.

As the results of this study show, newborns use EDs for primary healthcare services. Factors such as early discharge after birth (<24 hours), and insufficient baby care training, incomplete/insufficient primary health care services or primary care not being preferred, and on the other hand, easy access to EDs and access to a physician 24/7, increase the number of ED admissions of newborns. It should be kept in mind that many problems, especially in the early neonatal period, can be solved by family physicians. The referral of infants with an emergency referral indication will solve the problem to a great extent if the family physician communicates directly with the relevant ED and sends them by a neonatal ambulance.

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