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ORIGINAL ARTICLE

The Impact of Full-Time Attending Physician in the Pediatric Emergency Department

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Objective: The purpose of this study was to indirectly evaluate the impact of full-time pediatric emergency physician on the quality of medical services.

Methods: This study was a retrospective study that was performed by using the medical records of new patients aged less than 16 years old, residing in Cheonan and Asan, who visited the pediatric emergency department (PED) of Soonchyunhayng University Cheonan Hospital from December 1, 2011 to December 31, 2016. The correlations between the outpatient revisit following the emergency department visit and socio-demographic characteristics, number of physicians, reasons for the visit, severity based on the Korean Triage and Acuity System, length of stay, and whether or not tests were conducted were analyzed.

Results: Total of 30,728 patients were included. The significant factors affecting the outpatient revisit were the patient's age (P = 0.00; odds ratio [OR], 1.004), number of physicians (P = 0.03; OR, 1.066), and length of stay (P = 0.00; OR, 1.004). When the number of physicians was appropriate, the length of stay was reduced (P = 0.00; OR, 0.999), and the rate of test (P = 0.00; OR, 0.835) were reduced.

Conclusion: It is believed that having an appropriate number of physicians will indirectly increase the patient's satisfaction, and be helpful in improving the quality of the medical services in PED.

Keywords: Physicians; Outpatients; Personal satisfaction; Emergency medical services

INTRODUCTION

In the past 20 years, researchers in the United States have focused on improving the pediatric emergency medical care system [1-3]. Based on the result of a survey reported in 2012, the emergency department's pediatric readiness level in Korea hospitals was very low in 2010, and the need to establish standards for appropriate equipment, facilities, and personnel for pediatric emergency care has been reported [4]. In this regard, the pilot project for establishing pediatric emergency departments (PEDs) has started in 2010, based on policy and financial supports, and, currently, 9 pediatric emergency centers and 3 hospitals with PEDs have been designated to participate.

Although the PED in Korea has been operating for more than 6 years, only studies focusing on a caregiver's satisfaction with the emergency department and its care for children as well as the utilization of the emergency department for children have been reported. There is no known study on satisfaction of PEDs. According to the study reported by Kwak et al. [5] in 2012, children aged 1–4 years were most likely to use the emergency department in Korea, and more children were rushed to hospitals due to illnesses rather than injuries. The study based on a survey conducted by Jang et al. [6] in 2015 reported that the overall satisfaction with the emergency department services for children was relatively lower at below 50%. It also found that satisfaction was closely associated with full-time pediatric emergency physicians at the emergency department, severity, and length of stay. Furthermore, there has been a report that the quality of medical services and satisfaction have a positive influence on the intention to return to the medical institution [7,8]. However, there was no actual study on the associ-

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ation with returns. According to a study reported by Press et al. [9] in 1994, full-time attending physician coverage in a PED was associated with an increase in satisfaction and a decrease the amounts of disbursements. In addition, full-time attending physicians in the PED decreased length of stay and the mortality rate in the emergency department [10]. The study also raised the need for in-depth analysis on emergency department patients [11].

Therefore, this study aimed to analyze the factors indirectly affecting satisfaction with the PED through an objective indicator, outpatient revisit for follow-up among patients who visited the PED, and to investigate the association between the number of physicians and the quality of medical services provided.

MATERIALS AND METHODS

1. Patients and materials

This study was a retrospective study that was performed by using the medical records of new patients aged less than 16 years old, residing in Cheonan and Asan, who had visited the PED of Soonchyunhayng University Cheonan Hospital from December 1, 2011 to December 31, 2016. Established patients were excluded from the study after considering the impact of loyalty to the hospital, and only patients living in Cheonan and Asan were included to eliminate bias due to distance. The PED of this hospital has been in operation since January 2011. In the period from January 2011 to November 2011, there was no specialist in the PED; thus, the study period was set from December 1, 2011 when specialists were first employed. Patients who transferred to another hospital, inpatients, patients who died, patients who visited the emergency department more than once for the same reason within 24 hours, patients whose reason for their visits was not to seek medical treatment, and patients who had errors in their records or had incomplete records were excluded from the study.

To determine the factors affecting the outpatient revisit for a medical follow-up after discharge among new patients at the PED, a revisit within one week after discharge was set as a target variable. For illnesses and wounds, the outcome may vary, depending on the specialist who treated the patient at the emergency department and the outpatient clinic; thus, the target variable was observed for only one week. Input variables included socio-demographic characteristics, number of full-time pediatric emergency physicians, purpose of the visit, severity based on the Korean Triage and Acuity System (KTAS), length of stay at the emergency department, and whether a test was conducted (Table 1). The test items included blood tests, urine tests, culture tests, radiological examinations, and special examinations (e.g., cerebrospinal examination). If one or more of these tests were conducted, the case fell under the category of 'implementation of a test.' Additionally, in order to keep proper working hours (within 40 hours a week), at least 4.67 physicians are required; thus, the proper number of qualified physicians was selected as five or more persons.

Table 1. Characteristics of input variables

Variable	Value
Gender	Male, female
Age (mo)	0–180
Region	Cheonan, Asan
Cause of visit	Disease, injury
No. of physicians[a]	1–6
Triage in Korean Triage and Acuity System	Level 1–5[b]
Total length of stay (min)	0–1,440
Test[c]	Yes, no

[a]Full-time attending physicians. [b]Resuscitation, emergency, urgency, less-urgency, and non-urgency. [c]Laboratory test (blood, urine, cerebrospinal fluid) and radiologic test.

2. Statistical analysis

To assess the reliability of the model and to compare the associations between variables, the logistic regression analysis and the multivariate logistic regression analysis were performed with IBM SPSS ver. 20.0 (IBM Corp., Armonk, NY, USA), respectively. To compare the two groups in terms of categorical variables, the chi-square test and the Hosmer-Lemeshow goodness-of-fit were utilized. When the univariate logistic regression result was significant (P-value <0.1) or if there was an influence between variables, the associations between variables were compared through the multivariate logistic regression. The statistical significance was defined as P-value <0.05.

RESULTS

From December 1, 2011 to December 31, 2016, a total of 37,534 new patients aged less than 16 years visited the PED of Soonchunhyang University Cheonan Hospital. Of these patients, 30,728 were included in this study after excluding 5,094 patients who were hospitalized (13.71%) and 1,712 patients who did not meet the inclusion criteria.

Table 2. Socio-demographic characteristics according to outpatient department revisit

Variable	Revisit <1 wk		Univariate		Multivariate	
	Yes (n=4,445)	No (n=26,283)	P-value	OR	P-value	OR
Gende (male)	2,455 (55.2)	13,998 (53.3)	0.02[a]	1.083	0.034	1.072
Age (mo)	48.02±51.79	41.35±46.33	0.00[a]	1.003	0.000	1.003
Region						
Cheonan	2,875 (64.7)	16,917 (64.4)	0.69			
Asan	1,570 (35.3)	9,366 (35.6)				

Values are presented as number (%) or mean±standard deviation.
OR, odds ratio.
[a]Multivariate unconditional logistic analysis was conducted in variables that showed a P-value <0.05 on univariate logistic analysis.

Table 3. Estimated odds ratio from the univariate and multivariate logistic regression model to predict outpatient department revisit

Variable	Revisit <1 wk		Univariate		Multivariate	
	Yes (n=4,445)	No (n=26,283)	P-value	OR	P-value	OR
No. of physicians[a]	4.51±1.08	4.48±1.05	0.03	1.035	0.00	1.066
Cause of visit			0.00	2.784	0.00	3.593
Disease	2,051 (46.1)	18,519 (70.5)				
Injury	2,394 (53.9)	7,764 (29.5)				
Triage in Korean Triage and Acuity System			0.25		0.04	1.094
Level 2	191 (4.3)	911 (3.5)				
Level 3	3,669 (82.5)	22,199 (84.5)				
Level 4	547 (12.3)	2,828 (10.7)				
Level 5	38 (0.9)	345 (1.3)				
Total length of stay (min)	137.3±110.9	86.74±94.6	0.00	1.004	0.00	1.004
Test[b] (yes)	1,610 (36.2)	9,412 (35.8)	0.60		0.00	1.353

Values are presented as number (%) or mean±standard deviation.
OR, odds ratio.
[a]Full-time pediatric emergency physicians. [b]Laboratory test (blood, urine, cerebrospinal fluid) and radiologic test.

1. Associations with socio-demographic characteristics

Among the patients who were discharged from the emergency department, 4,445 patients (14.5%) revisited the outpatient clinic for a follow-up within one week (group A), and 26,283 patients (85.5%) did not return or visited after one week (group B). As a result of the univariate logistic regression, the gender and age (months) were found to be significant. Male patients were compared to the female patients (P=0.015; 95% confidence interval [CI], 1.016 to 1.154), and patients who were older (P=0.000; 95% CI, 1.002 to 1.003) were more likely to revisit the hospital. The difference in the region of origin (Cheonan versus Asan) was not significant. In the result of the multivariate logistic regression analysis, the male gender (P=0.034; 95% CI, 1.005 to 1.143) and age (P=0.000; 95% CI, 1.002 to 1.003) were both significant (Table 2).

2. Associations between the number of physicians and other factors

The number of dedicated physicians was 4.51 and 4.48 in group A and group B, respectively. A total of 20,570 people (66.9%) visited the hospital due to diseases. In terms of severity, level 3 was most common, afflicting 25,868 people (84.2%). The mean length of stay was 94.05 minutes. The length of stay was 128.96 minutes in level 2, 94.72 minutes in level 3, 83.28 minutes in level 4, and 43.23 minutes in level 5, indicating that the length of stay tended to rise with the increase in severity. In the results of the univariate logistic regression analysis, the significant factors affecting outpatient revisit included a larger number of available physicians (P=0.029; 95% CI, 1.003 to 1.067), injury compared to disease (P=0.000; 95% CI, 2.610 to 2.970), and longer duration of stay (P=0.000; 95% CI, 1.004 to 1.004). With regard to severity based on KTAS, level 1 was a resuscitation stage in the severity classification in which most of the patients died after the visit or needed to be hospitalized in the intensive care unit even after resuscitation, and there was no case of discharge within 24 hours. In the multivariate logistic regression analysis, the increase in severity (P=0.038; 95% CI, 1.005 to 1.190) and implementation of a test (P=0.000; 95% CI, 1.238 to 1.478) were found to be significant in addition to the variables that were significant in the univariate logistic regression analysis (Table 3).

3. Associations between the number of physicians and the length of stay and implementation of a test

Due to the nature of the PED, relatively more patients with moderate (level 3) to severe illnesses visited the hospital compared to patients with mild illnesses. A test was conducted for 11,022 patients (35.9%), while 19,706 patients (64.1%) did not undergo further testing. The univariate logistic regression analysis result revealed that the availability of physicians was significantly associated with the length of stay (P=0.000; 95% CI, 0.999 to 0.999) and the implementation of a test (P=0.000; 95% CI, 0.767 to 0.825). Consequently, when the number of physicians was sufficient, the length of stay was shorter and fewer patients received a test. These variables were also significant in the multivariate logistic regression analysis (Table 4).

Table 4. The relationship between the number of pediatric emergency physicians and total length of stay and the performance rate of tests

Variable	No. of physicians		Univariate		Multivariate	
	≥5 (n=16,532)	≤4 (n=14,196)	P-value	OR	P-value	OR
Total length of stay (min)	88.2±94.4	100.87±103.1	0.00	0.999	0.000	0.999
Test[a] (yes)	5,464 (33.1)	55,582 (39.2)	0.00	0.767	0.000	0.825

Values are presented as mean±standard deviation or number (%).
[a]Laboratory test (blood, urine, cerebrospinal fluid) and radiologic test.

DISCUSSION

In the case of pediatric emergency patients, the normal range of vital signs varies according to age, and there is a difference in severity depending on age group. Due to such uniqueness, the necessity of providing pediatric emergency medical service has increased. In Korea, to improve the quality of emergency medical services, a pilot project within a PED at the Asan Medical Center in Seoul and Soonchunhyang University Cheonan Hospital was initiated as a national project, funded by the Ministry of Health and Welfare.

Although more than 6 years have passed since the establishment of the PED, there have been no studies measuring satisfaction within the PED and the quality of medical services provided. This study was conducted with the medical record summary of new patients who visited the PED of this hospital for 5 years, from December 2011 to December 2016, to indirectly evaluate the degree of satisfaction with the PED and the quality of medical services through objective indicators, outpatient revisit, and the number of physicians.

Children aged 1–4 years old, or 14,311 patients (46.6%), were most likely to use the PED, presenting a similar result with that of the previous study. The second largest group to use this department were children under one year of age, or 9,092 patients (29.6%), which was different from the result of a study in which children aged 5–9 years (19.4%) was the second largest group [5]. This result seems to reflect the fact that as the PED has been established, caregivers of younger patients generally want to be separated from adult patients, and more and more caregivers want to administer care at the PED.

In this study, the revisit rate in the outpatient clinic rose with the increase in the number of physicians at the PED, which seems to be closely related to the impact of the full-time pediatric emergency physicians on the level of satisfaction with the PED shown in a previous study [6]. The result implies that excessive workload has been reduced by employing an adequate number of full-time pediatric emergency physicians, thereby limiting the number of mistakes. While the length of stay and unnecessary tests have decreased through appropriate patient classification and medical judgment, all of this may lead to an improvement in the quality of medical services. In terms of injury, the outpatient revisit rate rose with an increase in injury severity. The reason is considered there are relatively more patients with moderate to severe injuries, rather than patients with mild injuries due to the characteristic of the PED, and it is difficult to treat them at the primary health clinic.

In the results of this study, there was a difference between the results of the univariate logistic regression and multivariate logistic regression analyses regarding the associations of the outpatient revisit with the severity and implementation of a test. The reason is deemed to be the close relationship between the two variables. Based on the results of previous studies, the caregivers of patients with a higher severity exhibited higher satisfaction [12,13]. Many cases with a higher severity required further testing to determine the patient's condition, and physicians tend to take care of patients with increased attention compared to patients with mild conditions; thus, eliciting an impression to caregivers that the patients are treated well. This is also presumed to have an association with the outpatient revisit outcome according to the increase in the length of stay.

According to the results of a previous study, most of the pediatric patients visited the emergency department due to internal medical problems, such as fever or vomiting [4]. Moreover, in most cases, the treatment by pediatricians or emergency physicians was given after an initial consultation with interns. There are still many places where this treatment behavior is applied [4]. The initial consultation with an intern may cause unnecessary examinations and treatments. This study showed that there are significant differences in the length of stay and implementation of a test, depending on whether there are adequate numbers of physicians, implying that sufficient professional manpower may help improve the quality of medical services.

This study was a single center study that determined indirectly the level of satisfaction and the quality of medical services with limited variables, including the outpatient revisit rate, number of physicians, length of stay, and implementation of a test, which are considered limitations of this study. However, this study is signifi-

cant because it was the first study on the satisfaction of the PED indirectly, and it was conducted with objective indicators, instead of subjective indicators in terms of satisfaction through a survey. Future studies must be done by using multiple approaches, including multicenter research, questionnaires, and objective indicators.

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