Original Article

J Prev Med Public Health 2014;47:309-316 • http://dx.doi.org/10.3961/jpmph.14.044

pISSN 1975-8375 eISSN 2233-4521

Journal of Preventive Medicine & Public Health

The Impact of an Emergency Fee Increase on the Composition of Patients Visiting Emergency Departments

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Objectives: This study aimed to test our hypothesis that a raise in the emergency fee implemented on March 1, 2013 has increased the proportion of patients with emergent symptoms by discouraging non-urgent emergency department visits.

Methods: We conducted an analysis of 728 736 patients registered in the National Emergency Department Information System who visited level 1 and level 2 emergency medical institutes in the two-month time period from February 1, 2013, one month before the raise in the emergency fee, to March 31, 2013, one month after the raise. A difference-in-difference method was used to estimate the net effects of a raise in the emergency fee on the probability that an emergency visit is for urgent conditions.

Results: The percentage of emergency department visits in urgent or equivalent patients increased by 2.4% points, from 74.2% before to 76.6% after the policy implementation. In a group of patients transferred using public transport or ambulance, who were assumed to be least conscious of cost, the change in the proportion of urgent patients was not statistically significant. On the other hand, the probability that a group of patients directly presenting to the emergency department by private transport, assumed to be most conscious of cost, showed a 2.4% point increase in urgent conditions ($p<0.001$). This trend appeared to be consistent across the level 1 and level 2 emergency medical institutes.

Conclusions: A raise in the emergency fee implemented on March 1, 2013 increased the proportion of urgent patients in the total emergency visits by reducing emergency department visits by non-urgent patients.

Key words: Emergency fee, Hospital emergency service, Overcrowding, Difference-in-difference

INTRODUCTION

The emergency medical services system refers to an integrated system that arranges and connects the necessary components systemically for each level so that an effective and prompt medical response can be provided during emergencies [1]. The emergency medical institute in South Korea, as a key component of the emergency medical services system, are primarily divided into three levels according to their functions. The regional emergency medical center, the highest level (level 1 emergency medical institute), aims to treat patients in critical condition within the optimal timeframe where advanced medical technology and care are required. Currently, each region has one emergency medical center, and, as of September 2014, there are 20 regional emergency centers in total. The middle-level local emergency medical center (level 2 emergency medical institute) is for emergency patients with moderate symp-

Received: September 24, 2014 Accepted: October 27, 2014
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toms, and the lowest-level local emergency medical center (level 3 emergency medical institute) controls basic first-aid and emergency medical treatment for patients with simple and mild symptoms. In order for the emergency medical services system to work efficiently, patients must be properly distributed according to the functions of emergency medical institutes in the stage prior to hospital visit (pre-hospital stage). In South Korea, however, the primary decision makers for the selection of emergency medical institute to visit are the patients themselves and their families, and only 9% to 28% of selections are made by emergency rescue workers in the pre-hospital stage [2-4]. The percentage of inappropriate transfer was 49.4% when patients selected an emergency medical institute to visit, which is nine times higher than the percentage when patients were transferred by emergency rescue workers (5.5%). Further, the percentage of inappropriate use of higher-level emergency medical institutes was greater than that of lower-level institutes [4]. As such, the inappropriate use of higher-level emergency medical institutes is considered the main cause of emergency department overcrowding [5-7].

The Korean government has initiated various policy tools to discourage non-urgent patients from using higher-level emergency medical institutes inappropriately [4], and as a component of such policy tools, "emergency fee" was introduced in April 2000. Emergency fee is charged to all patients who visit an emergency medical institute, with differential pricing by level (e.g., 30 000 Korean won [KW] for levels 1 and 2 and 15 000 KW for level 3) [8]. In addition, non-urgent patients are charged 100% of the emergency fee, and urgent patients are charged 50%. Published research shows that the proportion of non-urgent patients has decreased since the introduction of this policy [8]. Further, the patient cost-sharing policy imposed to reduce non-urgent use of emergency medical institutes has discouraged non-urgent emergency department visits in the US, Canada, and Hong Kong [9-14].

The emergency fee had remained the same since its introduction in 2000, but it has since been raised on March 1, 2013 (level 1, 52 500 KW; level 2, 27 520 KW; and level 3, 18 280 KW). A raise in the emergency fee may act as a potential cost barrier to emergency department visits [15], and in the case of non-urgent patients with higher cost sharing and substitutes (pharmacy, self-treatment, or outpatient visit on the next day), it is likely that they will refrain from emergency department visits more than urgent patients will. As a result, a raise in the emergency fee is expected to increase the percentage of urgent patients in emergency department visits. This study intends to test our hypothesis that a raise in the emergency fee implemented on March 1, 2013 has increased the percentage of patients with emergent symptoms by discouraging non-urgent emergency department visits.

METHODS

Data Source

The National Emergency Department Information System (NEDIS) is an integrated information network that transmits real-time information related to urgent patients' medical treatment in their emergency department visits. The system has been instituted in 146 institutes as of December 2012 since its start in 2004. The rate of system building in level 1 and level 2 emergency medical institutes is 100%, and the rate of system building in level 3 emergency medical institute is 3%. While NEDIS has a disadvantage because level 3 emergency medical institute visits are harder to identify in this system than they are in the other existing data source, the system includes relatively accurate information on the pathway of emergency department visits, the main symptoms, and the result of emergency department care. This system also has the advantage of including not only patients with health insurance but also those with automobile insurance, workmen's compensation insurance, and even uninsured patients.

In order to maximize the validity of policy impact assessment in this study, we conducted an analysis of 768 510 patients who are registered in NEDIS and had visited level 1 and level 2 emergency medical institutes in the two-month time period from February 1, 2013, one month before the raise in the emergency service fee, to March 31, 2013, one month after the raise. Among them, 39 774 patients were excluded, namely, those who stayed longer than 72 hours (3 days), those who were not discharged at the time of being registered in NEDIS, those who had missing key variables, and those who used level 3 emergency medical institutes. Patients who stayed longer than 72 hours were excluded because the purpose of their emergency department visits was not characteristic of a typical emergency medical visit, but rather as an atypical visit due to factors such as waiting times for hospital admissions. Consequently, we conducted an analysis of 728 736 emergency department visits across 135 institutes as of February 2013 (18 level 1 emergency medical institutes, 117 level 2 emergency medical institutes).

Type of Visit

The type of visit, defined by combining the transportation type of visit and the pathway of visit, was used in this study as a surrogate indicator of patients' consciousness of costs. It is expected that patients making emergency department visits using public transport (119 ambulance, hospital ambulance, police car, or air transport) would consider the cost less than would those who came to the hospital by private automobile or on foot, as the former would have an additional influence from the emergency rescue worker. In terms of the pathway of visit, it was expected that patients transferred from other hospitals would have more influence from medical doctors than would those who directly present to the emergency department, and thus, they would consider the cost less when choosing an emergency department to visit.

Based on this assumption, emergency department visits were divided into five types: 1) patients transferred using public transport and regarded as the group least conscious of cost, serving as a baseline group; 2) patients transferred using private transport or on foot; 3) patients referred from an outpatient department regardless of the type of transport; 4) direct emergency department visits using public transport; and lastly, 5) direct visits using private transport or on foot.

Statistical Analysis

A difference-in-difference method was used to assess the impact of a raise in the emergency fee on the proportion of urgent patients. It is difficult to determine whether changes, if any, are caused by the policy or merely reflect time trends in a simple before-and-after comparison. Difference-in-difference is a method used to estimate the net effects of policy by taking into account all the changing trends over time and the baseline difference among groups. This study aimed to estimate the net effect of a raise in the emergency fee by comparing the baseline group, which is regarded as the group least affected by the increased emergency fee in emergency department visits (least conscious of cost), with other groups.

Specifically, our study model can be expressed by the following equation:

$$Y = \beta_0 + \beta_1\, POST + \beta_2\, GROUP_2 + \beta_3\, GROUP_3 + \beta_4\, GROUP_4 + \beta_5\, GROUP_5 + \beta_6\, (GROUP_2 \times POST) + \beta_7\, (GROUP_3 \times POST) + \beta_8\, (GROUP_4 \times POST) + \beta_9\, (GROUP_5 \times POST) + \beta_{10} X + \delta + \varepsilon$$

Y, the dependent variable, is a dichotomous variable representing whether an individual had an urgent or equivalent symptom in the emergency medical center visit. An emergent symptom was coded as 1 and non-urgent symptoms as 0. Patients with emergent symptoms were defined as urgent patients, and patients without emergent symptoms as non-urgent patients. *POST* is a dummy variable for the time period. February 2013, which was right before the policy implementation, was coded as 0, and March 2013, which was right after the policy implementation, was coded as 1. The coefficient β_1 represents how the percentage of urgent patients changed in the group with the lowest level of cost consciousness from before to after the policy implementation, reflecting a natural percentage change in urgent patients before and after the policy implementation. $GROUP_{2\text{-}5}$ represent the level of patient cost consciousness, reflecting a categorization according to the level of consideration for cost in choosing an emergency medical institute to visit. The coefficients of each group, $\beta_{2\text{-}5}$, show how much the percentage of urgent patients in each group differs from that of the baseline group in February 2013, before the raise in the emergency fee. The interaction terms, $GROUP_{2\text{-}5} \times POST$, are the key variables in this study, and their coefficients, $\beta_{6\text{-}9}$, represent how the percentage of urgent patients changes according to level of cost awareness from before to after the policy implementation (compared with the time trend for the group with the lowest level of cost consciousness). *X* is a set of control variables that includes patients' individual characteristics (gender, age, age squared, insurance type, time of visit, and the presence of traumatic wounds). δ, the hospital fixed effect, is used to control for the unobserved time-invariant facility-level effects.

Despite the dichotomous outcome variable, a linear probability model was used in this study instead of the commonly used logit model. The main reason is that the use of logit model makes it difficult to perform quantitative interpretation of the coefficient estimates of the interaction terms. SAS version 9.3 (Korean version; SAS Inc., Cary, NC, USA) and Stata/SE version 11.1 (StataCorp, College Station, TX, USA) were used throughout the analysis.

RESULTS

A total of 728 736 patients visited level 1 and level 2 emergency medical institute from February 1, 2013 to March 31, 2013. The percentage of patients with urgent or equivalent symptoms in emergency department visits was 75.4%. The most common type of emergency department visit was a direct visit by private transport (73.6%). Direct visits using public transport or ambulance accounted for 15.1%, patients transferred using private transport for 5.6%, patients transferred using public transport or ambulance for 3.9%, and patients referred from outpatient departments for the smallest proportion at 1.8%. The average age was 37.6 years old and the percentage of male patients was 51.9%. Most were covered by health insurance (89.2%). There were more patients with medical conditions (76.7%) than there were patients with traumatic wounds (23.3%) in emergency department visits, and 42.1% visited an emergency department during day hours (09:00 to 17:59), 35.5% from 18:00 to 23:59, and the rest, 22.6%, from 00:00 to 08:59.

Table 1. Summary statistics

Variables	2013 February 358 013 (100.0)	2013 March 370 723 (100.0)
Emergent symptom		
Exist	265 682 (74.2)	283 857 (76.6)
Type of visit		
Transferred (ambulance)	13 989 (3.9)	14 790 (4.0)
Transferred (personal)	19 442 (5.4)	21 029 (5.7)
From outpatient department	6428 (1.8)	6944 (1.9)
Direct visit (ambulance)	52 315 (14.6)	57 598 (15.5)
Direct visit (personal)	265 839 (74.3)	270 362 (72.9)
Age (mean, SD)	38.0 (25.5)	37.3 (25.8)
Sex		
Male	182 838 (51.1)	195 612 (52.8)
Female	175 175 (48.9)	175 111 (47.2)
Type of insurance		
National health insurance	320 514 (89.5)	329 688 (88.9)
Motor insurance	13 065 (3.6)	14 719 (4.0)
Workmen's compensation insurance	593 (0.2)	737 (0.2)
Private insurance	4 (0.0)	10 (0.0)
Medical care (part 1)	14 661 (4.1)	15 504 (4.2)
Medical care (part 2)	2984 (0.8)	3237 (0.9)
No insurance	6192 (1.7)	6828 (1.8)
Type of disease		
Medical	278 419 (77.8)	280 500 (75.7)
Trauma	79 594 (22.2)	90 223 (24.3)
Time of visit		
09:00-17:59	153 260 (42.8)	153 190 (41.3)
18:00-23:59	123 811 (34.6)	133 691 (36.1)
00:00-08:59	80 942 (22.6)	83 842 (22.6)
Level of emergency medical institute		
Level I	60 483 (16.9)	63 193 (17.0)
Level II	297 530 (83.1)	307 530 (83.0)

Values are presented as n (%).

Of all patients, 83.0% visited level 2 emergency medical institute, and the rest, 17.0%, visited level 1 medical institutes (Table 1).

The percentage of urgent patients before and after the policy implementation is described according to the type of visit in Table 2. First, it was observed in the percentage of urgent patients by type of visit that the group of patients transferred using public transport or ambulance (C), originally expected to have the lowest level of cost consciousness, had a higher percentage of urgent patients than did the other types of visits. The percentage of urgent patients in the group who made direct visits using private transport (D), which was expected to have the highest level of cost consciousness, was lower than the baseline group (C) by 23.19% points before the policy implementation and by 20.31% points after the implementation. The percentage of urgent patients varied according to level of emergency medical institutes and, generally, the percentage of urgent patients at level 1 was higher than it was at level 2.

In the percentage changes of urgent patients before and after the policy implementation (B-A), it was observed that the percentage of urgent patients slightly decreased by 0.03% points in the group transferred using public transport or am-

Table 2. Emergent patient proportion by type of visit and time

Type of visit	2013 February (A)	2013 March (B)	Difference (B-A)	
All				
Transferred (ambulance)	93.48	93.45	-0.03%p	(C)
Transferred (personal)	84.73	85.95	1.22%p	
From outpatient department	86.76	86.52	-0.24%p	
Direct visit (ambulance)	83.50	83.73	0.23%p	
Direct visit (personal)	70.29	73.13	2.84%p	(D)
Difference in differences (D-C)			2.87%p	
Level I				
Transferred (ambulance)	95.23	95.06	-0.17%p	(C)
Transferred (personal)	84.28	85.99	1.71%p	
From outpatient department	93.16	91.33	-1.83%p	
Direct visit (ambulance)	89.23	89.26	0.03%p	
Direct visit (personal)	77.60	81.05	3.45%p	(D)
Difference in differences (D-C)			3.62%p	
Level II				
Transferred (ambulance)	92.45	92.53	0.08%p	(C)
Transferred (personal)	85.10	85.99	0.89%p	
From outpatient department	84.10	84.59	0.49%p	
Direct visit (ambulance)	82.27	82.53	0.27%p	
Direct visit (personal)	68.85	71.61	2.76%p	(D)
Difference in differences (D-C)			2.68%p	

Values are presented as percent.

bulance and by 0.24% points in the group referred from outpatient departments. The percentage increased by 0.23% points in the group directly presenting to the emergency department by public transport or ambulance. However, the group transferred using private transport and the group directly presenting to the emergency department by private transport showed relatively large percentage changes, by 1.22% points and 2.84% points, respectively.

The results of regression analysis using a linear probability model estimating the probability that patients in emergency department visits have emergent symptoms are explained in Table 3. A time coefficient, β_1, shows that the percentage change of the probability that patients visiting emergency departments have urgent symptoms after a raise in the emergency fee was not significant compared to the percentage before the raise in the baseline group. β_{2-5} show that the probability that patients visiting emergency departments have emergent symptoms varies by type of visit before the emergency fee increase. All groups had a lower probability of emergent symptoms compared to the baseline group, and this difference was statistically significant. For instance, the percentage of emergent symptoms shown in the group directly presenting to the emergency department by private transport was lower than that of the baseline group by 15.3% points.

β_{6-9} are the coefficients of the interaction terms between type and time of visit, and they estimated the net effects of the policy by groups. The group transferred using private transport (β_6), the group referred from outpatient department (β_7), and the group directly presenting to the emergency department by public transport (β_8) did not show a significant percentage change in the probability of the emergency department visits having emergent symptoms. However, in the case of the group directly presenting to the emergency department by private transport (β_9), the group with the highest cost consciousness, a significant percentage increase, by 2.4% points, was observed in the probability of the group having emergent symptoms compared to the baseline group. The general tendency was the same as that in the analysis conducted by different levels of emergency medical institutes.

DISCUSSION

A raise in the emergency fee, which was implemented on March 1, 2013, appears to have been effective in increasing the percentage of patients with emergent symptoms in the emergency department visits by 2.4% points (or decreasing the percentage of non-urgent patients by 2.4% points). The percentage change in urgent patients before and after the raise in the emergency fee was not statistically significant in the baseline group, indicating that there has been only a negligible serial change in the percentage of urgent patients in the two-month time period straddling policy implementation. Further, this provides a basis for supporting the validity of the difference-in-difference method used in this study. The percentage change of urgent patients by level of cost consciousness was significant only in the group with highest cost consciousness. Therefore, a raise in the emergency fee changed the percentage of urgent patients in the desirable direction (towards a higher percentage

Table 3. Coefficients in linear probability model of patient having emergency symptoms

		All	Level I	Level II
Post	β_1	-0.001 (-0.009, 0.007)	-0.004 (-0.009, 0.017)	-0.002 (-0.012, 0.008)
Group (type of visit)				
Transferred by ambulance		Reference	Reference	Reference
Transferred personally	β_2	-0.040 (-0.048, -0.033)	-0.040 (-0.053, -0.027)	-0.042 (-0.051, -0.033)
From outpatient department	β_3	-0.041 (-0.051, -0.031)	0.011 (-0.007, 0.028)	-0.066 (-0.078, -0.053)
Direct visit by ambulance	β_4	-0.057 (-0.064, -0.051)	-0.055 (-0.066, -0.043)	-0.062 (-0.070, -0.054)
Direct visit personally	β_5	-0.153 (-0.159, -0.147)	-0.131 (-0.141, -0.121)	-0.162 (-0.169, -0.154)
Post×group				
Transferred by ambulance		Reference	Reference	Reference
Transferred personally	β_6	0.008 (-0.002, 0.018)	0.004 (-0.014, 0.022)	0.008 (-0.004, 0.021)
From outpatient department	β_7	-0.005 (-0.019, 0.009)	-0.010 (-0.034, 0.014)	-0.003 (-0.020, 0.014)
Direct visit by ambulance	β_8	0.007 (-0.002, 0.016)	0.000 (-0.015, 0.016)	0.008 (-0.003, 0.019)
Direct visit personally	β_9	0.024 (0.016, 0.032)	0.027 (0.013, 0.040)	0.024 (0.014, 0.034)

Model included age, age squared, sex, time of visit, type of disease, and type of insurance.

of urgent patients), particularly in the case of emergency department visits using private transport. Urgent patients are generally considered less sensitive to costs than are non-urgent patients, and thus, such percentage changes could be attributed to a greater decrease of non-urgent patients than of urgent patients. Additionally, the percentage of urgent patients visiting an emergency department during day hours increased significantly when the emergency fee was first introduced, and the rate of increase of urgent patients appeared to be higher than that of non-urgent patients [8].

Despite the small magnitude of the policy effect (2.4% points in the least cost-conscious group), this group of patients visiting the emergency department by private transport accounted for the majority of the total patients (73.4%, approximately 270 000 a month). Based on the estimates of this study, it is estimated that approximately 6000 patients monthly and 70 000 annually were affected by the emergency fee raise policy. Thus, it seems that the cost barrier has helped to reduce the number of non-urgent patients in emergency department visits in South Korea. However, a question can be raised regarding its cost-effectiveness, as it was also observed that in order to obtain such effects, approximately 82.7 billion KW of additional medical expenses (approximately 770 000 patients visiting level 1 annually × emergency fee increase 22 500 KW + approximately 3 730 000 patients visiting level 2 annually × emergency fee increase 17 520 KW) must be spent annually. Indeed, according to an additional analysis using NEDIS, it appears that the impact of a raise in the emergency fee on the reduction of emergency department length of stay was only about five minutes. It is also possible that raising the emergency fee discourages low-income patients in need of emergency department services from using them or creates issues of underuse caused by the inappropriate use of low-level emergency medical institutes. Further studies are needed to assess how the emergency fee has affected emergency department overcrowding and optimal treatment.

It remains controversial whether shutting off non-urgent patient inflow (patient block) can be an effective solution for emergency department overcrowding. Traditionally, non-urgent patients in emergency department visits have been indicated as one of the causes of emergency department overcrowding along with delay in admission to the hospital, medical staff shortage, and seasonal factors [16]. However, recent studies have shown that non-urgent patients have little influence on emergency department overcrowding because they use only a small portion of resources in the emergency department. Thus, the main cause of overcrowding is their prolonged emergency department stay due to hospital bed shortages [17]. This situation is called access block and, ironically, the solution for emergency department overcrowding is considered to be found in managing hospital inpatient bed stock. Besides such patient blockage being controlled by an emergency fee, several plans have been suggested in South Korea as a countermeasure against emergency department overcrowding, including the establishment of an emergency medical delivery system, medical services for non-urgent patients during night hours, a triage system for treatment by emergency severity scales, and non-urgent patient referrals [18,19]. In particular, it is reported that the recently proposed fast-track program run by specialists can reduce the length of emergency department stays by more than 30 minutes and bypass unnecessary diagnostic exams by providing sufficient physical exams and observations and basic medication administration to patients with mild symptoms [20,21].

This study did have some limitations. First, the control group in this study, unlike "a control group theoretically not affected by a policy" commonly used with a difference-in-difference method, could also have been affected by the emergency fee. Consequently, the result of this study might be more properly interpreted in terms of treatment heterogeneity of policy effects by cost consciousness rather than of net effects of policy. However, the possibility that the emergency fee increase affects decision making on choosing an emergency medical institute to visit when patients are transferred by public transport is considered practically negligible. Accordingly, we determined that this group can be considered as a control group in our operational definition.

Second, there are credibility issues on "presence of emergent symptoms" item of the NEDIS data sources. "Emergent symptoms," used in this study as a surrogate indicator of urgent patient criteria, refer to the presence of certain symptoms specified by law in order to calculate the copayment rate for the emergency fee. The presence of emergent symptoms is used to calculate the copayment rate for emergency fee, and only 50% of the fee is paid by patients if they have emergent symptoms, whereas 100% is paid by the patients if they do not. Therefore, the presence of emergent symptoms may not necessarily meet the urgent patient criteria, and it is also possible that emergent symptoms were included in the medical records at discretion in order to reduce patients' copayment even though there were no such symptoms. While the percentage of non-urgent patients by legal criteria was 38.2%, according to a study by Chung et al. [22], the percentage of non-urgent patients by medical criteria—the modified Manchester triage scale—was 15.3%, so the present study found a rate more than double the standard rate. Further, the kappa concordance was also low at 0.375.

Third, some of the non-urgent patients who could not use level 1 due to cost barriers might have used level 2, which may contribute to an underestimation of the non-urgent patient reduction effect by increasing the number of non-urgent patients at level 2. However, if patients were conscious of cost barriers in the level 1 emergency fee, they are highly likely to be conscious of the level 2 emergency fee as well, as the emergency fee difference between level 1 and 2 is only about 5000 KW. Accordingly, it would not have much influence on the number of non-urgent patients because patients would have found alternatives or used level 3, which was not included in this study.

Lastly, this study did not present long-term policy effects because it analyzed data collected over just a two-month period-the month before and after the policy implementation. However, it was intended to best satisfy the key assumption of the difference-in-difference method, which is that the control group and the group with policy implementation should have parallel time trends in the absence of policy. Several other factors may be involved in South Korea, such as staff replacement or the beginning of a new school year in March, but it is considered that the effect of such factors on emergency department visit decision making is low. Indeed, the estimated coefficient of the variable *POST* was not statistically significant, indicating that there was no statistically significant difference in the time trends for the control group between February and March.

Despite the limitations described above, this study has the advantage of using data on emergency department visits at a national level. In addition, it estimated the net effects of a raise in the emergency fee by applying the difference-in-difference method, thus improving causal inference for the policy effect.

ACKNOWLEDGEMENTS

This study was supported by the Ministry of Health and Welfare.

CONFLICT OF INTEREST

The authors have no conflicts of interest with the material presented in this paper.

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