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Clinical paper

Association of health insurance with post-resuscitation care and neurological outcomes after return of spontaneous circulation in out-of-hospital cardiac arrest patients in Korea

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Abstract

Background: We investigated the association of health insurance status with post-resuscitation care and neurological recovery in out-of-hospital cardiac arrest (OHCA) and whether the effects changed with age or gender.

Methods: Adult OHCAs with presumed cardiac etiology who had sustained ROSC from 2013 to 2016 were enrolled from the nationwide OHCA registry of Korea. Insurance status was categorized into 2 groups: National Health Insurance (NHI) and Medical Aid (MA). The endpoints were post-resuscitation coronary reperfusion therapy (CRT), targeted temperature management (TTM), and good neurological recovery (cerebral performance category of 1 or 2). Multivariable logistic regression models and interaction analyses (insurance × age and insurance × gender) were conducted for adjusted odds ratios (aORs) and 95% confidence intervals (CI).

Results: Of a total of 19,865 eligible OHCA patients, 18,119 (91.2%) were covered by NHI and 1746 (8.8%) by MA. The MA group was less likely to receive post-resuscitation CRT and TTM (aOR (95% CI): 0.75 (0.59–0.96) for CRT; 0.71 (0.57–0.89) for TTM) and had worse neurological outcomes (0.71 (0.57–0.89)) compared with the NHI group. In the interaction analyses, MA was associated with less CRT and good neurological recovery in the 45–64 year old group (0.54 (0.37–0.77) for CRT; 0.70 (0.51–0.95) for neurological outcome) and in the male group (0.69 (0.52–0.91) for CRT; 0.77 (0.61–0.97) for TTM; 0.70 (0.53–0.92)) for neurological outcome).

Conclusions: There were disparities in post-resuscitation care and substantial neurological recovery by health insurance status, and the disparities were prominent in middle-aged adults and males. Increasing health insurance coverage for post-resuscitation care should be considered.

Keywords: Out-of-hospital cardiac arrest, Health insurance, Post-resuscitation care

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Introduction

Neurological outcome and functional disability for survivors of out-of-hospital cardiac arrest (OHCA) are important to health-related quality of life and socioeconomic burden for patients, families, and communities.[1,2] A series of well-coordinated interventions for early cardiopulmonary resuscitation (CPR) by bystanders and emergency medical services (EMS) providers to appropriate advanced life support in hospitals should be delivered to achieve early return of spontaneous circulation (ROSC).[3,4] After an OHCA patient is resuscitated with sustained ROSC, post-resuscitation care including coronary reperfusion therapy and targeted temperature management (TTM) play important roles in optimal outcomes, especially for good neurological recovery.[5,6]

Various demographic and socioeconomic factors including age, gender, race, health insurance, neighborhood, and even religious beliefs affect disparities in decision-making processes, accessibility of medical treatment, and clinical outcomes in various critical illnesses, such as cardiac arrest.[7–13] Among those factors, health insurance status is known to be associated with prehospital and hospital factors including post-resuscitation care and survival outcomes after OHCA in countries with various health insurance systems.[14,15] However, these disparities have not been fully evaluated in OHCA patients in a country with a national health insurance system. Furthermore, the interaction effects between health insurance status and patient demographic factors such as age and gender have not been studied before.

We hypothesized that the social health insurance program would be associated with fewer post-resuscitation care needs and worse neurological outcomes in OHCA patients after achieving sustained ROSC and that the effect size of health insurance on post-resuscitation care and clinical outcomes would be modified in magnitude by age and gender. This study aimed to evaluate the associations between health insurance status and post-resuscitation care and substantial neurological outcomes and to investigate whether the effects of health insurance status changed with age or gender.

Methods

Study setting

Korea has a government-based public EMS system operated by the National Fire Agency. On-scene termination of resuscitation is not allowed unless there is an obvious sign of death or a written do-not-resuscitate consent form is available. EMS providers transport all OHCA patients to the emergency department (ED) under the EMS CPR protocol. All costs for medical procedures performed in prehospital areas and during ambulance transportation are covered by the tax-based EMS operation budget and not charged to patients regardless of the patients' health insurance status. EDs are designated as levels 1 to 3 by the government based on the volume and quality of human and medical resources.

The universal healthcare system in Korea consists of mainly two insurance plans.[16] National Health Insurance (NHI) covers most residents (97.1%) in Korea, except for the lower-income population supported by Medical Aid (2.9% in 2016). Inclusion in Medical Aid is mainly decided by individual socioeconomic level. Eligible recipients are persons with recognized income (of themselves and obligatory care-givers) smaller than 40% of the standard median income, homeless persons, disaster victims defined under the Disaster Relief Act, and a person and their family members who are governed by the North Korean Refugees Protection and Settlement Support Act. Medical Aid is tax-based, and the recipients are not charged any monthly premium. By contrast, for populations covered by the NHI, employee-insured individuals pay NHI monthly premiums based on their salary, and self-employed and unemployed individuals pay NHI premiums based on total property, income, motor vehicle possession, age and gender.

In terms of medical cost, after receiving any type of medical treatment and procedures covered by medical insurance, individuals are required to pay a certain portion of the medical care costs as copayments. The copayment rate is determined by the location of medical care (inpatient or outpatient) and level of ED/hospital where the medical care was provided. For patients admitted to a hospital, the copayment proportion is usually 5 ~ 20% of total medical cost for patients with NHI and 0 ~ 5% of total cost for patients with Medical Aid. Types of medical care and procedures covered by both insurance services are similar. Most medical care provided during treatment of cardiac arrest is covered by NHI and Medical Aid. However, specific sealing materials and stenting devices for percutaneous coronary interventions and some of external/internal cooling devices for TTM during post-resuscitation care are not fully covered by both insurance services.

Study design and data sources

This study is a cross-sectional study using a nationwide OHCA registry database in Korea. The nationwide OHCA registry was initiated in 2006 in collaboration with the National Fire Agency and the Korea Centers for Disease Control and Prevention (CDC). The EMS ambulance run-sheet, EMS cardiac arrest registry and hospital record review are combined to form the nationwide OHCA registry. Hospital record review for clinical information about in-hospital treatment and survival outcomes is organized by the Korea CDC and performed by trained medical record reviewers using Utstein guideline. Quality management protocols and the detailed data collection process and explanation of the registry are reported in previous studies.[17,18]

Study population

Adult OHCA patients with presumed cardiac etiology who had sustained ROSC in either prehospital areas or EDs from January 2013 to December 2016 were included. Patients with unknown information on health insurance status (usually foreign residents) and patients whose medical expense for cardiac arrest treatment were covered outside the universal healthcare system (for example, automobile insurance and industrial accident compensation insurance) were excluded. Patients with missing information on study outcomes were also excluded from the final analysis.

Outcome measures

The primary outcomes were post-resuscitation care, including coronary reperfusion therapy and TTM, and the secondary outcome was good neurological recovery, which was identified by medical record review. Post-resuscitation coronary reperfusion therapy included intravenous thrombolysis and percutaneous coronary intervention. All types of intentional temperature management for

minimizing reperfusion injury during post-resuscitation care was recorded as TTM regardless of cooling protocols or devices used during procedure, as was achievement of the target temperature. Good neurological recovery was recorded if the patient had a cerebral performance category score of 1 or 2 at hospital discharge.

Measurements

The main exposure was health insurance status recorded in the nationwide OHCA registry, which was categorized into 2 groups: the NHI group and the Medical Aid group.

All data used the same definition according to the Utstein data report form. Demographic variables including age, gender, past medical history (diabetes mellitus, hypertension, heart disease, and stroke), residential area (metropolis or urban/rural), location of arrest (public or private), and community-EMS-ED variables including witness status, bystander CPR, initial electrocardiogram at the scene, prehospital defibrillation by a bystander or an EMS provider, EMS response time interval, scene time interval, transport time interval, prehospital airway, ROSC upon arrival at the ED, transported ED level, in-hospital treatment, and survival outcomes were collected.

Statistical analysis

The selected demographic characteristics and outcomes of the study population according to health insurance status were described. The categorical variables were compared using the chi-squared test, and the continuous variables were compared using the Wilcoxon rank sum test.

Multivariable logistic models were conducted to evaluate the association between health insurance status and study outcomes, and the adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were calculated. A multivariable logistic regression model adjusted for potential confounders including age, gender, past medical history (hypertension, diabetes mellitus, heart disease, and stroke), residential area, location of arrest, witness, bystander CPR, shockable rhythm at scene, prehospital defibrillation, EMS response time interval, and ROSC upon arrival at the ED was conducted. To estimate change in the effect of health insurance status on provision of post-resuscitation care and the neurological outcomes by age and gender, interaction analysis was performed. Interaction terms between health insurance status and age/gender (health insurance status × age group, health insurance status × gender group) were added to the final model. All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA)

Ethics statements

The study complies with the Declaration of Helsinki, and its protocol was approved by the Seoul National University Hospital Institutional Review Board with a waiver of informed consent (IRB No. 1103-153-357).

Results

Demographic findings

Among the 110,348 EMS-assessed OHCAs during the study period, 19,865 patients were included in the analysis after excluding pediatric patients (n = 2218), patients with non-cardiac etiologies (n = 28,684), patients who did not have sustained ROSC (n = 58,772), and patients who had unknown information on health insurance status and patients whose medical expenses for cardiac arrest treatment were covered outside the universal healthcare system (n = 809) (Fig. 1).

Demographic characteristics according to health insurance status are summarized in Table 1. Among the eligible population, 18,119 patients (91.2%) were covered by NHI and 1746 patients (8.8%) were covered with Medical Aid. The patients with NHI were more likely to receive post-resuscitation coronary reperfusion therapy and TTM than the patients with Medical Aid (9.6% vs. 5.2% for coronary reperfusion therapy and 10.3% vs. 7.2% for TTM, respectively (both $p < 0.01$)). Furthermore, the NHI group showed better neurological recovery and survival to discharge compared to the Medical Aid group (15.3% vs. 8.5% for good neurological recovery and 24.7% vs. 18.7% for survival to discharge, respectively (both $p < 0.01$)).

Main analysis and interaction analysis

In multivariable logistic regression model was conducted to assess the association between health insurance status and study outcomes (Table 2). The Medical Aid group was associated with less likelihood for receiving post-resuscitation coronary reperfusion therapy and TTM (aORs (95% CIs): 0.75 (0.59–0.96) for coronary reperfusion therapy and 0.75 (0.62–0.91) for TTM) and having good neurological recovery (aOR (95% CI): 0.71 (0.57–0.89)) compared to the NHI group.

In the interaction model, the magnitude of the association between health insurance status and study outcomes was different according to the age and gender. In patients of 45–64 years old group, the Medical Aid was associated with lower likelihood to receive post-resuscitation coronary reperfusion and have good neurological recovery compared with the NHI group (aOR (95% CI): 0.54 (0.37–0.77) for post-resuscitation coronary reperfusion therapy and 0.70 (0.51–0.95) for good neurological recovery). Compared with the NHI group, having Medical Aid was associated with lower likelihood for having good neurological recovery in patients in the 65–74 year old group (aOR (95% CI): 0.53 (0.31–0.90)) and receiving post-resuscitation TTM in patients in the 75–84 year old group (aOR (95% CI): 0.40 (0.20–0.78)) (Table 3).

By gender, having Medical Aid was associated with less post-resuscitation care and good neurological recovery compared with the NHI group in males (aORs (95% CIs): 0.69 (0.52–0.91) for coronary reperfusion therapy, 0.77 (0.61–0.97) for TTM, and 0.70 (0.53–0.92))

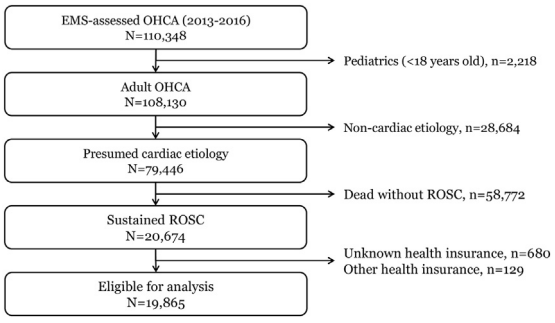

Fig. 1 – Patient flow.
EMS: emergency medical service; OHCA, out-of-hospital cardiac arrest; CPR: cardiopulmonary resuscitation.

Table 1 – Demographics of study population according to status of health insurance.

	Total N (%)	National health insurance N (%)	Medical aid N (%)	*p*-value
Total	19,865	18,119	1746	
Gender, female	6724 (33.8)	5975 (33.0)	749 (42.9)	<0.01
Age, year				
Median (IQR)	68 (55–78)	68 (55–78)	67 (54–78)	0.94
18–44	1864 (9.4)	1730 (9.5)	134 (7.7)	<0.01
45–64	7061 (35.5)	6374 (35.2)	687 (39.3)	
65–74	4500 (22.7)	4147 (22.9)	353 (20.2)	
75–84	4656 (23.4)	4274 (23.6)	382 (21.9)	
85–107	1784 (9.0)	1594 (8.8)	190 (10.9)	
Past medical history				
Diabetes mellitus	5171 (26.0)	4616 (25.5)	555 (31.8)	<0.01
Hypertension	7848 (39.5)	7137 (39.4)	711 (40.7)	0.28
Heart disease	3765 (19.0)	3416 (18.9)	349 (20.0)	0.25
Stroke	1,796 (9.0)	1596 (8.8)	200 (11.5)	<0.01
Residential area, metropolis	10,502 (52.9)	9531 (52.6)	971 (55.6)	0.02
Location of arrest, public place	6669 (33.6)	6125 (33.8)	544 (31.2)	0.03
Witnessed	12,686 (63.9)	11,622 (64.1)	1064 (60.9)	<0.01
Bystander CPR	9590 (48.3)	8859 (48.9)	731 (41.9)	<0.01
Primary shockable rhythm at the scene	5552 (27.9)	5235 (28.9)	317 (18.2)	<0.01
Prehospital defibrillation	6659 (33.5)	6239 (34.4)	420 (24.1)	<0.01
By an EMS provider	6608 (33.3)	6192 (34.2)	416 (23.8)	
By a bystander	183 (0.9)	163 (0.9)	20 (1.1)	
EMS response time interval, min, median (IQR)	6 (5–9)	6 (5–9)	6 (5–9)	0.19
EMS scene time interval, min, median (IQR)	9 (7–13)	10 (7–13)	9 (6–13)	0.01
EMS transport time interval, min, median (IQR)	6 (4–10)	6 (4–10)	6 (4–10)	0.31
Prehospital airway				0.54
Endotracheal intubation	1039 (5.2)	946 (5.2)	93 (5.3)	
Supraglottic airway	4808 (24.2)	4409 (24.3)	399 (22.9)	
ROSC upon arrival at the ED	5135 (25.8)	4791 (26.4)	344 (19.7)	<0.01
Level of ED: 1 or 2	16,509 (83.1)	15,168 (83.7)	1341 (76.8)	<0.01
ECMO	551 (2.8)	531 (2.9)	20 (1.1)	<0.01
Post-resuscitation care				
Targeted temperature management	1987 (10.0)	1862 (10.3)	125 (7.2)	<0.01
Coronary reperfusion therapy	1837 (9.2)	1746 (9.6)	91 (5.2)	<0.01
Survival to discharge	4808 (24.2)	4482 (24.7)	326 (18.7)	<0.01
Good neurological recovery	2929 (14.7)	2781 (15.3)	148 (8.5)	<0.01

IQR: interquartile range; CPR: cardiopulmonary resuscitation; EMS: emergency medical services; ROSC: return of spontaneous circulation; ED: emergency department; ECMO: extracorporeal membrane oxygenation.

Table 2 – Multivariable logistic regression analysis by health insurance status.

	Outcomes n/N (%)	Crude OR (95% CI)	Adjusted OR[a] (95% CI)
Post-resuscitation coronary reperfusion therapy			
Total	1837 / 19,865 (9.2)		
National health insurance	1746 / 18,119 (9.6)	1.00	1.00
Medical aid	91 / 1746 (5.2)	0.52 (0.42–0.64)	0.75 (0.59–0.96)
Post-resuscitation targeted temperature management			
Total	1987 / 19,865 (10.0)		
National health insurance	1862 / 18,119 (10.3)	1.00	1.00
Medical aid	125 / 1,746 (7.2)	0.67 (0.56–0.81)	0.75 (0.62–0.91)
Good neurological recovery			
Total	2929 / 19,865 (14.7)		
National health insurance	2781 / 18,119 (15.3)	1.00	1.00
Medical aid	148 / 1746 (8.5)	0.51 (0.43–0.61)	0.71 (0.57–0.89)

OR: odd ratio; CI: confidence interval.

[a] Odd ratios were calculated adjusting for age, gender, past medical history (hypertension, diabetes mellitus, heart disease, and stroke), residential area, location of arrest, witness, bystander CPR, shockable rhythm at scene, prehospital defibrillation, EMS response time interval, and ROSC upon arrival at the ED.

Table 3 – Multivariable logistic regression analysis with interaction term between health insurance and age group.

	Post-resuscitation coronary reperfusion therapy		Post-resuscitation targeted temperature management		Good neurological recovery	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Age, 18–44 years-old						
National health insurance (n = 1,730)	149 (8.6)	1.00	376 (21.7)	1.00	569 (32.9)	1.00
Medical aid (n = 134)	8 (6.0)	1.18 (0.53–2.61)	17 (12.7)	0.59 (0.35–1.01)	26 (19.4)	0.71 (0.40–1.28)
Age, 45–64 years-old						
National health insurance (n = 6,374)	969 (15.2)	1.00	813 (12.8)	1.00	1563 (24.5)	1.00
Medical aid (n = 687)	37 (5.4)	0.54 (0.37–0.77)	62 (9.0)	0.79 (0.60–1.04)	80 (11.6)	0.70 (0.51–0.95)
Age, 65–74 years-old						
National health insurance (n = 4,147)	392 (9.5)	1.00	388 (9.4)	1.00	447 (10.8)	1.00
Medical aid (n = 353)	28 (7.9)	1.01 (0.65–1.58)	32 (9.1)	1.01 (0.69–1.48)	21 (5.9)	0.53 (0.31–0.90)
Age, 75–84 years-old						
National health insurance (n = 4,274)	210 (4.9)	1.00	243 (5.7)	1.00	163 (3.8)	1.00
Medical aid (n = 382)	15 (3.9)	0.95 (0.54–1.68)	9 (2.4)	0.40 (0.20–0.78)	17 (4.5)	1.19 (0.66–2.13)
Age, 85–107 years-old						
National health insurance (n = 1,594)	26 (1.6)	1.00	42 (2.6)	1.00	39 (2.4)	1.00
Medical aid (n = 190)	3 (1.6)	0.99 (0.29–3.40)	5 (2.6)	1.00 (0.39–2.57)	4 (2.1)	0.76 (0.25–2.36)

OR: adjusted odd ratio; CI: confidence interval.
Odd ratios were calculated adjusting for age, gender, past medical history (hypertension, diabetes mellitus, heart disease, and stroke), residential area, location of arrest, witness, bystander CPR, shockable rhythm at scene, prehospital defibrillation, EMS response time interval, ROSC upon arrival at the ED, and interaction term (health insurance status × age).
p-value for interaction term (health insurance status × age): <0.01 for post-resuscitation coronary reperfusion therapy, <0.01 for post-resuscitation targeted temperature management, and 0.02 for good neurological recovery.

for good neurological recovery, respectively), whereas there were no significant differences between NHI and Medical Aid in females (Table 4).

Discussion

Using a nationwide prospective OHCA registry, we found an association between health insurance status and post-resuscitation care and clinical outcomes for patients with sustained ROSC after OHCA. Patients with Medical Aid for their health insurance were less likely to receive post-resuscitation care including coronary reperfusion therapy and TTM and had poorer neurological outcomes compared with the NHI group. Furthermore, there were interaction effects between health insurance status and age and gender. Having Medical Aid for males and young adults (45–64 years old) were significantly associated with less probability of receiving post-resuscitation coronary reperfusion therapy and worse neurological recovery. The results of our study suggested that there were disparities in post-resuscitation care and clinical outcomes for patients with ROSC after cardiac arrest by health insurance status. To eliminate disparities, post-resuscitation care including coronary reperfusion therapy and TTM should be covered by universal healthcare.

There are various reasons for the negative associations among Medical Aid and post-resuscitation care provision and neurological recovery. Type of health insurance is known to affect accessibility and affordability of medical care and subsequent clinical outcomes in various diseases, including OHCA.[9–15] The initial resuscitation care in OHCA is fully covered by health insurance, but the medical copayment costs during resuscitation care might be a relatively larger burden to patients and families with Medical Aid compared with those with NHI, even though copayment proportions are relatively smaller in the Medical Aid group. Additionally, in our universal health system, some costs of post-resuscitation care (for example, certain expenses for stent and closure materials in coronary reperfusion therapies and some cooling device and supply materials used during TTM) are not included in coverage by both health insurance options. Those factors might result in disparities in post-resuscitation care and subsequent neurological outcomes by health insurance status. Additionally, differences in underlying medical conditions, such as diabetes mellitus and stroke, prior to cardiac arrest by health insurance status might also contribute to poorer neurological outcomes in the Medical Aid group (Table 1).[13,19–22]

In addition, there were interaction effects between health insurance status and age and gender. The disparities in post-resuscitation coronary reperfusion therapy and subsequent neurological outcomes by health insurance status were more prominent in middle-aged adults (45–65 years old) and males. The findings might be influenced by the fact that young adults and males are economically active populations. Therefore, the costs of the patient's medical care will be a greater burden on the remaining family members.[19] Our results suggest that those age and gender groups might be the most vulnerable populations affected by health insurance status during post-resuscitation care, and there is a need for political strategies to eliminate the disparities.

Although the universal healthcare system in Korea covers almost all residents with either NHI or Medical Aid, coverage still varies for some medical care that is not fully expanded to post-resuscitation care, and there were disparities in post-resuscitation care by health insurance status. These disparities would be even worse in countries where a national health insurance system is not implemented. Health policy interventions including expansion and modification of coverage by health insurance should be considered to reduce health disparities in post-resuscitation care for OHCA according to socioeconomic status, especially considering the prominent disparities in the economically active population.[23,24]

Table 4 – Multivariable logistic regression analysis with interaction term between health insurance and gender.

	Post-resuscitation coronary reperfusion therapy		Post-resuscitation targeted temperature management		Good neurological recovery	
	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)	N (%)	aOR (95% CI)
Female						
National health insurance (n = 5,975)	208 (3.5)	1.00	463 (7.7)	1.00	530 (8.9)	1.00
Medical aid (n = 749)	24 (3.2)	0.98 (0.62–1.54)	41 (5.5)	0.72 (0.52–1.01)	47 (6.3)	0.74 (0.50–1.08)
Male						
National health insurance (n = 12,144)	1538 (12.7)	1.00	1399 (11.5)	1.00	2251 (18.5)	1.00
Medical aid (n = 997)	67 (6.7)	0.69 (0.52–0.91)	84 (8.4)	0.77 (0.61–0.97)	101 (10.1)	0.70 (0.53–0.92)

OR: adjusted odd ratio; CI: confidence interval.
Odd ratios were calculated adjusting for age, gender, past medical history (hypertension, diabetes mellitus, heart disease, and stroke), residential area, location of arrest, witness, bystander CPR, shockable rhythm at scene, prehospital defibrillation, EMS response time interval, ROSC upon arrival at the ED, and interaction term (health insurance status × gender).
p-value for interaction term (health insurance status × gender): <0.01 for post-resuscitation coronary reperfusion therapy, 0.03 for post-resuscitation targeted temperature management, and 0.01 for good neurological recovery.

Limitations

This study has several limitations. First, we classified post-resuscitation care as a homogeneous group despite the differences in hospital protocol, type of coronary reperfusion therapies, number of stent insertions or balloonings, cooling methods and duration of TTM, and achievement of the target temperature. This classification can under- or over-estimate the association between health insurance and study outcomes. In addition, there is no national standard protocol in place for providing post-resuscitation care, although most EDs in Korea generally follow the international guidelines. Second, we did not collect the information on the reasons for not receiving post-resuscitation care for cases where post-resuscitation care was not provided, on the post-resuscitation electrocardiogram used, or on the neurological status and vital signs immediately after ROSC in our national OHCA database for the entire study period. Lastly, this study was an observational study and there may be potentially unmeasured biases that were not controlled.

Conclusions

The findings of this study substantiated that health insurance status was associated with post-resuscitation care and substantial neurological recovery for adult patients with sustained return of spontaneous circulation after out-of-hospital cardiac arrest with presumed cardiac etiology. There were disparities in study outcomes by health insurance status. Furthermore, the disparities in post-resuscitation coronary reperfusion therapy and subsequent neurological outcomes were prominent in middle-aged adults (45–65 years old) and males. Expansion of health insurance coverage for post-resuscitation care for patients with Medical Aid should be considered to reduce disparities based on health insurance.

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Conflict of interest

None.

Author contributions

Drs. Kim and Ro had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Drs. Kim, Ro, and Shin.

Acquisition, analysis, or interpretation of data: Drs. Kim, Ro, Shin, Song, and Park.

Drafting of the manuscript: Drs. Kim and Ro.

Critical revision of the manuscript for important intellectual content: Drs. Shin, Song, Hong, Park, and Kong.

Statistical analysis: Drs. Kim, Ro, and Shin.

Obtained funding: Dr. Shin.

Administrative, technical, or material support: Drs. Hong, Park, and Kong.

Study supervision: Drs. Ro and Shin.

Manuscript approval: All authors.

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