

# Indicators Related to Cardiopulmonary Resuscitation According to Occupation Among Family Members of Coronary Heart Disease Patients

Gyung-Jae Oh<sup>1,2</sup>, Kyungsuk Lee<sup>3</sup>, Kyungsu Kim<sup>3</sup>, and Young-Hoon Lee<sup>1,2,\*</sup>

<sup>1</sup>Department of Preventive Medicine and Institute of Wonkwang Medical Science, Wonkwang University School of Medicine, <sup>2</sup>Regional Cardiocerebrovascular Center, Wonkwang University Hospital, Iksan, <sup>3</sup>National Institute of Agricultural Sciences, Rural Development Administration, Jeonju, Korea

This study aimed to evaluate differences in cardiopulmonary resuscitation (CPR)-related indicators among families of community-dwelling coronary heart disease (CHD) patients according to their occupation. A total of 6,867 family members living with CHD patients were selected for analysis from the 2016 Korea Community Health Survey. Respondents' occupations were classified into managers and professionals (MP), clerks (CL), service and sales workers (SSW), agricultural/forestry/fishery workers (AFFW), mechanical and manual laborers (MML), and homemakers and unemployed (HU). The adjusted odds ratio (aOR) for awareness of CPR in the MP (3.82), SSW (1.73), and MML (1.29) groups were higher than that in HU (reference), while the CL (1.42) and AFFW (1.04) groups showed no significant difference compared to HU. The aORs for experience with CPR education and manikin-assisted CPR training were higher among the MP (4.00 and 3.94), CL (2.61 and 2.26), SSW (2.02 and 1.91), and MML (1.99 and 1.69) groups than in HU, and only AFFW (1.22 and 1.18) showed no difference from HU. Finally, the aOR for self-efficacy in CPR performance was significantly higher among the MP (3.17), CL (1.64), SSW (1.87), and MML (1.44) groups than in HU. However, there was no significant difference between AFFW (1.22) and HU in self-efficacy in CPR performance. To improve the survival rate of CHD patients through successful CPR at the pre-hospital stage during cardiac arrest, it is important to increase the ability of family members of CHD patients to perform CPR, especially among those in AFFW and HU occupations.

**Key Words:** *Cardiopulmonary Resuscitation; Occupations; Coronary Artery Disease*

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## Article History:

Received August 12, 2020  
Revised August 20, 2020  
Accepted August 26, 2020

## Corresponding Author:

Young-Hoon Lee  
Department of Preventive Medicine,  
Wonkwang University School of  
Medicine, 460 Iksandae-ro, Iksan  
54538, Korea  
Tel: +82-63-859-1990  
Fax: +82-63-859-1995  
E-mail: lyh8275@hanmail.net

## INTRODUCTION

Sudden cardiac death (SCD) is a leading cause of mortality worldwide and accounts for approximately half of all coronary heart disease (CHD)-related deaths.<sup>1,2</sup> Early recognition of out-of-hospital cardiac arrest (OHCA) and rapid initiation of bystander cardiopulmonary resuscitation (CPR) are the most important factors in improving survival.<sup>3</sup> A meta-analysis of 19 studies indicated that bystander CPR increased the chance of survival from OHCA by 2.44 times.<sup>4</sup> In Korea, the survival rate for CPR implementation (16.5%) by the general public was 2.1 times higher than that for

CPR non-implementation (7.9%).<sup>5</sup> However, in cases of cardiac arrest in Korea, the performance rate of bystander CPR was only 21.0%.<sup>5</sup>

The majority of OHCA events in the United States occurs at homes/residences (69.5%), followed by public settings (18.8%) and nursing homes (11.7%).<sup>6</sup> In Korea, the most common places where OHCA occur are homes (47.0%), followed by roads/highways (8.3%), nursing hospitals (7.2%), ambulances (5.5%), and so on.<sup>5</sup> CHD is thought to be the structural basis of about 70% of all SCDs, and CHD patients are at a higher risk of cardiac arrest than the general population.<sup>1,7</sup> Therefore, the ability of bystander CPR im-

plementation, especially by family members living with CHD patients, is very important, because family members are most likely to witness a cardiac arrest and be the first aid providers. It takes at least a few minutes for emergency personnel to arrive at the site of OHCA, so CPR by family members can save a cardiac arrest patient's life.

However, there are only a few studies on the preparedness and willingness of the family members of CHD patients in performing CPR.<sup>8-10</sup> Moreover, to date, little information is available on the occupational differences in CPR-related indicators such as awareness, education, and self-efficacy among families of community-dwelling CHD patients. Occupation is a good indicator of overall education, income, social position, and health information contact.<sup>11,12</sup> Considering the high risk of cardiac arrest in CHD patients and the importance of family-initiated CPR in their homes, it is important to identify the occupational groups of families of CHD patients who would be required to perform CPR in an emergency. Therefore, among families of community-dwelling CHD patients in Korea, we evaluated the difference in CPR-related indicators according to their occupation.

## MATERIALS AND METHODS

### 1. Study population

Data from the 2016 Korea Community Health Survey (KCHS), conducted by the Korea Centers for Disease Control and Prevention, were used for analysis. Using a multi-stage, stratified, cluster-sampling procedure, the 2016 KCHS included a total of 228,452 individuals aged  $\geq 19$  years. Among them, 7,465 people had been diagnosed with CHD (myocardial infarction and/or angina pectoris) by a doctor. A total of 7,174 family members who were living with patients diagnosed with CHD participated in the analysis. After excluding participants who did not respond or refused to answer questions relating to either CPR-related indicators and/or sociodemographics, 6,867 individuals were included in the final analysis. This study was conducted in accordance with the guidelines of the Declaration of Helsinki, and written informed consent was obtained from all participants of the KCHS. The study protocol was approved by the institutional review board of Wonkwang University Hospital (WKUH 2020-01-016-001).

### 2. Measures

Sociodemographics and health status variables were investigated using a standardized questionnaire. According to occupation, respondents were classified into the following six categories: managers and professionals (MP), clerks (CL), service and sales workers (SSW), agricultural/forestry/fishery workers (AFFW), mechanical and manual laborers (MML), and homemakers and unemployed (HU). The respondents were classified into age groups of 19-29, 30-39, 40-49, 50-59, 60-69, and  $\geq 70$  years. The study involved both men and women. Residential region (urban or rural), marital status (married and living with a spouse, never

married, divorced or separated, and widowed), educational level (non-formal education, elementary school, middle school, high school, and college or higher), and monthly household income (<100, 100-199, 200-299, 300-399, 400-499, and  $\geq 500$  ten thousand KRW) were also used in the analysis. Diagnoses of hypertension, diabetes, and dyslipidemia were also evaluated.

Respondents were asked four CPR-related questions to assess their awareness and experience of CPR and self-efficacy in CPR performance. Question 1 was "Have you ever seen or heard about CPR?", and those who answered "Yes" were considered to be aware of CPR. Question 2 was "Have you ever had CPR education?" and those who answered "Yes, I have been educated within the last two years" were considered to have experience of CPR education. Question 3 was "Have you ever had manikin-assisted CPR training within the last 2 years?" and those who answered "Yes" were considered to have experience of manikin-assisted CPR training. Finally, question 4 was "Can you perform CPR if you witness a cardiac arrest patient?" and those who answered "Yes, I can perform it correctly" were considered to have self-efficacy in CPR performance.

### 3. Statistical analysis

The differences in the characteristics of family members of community-dwelling CHD patients according to occupation were assessed using the chi-square test for categorical variables and analysis of variance for continuous variable. The proportions of the CPR-related indicators (awareness of CPR, experience of CPR education, experience of manikin-assisted CPR training, and self-efficacy in performing CPR correctly) were compared between occupations. Multiple logistic regression analysis was used to evaluate the association between the CPR-related indicators and occupations, before and after adjusting for gender, age, residential region, marital status, education level, monthly household income, as well as diagnoses of hypertension, diabetes, and dyslipidemia. The odds ratio (OR) with a 95% confidence interval (CI) of each occupation was calculated and compared to that of HU. All statistical analyses were performed using SPSS software version 22.0 (IBM Co., Armonk, NY, USA). A p-value of  $<0.05$  was considered statistically significant.

## RESULTS

### 1. Characteristics of family members of CHD according to occupation

Table 1 shows the characteristics of the family members of CHD according to occupation. The mean age of all family members of CHD patients was  $58.0 \pm 16.8$  years, with the oldest in the HU (65.8 years) and the youngest in the CL (39.6 years) group. The proportion of males was highest in the MML (58.0%) and lowest in SSW (30.7%) and the proportion of rural residents was highest in the AFFW (95.0%) and lowest in the MP (30.8%) group. Regarding marital status, the proportion of married and living with spouse was

**TABLE 1.** Characteristics of family members of community-dwelling coronary heart disease patients according to occupation

Variables	Total (n=6,867)	Occupation						p-value
		Managers and professionals (n=536)	Clerks (n=414)	Service and sales workers (n=920)	Agricultural, forestry, and fishery workers (n=1,247)	Mechanical and manual laborers (n=1,082)	Housewives and unemployed (n=2,668)	
Age	58.0±16.8	42.5±13.6	39.6±12.1	49.1±13.9	64.9±11.5	53.0±14.6	65.8±15.3	<0.001
Age group, years								<0.001
19-29	542 (7.9)	121 (22.6)	105 (25.4)	113 (12.3)	16 (1.3)	80 (7.4)	107 (4.0)	
30-39	622 (9.1)	121 (22.6)	113 (27.3)	125 (13.6)	26 (2.1)	126 (11.6)	111 (4.2)	
40-49	893 (13.0)	130 (24.3)	112 (27.1)	174 (18.9)	82 (6.6)	225 (20.8)	170 (6.4)	
50-59	1,227 (17.9)	98 (18.3)	60 (14.5)	298 (32.4)	217 (17.4)	260 (24.0)	294 (11.0)	
60-69	1,587 (23.1)	48 (9.0)	17 (4.1)	164 (17.8)	419 (33.6)	241 (22.3)	698 (26.2)	
≥70	1,996 (29.1)	18 (3.4)	7 (1.7)	46 (5.0)	487 (39.1)	150 (13.9)	1,288 (48.3)	
Gender								<0.001
Male	4,062 (59.2)	224 (41.8)	185 (44.7)	282 (30.7)	621 (49.8)	628 (58.0)	865 (32.4)	
Female	2,805 (40.8)	312 (58.2)	229 (55.3)	638 (69.3)	626 (50.2)	454 (42.0)	1,803 (67.6)	
Residential region								<0.001
Urban	3,297 (48.0)	371 (69.2)	270 (65.2)	551 (59.9)	62 (5.0)	585 (54.1)	1,458 (54.6)	
Rural	3,570 (52.0)	165 (30.8)	144 (34.8)	369 (40.1)	1,185 (95.0)	497 (45.9)	1,210 (45.4)	
Marital status								<0.001
Married and living with a spouse	5,335 (77.7)	299 (55.8)	210 (50.7)	686 (74.6)	1,157 (92.8)	761 (70.3)	2,222 (83.3)	
Never married	1,105 (16.1)	208 (38.8)	186 (44.9)	191 (20.8)	53 (4.3)	238 (22.0)	229 (8.6)	
Divorced or separated	203 (3.0)	27 (5.0)	15 (3.6)	35 (3.8)	19 (1.5)	63 (5.8)	44 (1.6)	
Widowed	224 (3.3)	2 (0.4)	3 (0.7)	8 (0.9)	18 (1.4)	20 (1.8)	173 (6.5)	
Educational level								<0.001
Non-formal education	824 (12.0)	2 (0.4)	0 (0.0)	14 (1.5)	232 (18.6)	66 (6.1)	510 (19.1)	
Primary school	1,621 (23.6)	11 (2.1)	4 (1.0)	119 (12.9)	496 (39.8)	221 (20.4)	770 (28.9)	
Middle school	985 (14.3)	16 (3.0)	5 (1.2)	135 (14.7)	227 (18.2)	191 (17.7)	411 (15.4)	
High school	1,924 (28.0)	113 (21.1)	139 (33.6)	417 (45.3)	226 (18.1)	453 (41.9)	576 (21.6)	
College and higher	1,513 (22.0)	394 (73.5)	266 (64.3)	235 (25.5)	66 (5.3)	151 (14.0)	401 (15.0)	
Monthly household income, ten thousand KRW								<0.001
<100	1,759 (25.6)	27 (5.0)	15 (3.6)	71 (7.7)	480 (38.5)	167 (15.4)	999 (37.4)	
100-199	1,515 (22.1)	43 (8.0)	35 (8.5)	173 (18.8)	373 (29.9)	260 (24.0)	631 (23.7)	
200-299	1,178 (17.2)	77 (14.4)	59 (14.3)	192 (20.9)	192 (15.4)	260 (24.0)	398 (14.9)	
300-399	925 (13.5)	112 (20.9)	85 (20.5)	181 (19.7)	94 (7.5)	189 (17.5)	264 (9.9)	
400-499	567 (8.3)	90 (16.8)	70 (16.9)	126 (13.7)	49 (3.9)	90 (8.3)	142 (5.3)	
≥500	923 (13.4)	187 (34.9)	150 (36.2)	177 (19.2)	59 (4.7)	116 (10.7)	234 (8.8)	
Diagnosis of hypertension								<0.001
No	4,663 (67.9)	475 (88.6)	376 (90.8)	713 (77.5)	748 (60.0)	842 (77.8)	1,509 (56.6)	
Yes	2,204 (32.1)	61 (11.4)	38 (9.2)	207 (22.5)	499 (40.0)	240 (22.2)	1,159 (43.4)	
Diagnosis of diabetes								<0.001
No	5,984 (87.1)	512 (95.5)	405 (97.8)	846 (92.0)	1,058 (84.8)	974 (90.0)	2,189 (82.0)	
Yes	883 (12.9)	24 (4.5)	9 (2.2)	74 (8.0)	189 (15.2)	108 (10.0)	479 (18.0)	
Diagnosis of dyslipidemia								<0.001
No	5,459 (79.5)	475 (88.6)	369 (89.1)	753 (81.8)	976 (78.3)	879 (81.2)	2,007 (75.2)	
Yes	1,408 (20.5)	61 (11.4)	45 (10.9)	167 (18.2)	271 (21.7)	203 (18.8)	661 (24.8)	

Data are expressed as No. (%) or mean±SD.

highest in the AFFW (92.8%) and the proportion of never married was highest in the CL (44.9%) group. The MP and CL groups had higher education levels while AFFW and HU had lower educational levels and household incomes than the other groups; the proportion of education levels

above college was highest in the MP (73.5%) and CL (64.3%), and the proportion of household income over 5,000,000 KRW was the highest in the CL (36.2%) and MP (34.9%) groups. The proportions of CHD families with a member diagnosed with hypertension, diabetes, and / or dyslipide-

mia were 32.1%, 12.9%, and 20.5%, respectively – highest in the HU (43.4%, 18.0%, and 40.0%) and lowest in the CL (9.2%, 2.2%, and 10.9%) group.

## 2. CPR-related indicators according to occupation among family members of CHD

Table 2 shows the CPR-related indicators according to occupation. Among family members of CHD, the proportion of those aware of CPR was 77.2%, with the highest in the MP (98.5%) and the lowest in the AFFW (64.8%) group. However, the proportion of family members of CHD patients who experienced CPR education and manikin-assisted CPR training was relatively low at 15.7% and 12.7%,

respectively – highest in the MP (42.7% and 37.7%) and lowest in the HU (6.4% and 5.2%) group. Fewer than 1 in 10 family members (9.7%) reported that they could perform CPR correctly if they witnessed a patient experiencing cardiac arrest – highest in the MP (25.4%) and lowest in the HU (4.6%) group.

## 3. Associations between CPR-related indicators and occupation among family members of CHD

Table 3 shows the ORs and 95% CI for CPR-related indicators for each occupation. The unadjusted ORs for awareness of CPR were higher for the MP, CL, SSW, and MML groups than for the HU group. After adjustment, the ORs

**TABLE 2.** CPR-related indicators according to occupation among family members of community-dwelling coronary heart disease

Variables	Total (n=6,867)	Occupation						p-value
		Managers and professionals	Clerks	Service and sales workers	Agricultural, forestry, and fishery workers	Mechanical and manual laborers	Housewives and unemployed	
Awareness of CPR								<0.001
Yes	5,303 (77.2)	528 (98.5)	401 (96.9)	857 (93.2)	808 (64.8)	927 (85.7)	1,782 (66.8)	
No	1,564 (22.8)	8 (1.5)	13 (3.1)	63 (6.8)	439 (35.2)	155 (14.3)	886 (33.2)	
Experience of CPR education								<0.001
Yes	1,081 (15.7)	229 (42.7)	148 (35.7)	201 (21.8)	107 (8.6)	226 (20.9)	170 (6.4)	
No	5,786 (84.3)	307 (57.3)	266 (64.3)	719 (78.2)	1,140 (91.4)	856 (79.1)	2,498 (93.6)	
Experience of manikin-assisted CPR training								<0.001
Yes	875 (12.7)	202 (37.7)	117 (28.3)	163 (17.7)	87 (7.0)	166 (15.3)	140 (5.2)	
No	5,992 (87.3)	334 (62.3)	297 (71.7)	757 (82.3)	1,160 (93.0)	916 (84.7)	2,528 (94.8)	
Self-efficacy in performing CPR correctly								<0.001
Yes	666 (9.7)	136 (25.4)	67 (16.2)	127 (13.8)	86 (6.9)	127 (11.7)	123 (4.6)	
No	6,201 (90.3)	400 (74.6)	347 (83.8)	793 (86.2)	1,161 (93.1)	955 (88.3)	2,545 (95.4)	

Data are expressed as No (%).

CPR: cardiopulmonary resuscitation.

**TABLE 3.** Odds ratios and 95% confidence intervals for occupational CPR-related indicators among family members of community-dwelling coronary heart disease patients

Variables	Housewives and unemployed	Managers and professionals	Clerks	Service and sales workers	Agricultural, forestry, and fishery workers	Mechanical and manual laborers
Awareness of CPR						
Unadjusted	1.00 (reference)	32.82 (15.25-66.27)	15.34 (8.78-26.80)	6.76 (5.17-8.84)	0.92 (0.79-1.05)	2.97 (2.46-3.59)
Adjusted*	1.00 (reference)	3.82 (1.82-8.02)	1.42 (0.77-2.60)	1.73 (1.28-2.35)	1.04 (0.86-1.25)	1.29 (1.02-1.62)
Experience of CPR education						
Unadjusted	1.00 (reference)	10.96 (8.70-13.81)	8.18 (6.34-10.54)	4.11 (3.30-5.12)	1.38 (1.07-1.77)	3.88 (3.13-4.80)
Adjusted*	1.00 (reference)	4.00 (3.08-5.19)	2.61 (1.96-3.47)	2.02 (1.59-2.57)	1.22 (0.92-1.61)	1.99 (1.57-2.53)
Experience of manikin-assisted CPR training						
Unadjusted	1.00 (reference)	10.92 (8.56-13.94)	7.11 (5.41-9.35)	3.89 (3.06-4.94)	1.35 (1.03-1.79)	3.27 (2.58-4.15)
Adjusted*	1.00 (reference)	3.94 (3.00-5.19)	2.26 (1.67-3.07)	1.91 (1.47-2.47)	1.18 (0.87-1.60)	1.69 (1.30-2.21)
Self-efficacy in performing CPR correctly						
Unadjusted	1.00 (reference)	7.04 (5.39-9.18)	4.00 (2.91-5.49)	3.31 (2.55-4.30)	1.53 (1.15-2.04)	2.75 (2.12-3.57)
Adjusted*	1.00 (reference)	3.17 (2.34-4.29)	1.64 (1.16-2.34)	1.87 (1.40-2.48)	1.22 (0.89-1.67)	1.44 (1.08-1.92)

CPR: cardiopulmonary resuscitation.

\*Adjusted for gender, age, residential region, marital status, educational level, monthly household income, diagnosis of hypertension, diagnosis of diabetes, and diagnosis of dyslipidemia.

for awareness of CPR for were higher for the MP (3.82, 95% CI 1.82-8.02), SSW (1.73, 95% CI 1.28-2.35), and MML (1.29, 95% CI 1.02-1.62) groups than for the HU group. However, no significant difference of the OR for awareness of CPR between the AFFW and HU groups was observed before and after adjustment. The unadjusted and adjusted ORs for CPR education and manikin-assisted CPR training were higher for the MP, CL, SSW, and MML groups than the HU group. Although the unadjusted ORs for CPR education and manikin-assisted CPR training were higher in the AFFW group than in the HU group, the significant differences disappeared after adjustment (OR 1.22, 95% CI 0.92-1.61 and OR 1.18, 95% CI 0.87-1.60). Finally, compared to HU, all other occupations had high ORs for self-efficacy in performing CPR correctly. Moreover, the adjusted ORs for self-efficacy in performing CPR correctly were higher for the MP (3.17, 95% CI 2.34-4.29), CL (1.64, 95% CI 1.16-2.34), SSW (1.87, 95% CI 1.40-2.48), and MML (1.44, 95% CI 1.08-1.92) groups than for the HU group. However, the unadjusted OR for self-efficacy in performing CPR correctly was higher in the AFFW than in the HU group (OR 1.53, 95% CI 1.15-2.04), while the significant differences disappeared after adjustment (OR 1.22, 95% CI 0.89-1.67 of AFFW than HU).

When compared to MP (the highest group in awareness, education/training, and self-efficacy of CPR), adjusted ORs for awareness of CPR (0.27, 95% CI 0.13-0.58), CPR education (0.31, 95% CI 0.22-0.42), manikin-assisted CPR training (0.30, 95% CI 0.21-0.42), and self-efficacy in performing CPR correctly (0.38, 95% CI 0.27-0.55) were significantly low for the AFFW group. In addition, the adjusted ORs of the HU group for awareness of CPR (0.26, 95% CI 0.13-0.55), CPR education (0.25, 95% CI 0.19-0.33), manikin-assisted CPR training (0.25, 95% CI 0.19-0.33), and self-efficacy in performing CPR correctly (0.32, 95% CI 0.23-0.43) were significantly lower than that for the MP group (data not shown).

Meanwhile, the results of the sensitivity analysis, which limited the subjects to be analyzed to under 65 years of age, were similar to those for all age groups.

## DISCUSSION

The CPR awareness among family members of CHD patients was relatively high, but the proportion of people who received CPR education and manikin-assisted CPR training was relatively low – only about 1 in 10 CHD family members reported self-efficacy in CPR performance. The levels of CPR-related indicators such as awareness, education/training, and self-efficacy showed significant differences according to their occupation, especially the CPR-related indicators of the AFFW and HU groups were relatively poor compared to those of other groups.

Despite advances in medical technology over the years, bystander CPR remains the most important factor in saving OHCA victims. Bystander CPR is an essential part of OHCA survival, but infrequent bystander CPR is the weak-

est link in most communities.<sup>13</sup> While general community-level CPR education/training remains a cornerstone strategy, education/training for those who are most likely to witness a patient experiencing cardiac arrest is also useful. Since the most common place where OHCA occurs is the home,<sup>5,6</sup> family members of CHD patients are most likely to witness a cardiac arrest and, thus, provide first aid. Therefore, it is clear that family members who live and spend a lot of time with high-risk CHD patients should receive sufficient CPR education and training.<sup>14</sup>

Age, sex, educational level, household income, social grade, prior CPR training as well as knowledge, attitude, and self-efficacy in performing CPR were identified as factors related to willingness to perform bystander CPR.<sup>15-17</sup> Although previous studies have suggested potential barriers to bystander CPR, only a few studies have reported barriers to family member/cohabitant CPR training in cardiac patients.<sup>8-10,18</sup> The main obstacles to CPR training were “lack of information/skill or lack of opportunity regarding access to training programs” as well as “fear of harming patients” and “lack of time”.<sup>8-10</sup> These studies were conducted with family/cohabitants of hospitalized CHD patients, and none has been conducted with family/cohabitants living with community-dwelling CHD patients. Unlike the previous studies, our study involved all family members living with CHD patients in the community. Accordingly, our study provides the basis for developing community strategies for improving CPR performance of CHD patients’ families.

A previous study in Korea showed occupational differences in CPR knowledge, attitudes, self-efficacy, and performance willingness.<sup>19</sup> However, the study above only included a small family of CHD patients, occupational classification was not clear, and the result was derived without adjustment of other characteristics.<sup>19</sup> People spend a lot of time at work, so public health interventions targeting vulnerable occupational groups can be effective in reducing the inequalities in CPR-related indicators. Employees at offices, factories, and construction sites have many opportunities to receive group CPR education/training. However, AFFW and HU groups do not have a co-working space, so opportunities for collective CPR education/training are rare. In Korea particularly, many existing CPR education programs are conducted for population groups working at workplaces and schools. Occupations like AFFW and HU are becoming important groups for CPR education/training. Therefore, community-based CPR education/training strategies are needed to improve inequalities in CPR education and self-efficacy between occupational groups. In Korea, CPR education/training courses for AFFW and HU need to be promoted, especially with the help of public health institutions (public health centers, sub-health centers, and primary health care posts) installed in all rural and some urban areas.

Living with CHD patients is not a sufficient factor to motivate family members to seek CPR education/training, and lack of CPR education/training is primarily due to the

lack of information and training opportunities.<sup>8</sup> Healthcare providers should actively recommend and refer family members of CHD patients for CPR education/training because family members are more likely to be influenced positively by a physician's recommendation.<sup>9</sup> Additionally, CHD patients and their family members as well as healthcare professionals should be more concerned about learning and maintaining basic CPR skills than the general population.<sup>20</sup> However, most existing cardiac rehabilitation programs after coronary events do not provide CPR education/training to family members of cardiac patients.<sup>20</sup> Providing CPR education/training within the cardiac rehabilitation program can improve the CPR performance of the family members of CHD patients.<sup>9</sup> Moreover, collaboration with hospital cardiac rehabilitation and community CPR education/training should enable CHD patients and their families to participate in ongoing and repetitive CPR education/training to maintain CPR skills.

This study had some limitations. First, recall bias may exist because information on CPR indicators was collected from participants' self-reported data. Second, although we assessed the self-efficacy of CPR performance in families of CHD patients, we did not evaluate their actual skill of performing CPR. Responding to the need for CPR does not necessarily mean efficiency in performing CPR in an actual emergency. In the future, it is necessary to directly evaluate the CPR skills of family members of CHD patients using a manikin, not a questionnaire. Third, the target subjects of this study were families of patients diagnosed with CHD (myocardial infarction or angina pectoris) by a physician. However, the diagnosis of CHD was identified by the respondents, rather than being confirmed through medical records. Despite these limitations, this study has several strengths. First, this is the first study to demonstrate differences in CPR-related indicators by occupation in families of CHD patients. Second, our analysis included all family members living with CHD patients because every member of the family is likely to witness the patient's cardiac arrest.

Along with public health efforts including CPR campaigns and education/training programs, tailored intensive CPR programs for CHD patients and their families are important. The family members of CHD patients who are most likely to witness a patient experiencing cardiac arrest would be a principal resource and target for CPR education/training. Since family members of cardiac patients tend not to seek CPR training on their own,<sup>10</sup> cooperative strategies with hospital cardiac rehabilitation and community-based CPR education and training with manikins for family members of CHD patients, especially those involved in AFFW and HU occupations, should be established.

## ACKNOWLEDGEMENTS

This paper was supported by a research project of the Rural Development Administration in Republic of Korea

(no. PJ01250902).

## CONFLICT OF INTEREST STATEMENT

None declared.

## REFERENCES

1. Myerburg RJ, Castellanos A. Cardiac arrest and sudden cardiac death. In: Libby P, Bonow RO, Mann DL, Zipes DP, eds. *Braunwald's Heart Disease: a Textbook of Cardiovascular Medicine*. 8th ed. Philadelphia:Saunders, 2007;933-974.
2. Myerburg RJ, Junttila MJ. Sudden cardiac death caused by coronary heart disease. *Circulation* 2012;125:1043-52.
3. Stiell IG, Wells GA, DeMaio VJ, Spaite DW, Field BJ 3rd, Munkley DP, et al. Modifiable factors associated with improved cardiac arrest survival in a multicenter basic life support/defibrillation system: OPALS Study Phase I results. *Ontario Prehospital Advanced Life Support. Ann Emerg Med* 1999;33:44-50.
4. Sasson C, Rogers MA, Dahl J, Kellermann AL. Predictors of survival from out-of-hospital cardiac arrest: a systematic review and meta-analysis. *Circ Cardiovasc Qual Outcomes* 2010;3:63-81.
5. Korean Statistical Information Service [Internet]. Daejeon: Statistics Korea; c2015 [cited 2020 May 3]. Available from: [http://kosis.kr/statisticsList/statisticsListIndex.do?menuId=M\\_01\\_01&vwcd=MT\\_ZTITLE&parmTabId=M\\_01\\_01#SelectStatsBoxDiv/](http://kosis.kr/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ZTITLE&parmTabId=M_01_01#SelectStatsBoxDiv/).
6. American Heart Association CPR & ECC [Internet]. Dallas: American Heart Association [cited 2020 May 10]. Available from: <https://cpr.heart.org/en/resources/cpr-facts-and-stats/>.
7. Wong CX, Brown A, Lau DH, Chugh SS, Albert CM, Kalman JM, et al. Epidemiology of sudden cardiac death: global and regional perspectives. *Heart Lung Circ* 2019;28:6-14.
8. Cariou G, Pelaccia T. Are they trained? Prevalence, motivations and barriers to CPR training among cohabitants of patients with a coronary disease. *Intern Emerg Med* 2017;12:845-52.
9. Platz E, Scheatzle MD, Pepe PE, Dearwater SR. Attitudes towards CPR training and performance in family members of patients with heart disease. *Resuscitation* 2000;47:273-80.
10. Dracup K, Moser DK, Guzy PM, Taylor SE, Marsden C. Is cardiopulmonary resuscitation training deleterious for family members of cardiac patients? *Am J Public Health* 1994;84:116-8.
11. Fujishiro K, Xu J, Gong F. What does "occupation" represent as an indicator of socioeconomic status?: exploring occupational prestige and health. *Soc Sci Med* 2010;71:2100-7.
12. Ravesteijn B, van Kippersluis H, van Doorslaer E. The contribution of occupation to health inequality. *Res Econ Inequal* 2013; 21:311-32.
13. Becker LB, Pepe PE. Ensuring the effectiveness of community-wide emergency cardiac care. *Ann Emerg Med* 1993;22(2 Pt 2):354-65.
14. Kliegel A, Scheinecker W, Sterz F, Eisenburger P, Holzer M, Laggner AN. The attitudes of cardiac arrest survivors and their family members towards CPR courses. *Resuscitation* 2000;47: 147-54.
15. Sasaki M, Ishikawa H, Kiuchi T, Sakamoto T, Marukawa S. Factors affecting layperson confidence in performing resuscitation of out-of-hospital cardiac arrest patients in Japan. *Acute Med Surg*

- 2015;2:183-9.
16. Pei-Chuan Huang E, Chiang WC, Hsieh MJ, Wang HC, Yang CW, Lu TC, et al. Public knowledge, attitudes and willingness regarding bystander cardiopulmonary resuscitation: a nationwide survey in Taiwan. *J Formos Med Assoc* 2019;118:572-81.
  17. Dobbie F, MacKintosh AM, Clegg G, Stirzaker R, Bauld L. Attitudes towards bystander cardiopulmonary resuscitation: results from a cross-sectional general population survey. *PLoS One* 2018;13:e0193391.
  18. Thorén AB, Axelsson AB, Herlitz J. Possibilities for, and obstacles to, CPR training among cardiac care patients and their co-habitants. *Resuscitation* 2005;65:337-43.
  19. Park JM, Jun S. The effects of knowledge, attitude, and self-efficacy of CPR on willingness to perform CPR in family members of patients with heart disease. *Korean J Adult Nurs* 2018;30:79-88.
  20. Liu H, Clark AP. Cardiopulmonary resuscitation training for family members. *Dimens Crit Care Nurs* 2009;28:156-63.