TITLE: Clinical Effects of a New Dispatcher-Assisted Basic Life Support Training Program in a Metropolitan City: A Before-and-After Intervention Study

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Study design and setting

This was a before-and-after intervention study that took place in Seoul. The study was registered on ClinicalTrials.gov: NCT02142387. Seoul is the capital city of the Republic of Korea, with approximately 10 million people and an area of 605 km^2. In 2016, 4,569 OHCAs occurred in Seoul and the bystander CPR rate was 29.6%.

The city has 116 ambulance stations and 24 emergency medical service (EMS) agencies with a single dispatch center operated by the Seoul Metropolitan Fire Department (SMFD). There are 149 ambulances and 1,321 emergency medical technicians (EMTs) who belong to ambulance stations. They were dispatched to 541,117 incidents in 2017. EMS ambulances are usually staffed by three personnel: one level-1 EMT (EMT-intermediated in the USA), one level-2 EMT (EMT-basic in the USA), and one trained driver. An emergency department (ED) is formally categorized into level I, level II, III, or above level by law. There are 67 EDs in Seoul: 6 level I EDs, 24 level II EDs, 36 EDs over level III, and 1 specialty center (burn care) in Seoul. The level of an ED is based on its resources, and level I and II EDs should be staffed by emergency physicians.

The SMFD started a DA-CPR program in 2010, which led to increased bystander CPR rates and survival outcomes When primary call dispatchers detect cardiac arrest using two key questions (altered mental status and abnormal breathing), they transfer the call to a secondary call dispatcher who helps bystanders perform CPR until the ambulance arrives. All OHCA cases with dispatcher instructions are recorded in the electronic dispatcher CPR registry by the secondary call dispatchers. Dispatch medical directors, who are certified by the Ministry of Health and Welfare, are required to review about 10% of DA-CPR audio recordings and provide feedback to the dispatchers for quality assurance.

There are 25 districts in Seoul and each one has a community health center that is responsible for providing BLS training for citizens and first responders (police officers, nursing teachers, safety guards, etc.). In 2016, it was reported that 324,574 laypersons were trained by a rescue and first-aid education program including BLS.

Selections of study population

The study population included OHCA patients with presumed cardiac etiology that occurred in a private place in Seoul. They were treated by EMS providers from January 2014 to December 2017. Patients under 19 years old, those who did not receive CPR, and OHCA patients initially witnessed by EMS providers were excluded. In addition, patients with unknown survival outcomes because of a lack of medical records were also excluded.

Data source

We used the Korean OHCA registry for our data source. It is a nationwide prospective clinical registry that was established in 2006 and has been supported by the Korea Centers for Disease Control and Prevention (CDC) since 2007. Data were collected from EMS records and hospital medical records. EMS records include an EMS run sheet with information on ambulance operation, an EMS cardiac arrest registry based on Utstein-style data collection, and the dispatcher CPR registry with information on dispatcher instructions. Hospital medical records were recorded by well-trained medical record reviewers who visited all hospitals that treated OHCA patients and reviewed the medical records to extract clinical information including survival outcomes.

Interventions and control

The HEROS program is a one-hour training course that includes a 30-minute video-based self-instruction (VSI) training session, a short role-play, and a debriefing. The video consists of a bystander CPR simulation with dispatcher instructions using the trainee's own phone and practice session following demonstration by a simulated layperson. After watching the video clip, all trainees are divided into two groups and conduct a role-play as dispatchers and laypersons for 15 minutes. Finally, there is a 15-minute debriefing session with several assignments. The HEROS program focuses on cooperation with a dispatcher, from recognition of cardiac arrest to performing DA-CPR, with hands-on practice so that laypersons can provide bystander CPR immediately in a real situation. Moreover, the HEROS program emphasizes practice for providing the correct address of the scene and switching to speakerphone mode, especially for the elderly. Because dispatchers usually instruct CPR using bystanders' mobile phone, it is important for bystanders to quickly switch to speakerphone mode and place the phone on the floor. But, most elderly people are not familiar with using a mobile

phone and have difficulty switching to speakerphone mode.

Community health centers in Gangbuk, Nowon, and Junglang districts have provided the HEROS program since 2015 and were defined as the intervention group. The other 22 districts were regarded as the control group. The control group commonly used a one-hour training program that was developed by the Korea CDC and it was based on the AHA BLS provider course (http://www.cdc.go.kr/board.es?mid=a20503050000&bid=0021&tag=&act=view&list_no=127655). The program consists of a 30-minute VSI, and a 30-minute practice debriefing session. It focuses on detailed techniques for performing high-quality chest compressions including the correct hands and body position of the bystanders. Among the four years of the study period, 2014 was the control, 2015 was the run-in period, and from 2016 to 2017 was the intervention period.

Main outcomes

The primary outcome was survival to hospital discharge. The secondary and tertiary outcomes were the return of spontaneous circulation (ROSC) and good neurological recovery (defined as a cerebral performance category of 1–2).

Statistical analysis

Counts and proportions were calculated for the categorical variables and median and interquartile ranges (IQR) were calculated for the continuous variables. A χ^2 test for the categorical variables and a Wilcoxon rank sum test or Kruskal-Wallis test for continuous variables were used to compare characteristics between the two groups. We showed the trend of survival outcomes for the intervention and control groups by year using the Cochran-Armitage test. Changes over the period in the survival outcomes between the two groups were assessed using difference-in-difference (DID) analysis. The results of the DID method are expressed as adjusted estimates and the 95% confidence interval (calculated from least-square means). All analyses were performed using SAS software, version 9.4 (SAS Institute Inc., Cary, NC, USA).

Ethical statement

This study was approved by the Institutional Review Board of Seoul National University Hospital IRB (No. 1607-210-784). Informed consent was waived and patient information was anonymized prior to analysis.