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Editorial

The prehospital emergency medical service system in Korea: its current status and future direction

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INTRODUCTION

In 2022, the number of prehospital emergency medical service (EMS) calls in Korea reached 3.61 million, resulting in two million transports, which was twice the number recorded in 2002. The increasing demand for EMS transport is accompanied by public demand for safe and effective EMS care. Quality measurement is fundamental for improving EMS systems. This commentary introduces the current status of the Korean EMS system and its quality measurement and discusses the future direction of the EMS system with a focus on quality measurement.

THE KOREAN EMS SYSTEM

Korea's fire-based public EMS system is exclusively operated by the National Fire Agency of Korea (NFA) and has 18 provincial fire departments and dispatch centers. A designated call number of 119 is used for EMS, fire, and rescue calls. Medical directors at dispatch centers provide online medical directions 24/7/365 for EMS providers' requests for services, such as advanced airway management, fluid administration, cardiopulmonary resuscitation (CPR) withdrawal, drug administration, and complex problems at the scene. Dispatcher-assisted bystander CPR began in 2011 [1], and video instruction became available in 2017 [2]. In 2022, 13,896 EMS providers and 1,625 ambulances were operating nationwide. Each ambulance run is attended by two or three EMS providers, with 63% of all runs being attended by three EMS providers in 2022. Multiple dispatches for cardiac arrest and severe trauma were introduced in 2015 [3], and 79% of cardiac arrest patients and 38% of severe trauma patients received multiple dispatches in 2022. Most multiple dispatches consist of multiple ambulances of the same service level, but 5% of multiple dispatches for cardiac arrest and 20% for severe trauma were by a fire engine (pumbulance) in 2022. EMS providers in Korea include emergency medical technicians (EMTs), who are classified as advanced or basic, and nurses. Most advanced EMTs (AEMTs) graduate from EMT schools (3–4-year courses) and must also pass the national certification examination. Nurses and AEMTs provide prehospital advanced cardiac life support, including advanced airway management and fluid administration under online medical direction. In 2022, 66% of EMS providers were AEMTs

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or nurses, and ambulance teams with AEMTs or nurses responded to 97% of calls. Because of the limited scope of practice for EMTs, the use of prehospital epinephrine in cardiac arrest has not been systemically implemented, but pilot projects, including the Smart Advanced Life Support program (which began in 2016 and has been supported by the Ministry of Health and Welfare of Korea) [4] and the nationwide designated response for severe disease program of the NFA (started in July 2019), have made significant progress [3]. In 2023, the Central EMS Committee expanded the scope of practice for EMTs to include prehospital epinephrine administration.

EMS QUALITY MEASUREMENT

The main data sources for EMS quality measurements are the EMS run sheet and the in-depth EMS registry for severe diseases. Under the Act on 119 Rescue and EMS, all EMS providers should record ambulance run sheets for all dispatches. The ambulance run sheet collects basic ambulance operational information, chief complaints, patient's clinical status, field management, transported hospitals, and medical direction. There are three in-depth EMS registries for severe diseases: the EMS out-of-hospital cardiac arrest registry (started in 2011), the EMS Severe Trauma Registry (started in 2012), and the EMS Cardiovascular Registry (started in 2013). The collected information includes Utstein variables in the EMS Out-of-Hospital Cardiac Arrest Registry [5]; field triage decisions [6], field trauma care, and heli-EMS in the EMS Severe Trauma Registry; and chest pain characteristics, electrocardiogram findings, prehospital stroke screening, and severity assessment results in the EMS Cardiovascular Registry [7–9]. All EMS run sheets and in-depth EMS registries are electronically stored at each fire department, and EMS providers can enter data using tablet devices in all regions. Dispatcher CPR registries for out-of-hospital cardiac arrest (OHCA) have been collected by dispatchers since 2012. The Smart Advanced Life Support program or the nationwide designated responses for severe disease program use independent records focused on detailed information regarding field treatment [3,4].

The EMS records are linked to external data for quality measurements. NFA and the Korea Disease Control and Prevention Agency (KCDA) constructed the Korean Out-of-Hospital Cardiac Arrest Registry (KOHCAR) in 2006. All OHCA-related EMS records are merged by the EMS Quality Committee of the NFA and sent to the KCDA. The KCDA collects hospital information and clinical outcomes through medical record reviews [10]. Since KOHCAR represents nationwide complete data collection rather than sampling, and most collected data are open to the public, KOHCAR data are used to evaluate regional and national quality improvement programs in Korea [10,11]. In 2012, NFA and KCDA started pilot projects for data collection targeting severe injury similar to KOHCAR; nationwide data collection was implemented in 2016. The Korea Severe Trauma Registry captures three target patient populations: traumatic injury, i.e., patients who met trauma center transport criteria during field triage [6]; nontraumatic injury, i.e., nontraumatically injured patients with hypotension (systolic blood pressure ≤ 90 mmHg), an abnormal respiration rate (< 10 or > 29 respirations/min), or an abnormal mental status (nonalert response according to the AVPU [alert, voice, pain, unresponsive] scale) in the field [12]; and multicasualty incidents, i.e., accidents resulting in EMS requests for six or more patients [13]. Unlike the KOHCAR, the Korea Severe Trauma Registry does not collect data on patients transported to nonemergency medical centers, and approximately 5% of patients are excluded from data collection for this reason. In addition to the two nationwide registries that collaborate with the KCDA, EMS records are also used by research consortiums, such as the Korean Cardiac Arrest Research Consortium (KoCARC) [14] or regional emergency medical service programs. Recently, the National Emergency Department Information System (NEDIS) database, which is compiled by the National Emergency Medical Center to evaluate emergency medical centers, has been linked and used for EMS quality measurement. However, because neither database contains personally identifiable information, it is difficult to link the entire dataset. Approximately 78% of all EMS transport records were linked to NEDIS data from 2017–2021. Linking the NEDIS database, which encompasses all patients who visit emergency medical centers, enables diverse EMS quality measurements beyond specific diseases.

CHALLENGES AND OPPORTUNITIES

EMS records and quality measurements have improved the Korean prehospital EMS system. However, new demands persist. First, the demand for real-time information on ambulance operation and key patient characteristics continues to increase. Since the beginning of the COVID-19 pandemic, the number of difficult cases for the selection of transfer hospitals has increased because of frequent screening or ambulance diversion from overcrowded emergency medical centers. If ambulance operating information and key patient characteristics can be accessed at the hospital level, and communication between hospitals and EMS can be strengthened, this will help solve the difficulty of selecting a transfer hospital. This strategy could also improve direct medical control, which is currently based on subjective information exchanges between personnel using cellular phones. The automatic

transfer of data collected from monitoring devices can also increase the effectiveness and efficiency of real-time data exchanges. Second, the demand for faster, easier, and wider data use is increasing, particularly among medical directors. Currently, medical directors appointed by each fire station provide feedback for EMS care; however, the scope of evaluation is limited, and feedback based on clinical diagnosis and results is difficult to obtain at this stage because only EMS records can be used. If the collection and use cycle of various data sources, including KOHCAR, Korea Severe Trauma Registry, and NEDIS databases, can be shortened and medical directors and EMS providers can more easily use these resources, more effective feedback can be achieved. The increasing demand for quality measurements in diseases beyond cardiac arrest or severe trauma emphasizes the importance of feedback linked to clinical data, as on-site screening and evaluation take precedence over field management. Further effort is required to develop a quality improvement system that allows medical directors to use data, develop quality indicators, and provide practical, authoritative feedback. Finally, the importance of acquiring patients' medical histories in the field continues to increase. Owing to the aging population and the increase in the prevalence of underlying diseases, a patient's medical history is an important factor for on-site management and selection of transfer hospitals. However, systematic information collection in the field is often not possible. Because each hospital uses different information and security systems, hospital data may be difficult to connect individually. However, health insurance data, which includes accumulated national data, and the National Health Insurance Service's responsibility for managing the data, offer new possibilities for linking EMS records to hospital data. If health insurance data are summarized systematically and can be used in the field or emergency departments, the accuracy of patient evaluation and the safety of field management will be further improved. This link can also be used to calculate risk-adjusted outcomes, which can contribute to a more objective evaluation of EMS system effectiveness.

CONCLUSION

The quantitative and qualitative demands for EMS in Korea are continuously increasing. The Korean EMS is operated by the NFA through fire-based public services. Quality measurement is crucial for improving EMS systems, and various EMS records have been developed, utilized, and linked for quality measurement. The need for real-time information exchange; faster, easier, and wider utilization of databases; and the prompt acquisition of patients' medical histories continues to increase. Strengthening communication between hospitals and EMS, improving data exchange, and linking EMS records with health insurance data can enhance the effectiveness and efficiency of EMS systems.

ETHICS STATEMENT

Not applicable.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

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