Editorial

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Prehospital EMS system in Korea: Current Status and Future Direction

Running title: Status of Korean EMS System

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Introduction

In 2022, the prehospital emergency medical service (EMS) calls in Korea reached 3.61 million, resulting in 2.00 million transports, twice as many as 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 quality measurement, and discusses the future direction of the EMS system, focusing on quality measurement.

Korean EMS system

South Korea’s fire-based public EMS system is exclusively operated by the National Fire Agency (NFA), with 18 provincial fire departments and dispatch centers. A designated call number of 119 is used for EMS, fire, and rescue. Medical directors in dispatch centers provide online medical directions 24/7/365 for EMS providers’ requests for services such as advanced airway management, fluid administration, CPR withdrawal, drug administration, and complex problems at the scene. Dispatcher-assisted bystander CPR started in 2011,[1] and video instruction 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 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), classified as advanced or basic, and nurses. Most advanced EMTs (AEMTs) graduate from EMT schools (3–4-year course) and pass the national certification examination. Nurses and AEMTs provide prehospital ACLS, including advanced airway management and fluid administration, under online medical control. In 2022, 66% of EMS providers were AEMTs 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 (supported by the Ministry of Health and Welfare and started in 2016)[4] and the nationwide designated response for severe disease program of NFA (started in July 2019), have made significant progress.[3] In 2023, the central emergency medical service committee expanded the scope of practice for EMTs, and included prehospital epinephrine.

**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 running sheets for all dispatches. The ambulance run sheet collects basic ambulance operational information, chief complaints, clinical status, field management, transported hospitals, and medical direction. There are three in-depth EMS registries for severe diseases: the EMS OHCA 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 OHCA 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 in each fire department, and EMS providers can enter data using tablets in all regions. Dispatcher CPR registries for OHCA have been collected by dispatchers since 2012. The Smart Advanced Life Support program or nationwide designated responses for severe disease program use independent records focused on detailed information of 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 Korea 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. KCDA collect hospital information and clinical outcomes through medical record review.[10] Since KOHCAR is 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 similarly to KOHCAR, and implemented nationwide data collection in 2016. The Korea severe trauma registry captures three target patient populations: traumatic injury (patients who met trauma center transport criteria in field triage),[6] non-traumatic injury (non-traumatically injured patients with hypotension [systolic blood pressure ≤90 mm Hg], abnormal respiration rate [<10 or >29 respirations/min], or abnormal mental status [non-alert response according to the AVPU scale] in the field,[12] and multi-casualty incidents (accidents resulting in EMS requests for six or more).[13] Unlike KOHCAR, Korea severe trauma registry does not collect data on patients transported to non-emergency medical centers, and approximately 5% of patients are excluded from data collection for this reason. In addition to two nationwide registries collaborating 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, collected by the National Emergency Medical Center to evaluate emergency medical centers, has been linked and used for EMS quality measurement. 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 to 2021. Linking the NEDIS database, which encompasses all patients visiting 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 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 could also improve direct medical control, which is currently based on subjective information exchanges 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 at this stage because only EMS records can be used. If the collection and use cycle of various data sources, including the KOHCAR, Korea Severe Injury Registry, and NEDIS databases, can be shortened and medical directors and EMS providers can use these resources more easily, 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. Continuous 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 continuously increases. Owing to the aging population and the increase in underlying diseases, a patient’s medical history is an important factor for the on-site management and selection of transfer hospitals. However, systematic information collection in the field is often not possible. Because each hospital operates different information and security systems, hospital data may be difficult to connect individually. However, health insurance data, in which national data are accumulated, 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 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 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.
References


