

Public health perspective on quality of emergency medical services in Riyadh Province of Saudi Arabia

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Summary

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Emergency medical services (EMS) are comprehensive and integrated medical systems that take care of patients exposed to different types of emergencies. Providing emergency healthcare is not limited to indoor locations such as hospitals and primary healthcare centers but instead extends to dispatch crews for people in need of medical aid at the emergency location. EMS responds to medical emergencies, tragedies, and situations where life is at imminent risk. The EMS in Saudi Arabia, like that of any nation, needs continuous quality assessment of their performance indicators to provide the best possible out-of-hospital care. Evaluation of EMS in Riyadh province can be generalizable to the rest of all other provinces of Saudi Arabia (SA). In Addition, Riyadh Province is the largest province in terms of population and the second in terms of geographical area.

This dissertation aims to evaluate the current status of EMS quality in the Riyadh province of SA from the extent of demand and acceptability of services by patients as the choice for medical aid and transportation and the amount of time spent by the dispatched crews in all consecutive intervals of missions. We developed our aim due to our recognition that evaluating EMS for those patients requesting emergency support because they were victims of consequences of high prevalence chronic diseases and unexpected injuries that are common to some extent in the Saudi population. Furthermore, we considered our work in this dissertation to draw attention to the fact that our findings will have several implications for future improvement in community medicine practice, health policy reforms, reducing the knowledge gap, and conducting further related research to end up with efficient EMS. To do so, we conducted four studies, started with a systematic review and then followed by three retrospective population-based registry analyses, to evaluate the quality of pre-hospital EMS in Riyadh province of Saudi Arabia.

Chapter 1 introduced the central concept of this dissertation, i.e., 'evaluation', 'quality of emergency medical services', 'in Riyadh province of Saudi Arabia', 'to improve public health', and presents the main goals and objectives of this dissertation.

In chapter 2, we assessed the quality of EMS in the Arabian Gulf States (AGS) according to the six quality domains of the Institute of Medicine. We searched four databases (i.e., PubMed, EMBASE, Web of Science, and CINAHL) for studies that reported on the quality of EMS in any of the AGS using clinical or non-clinical performance indicators. To quantify study quality and risk of bias, the adapted Newcastle Ottawa Scale was used. We focused on structural and functional indicators, clinical and non-clinical. We found that twenty-five studies were eligible for inclusion. One study contained the result of safety, fifteen time-centeredness, twenty effectiveness, five patient-centeredness, and thirteen studies reported on equity of EMS. None of those studies reported on the efficiency of EMS. A significant proportion of studies showed high scores on the Newcastle-Ottawa scale. Limited studies on EMS quality were available but did not cover all relevant quality

domains and did not cover the whole AGS region. The equity domain showed the best outcome performance finding, whereas the finding of the patient-centeredness domain showed room for improvement in the foreseeable future. The systematic review highlights the need for more and better studies of sufficient quality about all six quality domains in EMS in all the AGS. EMS research in Kuwait and Bahrain is warranted, as current studies of EMS quality are unavailable for these States. Moreover, research exploring efficiency domain discipline should be conducted, primarily since no studies have been found to search this domain.

In chapter 3, we explore characteristics of missions dispatched by EMS in rural and urban areas of Riyadh province in Saudi Arabia (SA), and we identified weaknesses related to utilization and response time (RT) to be improved in the system. We retrospectively evaluated all 146,639 missions in 2018 by measuring the utilization rate in rural and urban areas based on different demographics features. RT was computed and compared to the benchmark of 20 min targeted by Saudi EMS. We found that the available ambulance crews for rural areas were six times in comparison to urban. There were 22.1 missions per 1000 urban inhabitants and 11.1 missions per 1000 in rural areas. The median RT for high urgent trauma cases was 20.22 min in rural compared to 15.23 min in urban areas, $p < .001$. In urban areas, the median RT was 16.08 min in high urgent medical emergency cases, and for high urgent trauma emergencies, 15.23 min, $P < .001$. Around 65% of all cases were responded to within 20 minutes. We concluded that lower utilization of services in rural areas was found, specifically for medical emergencies. Women utilized EMS less frequently, in part, possibly because of the lower number of women who work and drive cars, and it might be due to other cultural factors. RT was increased in urban areas compared to previous studies. To further improve adherence to the 20' target, reorganizing the lowest urgent cases in the rural areas seems necessary.

In chapter 4, we identified the inter-gendervariation of on-scene time (OST) for high urgent emergency cases conveyed by EMS in Saudi Arabia and assessed other OST predictors. We conducted a retrospective population-based registry study of Riyadh Province, the largest province in terms of population and the second in terms of geographical area. We analyzed all highly urgent medical and trauma emergency cases that were transported from the scene in urban and rural locations to emergency departments of governmental and private hospitals during 2018. Different consecutive intervals of EMS time were measured, including total EMS time for the urgent transported cases. OST difference between men and women was investigated based on different demographic and EMS missions background. Using crude and adjusted linear and logistic regression analysis, we determined what characteristics were predictors of OST and predictors of prolonged OST of more than 15-minutes (the Saudi benchmarks of OST). We found that 21,878 patients were included for analysis. 33.9% of the total were women, and 66.1% were men. The