

Challenges to Use Response Time Standard in Assessing Emergency Medical Services in Iran: A Systematic Review

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Abstract

Response time (RT) accounts as a common tool for emergency medical services (EMS) assessment. While the national standard RT has been established in Iran since 2007, its application has hardly been put into scrutiny. This study aimed at investigating the use of RT standard in assessing EMS in Iran. This systematic review included papers focusing on prehospital EMS assessment published in Google Scholar, Scopus, Embase, PubMed, and the Persian databases of Magiran and SID. Selection criteria involved all English and Persian studies focusing on RT as an assessment of prehospital EMS in the context of Iran. Repetitious papers and those presented in conferences were omitted, which left 21 papers published from 2007 to mid-2016 for systematic review. A data collection form was designed. This provided both inclusive information about the papers and indicators used to report RT in each paper (i.e., mean and percentages of RT below 8 min) as well as the use of these indicators *vis-a-vis* that of the standard. From among the 21 papers focusing on RT, seven (33%) reported RT as percentages of operations performed in <8 min according to the national standard and compared the percentage with the national standard. A total of 18 (86%) reported the means of RT; nine studies compared mean and the national standard as expressed in percentage. Limited use of the national standard to report RT was identified as a challenge to EMS assessment. Further, the inconsistency that exists when comparing RT in terms of means and percentage is a challenge to the validity of judgments expressed in some previous studies. Employment of uniform methods to report and evaluate performance based on the national standard will lead to greater transparency in emergency operation performance.

Keywords: Emergency medical services, Iran, performance evaluation, prehospital emergencies, response time

INTRODUCTION

To have continuing improvement, emergency medical services (EMS) need ongoing quality assessment and to this end, performance assessment indicators, as quantitative tools for measuring quality, are applied.^[1] The standards set in these indicators are stimuli to quality improvement programs. However, it is usually complex and challenging to assess EMS performance given the high number of indicators and provision of on-site services.^[2,3]

Response time (RT) is one of the most common and best known quantitative indicators to assess EMS performance.^[4,5] It is defined as the time interval from awareness of the incidence to arrival of the ambulance in the site.^[6] Since time in the past, prehospital EMS quality has been often focused on quick response.^[7,8]

There are two approaches to RT assessment: Mean RT and percentage of responses within a specified time limit.^[9] Mean cannot be a good criterion to demonstrate efficacy. It is because when the mean equals the life-saving time to reach the victim, it shall mean that not more than half of the victims have received care at the golden time while half have received inefficient and delayed care.^[10] Thus, application of an indicator that indicates an acceptable percentage of patients receiving care is more credible and to ensure EMS service quality; the RT percentage has been adopted.^[10,11]

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Several institutions around the world have established indicators to assess prehospital emergency RT.^[4] The American National Association of EMS Officials has appointed RT mean and the arrival time to the patient in 90% of cases as indicators of EMS performance quality.^[12] The UK's National Coronary Artery Disease Network has established its EMS operational indicator as RT within 8 min in 75% of high-priority emergencies.^[13] The standard RT for the Commission on Accreditation of Ambulance Services of America is 8 min 59 s RT in 90% of cases.^[14] Taking into account, the recommendations of the American Heart Association and the National Fire Protection Association of America has also clearly defined RT standards and its components in percentile.^[15]

The American Institute of Medicine recommends that any country devise its own national standard according to evidence-based operational indicators.^[16] The national standard is unique to any country and can be used to compare systems within different regions of the country.^[9] In Iran, the by-law for comprehensive coverage plan prehospital EMS was approved by the Council of Ministers in 2007. Accordingly, the Ministry of Health and Medical Education was infused with the responsibility to enhance prehospital emergency performance indicators. In the by-law, the standard established for EMS performance assessment is arrival of ambulance to the patient within 8 min in urban areas and within 15 min on roads in 80% of the cases.^[17]

Given the huge number of natural disasters and transportation as well as nontransportation incidents in Iran,^[18-20] the Iranian EMS has developed significantly in recent years.^[21,22] However, its development is not well organized.^[23] An assessment of the status quo of the system can be beneficial in either enhancing its performance or, otherwise, recognition of opportunities to enhance it.^[24] Several studies have tried to assess EMS system in the context of Iran using the RT standard. Nonetheless, in light of the difficulties in EMS performance assessment, any recognition of challenges to prehospital service assessment can be a further step to understanding limitations and finding solutions.^[2,24,25]

OBJECTIVES

After nearly a decade from the establishment of the national RT standard in Iran, it seems necessary to enquire into its proper employment in the EMS assessment. A systematic review can aggregate the existing evidence in this regard, analyze the evidence,^[26] and contribute to better application of these indicators, leading finally to improved service quality. Therefore, this study aimed to investigate the way the standard RT is used in assessing EMS in Iran.

Add in value

This stands as the first research endeavor to critically investigate EMS performance assessment in Iran.

DATA SOURCES

This study aimed to systematically review articles published in English or Farsi in Iran concerning prehospital care evaluated

using the RT indicator. Based on a predesigned protocol, the study examined papers published from 2007 to mid-2016 (after establishing national standard RT) using the preferred reporting items for systematic reviews and meta-analyses as a standard guideline for systematic reviews (PRISMA).^[27] In this study, EMS characterized the prehospital setting.

Search strategy

In the current systematic review, a set of electronic databases including PubMed, Embase, Scopus, Google Scholar, and the Persian databases of Magiran and SID were searched by assistance from experienced librarians. The necessary strategies to search – which were specific to any of the databases – and Mesh and Free Text guidelines were followed. The key terms to search included Iran, (time, interval), (EMS, Emergency Medical System, prehospital, prehospital, and ambulance) as well as their combinations in English and their equivalents in Persian databases. Manual search was also performed in the reference lists of the related papers.

STUDY SELECTION

Inclusion and exclusion criteria

Original and full-text articles published in Persian and English journals concerning EMS RT, published from 2007 to mid-2016, were included. No limitations were imposed in terms of study type or methods. The inclusion indicator consisted of papers that used RT in prehospital emergency performance assessment.

Exclusion criteria involved papers that were republished using a second language elsewhere. Unpublished papers, the ones presented in conferences, papers with imperfect statistical data, articles reporting RT from other studies, papers irrelevant to RT despite their seemingly relevant titles, and papers that examined RT from other medical fields rather than EMS were also considered as exclusion criteria.

DATA EXTRACTION

A data collection form was designed according to the purpose of the study. This provided both inclusive information about the papers including the title, the author (s), aim of the study, methods (i.e., type of study, sample size, period, and context), and publication year. The indicators used to report RT in each paper consisted of mean and percentages of RT below 8 min. The way the results were compared in terms of the indicators used (i.e., comparison of means, comparison of percentile and the national standard, or comparison of mean and the percentile standard) and the final evaluations made on EMS performance were extracted.

Evaluation of studies

The key terms were searched in the selected databases, yielding 110 articles. Two researchers studied independently both titles and abstracts of the papers, whereby 33 articles were found relevant to the purposes of the current study. Afterward, the full text of the articles were prepared and

examined. Nonetheless, some of the papers were excluded in this stage: three papers reported RT in other medical fields, two were repetitious, three were published in both Persian and English, two used results from other studies, and finally, two were merely presented in conferences. Given the purpose of the study, which was a critical enquiry into EMS performance assessment reports, all the relevant papers were included irrespective of their quality. Two researchers completed the previous steps independently, and inconsistencies were relieved by mutual consultation. A total of 21 papers were ultimately included in the study; the characteristics of which are detailed in Figure 1.

RESULTS

Having examined the databases, the researchers found 21 full-text papers eligible for the purposes of this study. They were published from 2007 to mid-2016, and none were excluded given the critical nature of this review. Table 1 displays the details of the papers.

The majority of the papers (71%) were conducted in the last 4 years (2013–2016), and 61% of them were published in English. The studies were performed in different cities with none performed on the national scale. A vast majority of the studies (90%) were cross-sectional and performed during a limited period. Only two papers compared RT changes over different time points.

In the studies under focus, RT was reported in different ways. From among the 21 papers focusing on RT, seven (33%) reported RT as percentages of operations performed in <8 min. Four papers reported both mean and percentile indicators for RT concurrently. A total of 18 (86%) papers reported RT mean.

RT was examined differently in the studies. The seven articles which presented RT in percentile had the opportunity to and made comparisons against the national standard. From among the papers which reported on RT mean, 14 compared their resultant means with those of other studies in Iran or those of other countries.

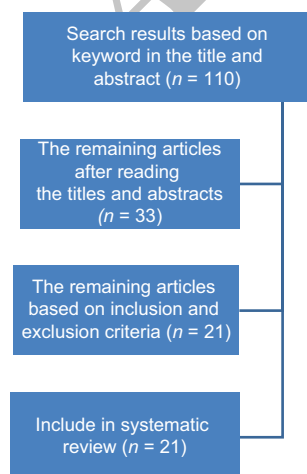


Figure 1: Flowchart of systematic review

The nine articles which reported RT based on means had made comparisons with the national standard – which uses a percentile indicator – and had made conclusions about reaching the standard time limit.

All the papers had in some way judged about EMS performance with 76% approving the status quo. The results of the studies are summarized in Table 2.

CONCLUSIONS

The findings indicate that the heterogeneity in reporting and assessing RT imposes a constraint on using the published data to judge achievement of standards and also leads to the following challenges in EMS performance assessment.

The manner to report response time

The results of the review indicate that the approach to report the acquired RT is dissimilar in different studies. Given the status of the national standard, which is to reach the victim in <8 min in 80% of cases, it is expected that the acquired RT is reported <8 min. Under this circumstance, it would be possible to compare the results of this study with the standard and the results of other studies.

In spite of the status of the national standard of RT, only some studies (33%) have reported cases <8 min. In contrast, it was RT mean that was expressed in most of the studies. Although RT is expressed traditionally in terms of mean, using mean as an indicator means that half of the missions would last beyond the desirable indicator. Using percentile is a more appropriate statistical technique and indicates that an acceptable percentage of the operations has been performed at the right.^[13,49]

To use RT as a criterion to assess and compare performance, RT must be reported in the same way in all EMS.^[10] It is because the difference in RT calculation procedure in different studies will lead to different results.^[1]

RT reports are more valid in percentile and depict a more reliable picture than EMS temporal performance.^[15] It seems that failure to report RT based on the national standard is a major challenge to assessing EMS performance in Iran. Therefore, it is necessary to extract and declare RT in percentile points and according to the Iranian national standard.

Comparison of response time with the standard

Results also indicated that like the limited application of the national standard to express RT, the national standard was used in a limited manner to assess EMS performance. Given the percentile description of the national standard, only one-third of the studies reported the operations made within 8 min in percentile, holding the opportunity to compare their results with the national standard. The majority of the studies used mean to assess EMS performance, impeding from comparison with the national standard. RT means reported in these studies can be compared with those of other studies conducted inside or outside Iran in dissimilar time and places. However, the circumstances are not similar,

Table 1: Summary of data about included studies and the details of the papers

Authors	Title	Study place	Sample size	Study design	Study time	Language	References
Safarabadi <i>et al.</i> , 2016	The Performance of Emergency Medicine Services for Patients with Suspected Acute Coronary Syndrome, Arak, Iran	Arak	374	Cross-sectional	2011-2012	English	[28]
Delshad <i>et al.</i> , 2016	The Effect of Applying Global Positioning System in Ambulances on Response Time of Tehran Emergency Medical Service	Tehran	Missions of 24 station	Descriptive	2009-2011	English	[29]
Mohammadi <i>et al.</i> , 2015	The Evaluation of Time Performance in the Emergency Response Center to Provide Prehospital Emergency Services in Kermanshah	Kermanshah	500	Cross-sectional	2012-2013	English	[30]
Kazamnaghad <i>et al.</i> , 2015	Quality survey of prehospital emergency services in Gilan province	Rasht	4374	Descriptive	2013	Persian	[31]
Peyravi <i>et al.</i> , 2015	Does temporary location of ambulances ("fluid deployment") affect response times and patient outcome?	Shiraz	1571	Prospective	2012-2013	English	[32]
Paravar <i>et al.</i> , 2014	Prehospital Care and In-hospital Mortality of Trauma Patients in Iran	Kashan	2000	Retrospective	2010-2011	English	[33]
Aghababaeian <i>et al.</i> , 2014	Investigation of Causes, Time Indices, and Results of Pediatric Prehospital Emergency Missions in Emergency Medical Centers	Dezful	594	Cross-sectional	2011-2012	Persian	[34]
Bahrapouri <i>et al.</i> , 2014	Diagnosis and Transfer of Stroke Patients by Emergency Medical Services: Case of Vali-Asr hospital, Arak	Arak	231	Descriptive cross-sectional	2010-2011	English	[35]
Gholipour <i>et al.</i> , 2014	Success Rate of Prehospital Emergency Medical Service Personnel in Implementing Prehospital Trauma Life Support Guidelines on Traffic Accident Victims	Tabriz	100	Cross-sectional	2011	English	[36]
Monsef <i>et al.</i> , 2014	Investigate time period and associated factor in delivering emergency services, Guilan	Guilan	141	Cross-sectional	2011-2013	Persian	[37]
Rahbar Taramsari <i>et al.</i> , 2013	Assessment of prehospital emergency performance in missions of 115 emergency bases of Rasht, Iran	Rasht	4012	Cross-sectional	2007-2008	English	[38]
Peyravi <i>et al.</i> , 2013	An Overview of Shiraz Emergency Medical Services, Dispatch to Treatment	Shiraz	68,021	Retrospective analytic study	Compare 1999-2000 with 2011-2012	English	[39]
Paravar <i>et al.</i> , 2013	Prehospital Trauma Care in Road Traffic Accidents in Kashan, Iran	Kashan	1600	Retrospective	2011-2012	English	[40]
Hajinabi <i>et al.</i> , 2013	The Relationship between Prehospital Time Indices and On-Scene Death Rate in Traffic Accidents in the 22 regions of Tehran	Tehran	68,355	Correlation	2011-2012	Persian	[41]
Moradian <i>et al.</i> , 2013	Studying the Time of Response and Results of Delay in Emergency Medical	Shiraz	6068	Cross-sectional	2012	Persian	[42]
Soltani <i>et al.</i> , 2012	Predicting the time required for Eslamshahr Township emergency personnel to attend at the scene of a disaster	Eslamshahr	4267	Cross-sectional	2007-2008	Persian	[43]
Bahrami <i>et al.</i> , 2011	Prehospital Emergency Medical Services in Developing Countries: A Case Study about EMS Response Time in Yazd, Iran	Yazd	11,961	Survey	2008-2009	English	[44]
Bigdeli <i>et al.</i> , 2010	Prehospital care time intervals among victims of road traffic injuries in Iran. A cross-sectional study	Urmia	2027	Cross-sectional	2005-2007	English	[45]

Contd...

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Table 1: Contd...

Authors	Title	Study place	Sample size	Study design	Study time	Language	References
Peyravi <i>et al.</i> , 2009	The Efficiency of Motorlance in Comparison with Ambulance in Shiraz, Southern Iran	Shiraz	46,133	Cross-sectional	2006-2007	English	[46]
Panahi <i>et al.</i> , 2007	Prehospital Emergency Service for Internal Medicine Problems in pediatrics; Causes, Time Indices. and Outcomes	Tehran	717	Retrospective	2005-2006	Persian	[47]
Bidari <i>et al.</i> , 2007	Quality Assessment of Prehospital Care Service in Patients Transported to Hazrat-e-Rasoul Akram Hospital	Tehran	500	Cross-sectional	2004	Persian	[48]

highlighting the necessity for a standard indicator in order for valid conclusions.

Establishment of a national standard provides the opportunity to assess performance on regional and national scales and improve performance. Comparison of the obtained RT and the national standard is necessary to gain confidence about whether the objectives are fulfilled or to provide feedback to the EMS system to apply proper interventions and modifications.^[1,15] However, the different RT assessment approaches have resulted in discrepancy in the obtained results^[50] and have turned into a challenge as for comparability of the findings.

Discrepancy in assessment

The discrepancy observed concerned with comparisons made in some studies of the RT mean and the national standard which is in percentile. Based on this, they made conclusions about obtaining standard. Reasonably enough, RT expressed in terms of mean and percentile are not comparable, a discrepancy that leads to vagueness and invalidity of conclusions made in some of the studies.^[3,51] It seems that a comparison of these two unparalleled scales (i.e. mean and percentile) is a challenge to EMS performance assessment, limiting clarity of the results reported in the studies.

Limited regional and cross-sectional studies

The results report findings from cross-sectional and short-term examinations in certain areas of Iran. Only a few studies have monitored RT change over time and attainment of RT standard on the national scale. Nonetheless, it is necessary to assess EMS performance on national scale and investigate change trend in different periods to inquire into the effects of interventions performed.

Other studies have emphasized lack of national statistics on time intervals.^[51] Performance assessment and service improvement require collecting and comparing the data continuously.^[52] System requirements, evidence-based guidelines for system improvement, budget determination, policy-making, and research objectives can be developed by specifying the EMS systems' performance criteria and their changing procedure.^[53]

Unfortunately, there are significant differences in the reports about EMS performance in Asia which makes it difficult to

compare EMS performance indicators. Thus, collaboration is needed to create a uniform information system. EMS performance assessment based on the implemented indicators and publishing the results will lead to increased accountability in EMS and also the creation of organizations which provide sufficient information for performance assessment and strategic planning.^[54]

The national standard can be used to assess, monitor performance, and assess the effectiveness of instructions in EMS systems. It can also be used to answer the question "How do EMS improve patient care?"^[2,3] In spite of the need for EMS development in developing countries, there are several challenges in the reports on EMS systems' performance criteria.^[54] Quality improvement and monitoring EMS systems' performance have been less emphasized in such countries.^[16] Clarity and accountability in EMS systems' performance are necessary and must be prioritized because of these challenges.^[55] In fact, clarity is the key to adequate care and is necessary to ensure that EMS accountability is fully performed.^[56]

Although determining the national standard for RT is an opportunity to improve the quality of EMS, limited use of the national standard to report RT and EMS systems performance assessment may impede assessment of the status quo and the effect of quality improvement programs. Using heterogeneous data will also lead to vague judgments about the national standard. Despite the fact that pre-hospital emergency system was established in Iran in 1975,^[57] the gap is felt for a uniform and inclusive method for performance assessment to improve clarity and accountability.

Suggested strategies to resolve challenges

It is necessary to establish a uniform extraction process and compare EMS systems' performance according to the national standard at specified periods on both national and regional scales and record the results in a national integrated information system. Thus, it is suggested to use external assessment and implement accreditation for clarity and accountability of EMS.

Suggestions for future studies

It is necessary to design profound, qualitative studies to find solutions to barriers and challenges of clarity and

Table 2: Key findings of studies about assessing emergency medical services performance with response time national standard

Goal	Report of percentage >8 min	Report of mean	Compare mean with mean	Compare percentage and percentage	Compare mean and percentage	Conclusion of compare
Investigate the EMS performance to find its defects	-	5.9	+	-	+	Desirable
Identification of the effective factors in reducing response time in ems	-	9.86	+	-	-	Improvement
Evaluate the time performance in the emergency response center	-	7.28	+	-	+	Better than the standard
To assess quality of prehospital emergency based on national standards	81.8	-	-	+	-	Better than the standard
Evaluate the response times and outcome of patients in permanently and temporarily stationed ambulances	49	12.39	+	+	-	Need to improvement
Determine the effect of prehospital time for trauma patients	-	6.6	-	-	-	Acceptable
Survey the causes and time and place indices of pediatric prehospital emergency	-	5.53	+	-	-	Acceptable
Investigate the diagnosis and transfer of stroke patients by EMS	68.4	6.9	+	+	-	Need to improvement
Study of the success rate of PHEMS personnel in implementing PHTLS guidelines	-	13.35	+	-	-	Not acceptable
Investigation time period and associated factors in delivering emergency services	-	7	-	-	+	Meet the standard
To describe current status of ems to compare with global standards	-	6.18	+	-	+	Better than the standard
Evaluate the current situation of Shiraz's EMS by comparing data obtained during two different time periods	-	10.50	+	-	-	Improvement
Evaluating prehospital trauma care	-	6.6	+	-	+	Satisfactory
Determining the relation between Prehospital time indices and on-scene mortality rate in traffic accidents	-	13.65	-	-	+	Below standard
Investigate the causes of delay in emergency missions	2.5	-	-	+	-	Below standard
Evaluate arrival time of ems in scene	-	5.36	+	-	+	Better than the standard
Calculate the response time in EMS stations of Yazd, Iran	81.1	-	-	+	-	Acceptable
Estimate the average of various time intervals occurring during the prehospital care process	90	5	+	+	-	Better than the standard
Evaluate the impact of using motorcycles on arrival time of EMS technicians to the scene	-	7.5	+	-	+	Better than the standard
Assessment of time indices of service providing by EMS	8.5	15.1	+	+	-	Acceptable
Qualitative performance evaluation of emergency medical services and compare with standard	-	12.54	-	-	+	Below standard

EMS: Emergency medical services, +: The item is presented in the article, -: Item not presented in the article

accountability in EMS. In addition to examining the approach to assess RT, the approach to extract RT in the Iranian context requires revision.

Given the increased number of studies on EMS performance assessment in recent years, it is recommended to conduct a systematic review of prehospital emergency RT in Iran using reliable studies published in this field.

Study limitations

In light of the purpose and critical point of view of the present study, all studies on EMS performance assessment using RT were included in the study. Examination of unpublished data and the reports available on the websites on prehospital emergency centers was not among the objectives of the study.

Using only Persian and English was also another limitation of this study.

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Conflicts of interest

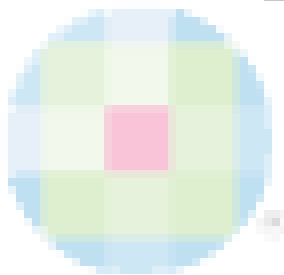
There are no conflicts of interest.

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