# Epidemiological study on cardiac emergencies in Indian states having GVK Emergency Management and Research Institute services

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## ABSTRACT

**Background:** Emergency medical service (EMS) is critical for the healthcare system as it saves lives by providing care immediately. Rapid access to medical care after a major cardiovascular event decreases morbidity and mortality. GVK Emergency Management and Research Institute (GVK EMRI) is a pioneer in emergency management services operated as a public private partnership (PPP) with various state governments. GVK EMRI coordinates medical, fire, and police-related emergencies through a single toll-free number, 108, across 15 states and 2 union territories of India. **Material and Methods:** This is a retrospective study of reported cases of cardiac emergencies in 2015 across 11 states with GVK EMRI services: Andhra Pradesh, Telangana, Assam, Goa, Gujarat, Karnataka, Madhya Pradesh, Meghalaya, Rajasthan, Tamil Nadu and Uttarakhand. Descriptive statistics using frequencies, proportions and means were calculated. **Results and Discussion:** This study aimed to describe the epidemiology of cardiac emergencies presenting to GVK EMRI across 11 states in India in 2015. There were increased cases of cardiac emergencies reported by higher age group individual across all states. The mean age was reported between 43 years to 62 years across the states. In this study, men called EMS for cardiac emergencies more often than women, except in the state of Gujarat. A higher number of cardiac emergency cases were reported by individuals living below the poverty line in Andhra Pradesh, Telangana, Assam, and Goa. Often (82.8%) people called 108 greater than six hours of symptom onset. Variation in call volume per day was minimal between the days of the week. At 48 hours, there were 2,675 reported deaths (1.1%). **Conclusions:** The current study stresses the scale and seriousness of the emerging challenge of cardiac emergencies, with particular emphasis on socioeconomic deprived groups in the operated states of GVK EMRI.

Key words: Emergency medical services (EMS), cardiac emergencies, cardiovascular disease (CVD)

### INTRODUCTION

It is estimated that by 2020, cardiovascular disease (CVD) will be the largest cause of disability and death in India. The country already has more than 118 million people with

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hypertension, which is expected to increase to 213 million by 2025.<sup>[1.3]</sup> Within CVD, coronary heart disease (CHD) and congestive heart failure are major contributors to

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the disease burden. CHD has led to an estimated 23% of deaths across all age ranges and 32% of adult deaths from 2010 to 2013.<sup>[4]</sup> In 2010, it was the leading cause of disability-adjusted life years worldwide (up from fourth in 1990 and increased by 29%).<sup>[5]</sup>

Cardiac emergency conditions are life-threatening situations that need immediate identification, and delays in the management could lead to morbidity or mortality. Patients with cardiac emergencies may present in a variety of ways, including hypotension or severe hypertension, chest pain, abnormal cardiac rhythms, or cardiac arrest. Specifically, acute coronary syndrome refers to any group of clinical symptoms compatible with acute myocardial ischemia and includes unstable angina, non-ST-segment elevation myocardial infarction, and ST-segment elevation myocardial infarction. These high-risk manifestations of coronary atherosclerosis are the important causes of the use of emergency medical care and hospitalization.<sup>[6]</sup>

In addition, cardiac arrhythmias, such as bradycardia (heart rate <50/min) and tachycardia (heart rate >100/min), require rapid therapeutic intervention. Myocarditis is an acute infectious or immunologic syndrome that is uncommon but can be devastating with limb-threatening and life-threatening potential. Clinically, patients may present with fulminant myocarditis, manifested by cardiogenic shock.

Chest pain is a common symptom among patients contacting emergency medical service (EMS). Risk stratification of these patients is warranted before arrival to the hospital regarding likelihood of an acute life-threatening condition (LTC). There is strong evidence for an increased risk of an acute LTC with increasing age, male gender, elevated heart rate, low systolic blood pressure, and ST elevation or ST depression on a 12-lead electrocardiogram.<sup>[7]</sup>

EMSs are an essential part of the overall healthcare system as it saves lives by providing care immediately. These services are not limited to actual in-hospital treatment, from hospital arrival to stabilization but include prehospital care and transportation.<sup>[8]</sup> The World Health Organization regards EMS systems as an integral part of any effective and functional healthcare system.<sup>[9]</sup> It is the first point of contact for the majority of people to healthcare services during emergencies and life-threatening injuries and can connect people to necessary secondary and tertiary healthcare services.<sup>[10,11]</sup> India faces a growing number of emergencies amenable to EMS care and requires a stronger EMS system.<sup>[12]</sup> GVK Emergency Management and Research Institute (GVK EMRI) has been providing comprehensive emergency services, in partnership with various state governments, by running a single toll-free number 108 in 17 states and union territories across India.<sup>[13]</sup> The aim of this study is to describe the epidemiology of suspected cardiac emergencies presenting to GVK EMRI across 11 states in India in 2015.

# **MATERIALS AND METHODS**

This study is a retrospective study of reported cases of cardiac emergencies in 2015 across 11 states with GVK EMRI services: Andhra Pradesh, Telangana, Assam, Goa, Gujarat, Karnataka, Madhya Pradesh, Meghalaya, Rajasthan, Tamil Nadu, and Uttarakhand.

Data were collated from three sources. First, data are collected via emergency response officers in each state's central call center and stored as computer telephonic integrity (CTI) data. CTI data contain patient demographics, location, and contact information. Second, prehospital care records (PCRs) are forms filled out by EMTs after a patient has been transported to a hospital. PCRs contain information on operational characteristics, including distances travel, time per distance traveled, patient characteristics, prehospital care provided, and hospital to which the patient was transported. Third, GVK EMRI strives to complete 48-h follow-up on all patients who use transport services. All of these data sources (CTI, PCR, 48-h follow-up) are linked by a single incident ID.

All calls categorized as "cardiac emergency" or "chest pain" by the emergency response officer after speaking with the patient were included in this study.

Around 248,828 reported cardiac emergency cases were selected for the study.

We reviewed calls for age, gender, social status, economic status, total time from call to hospital arrival, response time (time from EMS dispatch to ambulance arrival at scene), hospital admission, and 48 h mortality or status, if alive. A patient's status at 48 h was categorized as "alright and discharged from hospital;" "stable, out of danger but still in the hospital;" "critical and still in the hospital;" or "expired." Descriptive statistics using frequencies, proportions, and means were calculated.

# RESULTS

In 2015, there were 248,828 cardiac emergency cases across these 11 states of GVK EMRI. The reported pattern

follow-up,	<b>GVKEr</b>	nergen	cy Mana	gement	CITVE IN	1.5100	j															
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		(%)												(%)						(%)		
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Weekday	Total	21,079		7297		18,530		2765		46,157		41,917		0		350		15,785		58,703		3733
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Saturday	2961	14	677	13	2538	14	410	15	6533	14	6123	15	NA	NA	38	11	2278	14	8282	14	560	15
Response time	Total	12 0 2		1187		18,531		2765		46,157		41,917		25,176		350		15,785		58,703		3733
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Case closing	Total	15,778		6103		17,428		1925		44,608		39,662		24,983		147		15,103		29,626		3027
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Table 1: Co	ntd																					
Characteristics	Andhra Pradesh	Andhra Pradesh (%)	Telangana	Telangana (%)	Assam	Assam (%)	Goa	Goa Gu (%)	jarat Gu	jarat Ka %)	arnataka K	arnataka (%)	Madhya N Pradesh P	ladhya I radesh (%)	Meghalaya I	Meghalaya (%)	Rajasthan	Rajasthan (%)	Tamil Nadu	Tamil I Nadu (%)	Uttarakhand	Jttarakhand (%)
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of cardiac emergency cases varied by the state was not proportional to individual state size. Sociodemographic analysis [Table 1] showed a mean age of 50 years for the entire study population. However, there was a considerable range in mean age by state (from Tamil Nadu: 43 years to Uttarakhand: 62 years). Many patients (37.7%) were older than 58 years. Over half of patients were men (57.1%), except in Gujarat (42% men). Almost half of patients lived below the poverty level (46.4%).

More number of cases was reported to GVK EMRI and sought 108 EMS services in after 6 h in the operated states. The variation observed among the week days was minimal as far as the number of cases being reported for medical emergency services.

We were unable to calculate response times for 13.4% of the records (n = 33,322). Of the remaining records, the response time was defined as the interval of the notification for the emergency ambulance service and arrival of the ambulance at the victim's location. A good number of victims were provided the emergency service with response time of <8 min and response time was under 8 min in 22.8% of cases (n = 49,168). However, lower mean response time (in minutes) was observed in Goa and Gujarat as 15 and 16 min, respectively. Mean response times by state ranged from 15 min in Goa to 32 min in Assam.

Only 17.2% (n = 41,312) of patients called within 6 h of symptom onset. There were 7458 cases of patients who died before the ambulance arrived (3.0%), with some states having much higher rates: Tamil Nadu 2831 (10%) and Andhra Pradesh 1369 (9%). The follow-up rate at 48 h was 45.5% and varied greatly between states (1% and 93%). At 48 h, there were 2675 reported deaths (1.1%).

# **DISCUSSION**

The present study reported on epidemiological profile of reported cardiac emergencies in 11 GVK EMRI operated states of India. CVD, especially CHD, is epidemic in India and India must have the critical prehospital EMS infrastructure to respond to cardiac emergencies from CVD.

In this study, patients over the age of 58 years represented the highest volume of cardiac emergencies compared to other age groups. The mean age for all states was 52 years, which is similar to literature reporting the mean age for initial presentation of acute myocardial infarction in Indians as 53 years.<sup>[14]</sup> One limitation of this study is that we do not have a final diagnosis for patients using 108 for cardiac emergencies. Therefore, we do not know what proportion of these calls is for acute myocardial infarction.

Gender differences have been reported in earlier studies as an established risk factor for CHD, with reports of higher incidence among men than women.<sup>[15-20]</sup> The present study also found that calls for cardiac emergencies were predominantly for men. However, this may be confounded by a greater likelihood of men to use EMS for any chief complaint. Further research will need to investigate gender differences in the use of EMS and compare this to the cardiac emergency population.

The relationship of socioeconomic status to CVD is changing as the epidemic evolves.<sup>[21]</sup> The current research shows that socioeconomically disadvantaged individuals now carry the dominant burden of CVD and its associated risk factors.<sup>[22,25]</sup> In this study, most of the callers were from a poorer socioeconomic, rural background, and/or backward castes. However, this may reflect larger patterns of GVK EMRI 108 service utilization. Individuals from higher socioeconomic groups may have greater access to other modes of transportation and do not need to utilize this free service. This study reveals that people from lower socioeconomic strata use a free EMS system more often than those from upper economic strata. There was also preliminary evidence that the burden of CVD in rural areas is increasing.<sup>[26]</sup>

Twenty-three percent of cases the response time were found to be within 8 min, a referenced standard for EMS.<sup>[27]</sup> Vukmir in his study found that response time affects the survival rate in cardiac emergencies.<sup>[28]</sup> The mean response time varied in different states and likely due to different landscape and terrains across different operating states. Although the response times were comparable with the rest of the world, we believe that such times need to improve to provide the best quality care.

Further research is necessary to evaluate similar EMS data and identify ways to capture their full utility.

## **CONCLUSIONS**

In cardiac emergencies, ambulance based emergency medical services are the important link in the chain of survival. In view of the time sensitive interventions required in cardiac emergencies and anticipated growing burden of CVDs, such EMS services should be available throughout the country including rural areas on high priority.

Close monitoring of the response time of EMS is critical. Plans should be in place to further reduce the

current response times. Training of Emergency Response Officers and involvement of Emergency Response Center Physicians in cardiac emergencies may have higher survival rates and desired prognosis.

Bystander CPR, Public Access AED and Telephone CPR are strongly recommended in case of sudden cardiac arrest situations. EMT education and re-education should remain to be a continuous endeavor. Protocol adherence by pre hospital care providers and ERC Physicians in providing On Line Medical Direction can reduce deaths and enable appropriate management of cardiac emergencies. Pre arrival information including ECG transmission should be considered even in India at the earliest. Communities, EMS and hospital based care should have care continuum. Cardiac emergency education, training and research at basic and advanced levels of care should remain high in Non Communicable Diseases agenda at the national level.

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#### **Conflicts of interest**

There are no conflicts of interest.

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