

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

hypertension, which is expected to increase to 213 million by 2025.^[1-3] 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.^[4] In 2010, it was the leading cause of disability-adjusted life years worldwide (up from fourth in 1990 and increased by 29%).^[5]

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.^[6]

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.^[7]

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.^[8] The World Health Organization regards EMS systems as an integral part of any effective and functional healthcare system.^[9] 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.^[10,11] India faces a growing number of emergencies amenable to EMS care and requires a stronger EMS system.^[12]

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.^[13] 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

Table 1: Percent distribution of reported cardiovascular disease emergencies by type of ambulance, ERCP advice, case closing management, and victim's status after 48 follow-up, GVK Emergency Management and Research Institute operated states in India

Characteristics	Andhra Pradesh	Andhra Pradesh	Telangana	Telangana	Assam	Goa	Goa	Gujarat	Gujarat	Karnataka	Karnataka	Madhya Pradesh	Madhya Pradesh	Meghalaya	Meghalaya	Rajasthan	Rajasthan	Tamil Nadu	Tamil Nadu	Uttarakhand	Uttarakhand
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Age group	Total	18,579	6531	18,530	2575	45,500	41,917	25,525	347	15,785	58,703	3733	3733	3733	3733	3733	3733	3733	3733	3733	3733
0-17	411	2	189	3	75	2	1257	4	31	7	1499	3	4	151	4	151	4	151	4	151	4
18-27	1326	7	623	10	182	10	3436	11	57	6	3565	6	11	1006	6	3565	6	3565	6	3565	6
28-37	2077	11	965	15	284	11	4724	13	40	12	6356	11	13	1680	11	6356	11	6356	11	6356	11
38-47	3901	17	1111	17	3261	17	6762	16	40	12	11061	19	19	2831	18	11061	19	11061	19	11061	19
48-57	3109	21	1256	19	4549	25	8658	21	59	17	14596	25	25	3178	20	14596	25	14596	25	14596	25
58+	7755	42	2387	37	1228	48	17485	38	110	32	21626	37	37	5975	38	21626	37	21626	37	21626	37
Mean age (in years)	50	47	47	46	53	50	45	57	45	48	43	62	62	62	62	62	62	62	62	62	62
Gender	Total	18,579	6531	18,530	2746	45,574	41,917	26,431	348	14,993	58,703	3681	3681	3681	3681	3681	3681	3681	3681	3681	3681
Male	10,661	57	3669	56	1612	59	25,310	60	197	57	58,703	61	61	11259	57	58,703	61	58,703	61	58,703	61
Female	7918	43	2862	44	1134	41	16,607	40	151	43	23,445	39	39	3734	43	23,445	40	23,445	40	23,445	40
Social status	Total	18,520	6473	18,530	2592	45,458	41,917	25,525	347	15,785	58,703	3583	3583	3583	3583	3583	3583	3583	3583	3583	3583
SC	5608	30	1940	30	1762	10	6947	17	12	4	20,524	17	17	NA	4	20,524	35	20,524	35	20,524	35
ST	1024	6	593	9	1896	6	2718	6	264	84	570	1	1	NA	84	570	1	570	1	570	1
BC	7932	43	2935	45	4832	26	15,909	38	NA	2	36,767	63	63	NA	1	36,767	63	36,767	63	36,767	63
OC	3956	21	1005	16	10,040	54	16,343	39	35	11	842	1	1	NA	11	842	1	842	1	842	1
Economic status	Total	18,375	6377	18,530	2605	45,385	41,917	25,525	347	15,785	58,703	3250	3250	3250	3250	3250	3250	3250	3250	3250	3250
Below poverty line (white card)	17,872	97	6054	95	14,525	78	6830	16	46	13	0	1032	1032	1032	1032	1032	1032	1032	1032	1032	1032
Above poverty line (pink card)	503	3	323	5	937	36	35,087	84	NA	296	NA	68	68	NA	87	NA	NA	58,703	100	2218	68
Call time (h)	Total	21,079	7297	18,530	2634	46,157	41,917	23,728	346	15,785	58,703	3733	3733	3733	3733	3733	3733	3733	3733	3733	3733
0-6	4348	21	1572	22	506	19	6833	16	3715	16	12,381	21	21	1080	13	12,381	21	12,381	21	12,381	21
6-12	5778	27	1851	25	688	26	9856	24	6553	28	17,770	30	30	5216	23	17,770	30	17,770	30	17,770	30
12-18	5297	25	1680	23	739	28	12,331	29	5786	24	13,374	23	23	4898	35	13,374	23	13,374	23	13,374	23
18-23	5656	27	2194	30	701	27	12,897	31	7674	32	15,178	26	26	4591	29	15,178	26	15,178	26	15,178	26
Weekday	Total	21,079	7297	18,530	2765	46,157	41,917	25,525	347	15,785	58,703	3733	3733	3733	3733	3733	3733	3733	3733	3733	3733
Sunday	2839	13	1024	14	393	14	5774	14	NA	NA	7844	13	13	2101	15	7844	13	7844	13	7844	13
Monday	3199	15	1048	14	391	14	6108	15	NA	NA	8711	15	15	2302	16	8711	15	8711	15	8711	15
Tuesday	3060	15	1059	15	398	14	5773	14	NA	NA	8317	14	14	2257	15	8317	14	8317	14	8317	14
Wednesday	2997	14	1034	14	392	14	6035	14	NA	NA	8639	15	15	2258	14	8639	15	8639	15	8639	15
Thursday	2987	14	1060	15	380	14	6102	15	NA	NA	8569	15	15	2299	16	8569	15	8569	15	8569	15
Friday	3036	14	1095	15	401	15	6002	14	NA	NA	8341	14	14	2280	12	8341	14	8341	14	8341	14
Saturday	2961	14	977	13	410	15	6123	15	NA	NA	8282	14	14	2278	11	8282	14	8282	14	8282	14
Response time (in min)	Total	1202	1187	18,531	2765	46,157	41,917	25,525	347	15,785	58,703	3733	3733	3733	3733	3733	3733	3733	3733	3733	3733
0-8	231	19	44	4	992	36	11,129	27	4413	18	15,596	27	27	2058	21	15,596	27	15,596	27	15,596	27
9-15	954	45	2372	33	733	27	8737	21	3836	15	12,582	21	21	2189	20	12,582	21	12,582	21	12,582	21
16+	952	79	1052	89	1040	38	22,051	53	16,927	67	30,525	52	52	11,538	59	30,525	52	30,525	52	30,525	52
Mean response time	7	18	18	32	15	16	17	34	25	28	20	35	35	28	28	20	20	20	20	20	20
ERCP advice (in min)	Total	21,079	7297	18,530	2765	46,157	41,917	25,525	347	15,785	58,703	3733	3733	3733	3733	3733	3733	3733	3733	3733	3733
Yes	9554	45	2372	33	730	25	28,113	61	3118	12	27,381	47	47	NA	50	27,381	47	27,381	47	27,381	47
No	11,525	55	4925	67	2065	75	37,491	89	22,745	88	31,322	53	53	NA	50	31,322	53	31,322	53	31,322	53
Case closing management-availed cases	Total	15,778	6103	17,428	1925	44,608	39,662	24,983	174	15,103	29,626	3027	3027	3027	3027	3027	3027	3027	3027	3027	3027

Contd..

Table 1: Contd...

Characteristics	Andhra Pradesh	Andhra Pradesh (%)	Telangana	Telangana (%)	Assam	Assam (%)	Goa	Goa (%)	Gujarat	Gujarat (%)	Karnataka	Karnataka (%)	Madhya Pradesh	Madhya Pradesh (%)	Meghalaya	Meghalaya (%)	Rajasthan	Rajasthan (%)	Tamil Nadu	Tamil Nadu (%)	Uttarakhand	Uttarakhand (%)
Closed (victim admitted at hospital)	14,241	90	5657	93	16,97	97	1814	94	43,061	97	37,684	95	23,962	96	143	97	14,941	99	26,697	90	2972	98
Closed first aid (EMT gave first aid to the victim)	168	1	71	1	330	2	62	3	118	0	1181	3	723	3	1	1	43	0	98	0	48	2
Victim expired (before ambulance reached the spot)	1369	9	375	6	181	1	49	3	1429	3	797	2	298	1	3	2	119	1	2831	10	7	0
Victims status after 48 h follow-up	Total	19,527		6823		1102		807		46,157		4399		50		296		0		23,160		3405
All right and discharged from the hospital	1511	8	959	14	0	0	690	86	25,993	56	1283	29	0	0	137	46	NA	NA	23,160	100	757	22
Expired	342	2	183	3	0	0	114	14	1615	3	320	7	0	0	31	10	NA	NA	NA	NA	70	2
Not categorized	17,674	91	5681	83	1102	100	3	0	18,549	40	2796	64	50	100	128	43	NA	NA	NA	NA	2578	76
Total availed cardiac cases	20,972		13,039		18,586		2763		46,490		41,917		26,446		378		15,798		58,703		3736	
Case closing management-unavalied cases	Total	292		301		83		0		305		425		237		0		505		1572		64
Victim already shifted	266	91	268	89	83	100	NA	NA	305	100	389	92	191	81	0	NA	501	99	1551	99	64	100
Hoax call	26	9	33	11	0	0	NA	NA	0	0	36	8	46	19	0	NA	4	1	21	1	0	0

The number of cases is shown in the table as per the reported cases of the parameters. NA: Data not available, SC: Schedule caste, ST: Schedule tribe, OC: Other caste, EMTs: Emergency medical technicians, ERCP: Emergency response centre physician

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.^[14] 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.^[15-20] 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.^[21] The current research shows that socioeconomically disadvantaged individuals now carry the dominant burden of CVD and its associated risk factors.^[22-25] 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.^[26]

Twenty-three percent of cases the response time were found to be within 8 min, a referenced standard for EMS.^[27] Vukmir in his study found that response time affects the survival rate in cardiac emergencies.^[28] 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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