

Original Research Paper:

Transporting snake bite victims to appropriate health facility to save lives through toll free emergency ambulance service in India

Background: Snakebite is a neglected public health issue in India. The big four venomous snakes are Cobra, Krait, Russell's viper and Saw scaled Viper. Estimates of annual snakebite mortality in India are upto 50,000 deaths as exact figure is not known due to snakebite not being a notifiable event.

Methods and Materials: Computer Telephonic Integrated (CTI) data of snakebite patients transported by ambulances was obtained from Emergency Response Center of 12 states out of 16 GVK EMRI operating states for the year 2014. Data analysis was done using Micro Soft Excel. Victims who complained of snakebite and decided to avail the 108 emergency ambulance service were included in this study from GVK EMRI operating 10 States and 2 Union Territories.

Results: A total of 29,231 snake bite cases were enrolled in this study period. Of these 28206 used and 1025 did not use 108 transportation. 27805 were admitted to hospital. 114 were given first aid, 168 cases expired before the EMS ambulance arrival and 72 cases expired before on way to the hospital. Type of hospitals, patients transported and admitted to were Government 23822, Private 2583 and Trust 193. Overall mean response time from base to scene was 00:22:56, at scene 00:10:06 and scene to hospital arrival was 00:47:02 (hh:mm:ss), nearer to golden hour. Out of 27805 admitted cases 8519 completed 48 hours follow up and 6050 were all right and discharged from the hospital, 1879 were stable and out of danger but still in hospital, 9 were with condition still critical-in hospital, 41-First-Aid cases and 359 had expired after 48 hours of transportation and status could not be stated in 181 cases (EMS 108 activated by bystander).

Conclusion: The GVK EMRI ambulances that are fully equipped with all life saving equipments and drugs including anti snake venom are able to save lives in critical condition of snakebite victims while they are called on toll free number. This free transportation in emergency model needs to be replicated in other parts of the country and also in high snakebite incident countries of Asia and Africa.

Keywords: Free Emergency Transportation Ambulance service and Anti Snake Venom.

33 **Introduction:**

34 Snake bites are the common cause of morbidity and mortality in tropical
 35 countries¹. According to World Health Organization estimates, between 35,000 and
 36 50,000 people die of snake bite each year². Actual global incidence of Envenomation
 37 and their severity remain largely misunderstood since the snakebite is not a
 38 notifiable incident in India³. Of the 3,000 snake species that exist in the world, about
 39 600 are venomous⁴. In India, there are 216 species of snakes, of which mainly four
 40 are venomous snakes (Cobra, Krait, Russell's viper and Saw scaled viper)⁵.
 41 Venomous snakes immobilize their prey by injecting modified saliva (venom) that
 42 contains toxins into their prey's tissues through their fangs (Fangs-specialized,
 43 hollow teeth)⁷. Snakes also use their venoms for self defense and will bite people
 44 when threatened, startle or provoke them. Snakebites caused by the families
 45 Viperidae (pit vipers) and Elapidae (kraits and cobras) are particularly dangerous to
 46 people⁴ in South and Southeast Asia. India is the country with the highest annual
 47 number of envenoming (81,000) and deaths are reported⁴. In South India, 60% did
 48 not have clinical evidence of bleeding, but demonstrated laboratory evidence of
 49 abnormal parameters. Acute kidney injury (AKI) was evident in 28% of patients and
 50 15.3% required haemodialysis²¹. Using ASV based on appropriate identification of
 51 snakes can also save ASV and victims from unnecessary side effects of ASV²².
 52 Indirect estimates of annual snakebite mortality in India that varied from
 53 approximately 1,300 to 50,000^{2, 3, 4}. Annual snakebite deaths were greatest in the
 54 states of Uttar Pradesh (8,700), Andhra Pradesh (5,200), and Bihar (4,500).⁶

55 **Objective:**

56 To study the epidemiology of snake bite cases reported to GVK EMRI (Emergency
 57 Management and Research Institute) 108 Emergency Ambulance Services operating
 58 states for the year 2014 in India. 12 states were selected for study out of 16 states
 59 and snake bite cases reported and victim status (follow up) after 48 hours was
 60 studied from the date of incident.

61 **Methods and Materials:**

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 63 It is a Retrospective secondary data analysis, based on the snake bite emergencies
 64 reported to GVK Emergency Management and Research Institute (EMRI – 108)
 65 services in the operating states. Analysis of records was done for the year 2014.

Computer Telephonic Integrated (CTI) data obtained from Emergency Response Center of 12 states out of 16 GVK EMRI operating states was studied. Data analysis was done using Micro Soft Excel. Victims who complained of snakebite and decided to avail the 108 emergency ambulance service for the period of 12 months (January to December) for the year 2014 were included in this study from GVK EMRI operating 10 States and 2 Union Territories. The states included were, 1.AndhraPradesh 2.Chhattisgarh 3.Goa 4.Gujarat 5.Himachal Pradesh 6.Karnataka 7.Meghalaya 8.Tamilnadu 9.Telangana 10.Uttarakhand and Union Territories were 1.Dadar and Nagar Haveli 2.Daman & Diu respectively.

About GVK-EMRI: GVK EMRI (Emergency Management and Research Institute) is a pioneer in Emergency Management Services in India, as a not – for – profit professional organization operating in the Public Private Partnership (PPP) mode with the respective governments funding the concept. April 2005 was the turning point for emergency medical services (EMS) in India. The EMRI organization was incepted with the objective of delivering comprehensive, speedy, reliable and quality Emergency Care Services. This has been done by establishing an Emergency Response System that coordinates every emergency related to Medical, Police and Fire through a single toll free number 1-0-8 which when called in an emergency, ensures prompt communication and activation of a response that includes, assessment of the emergency, dispatch of the ambulances, along with a well trained Emergency Medical Technician to render quality pre-hospital care and transport of the patient to the appropriate health care facility¹⁹

Limitations of the study:

The source data we have obtained unable to describe the signs and symptoms and pre-hospital treatment given by emergency medical technician (EMT) in 108 ambulance services was not documented in all states hence took very less variables for which the data is available to maintain uniformity. However we need to emphasise that ASV was given inside the ambulances to critical patients and have proved effective²⁵ as medicines to contain any adverse reaction are available inside the ambulances.

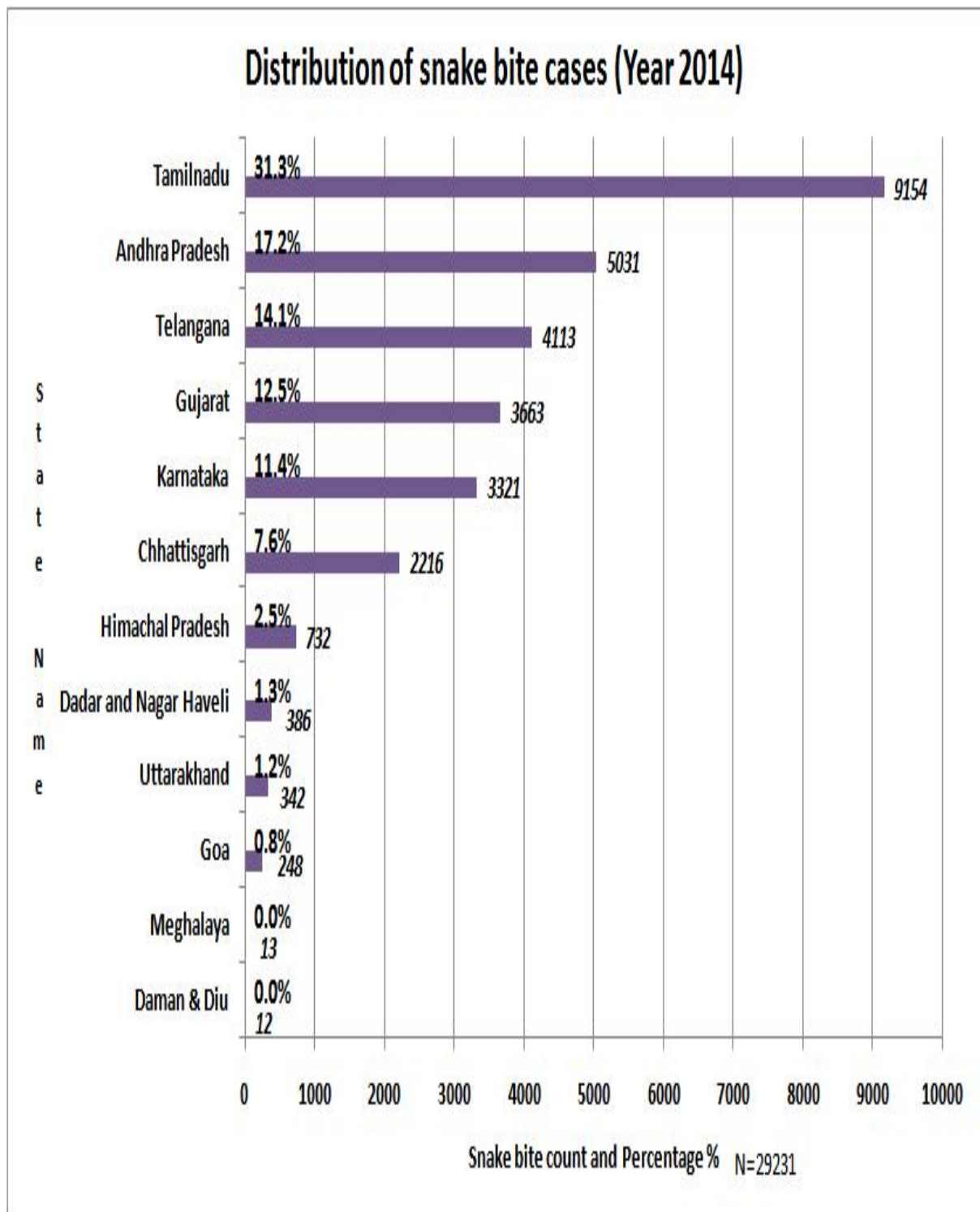
99 **Results:**

100 **Snake bite sample distribution:**

101 **Total 29,231** snake bite cases were enrolled in this study period. Of these 28206
 102 used and 1025 did not use 108 transportation. **27,805** were total hospital
 103 admitted, 114 were given first aid, 168 cases expired before the EMS arrival, and 72
 104 cases expired on reaching the hospital.

105 **Figure 1: Distribution of sample of Snake bites cases for the year 2014.**

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107 **Table 1: Monthly distribution of snake bite cases:**

State Name	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Grand Total
<i>Andhra Pradesh</i>	262	204	276	350	346	448	624	711	621	487	393	309	5031
<i>Chhattisgarh</i>	39	62	107	124	180	328	398	358	293	178	114	35	2216
<i>Dadar and Nagar Haveli</i>	15	10	19	8	21	44	83	59	35	48	34	9	385
<i>Daman & Diu</i>	1		2			2	2	1	1	3	1		13
<i>Goa</i>	23	23	15	19	26	28	17	16	12	32	18	19	248
<i>Gujarat</i>	93	95	140	158	207	294	492	606	534	526	361	157	3663
<i>Himachal Pradesh</i>	1	1	7	25	42	82	154	179	155	70	8	8	732
<i>Karnataka</i>	163	192	201	229	302	375	295	280	342	348	294	300	3321
<i>Meghalaya</i>		1			1	4		4	1	2			13
<i>Tamilnadu</i>	545	477	541	649	811	650	685	1041	1032	1158	819	746	9154
<i>Telangana</i>	196	179	217	308	325	409	579	658	508	321	275	138	4113
<i>Uttarakhand</i>		3	4	7	21	25	47	65	110	47	8	5	342
Grand Total	1338	1247	1529	1877	2282	2689	3376	3978	3644	3220	2325	1726	29231

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109 **Table 2: Hour wise distribution:**

Hour wise	Andhra Pradesh	Chhattisgarh	Dadar and Nagar Haveli	Daman & Diu	Goa	Gujarat	Himachal Pradesh	Karnataka	Meghalaya	Tamilnadu	Telangana	Uttarakhand	Grand Total
0	126	56	8		6	78	20	101	2	222	104	5	728
1	63	61	5		5	60	22	76		183	87	5	567
2	59	56	5	1	3	56	12	86		158	75	4	515
3	60	41	3		6	57	11	51		135	68	5	437
4	57	40	6		6	53	10	53		126	57	3	411
5	57	63	9		2	46	21	48		173	70	4	493
6	83	64	14		2	71	19	45		229	83	9	619
7	120	80	9		3	95	26	65		243	100	8	749
8	153	99	11		2	133	20	99	1	334	104	5	961
9	223	86	17		5	192	21	125		513	139	14	1335
10	292	115	19		7	219	39	142	1	558	206	22	1620
11	356	124	18		10	192	46	187		536	233	32	1734
12	302	95	21		13	196	32	205		555	269	23	1711
13	256	89	15		13	179	34	214	2	466	234	19	1521
14	234	74	16	1	3	174	22	207		415	223	10	1379
15	238	102	31		7	224	36	173	1	355	211	13	1391
16	223	95	17		9	185	29	187		375	211	15	1346
17	260	70	14	2	18	180	32	157	3	418	207	16	1377
18	274	120	24		13	206	35	151		448	228	20	1519
19	418	156	27		28	241	44	206	1	663	294	30	2108
20	395	173	38	2	28	311	51	228		673	324	32	2255
21	348	164	26	3	18	234	67	211	1	620	254	20	1966
22	267	103	21	2	25	173	51	198		464	189	19	1512
23	167	90	11	2	16	108	32	106	1	292	143	9	977
Grand Total	5031	2216	385	13	248	3663	732	3321	13	9154	4113	342	29231

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111 **Table 3: Distribution of total sample (availed and un-availed cases):**

State Name	Closed	First-Aid	No Emergency	Victim shifted by other ambulance	Victim Expired (Before ambulance reached the spot)	Enroute death	Service Not Required	Victim Already Shifted	Victim Not Found	Grand Total
Andhra Pradesh	4802	1			3	11	214			5031
Chhattisgarh	2033	11	8		17	17	130			2216
Dadar and Nagar Haveli	385				1					385
Daman & Diu	12									12
Goa	244						4			248
Gujarat	3518	1	3		74	33	34			3663
Himachal Pradesh	714	10		1	2	2		3		733
Karnataka	3198	90			26			2	5	3321
Meghalaya	12	1								13
Tamilnadu	8611		34		39		225	243	2	9154
Telangana	3950				3	4	156			4113
Uttarakhand	326		1		3	5	2	4	1	342
Grand Total	27805	114	46	1	168	72	765	252	8	29231

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114 **Demographics:**

115 **Table 4: Gender distribution:**

State	Male	Female	Grand Total
Andhra Pradesh	3034	1783	4817
Chhattisgarh	1030	1054	2084
Dadar and Nagar Haveli	168	216	384
Daman & Diu	11	1	12
Goa	159	85	244
Gujarat	1776	1852	3628
Himachal Pradesh	306	414	720
Karnataka	1880	1216	3096
Meghalaya	5	8	13
Tamilnadu	4683	3543	8226
Telangana	2231	1725	3956
Uttarakhand	131	198	329
Grand Total	15414	12095	27509

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118 **Table 5: Distribution of Age Group:**

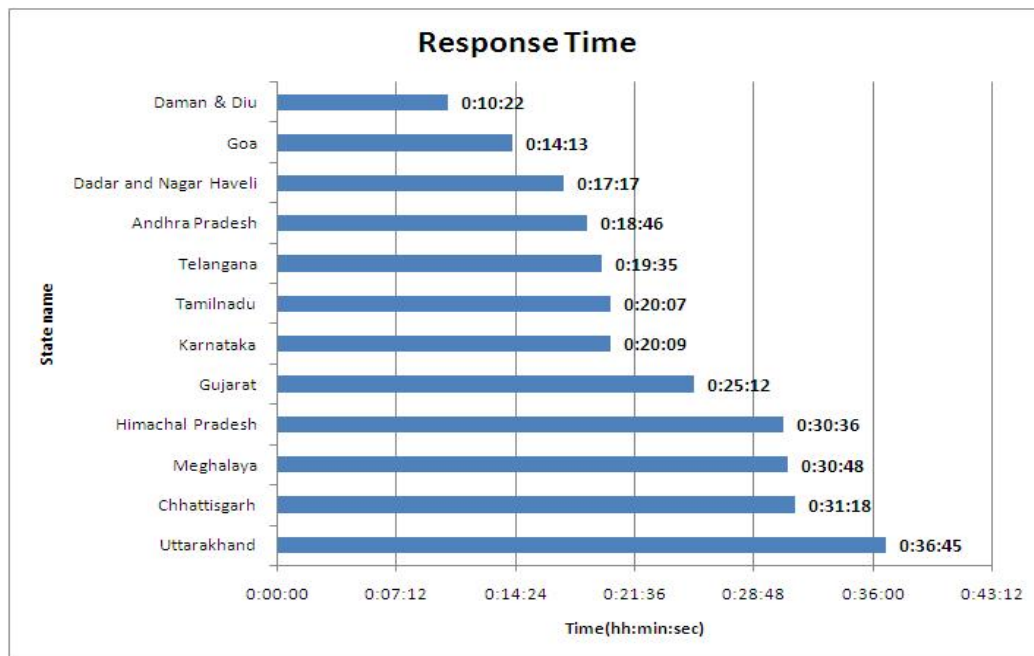
Victim Age in Years	1 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	71 to 80	81 to 90	91 to 100	> 100
Andhra Pradesh	177	559	1143	1204	918	563	214	34	4	0	1
Chhattisgarh	142	367	585	476	294	132	73	11	4	0	0
Dadar and Nagar Haveli	46	75	92	70	52	40	7	1	2	0	0
Daman & Diu	0	5	5	0	1	1	0	0	0	0	0
Goa	7	38	83	54	35	16	9	2	0	0	0
Gujarat	216	597	974	798	582	300	129	26	3	3	0
Himachal Pradesh	32	157	156	137	126	52	40	15	5	0	0
Karnataka	195	457	752	657	503	322	153	51	5	0	1
Meghalaya	3	3	4	3	0	0	0	0	0	0	0
Tamilnadu	345	944	1546	1843	1641	1188	556	138	22	1	1
Telangana	162	501	1101	948	689	385	146	21	3	1	0
Uttarakhand	16	69	93	72	31	23	22	2	1	0	0

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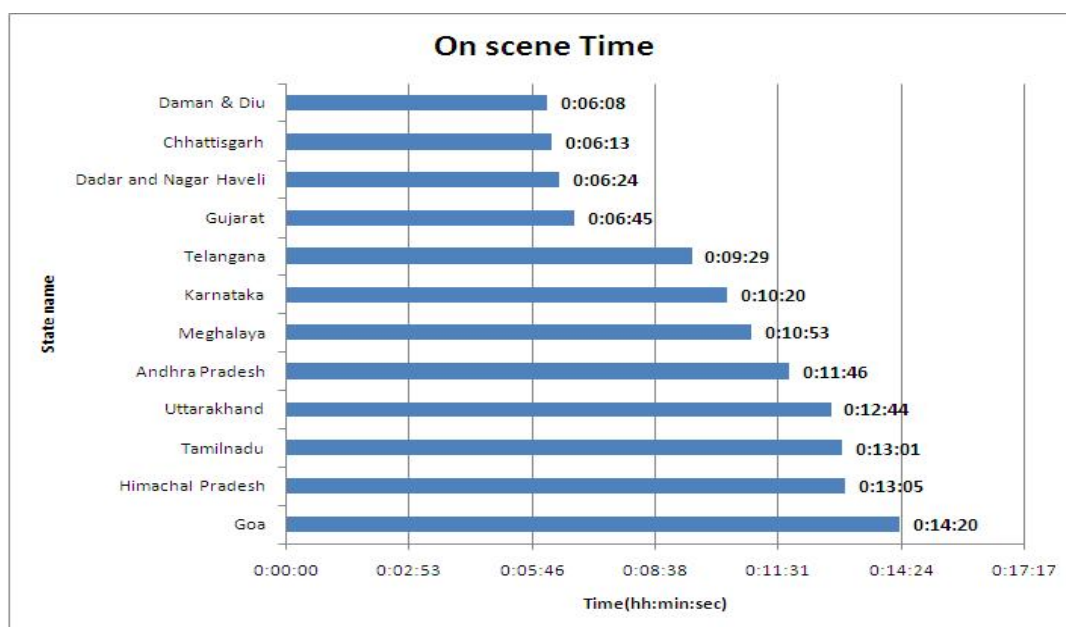
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121 **Time lines:**

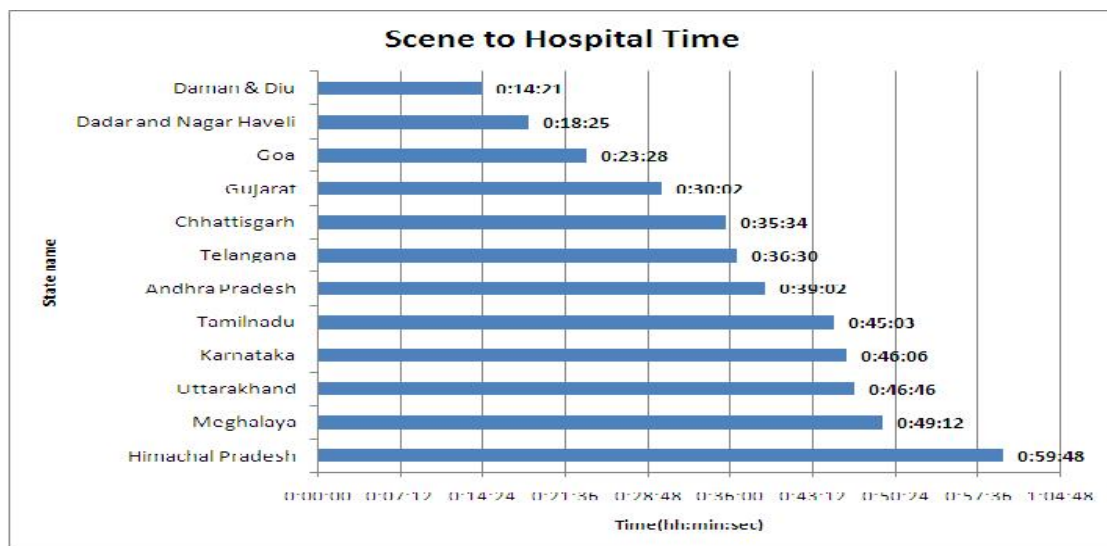
122 **Response Time (RT):** Out of the total sample received overall mean response time
 123 for activation of EMS to scene of arrival. was 00:22:56, on scene 00:10:06 and
 124 scene to hospital arrival was 00:47:02 (hh:mm:ss). As shown in (Figures 2, 3, 4)
 125 below:



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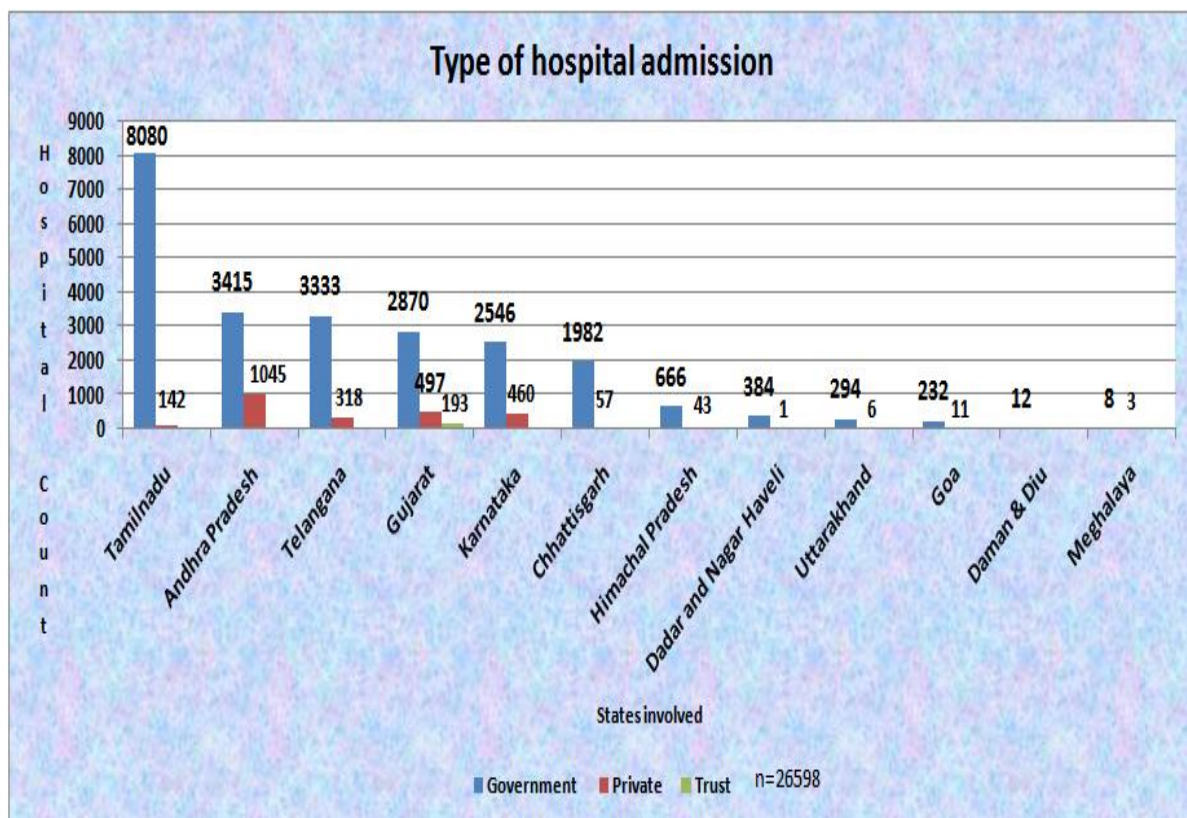


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129 **Types of hospitals admissions:**

130 Type of hospitals patients transported and admitted to various hospital were:

131 Government 23822, Private 2583 and Trust 193.



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Follow up status of victim at 48 Hours:

Out of 27805 admitted cases 8519 completed 48 hours follow up. 6050 patients were all right and discharged from the hospital, 1879 were stable and out of danger but still in hospital, 9 were having their condition as still critical-in hospital, 41-First-Aid, 359- had expired after 48 hours of transportation and status could not be stated in 181 cases (because EMS 108 activated by bystanders). We have observed that the low doses of ASV given inside the ambulances have high protective effect as observed in some studies ²⁰.

Table 6: 48 hours follow up- Victim status:

States	All right and discharged from the hospital	Stable, Out of danger, but still in hospital	Condition is still critical in hospital	First-Aid	Can't say	Expired	Grand Total
Andhra Pradesh	1555	120	1	2	53	71	1802
Chhattisgarh	670	125	1	21	16	52	885
Dadar and Nagar Haveli	160	25	2		8	1	197
Daman & Diu	3	2					5
Goa	88	5		1			94
Gujarat	1629	461	2	3	3	91	2190
Himachal Pradesh	207	93	1	10	1	13	325
Karnataka		199					199
Meghalaya	7			1			8
Tamilnadu		774				35	809
Telangana	1672	75	2	2	100	92	1943
Uttarakhand	59			1		4	64
Grand Total	6050	1879	9	41	181	359	8519

145 **Discussion:**

146 Snake bite is a neglected public health problem in India and remains an
 147 underestimated cause of accidental death in developing countries ⁶. The
 148 potentially fatal effects of being "envenomed" (having venom injected) by these
 149 snakes include widespread bleeding, muscle paralysis, and tissue destruction
 150 (necrosis) around the bite site. Bites from snakes can also cause permanent
 151 disability but mortality is less likely to occur. Existing literature about disease
 152 burden of snake bites says Young agricultural workers, especially males, are the
 153 most highly affected group, making snake bite envenoming a truly occupational
 154 disease ⁷ our study support this statement as the study results show majority of
 155 victims belong to young & actively working age group from agriculture
 156 background, rest of the incidences are while on natural calls and other domestic
 157 purposes like grass cutting etc ⁷ and The majority of the victims received snake
 158 bite to their lower extremities while walking bare foot. A small number received
 159 some sort of management within two hours of snake bite but a large number did
 160 not seek any medical care but preferred traditional remedies and went to Faith
 161 Healers ⁸. The use of traditional medicine for snake bite is a feature of most
 162 areas of the developing world where venomous snakes are prevalent ⁸.
 163 Improvements in early referral and appropriate care will only occur when
 164 traditional healers are integrated into primary health care and hospital-based
 165 healthcare systems. Many snakebite victims from rural areas are not rushed for
 166 hospitalization but seek traditional treatments ⁹ Unfortunately, public health
 167 authorities, nationally and internationally, have given little attention to this
 168 problem, relegating snake bite envenoming to the category of a major neglected
 169 disease of the 21st century⁷

170 Snake bite is an important preventable health hazard ¹⁰ in India with its
 171 population over a billion people, accounted for the highest estimated number of
 172 bites and deaths for a single country. ⁴ The reasons for the high levels of snake
 173 bite mortality include scarcity of anti-venom, poor health care services, and
 174 difficulties with rapid access to health centers ¹¹. One may assume that some
 175 snakebite victims die before reaching the health centre in due time (leading to

underestimation of snakebite mortality), and others do not go to the health centres because they were cured (leading to underestimation of morbidity) ¹². It is essential for drawing up guidelines for dealing with snake-bites, to plan drug supplies, particularly antivenom, and to train medical staff on snake-bite treatment protocols that are different at different centres due to difficulties in variable presentations ^{23, 24}. Present cost of one vial of 10 ml of ASV of Serum Institute of India is \$ 6 ¹⁰. The patient should be given strict instructions to return to the hospital after ASV treatment if any of the following occurs: increase in pain or onset of redness or swelling, fever, epistaxis, bloody or dark urine, nausea or vomiting, faintness, shortness of breath, diaphoresis, or other symptoms except mild pain at the bite site¹

An ounce of prevention is worth a ton of first aid:

Avoid places like tall grass, bushes and deep holes and always poke the way forward.

While walking in dark places wear long pants, rubber boots etc for protection.

Use light source in dark places and watch as you step/sit in outdoors.

Never handle a snake, even if you think it is dead. A moment ago killed snakes may still bite by reflex.

Do not give anything per oral to victims of snake bite.

Do not cut/suck/put ice at the site of bite.

Do not administer stimulants or pain medications unless directed by a physician.

Remove any items or clothing which may constrict the bitten limb if it swells and do not use tourniquet.

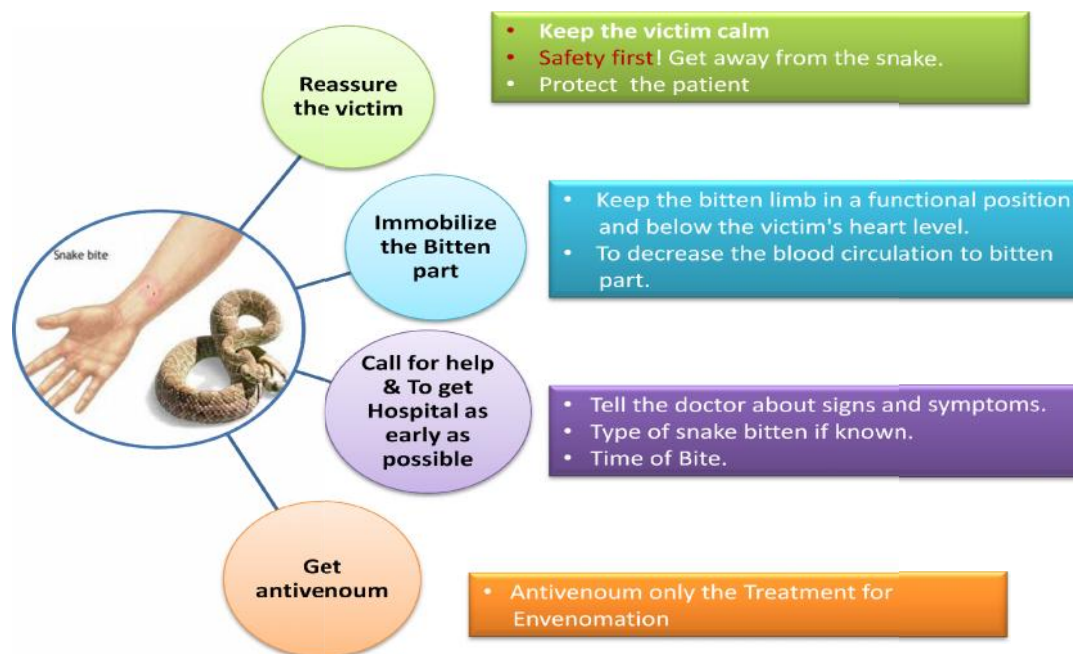
Educate the people in recognition of various snakes & their symptoms after the bite.

Drawing up guidelines for management, planning health care resources (particularly anti venom), and training medical staff to treat snakebites.

Educate the people on traditional healer's approach who delay anti-venom administration.

206 Do it **RIGHT** immediately after the bite: ^{2,8,12, 13}

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209 **Conclusion:**

210 The GVK EMRI ambulances that are fully equipped with all life saving equipments
 211 and drugs including anti snake venom are able to save lives in critical condition of
 212 snakebite victims while they call on toll free number 108 in 16 states of India. This
 213 model needs to be replicated in other parts of the country and also in high snakebite
 214 incident countries of Asia and Africa.

215 Public health authorities need to create awareness among people in snake bite prone
 216 areas. It is highly associated with active working age group so this group deserves
 217 attention from national and international health authorities. Victims may die before
 218 reaching the health care centers or others thinking they are cured may leave the
 219 hospitals leading to underestimation of morbidity. The only specific treatment for
 220 poisonous snake bite is to receive anti- venom, so every victim must be transported
 221 to treatment centers where anti-snake venom is available within first hour after the
 222 bite. Traditional healers need to be integrated into primary health care and hospital-
 223 based healthcare systems.

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