Asian Pac. J. Health Sci., 2019; 6(3):43-51 e-ISSN: 2349-0659, p-ISSN: 2350-0964

Document heading doi: 10.21276/apjhs.2019.6.3.9 Original Research Article

Pre hospital emergency medical services in Maharashtra: primary survey and analysis of response times, care provisioning, user experience and expectations from the PPP project

U. D. Shah*, H. Thakur

Tata Institute of Social Sciences, V.N. Purav Marg, Deonar, Mumbai, Maharashtra, India

Received: 13-08-2019 / Revised: 20-8-2019 / Accepted: 24-09-2019

ABSTRACT

Background: Pre-hospital emergency medical services (PHEMS), have a positive impact, the health outcomes of trauma and accident cases, but, can be relatively inefficient and wasteful. PHEMS are generally operated on a public private partnership (PPP) basis and the inherent inefficiencies can be attributed to the structural arrangement. **Objectives:** This paper examines the efficacy - response times, service provisioning and user experience, of PHEMS in Maharashtra (108 MEMS) to provide recommendations to improve sustainability. **Methods:** A primary survey covering 230 respondents across six locations in Maharashtra, India, was undertaken. Official project data across sample months was also analyzed. **Results:** Response time were inconsistent and exceeded 30 minutes in 25% of the emergencies. The service provider, was however, in compliance to the service level expectations, due to the defined computation methodology in the contract. The quality of services and the behavior of the staff were rated satisfactorily; by the respondents, however the ambulance infrastructure, maintenance and timeliness of services were rated below satisfactory. Findings also suggested 'potential misuse' of PHEMS for primary care and basic maternal transportation needs, with no 'corrective action' from the service provider to optimize usage. **Conclusion:** PHEMS PPP projects are constrained due to inflexible contract and predefined set service levels, leading to inherent inefficiencies and risk of moral hazards. Contracts should allow private provider to innovate, develop strategies to perk up response times and minimize 'potential misuse'. Further options to operationally integrate similar schemes like 108 and 102 ambulance services, can be considered to make projects sustainable.

Key words: Public Private Partnerships, Pre Hospital Emergency Medical Services

INTRODUCTION

By and large, health policies in most developing countries focuses on select vertical programs for maternal and child health or control of communicable diseases, which is often unable to respond to emergencies or mass casualties [1]. It has been estimated that in the absence of any specific intervention, 'Injury' will be the third cause of Global Burden of disease by 2020 [2]; reiterating the crucial significance of emergency response systems globally. A systematic review of pre-hospital trauma/emergency services in Low and Middle Income Countries (LMICs) indicated that they helped in a 25% reduction in trauma-related mortality [3].

*Correspondence
U.D Shah
Tata Institute of Social Sciences, V.N. Purav Marg, Deonar, Mumbai, Maharashtra, India- 400088
E-mail: utkarsh.shah2016@tiss.edu

Another study, which evaluated the impact of transportation time on outcomes of seriously injured cases, across three different cities, viz. - Kumasi in Ghana, Monterrey in Mexico and Seattle in United States also reiterated the value of the availability of pre-hospital emergency medical services. Statistics reveal that pre-hospitalization deaths decreased from 51% in Kumasi to 40% in Monterrey to 21% in Seattle, with pre-hospital time decreasing from an average of 102 minutes in Kumasi to 73 minutes in Monterrey to 31 minutes in Seattle[4]. Pre-hospital emergency medical services (PHEMS) in low and middle income countries are greatly impacted by high costs of transportation, diverse terrain and geography, poor communication systems and sub-optimal location and distribution of facilities; which consequently limits their availability and makes them out-of-bounds for the poor. [5]. It is therefore imperative to provide 'free' ambulance and pre-hospital medical services, to improve access and utilization, especially for the poor.

In another analysis of three EMS programs across India and Pakistan, it was noted that public sector funding is necessary for the sustainability of pre-hospital emergency medical services [6].Pre-hospital emergency medical services (PHEMS) have been available in India as early as 1984, however, it was only in 2005 that a dedicated funding program was designed and deployed, under NRHM [7]. The preferred model for provisioning was through the Public Private Partnership (PPP) approach. The PPP approach was preferred given that a comprehensive state run PHEMS in 2005 wasn't in existence and the need was being fulfilled by a strong heterogeneous network of private sector providers[5]. What's more, the provisioning of PHEMS is rather complex and requires a whole range of expertise including - manning and managing the call centre, fleet management, GPS (Global Positioning System) tracking, training and deploying emergency Medical technicians (EMT). Hence, it was considered more prudent to transfer the onus of the operations to private players having the relevant and pertinent expertise[8]. Finally, global evidence also suggests that PHEMS services are usually contracted out to private partners [9].While PPP appears to be an operationally preferable strategy for PHEMS, its effectiveness and competence need to be reviewed. Global studies suggest that the utilization of ambulances is usually not efficient. In Taiwan, in about 32% cases of ambulance dispatch, no patients were transported [10]; while in the United States, in about 30% cases of ambulance dispatch, the patient refused to get transported[11]. In England and Wales, around17% patients were not transported [12]. Other studies in UK have demonstrated that the inappropriate use of emergency ambulance services may be in the range of 16 to 52% [13]. Additionally, the arrangement and deployment distribution of PHMES across urban and rural settings may not be equitable under PPPs, due to a better access to facilities and lesser travel distances in urban settings[8].This paper examines the effectiveness (response times and care provisioning), user experience and the expectations regarding PHEMS in Maharashtra; also referred to as the 108 Maharashtra Emergency Medical Services (108 MEMS), operated by a private provider. This paper also provides suggestions and recommendations to help enhance PHEMS efficiencies.

MATERIALS AND METHODS

Ethical issues

Ethical clearance was obtained from the Institutional Review Board, Tata Institute of Social Sciences. Informed consent was obtained from the respondents, using detailed participant information sheets.

Study Setting

Primary survey was conducted from February 2019 to April 2019, with two discrete categories of participants- patient group and population group. The study was conducted across six locations in Maharashtra, including three rural blocks- Chikhli (Buldana), Ausa (Latur) and Pachora (Jalgoan) and three urban cities- Nagpur (Nagpur), Aundh (Pune) and South Mumbai (Greater Mumbai).

Sample size and Sampling Technique

The sampling method was a stratified, cluster-based convenience sampling approach. The population group respondents were identified from community sites, while those from the patient group were identified at the hospital/ healthcare facilities. The total sample size was 230 respondents (56 patient group and 174 population group). The population group included participants who were not aware of the MEMS services (n=61), participants who were aware of the services but had never used them (n=83) and participants that had used the services (n=30). Cumulatively, 37.3% (n=230), 86 respondents had used the services, which included patient group (n=56) and part of the population group (n=30).

Official MEMS data

Official reports of the project including ambulance utilization, mileage and distance travelled, materials consumed and emergency cases manage were compiled and reviewed. The data of four sample months (May 2017, November 2017, March 2018 and August 2018) was selected to ensure comparability across different parameters. The official data had several errors in recording and duplicate/ repeat entries. These entries were removed and subsequently the information was analyzed.

Statistical analysis

Data was entered into Microsoft Excel 2007 and evaluated. The findings of the study were compared using Chi Square tests to assess the significance for the difference between the two proportions.

RESULTS

The respondents profile has been depicted in Table 1 below.

Table 1: Demographic and Economic Profile of the Study population

Background Characteristics	Females	Percentage (Females)	Males	Percentage (Males)	Grand Total	Percentage (All)
Age						
> 30	39	46.4%	86	58.9%	125	54.3%
30-50	26	31.0%	43	29.5%	69	30.0%
<50	19	22.6%	17	11.6%	36	15.7%
Total	**84**	**100.0%**	**146**	**100.0%**	**230**	**100.0%**
Occupation						
Causal labour	25	29.8%	49	33.6%	74	32.2%
Cultivator	3	3.6%	21	14.4%	24	10.4%
Government Service	2	2.4%	4	2.7%	6	2.6%
Private service	12	14.3%	17	11.6%	29	12.6%
Professional	11	13.1%	23	15.8%	34	14.8%
Housewife	14	16.7%	1	0.7%	15	6.5%
Self Employed	7	8.3%	22	15.1%	29	12.6%
Others	10	11.9%	9	6.2%	19	8.3%
Total	**84**	**100.0%**	**146**	**100.0%**	**230**	**100.0%**
Residence						
Buldana (Rural)	21	25.0%	28	19.2%	49	54.8%
Jalgoan (Rural)	14	16.7%	26	17.8%	40	
Latur (Rural)	18	21.4%	19	13.0%	37	
Mumbai (Urban)	10	11.9%	25	17.1%	35	45.2%
Nagpur (Urban)	8	9.5%	23	15.8%	31	
Pune (Urban)	13	15.5%	25	17.1%	38	
Total	**84**	**100.0%**	**146**	**100.0%**	**230**	**100.0%**
Income Status						
APL	34	40.5%	54	37.0%	88	38.3%
BPL	39	46.4%	71	48.6%	110	47.8%
Did not Disclose	11	13.1%	21	14.4%	32	13.9%
Total	**84**	**100.0%**	**146**	**100.0%**	**230**	**100.0%**

(Source: Researchers field work)

Deployment Patterns

Under 108 MEMS, 937 ambulances were deployed across selected stations, with 715 ambulances in designated rural areas and remaining 222 ambulances in designated urban localities. There was one ambulance deployed per 118,605 person*(SD +/- 29,997)* with Sindhudurg having the most number of ambulances per person (one per 70,804 persons) while, Thane had the least (one per 269,760 persons). On an average 108 MEMS ambulances covered approximately 422.7 sq.kms(*SD+/- 217*)with each ambulance in Mumbai city and Suburban region covering 4.7 sq kms, while those is Gadchiroli covering 1441.2sq kms per ambulance.

Nature of Medical Emergencies managed

Official data indicates that a total of 34.8 Lakh emergencies were handled as on 9th December 2018. About 81% of all emergencies handled, cumulatively attributed to medical conditions, labor/ pregnancy and vehicular accidents. The 108 MEMS data also suggested that about 29,697 births took place in the ambulances, 3249 patients were ventilated and 155 patients were defibrillated, to resuscitate the patients, as on 9th December 2018.

The primary survey revealed, that medical emergencies including poisoning and snakebites contributed to 42% (n=86), while pregnancy, labor and child birth contributed to 37% (n=86) of the emergencies. Road accidents and assaults-related injuries contributed to another 14% (n=86) of the emergencies. Chi square tests for independence did not demonstrate any association between the nature of emergency and location of the emergency i.e. urban or rural *(x2= 1.6349, p=0.651496)*. The Table 2, below depicts the details of emergencies handled as per official MEMS data alongside primary sample data compiled by the researcher.

Table 2: Overview of Emergencies handled- Official MEMS and Primary Survey

S. No	Emergency Category	Official MEMS Data (31st January 2014 to 9th December 2018)		Primary Survey Data (n=86)			
		Total Emergencies	Percentage	Urban localities	Rural localities	Total Emergencies	Total Percentage
1	Cardiac	11310	0.32%	20	16	36	41.9%
2	Burns	18277	0.52%				
3	Intoxication/Poisoning	114691	3.29%				
4	Medical	1690302	48.46%				
5	Mass casualty	17901	0.51%	1	2	3	3.5%
6	Assault	42024	1.20%				
7	Child Birth	22504	0.65%	17	15	32	37.2%
8	Labour/ Pregnancy	849037	24.34%				
9	Poly Trauma	7583	0.22%	4	5	9	10.5%
10	Fall	96176	2.76%				
11	Accident(Vehicle)	299571	8.59%				
12	**Others**	**318331**	9.13%	2	4	6	7%
Total		**3487707**	100.00%	44	42	86	100%

(Source: Official MEMS Data, NHM, Maharashtra, Primary Data)

Ambulance Response time

Ambulance response time refers to the time between the call being made and the ambulance arriving on site. Contractually, the average response time has been stipulated to be equal to or less than 20 minutes for urban areas and 30 minutes for rural areas. A break up analysis of the official data, from the four selected sample months indicated that nearly 10% of emergencies were handled in less than a minute, 18% of emergencies were handled within seven minutes and about 25% emergencies took more than 30 minutes. Chi square tests for independence demonstrated a strong association of the breakup of response time across the sample months *(x2=217790.1032, p<0.00001).*

Table 3A below, depicts the response times, along with Standard deviation (SD) and response time range. A high standard deviation (in reference to the arithmetic means) indicates a significant variation in response times.

Table 3: Ambulance Response time: Official MEMS Data (sample set of selected months) and Primary Survey (n=86)

A. Response Time: Official MEMS Data for Sample Selected Months

Month	Response times (hh:mm:ss)						Response Time Break Up (hh:mm:ss)				
	Average Response time		Response Time Standard Deviation		Response Time Range		0:00:59 or less	0:01:00 to 0:06:59	0:07:00 to 0:29:59	0:30;00 to 0:59:59	> 1:00:00
	Rural	Urban	Rural	Urban	Min	Max					
May-17	0:23:22	0:19:24	0:20:48	0:19:15	0:00:00	3:44:40	1528	9079	24048	10025	2769
Nov-17	0:24:21	0:19:23	0:21:02	0:18:28	0:00:00	3:36:58	1384	8378	23326	10325	2954
Mar-18	0:19:36	0:12:55	0:20:33	0:16:07	0:00:00	4:14:26	12751	11503	26390	10829	2927
Aug-18	0:21:41	0:20:21	0:21:36	0:17:13	0:00:00	3:45:24	7884	11298	26932	11731	3494
							10.72%	18.34%	45.86%	19.54%	5.53%

B. Response Time: Primary Survey (n=86)

Locations (Districts)	Response time Break Up (actuals)				Response time Break Up (relative percentage) District wise			
	< 15 mins	**15-30 mins**	**>30 mins**	**Total**	**< 15 mins**	**15-30 mins**	**>30 mins**	
Buldana	5	4	10	19	26.3%	21.1%	52.6%	
Jalgoan	5	4	4	14	38.5%	30.8%	30.8%	
Latur	1	5	4	10	10%	50%	40%	
Mumbai	4	3	6	13	30.8%	23.1%	46.2%	
Nagpur	5	3	4	12	41.7%	25.0%	33.3%	
Pune	3	9	7	19	15.8%	47.4%	36.8%	
Total	**23**	**28**	**35**	**86**				
Percentage	**26.7%**	**32.6%**	**40.7%**	**100%**				

(Source: Official MEMS Data, NHM, Maharashtra, Researcher's analysis, Primary data)

The primary survey findings reiterated official data analysis, as nearly 40.6% (n=86) of respondents specified waiting for more than 30 minutes. Table 3Babove depicts the arrival time distribution among the survey sample, across the different locations. A district level percentage distribution of response time, indicated, response times exceeded 30 minutes in one third or more instances, across all surveyed regions. Chi square tests for independence did not demonstrate any association between location (urban and rural areas) and response times *(x2= 0.0806, p=0.960524)*.A study conducted at Pune's Dinnanath Mangeskar Hospital,to study the outcomes related to 108 MEMS emergencies also noted that the ambulance reached the scene within 15 minutes in 58.5% of the cases (n=849) and reached later than 25 minutes in nearly 25% of the cases [14].

Treatment and Care provision

An analysis of official data indicated that 75-95% of the emergencies were transported to a government facility, while only about 2% to 5% of the emergencies were transported to a private facility. Almost 2% to 23% of emergencies were managed on site and not transported. The primary survey findings were not consistent with official data, since most of the patient group respondents were recruited at public health facilities. Among the patient group respondents,50 %(n=56) of the patients were only transported and not provided with any other treatment on board. The remaining 50% (n=56) provided with one or more additional services. Intramuscular injections (16.1%) or oral medications (14.3%) were the most commonly dispensed treatment on board, followed by wound dressing (7.1%) and IV line (5.4%).

Quality of services

During the primary survey, only the patient group (n=56), was asked to rate the quality of their experience (and services provided) on a scale of 1 to 5 across different parameters. The general population group was excluded from this rating, given that, recall bias was considered a possibility. The summary of the rating has been depicted in the Table 4 below,

Table 4: Rating of services and experience regarding MEMS by patient group on a 5 point scale (n=56)

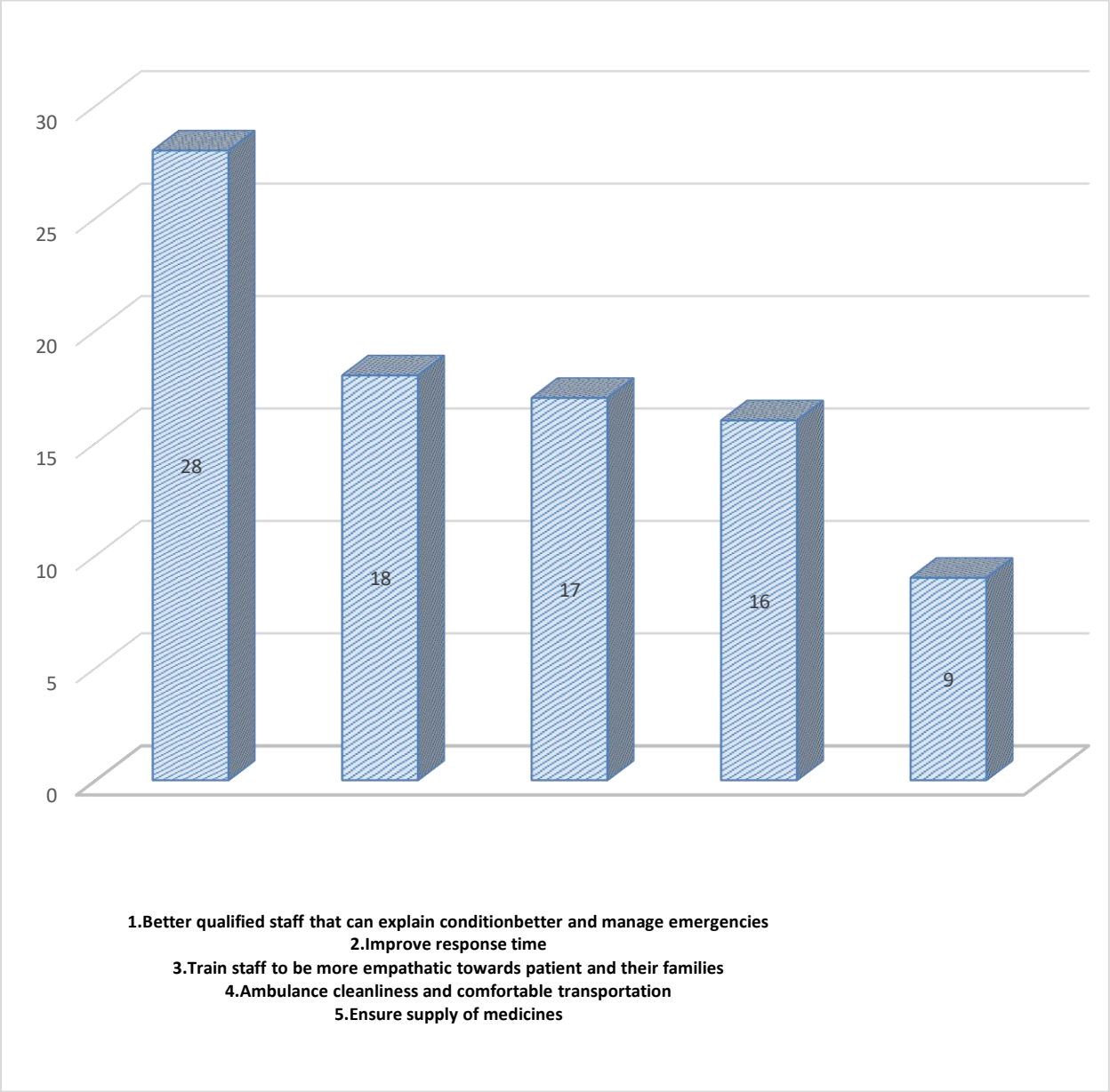
Rating	Overall Quality of Services	*Per. dist*	Timeliness of Services	*Per. dist*	Behavior of Ambulance Staff	*Per. dist*	Ambulance Infrastructure and Maintaince	*Per. dist*
1, Very Poor	0	*0.0%*	0	*0.0%*	0	*0.0%*	0	*0.0%*
2, Poor	0	*0.0%*	0	*0.0%*	0	*0.0%*	4	*7.1%*
3, Average	8	*14.3%*	19	*33.9%*	5	*8.9%*	21	*37.5%*
4, Good	29	*51.8%*	23	*41.1%*	23	*41.1%*	25	*44.6%*
5, Very Good	19	*33.9%*	14	*25.0%*	28	*50.0%*	6	*10.7%*

(Source: Primary data)

The measurement of ratings collated during the primary survey indicated that the Quality of services (85%) and behavior of the ambulance staff (91.1%), were rated as above average (i.e. Good and above). However, about 43.6%, rated the ambulance infrastructure and maintenance as average or below, while about 34% rated timeliness of provision of services average. These ratings indicate an unmissable need to improve the maintenance and infrastructure of the ambulances along with making services more readily accessible and available. Chi square test for independence indicated a significant relationship between the ratings (above average, average and below average) and the parameters of quality of services, timeliness, behavior of staff and ambulance infrastructure*(X2= 26.4711, p<0.00001).*

About 24.7% (n=230, 57) provided a total of 88 suggestions regarding 108 MEMS, which were consolidated, standardized and sorted into distinct categories. Five categorizes of suggestions emerged, which have been depicted in the Figure 1 below.

Figure 1: Distinct categories of suggestions with regards to improvements (n=88)



(Source: Primary data)

The 'need for better qualified staff to explain the condition and manage the emergency more efficiently' was a top suggestion, by nearly 32% (n=88) making this statement. This was followed by the need to improve response times with 20.45% (n=18) making this suggestion, which further reiterated the findings related to response times.

The third category statement was 'need to be more empathetic towards the patients', with 19.3% (n=17) making this statement. Statements made by the patients were - ' being considerate and sensitive to patient's condition', ' accommodating requests/ demands' , 'being tolerant and accommodating and spending more time with the patient' and ' make efforts to allay the anxiety and apprehension'. Cleanliness and having an adequate supply of medicines appeared to be the next two suggestions. In addition about 12.5% (n=168) of respondents, aware of the 108 MEMS service, did not find the services adequate and suggested additional

services for treatment of common conditions, chronic ailments and wanted specialist consultations.

DISCUSSION

Ambulance response time is an important measure of the availability of PHEMS. In the United States, a response time target of 8 minutes for 90% calls has been proposed, which is considered appropriate to influence outcomes of cardiac arrests [15].South Africa, on the other hand, has ambulance respond time target of 15 minutes in urban centers and 40 minutes in rural area[16]. In Iran, the standard is set at 8 minutes, for 80% of cases, while in Virginia; the average time for arrival was recorded to be 12 minutes in 2004. In the Saskatchewan province of Canada 88.3% emergency calls were responded to within 9 minutes in urban settings in 2007 [17]. Under the 108 MEMS project in nearly 25% of the emergencies, the response times were higher than 30 minutes.

Ambulance deployment per population influences response times. In Maharashtra, one ambulance is deployed per 118,605 people *(SD+/- 29,997)*. In Monterrey, Mexico, one unit serves 100,000 people and is able to manage an average response time of 10 minutes, while in Hanoi, Vietnam where one unit serves 3 million people, the average response time is about 30 minutes [18]. It is obvious that in order to reduce response times, more ambulances need to be deployed, which has a financial implication. Reconsidering the deployment design however, may be a potential and workable option. A station based static model is more expensive to serve in contrast to a temporal deployment model [19]. In a station based static model, an ambulance is tagged to a base location and moves to and fro this location. On the other hand, a temporal deployment model deploys ambulances in the community, closer to patients, to reduce the response time as well as to improve efficiency. A risk analysis and statistics of previous ambulance runs helps determine 'temporary' stations during peak hours [20]. Another study in Melbourne Australia, showed that a temporal deployment, if managed based on varying demands can increase efficiencies[21]. There is a potential scope to review the deployment plan under 108 MEMS services and explore a dynamic temporal deployment model. However, the rigidity of the contract arrangement, limits the ability of the private partner to make this design change, without a consultation and approbation from the State authorities. A large proportion of emergencies (nearly 25%) handledunder the 108 MEMS services arerelated to pregnancy, labor and child-related emergencies. Evidence from other states also indicated a similar pattern, with an assessment report in 2009, noting that pregnancy-related (20-33%) and trauma or accident cases (18-39%) were the leading causes of using of PHEMS across three states of Andhra Pradesh, Gujarat and Rajasthan [22]. In Maharashtra, 2754 ambulances operated under the 102 ambulance service scheme [23]funded under the Janani Shishu Suraksha Karyakaram (JSSK), which are meant for transportation and management of pregnant women and sick infants. Other States have clearly devised strategies and protocols to ensure the appropriate usage of the two simultaneously operating services [24]and to reduce wastage. This recapitulates the necessity to perk upthe coordination between 102 and 108 ambulance services. Alternatively, integration of the two services may also be explored. A requisite to upgrade the ambulance infrastructure, cleanliness and response times was also identified, through the primary survey. Internationally, the National Health System (United Kingdom) and Medicare (United States), engage in regular patient satisfaction surveys to identify issues and concerns related to the provision of ambulance services and to understand patient experiences. However, under the 108 MEMS project, no such independent patient surveys have been carried out. It is therefore suggested, that it is vital to undertake these assessments, to ensure that the quality of services provided are satisfactory and acceptable to the community. Mandating the private partner to incorporate independent patient experience survey studies should be an integral part of the contract arrangement. The communities' expectations of availing primary care and specialized care services, was also noted. This need emerged from direct suggestions to 'make primary care and specialized services available' as well as indirect suggestions which implied the requirement for 'a better qualified staff to explain the condition and manage emergencies'. The latter suggestion was attributed to situations where Emergency Services Medical Officers (EMSOs)refused to provide specific clinical management advice without a thorough assessment by a primary care physician. Additionally, a high percentage of instances of 'treated on scene', also pointed to the possibility of 108 MEMS being used for non-emergency care needs. Globally, pre-hospital emergency medical services are often used as a substitute for primary care, which hampers the sustainability and efficiency of emergency care services [9].Unfortunately, PPP arrangements are prone to moral hazards, in which, despite being aware of an inappropriate utilization of services, the private partner avoids any corrective action; since the costs are covered by the State [8].Additionally, a fear of action

by the State against the private provider for denial, in cases of non-emergency conditions, is a matter of huge concern, unless explicitly mentioned in the contract. Evidence suggests, it may not be completely possible to avoid the misuse of PHEMS by those needing primary care services [25]; conversely, creating an awareness among the community and care-givers about the scope and coverage of the services, through communication material will help reduce misuse. What's more, frameworks to restrict MEMS to 'repeat misusers', may also be used as a strategy, with a mechanism to minimize the risk of denial of services for genuine cases.

CONCLUSION

The 108 MEMS ambulance services has catered to more than 3.4 million emergencies, in five years. However, findings are suggestive of need to improve ambulance response time and reduce misuse of services for primary care or maternal and child transportation. What's more, a lack of framework to capture appropriate feedback on experience and suggestions is worrisome.

There is a need to examine and assess the contractual terms, to allow the private partner to redesign the deployment plans and protocols to avoid the misuse of services. Exploring the possibility of a single vender (private partner) to operate the two different ambulance services (102 and 108) designed for different needs, in the interest of enhancing efficiencies, should definitely be considered. PHEMS are an integral part of the health system and exceedingly vital to improve the access to health services. Nonetheless, in order to make these services sustainable, it is critical to enhance efficiencies, without impacting the quality. Flexibility in the contract should be allowed, to promote and encourage innovation.

References

1. Razzak J, Kellermann A. Emergency medical care in developing countries: is it worthwhile?. Bull World Health Organ2011; 80: 900-5.
2. Henry J, Reingold A. Prehospital trauma systems reduce mortality in developing countries: A systematic review and meta-analysis. J Trauma Acute Care Surg 2012; 73: 261-8.
3. Nielsen K, Mock C, Joshipura M, Rubiano AZ, Rivara F. Assessment of the Status of Prehospital Care in 13 Low- and Middle-Income Countries. Prehos Emerg Care 2012; 16: 381-9.
4. Mock C, Amon-Kotei D, Arreola-Risa D, Maier R. Trauma Mortality Patterns in Three Nations at Different Economic Levels: Implications for Global Trauma System Development. J Trauma 1998; 44:804-14.
5. Sydney K, Ryan K,Diwan V, De Costa A. Utilization of state run public private emergency transportation service exclusively for childbirth: the Janani (Maternal) express program in Mahdya Pradesh, India. PLoS One 2014; 9:1-9.
6. Sriram V, Gururaj G, Razzak J, Naseer R, Hyder A. Comparative analysis of three prehospital emergency medical services organization in India and Pakistan. Public Health 2016; 137: 169-75.
7. Das S, Desai R. Emergence of EMS in India. J Emerg Med Serv [serial on internet] 2017 [cited 22 January 2019]. Available from https://www.jems.com/articles/print/volume-42/issue-4/features/emergence-of-ems-in-india.html
8. Rajasulochana S, Maurya D. 108 in crisis: Complacency and compromise undermine emergency services' potential. Econ Polit Wkly [serial on internet] 2018 [cited 25 January 2019] ;53:1-10. Available from https://www.epw.in/engage/article/108-services-are-plagued-complacency-and
9. Lethbridge J. Privatisation of ambulance, emergency and firefighting services in Europe- A growing threat?. [Monograph on Internet]. London: Public Services International Research Unit (PSIRU); 2009 [cited 2019 Jan 21]. Available on https://www.epsu.org/article/privatisation-ambulance-emergency-and-firefighting-services-europe-%E2%80%93-growing-threat-0
10. Chen J, Bullard M, Liaw S. Ambulance use, misuse, and unmet needs in a developing emergency medical services system. Euro JEmerg Med 1996; 3:73-8.
11. Hipskind J, Gren J, Barr D. Patients who refuse transportation by ambulance: a case series. Prehosp Disaster Med 1997; 12:278-83.
12. Victor C,Peacock J, Chazot C, Walsh S, Holmes D. Who calls 999 and why? A survey of the emergency workload of the London Ambulance Service. J Accid Emerg Med 1999; 16: 174-8.
13. Gardner G. The use and abuse of the emergency ambulance service: some of the factors affecting the decision whether to call an emergency ambulance. Arch Emerg Med 1990; 7: 81-9.
14. Rajhans A,Kulkarni P, Kelkar D, Jog S, Ranade G, Utpat S et al. Assessment of Major Outcomes of Emergency Medical Services (EMS) in Relation to Signs and Symptoms at the Time of EMS call.Int J Med Public Health [Serial on Internet] Jan- Mar 2017 [cited 25 January 2019]; 7; 18-22.Available fromhttps://www.ijmedph.org/sites /default/files /10.5530ijmedph.2017.1.2%20%281%29.pdf
15. Pons P, Markovchick V. Eight minutes or less:

Does the ambulance response time guideline impact trauma patient outcome?. J Emerg Med 2002; 23: 43-8.

16. MacFarlane C, van Loggerenberg C, Kloeck W. International EMS systems in South Africa--past, present, and future. Resuscitation 2005; 54:145-148.

17. Bahrami M, Maleki A, Ezzatabadi R, Askari R, Tehrani GA. Pre-Hospital Emergency Medical Services in Developing Countries: A Case Study about EMS Response Time in Yazd, Iran. Iran Red Crescent Med J 2011; 13 :735-8.

18. Kobusingye O, Hyder A, Bishai D, Joshipura M, Romero Hicks M, Mock C. Emergency Medical Services. In: Jamison DT, Breman JG, Measham AR, et al., editors. Disease Control Priorities in Developing Countries.[Serial on Internet]2nd ed. New York:Oxford University Press [cited on 25 January 2019]; 2006. pp 1261-79. Available from https://www.ncbi.nlm.nih.gov/books/NBK11744/pdf/Bookshelf_NBK11744.pdf

19. Washko J. Understanding Why EMS Systems Fail. J Emerg Med Serv [serial on Internet] January 2015.[cited on 25 January 2019]. Available from https://www.jems.com/articles/print/volume-40/issue-2/administration-and-leadership/understanding-why-ems-systems-fail.html

20. Peyravi. M, Khodakarim.S , Örtenwall. P, Khorram-Manesh A. Does temporary location of ambulances (Fluid Deployment) affect response times and patient outcomes?. Int JEmerg Med 2015; 8:1-11.

21. Cantwell K, Morgans A, Smith K, Livingston M. Time of Day and Day of Week trends in EMS demand. Prehosp Emerg Care; 2015; 19: 1-7.

22. National Health Systems Resource Centre. Emergency Medical Service (EMS) in India: a concept paper: National Rural Health Mission, MoHFW; 2010. Available from http://nhsrcindia.org/sites/default/files/Emergency%20Medical%20Service%20in%20India%20Concept%20Paper.pdf [Last accessed on 25 January 2019].

23. Press Information Bureau, GOI. Ministry of Health and Family Welfare. Ambulance under NRHM. Available from http://pib.nic.in/newsite/PrintRelease.aspx?relid=176243. [Last accessed on 27 March 2019].

24. NRHM Orrisa. Salient Features of 102 Ambulance Services. Available from http://www.nrhmorissa.gov.in/writereaddata/Upload/Documents/102%20Final.pdf. [Last accessed on 27 March 2019].

25. Mould-Millman N, Rominski S, Bogus J, Ginde A, Zakariah A, Boatemaah C, et al. Barriers to accessing emergency medical services in Accra, Ghana: Development of a survey instrument and initial application in Ghana. Glob Health: Sci Pract 2015; 3; 577-90.

Conflict of Interest: None
Source of Support: Nil