

## Saving lives through rural ambulance services: Experiences from Karnataka and Tamil Nadu states, India

A Xavier Raj<sup>20</sup>

### Abstract

Transportation of trauma cases is an integral component of health care provision. Ambulance services to transport pregnant women, children and those that require emergency medical attention remains a challenge in India even after 50 years of public health care provision. The transport component is known to contribute to accelerating the achievement of various Millennium Development Goals, including those relating to reducing maternal and infant mortalities. It was in this context that the National Rural Health Mission (NRHM) in India funded a nationwide initiative to support rural ambulance service - the "Dial 108 service". This was largely adopted from a not-for-profit organization, the Emergency Medical Research Institute (EMRI), which has initiated 108 services early on. This case study analyzes the experiences of the states of Karnataka and Tamil Nadu in the context of the NRHM initiative. The analysis provides insights on factors contributing to efficiency, cost-effectiveness and likely impact. The case study demonstrates the usefulness of the public-private partnership model in converging technology, management, skill-building, funds and political will, and offers useful suggestions for setting up low-cost emergency medical transportation services for the rural population, which can also serve urban areas, both in India and in other countries.

*Keywords: public health, emergency response services*

### 1. Introduction

As an emerging economy, India shows potential for growth. It has a stable democracy, educated and skilled young population, and a rapidly growing infrastructure. On the other hand, although life expectancy has gone up by 7.9 years since 1990, raising the quality of life for the majority remains a challenge (Nagaraj, 2010; The Times of India or TOI, 2014). For example, India will miss the target of reducing maternal deaths (maternal mortality ratio or MMR) to 109 per 100,000 deliveries by 2013. The national MMR is likely to remain at 139 in 2015 (Live Mint, 2014).

In India, about 69% of the population lived in rural areas in 2011. According to the national census of 2011, the number of rural villages in India is 540,867. Out of these, only 22% of the rural population live within 5 kilometers from the nearest town; 28% are in a range of 5 to 10 kilometers from a town; and the majority of 50% are located 10 kilometers from the nearest town (Census, 2011). Although the number of poor people living in urban areas is growing, poverty remains a predominantly rural phenomenon.

It was in this context that the Government of India (GOI) initiated the National Health Mission (NHM). Access to quality health care was recognized as an important factor in well-being, productivity, addressing poverty and overall economic growth. The NHM therefore took on the challenge of infusing appropriate financial, technical and managerial inputs to strengthen health care delivery. A Rural Ambulance Service (RAS) was one of the key inputs, primarily to ensure timely comprehensive maternal, infant, and child care, while also providing emergency response transportation for other types of trauma and incidents requiring emergency medical care.

### 2. Current status of health-care in rural areas

#### 2.1 Overview of the health-care Network in India

The GOI has established norms for the provision of primary, secondary and tertiary health care. Primary health care institutions such as Community Health Centre (CHC), Primary Health

<sup>20</sup> Technical and Management Consultant, OfERR in India and Sri Lanka. Email: xavier.rajin@gmail.com.

Centre (PHC) and Health Sub Centre (HSC) cater to the preventive, curative and health information needs of rural population.

As of March 2012, there were 148,366 HSCs, 24,049 PHCs and 4833 CHCs catering to India's rural population (Ministry of Health and Family Welfare – Government of India or MoHFW-GOI, 2012). The CHC is often the First Referral Unit (FRU) with facilities to stabilize the patients, perform general surgeries and importantly, perform C-section with obstetric and gynecological complications during pregnancy or child birth.

Referrals from CHC or PHCs are sent to secondary hospitals, which consist of District Hospitals and Sub-District Hospitals at Tehsil level (a sub-district revenue division). These secondary hospitals have specialists, better diagnostic capabilities and larger bed strength. Tertiary hospitals, which are mostly teaching hospitals, provide specialized medical care. Most specialty or super specialty hospitals are located in metropolitan cities.

In addition, there are nursing homes with 5 to 25 beds found in other cities and bigger towns. These nursing homes mostly stabilize patients and refer them to general hospitals or super-specialty hospitals.

## 2.2 Inter-state and rural-urban variations in health-care provision

India promotes universal access to preventive and curative care. However, large scale inter-state variations, gender (male-female differences) and intra-state (tribal, rural and urban differences) persist. In particular, there are huge variations in health infrastructure across states. The table below compares some of the parameters for rural health provision of three states in South India (two being high performing states – Kerala and Tamil Nadu, and one a medium performing state - Karnataka), Madhya Pradesh in Central India, a low performing state, and Bihar in Eastern India, another low performing state. As can be seen, in the low-performing states of Madhya Pradesh and Bihar, health care facilities cater to the needs of a larger number of villages than in the other states.

**Table 1. Comparison of rural Health provision in high, medium and low performing states on Millennium Development Goals in India**

State/UT	Average Rural Area [Sq. Km.] covered by		Average Radial Distance [Kms] covered by			Average Number of Villages covered by			Number of Sub centres per PHC	Number of PHCs per CHCs
	PHC	CHC	Sub Centre	PHC	CHC	Sub Centre	PHC	CHC		
India	129.66	645.21	2.59	6.42	6.42	4	27	133	6	5
Tamil Nadu	95.79	305.28	2.07	5.52	9.86	2	13	42	7	3
Karnataka	80.79	1036.8	2.59	5.07	18.16	3	13	163	4	13
Kerala	44.02	164.11	1.57	3.74	7.23	0	1	5	6	4
Madhya Pradesh	260.63	904.75	3.29	9.11	16.97	6	47	165	8	3
Bihar	49.58	1319.41	1.74	3.97	20.49	6	47	165	8	3

Source: Rural Health Statistics in India (2012)

There are also significant variations in the availability of hospital beds and health care personnel between rural and urban areas. While nearly 70% of the population lives in rural areas, there are only 143,069 government hospital beds in rural areas, compared to 369,351 in urban areas.

In other words, roughly 80% of government hospital beds cater to only 30% of the total population.

Furthermore, in 2009, 31% of the rural population travelled over 30 km for medical treatment (KPMG, 2010). Due to the long distances to health facilities, geographical access to health care is a significant barrier to institutional delivery in rural areas. This is exacerbated by shortages of health care personnel, particularly doctors and specialists, in the primary health care sector. In Karnataka, for example, 30 percent of the posts for general physicians and primary caregivers which serve the rural population are vacant in PHCs, CHCs and sub-centers. The vacancies are as high as 65 percent when it comes to specialists and super specialists. In state hospitals, 1,148 posts for specialist doctors and 2,727 posts for doctors lay vacant (The New Indian Express, 2013).

### 2.3 Effects of out-of-pocket spending for health on the households

There is also growing evidence of widening income inequalities along both spatial and socioeconomic dimensions. The benefits from economic growth appear to dissipate radially around towns. Between 1993 and 2005, inflation-adjusted per capita incomes grew in villages located within five kilometers of towns, while inflation-adjusted per capita income, fell in villages located at greater distances. The deepest reductions occurred in the farthest villages, which to begin with had lower per capita incomes. The poorest income groups in more remote villages suffered the largest cuts in purchasing power (Krishna and Bajpai, 2011). Within the towns, those who live in lower socioeconomic areas are equally affected by the widening inequality, often located away from hospitals and have congested and poor amenities.

Illnesses can push people into poverty if out-of-pocket spending for health costs is high. Based on the World Health Statistics (2011), India has the 42nd highest average out-of-pocket expenses among countries. Seventy-four percent (74%) of health expenses are being paid out-of-pocket while a mere 2-3 percent are borne by the insurance sector. "It is reported that 39 million Indians are pushed to poverty because of ill health every year" (Selvaraj and Karan, 2009). About 3.6 percent and 2.9 percent of households in rural and urban India, respectively, slipped into poverty owing to debt incurred in meeting medical expenses (Gupta, 2009). "Around 30% in rural India didn't go for any treatment for financial constraints in 2004 — up from 15% in 1995. Similarly, in urban areas, 20% of ailments were untreated for monetary problems in 2004 — up from 10% in 1995. Loans and sale of assets helped in financing 47% and 31% of hospital admissions in rural and urban areas, respectively" (Kounteya, 2011).

In this context, government health care provision assumes importance, particularly in assisting the poor in accessing quality health care. Various studies show that the poor utilize the government health care system. About 68% of the first quintile (Q1) of the population (the poor) used government health care institutions for institutional delivery (Chakrobarty and others, 2012). Similarly, 60 % of the poor accessed government services for preventive and curative health care.

The National Rural Health Mission (NRHM) established in 2005 and the Rashtriya Swasthya Bima Yojana (RSBY), a national health insurance scheme for people below the poverty line, are the two most important health initiatives by the central government. Several state governments, including Tamil Nadu and Karnataka, established health insurance schemes to improve medical care. However, these did not substantially improve access to and the quality of health care nor reduce out-of-pocket spending of families.

### 3. Impact of the national rural health mission on rural ambulance service provision

Under the NRHM, the Government of India initiated the National Ambulance Service (NAS) as one of the key interventions (MoHFW, 2014). The aim is to extend universal access to basic and advanced life support services to those living in rural areas. One of the key objectives is to reduce maternal, infant, and child mortality by transporting those who need emergency medical attention within the 'Golden Hour'<sup>21</sup>. Emergency Response Services (ERS) transports pregnant women, infants, children, trauma (accidents, cardiac arrest and others), and other patients, and provide referral transport (inter-facility transfer).

<sup>21</sup> The Golden Hour refers to a time period lasting for one hour following traumatic injury being sustained by a casualty or medical emergency, during which there is the highest likelihood that prompt medical treatment will prevent death (American College of Surgeons, 2008).

The ministry also launched the Janani Shishu Suraksha Karyakaram (JSSK) in 2011. The initiative entitles all pregnant women delivering in public health institutions to absolutely free delivery, including caesarean section. Pregnant women are also entitled to free transport from their homes to government health facilities, between the facilities in case they are referred on account of complications, and back to their homes after delivery.

### 3.1 Expanding the reach of ambulance services in rural areas

Recognizing the need to provide timely medical care in hospitals, particularly to pregnant women and infants in order to bring down MMR and infant mortality ratio (IMR), NRHM supports state governments in launching and augmenting the ERS. The NRHM provides 100% financing for the capital expenditure of ambulances for 108 services. Operational cost is supported on a diminishing scale of 60 % in the first year, 40 % in the second year and 20% thereafter. For 102 services, NHM provides financing for both capital and operational costs. The classification of 108 services and 102 services are discussed further in succeeding sections.

NRHM stipulates that all state governments must ensure the universal availability of global positioning system (GPS) fitted ambulances, provide a reliable and assured free transport for pregnant women and newborns/ infants, and establish control rooms for timely response and provision of services. NRHM also requires drop-back facilities for mothers and newborn or neonate admissions. The fleet should have a prudent mix of basic level ambulances and emergency response vehicles, and more importantly, the response time for the ambulance to reach the beneficiary is not to exceed 30 minutes.

### 3.2 Models of rural ambulance services in India

NHM<sup>22</sup> classifies NAS into 108 services and 102 services, according to the number dialed when calling the ambulances. The 108 services is an ERS transporting accident victims, critical care, trauma and other medical emergency patients. The 102 services is a basic patient transport system for pregnant women and children. Currently, 108 services has 7,239 ambulances (490 advanced life support and 6,749 basic life support. The 102 services has 8,122 ambulances, with the capital expenditure for 2,677 out of 8,122 ambulances borne by the states<sup>23</sup>. NAS also includes an additional 4,769 empanelled vehicles used in some states to transport pregnant women and children, such as the Janani express in Madhya Pradesh, Odisha, Mamta Vahan in Jharkhand, Nishchay Yan Prakalpa in West Bengal and Khushiyo ki Sawari in Uttarakhand.

States have the flexibility to establish referral systems to transport pregnant women and newborns/infants. This spawned off different models of operations in providing emergency transport or referral transport services (see Box 1). At present, India has over eighteen (18) different models of transportation for emergency, pregnant women, children and other categories of patients. These can be broadly categorized as follows:

- a. State-wide models. This is the “108 Emergency Transport Facility”, where the ambulance comes with equipment and trained staff to manage emergencies during transit.
- b. Decentralized district or block-level public-private partnership (PPP) models. The fleet includes government and contracted private vehicles, such as the Janani Express Yojana in Madhya Pradesh, and the District Health Society<sup>24</sup> manages the services.
- c. Decentralized community-based models. These are managed by community-based organizations and there is significant involvement of communities and private vehicle owners. Typically, the vehicles are not dedicated for RT. Examples are Cheeranjeevi Yojana in Gujarat, Ayushmati Scheme in West Bengal, in Khunti district of Jharkhand and in Dholpur district of Rajasthan.

<sup>22</sup> The National Health Mission is a framework that governs the National Rural Health Mission, National Urban Health Mission, National Ambulance Services, and other related health improvement activities. Funds for NAS is provided through NRHM.

<sup>23</sup> Although NHM assures capital expenditure for 102 services, in some of the states capital expenditure for some or all 102 ambulances were borne by the respective states

<sup>24</sup> District Health Societies are formed under NRHM for the implementation of the plan, monitoring and reporting.

### Box 1. Variety of emergency response service models in India

**State-wide Emergency Response Services:** Many states contracted Emergency Medicine Research Institute (EMRI) for setting up and running ERS. EMRI started as a PPP initiative in Andhra Pradesh in 2005 and took responsibility for a statewide ERS in Gujarat in 2007. In 2008, six more states, Uttarakhand, Tamil Nadu, Rajasthan, Goa, Karnataka and Assam entered into a memorandum of understanding with EMRI to launch ERS services. Currently, EMRI is running ERS in 15 states. Other players are Ziquitza Health Care Limited (ZHCL) (Rajasthan, Punjab, Kerala, Orissa and Bihar), and the Bharat Vikas Group India Ltd. (Maharashtra).

**Rural Ambulance Services:** Karnataka and Madhya Pradesh have deployed vehicles at PHCs and CHCs through a partnership arrangement with private providers. The Accredited Social Health Activists (ASHA) and Auxiliary Nurse Midwives (ANM) call the drivers on their mobile phones when the vehicle is required. Janani Express Yojana in Madhya Pradesh and Janani Suraksha Vahini in Karnataka are two examples of this model.

**Referral Transport for Maternity Services:** The United Nations Children's Fund (UNICEF) is assisting District Health Societies to develop low-cost referral transport for maternity services using existing resources. Guna in Madhya Pradesh, Dholpur in Rajasthan and Khunti in Jharkhand are good examples of decentralized models conceptualized and supported by UNICEF.

**Rural Ambulance Services at subdistrict level:** Deepak Foundation, with support from the district and the Government of Gujarat, has been operating an emergency transport facility across several blocks in the Vadadora district.

**Decentralized community-based models:** The Government of Gujarat also outsourced maternity services (normal and complicated deliveries) including referral transport to private gynecologists. The scheme is called Cheeranjeevi Yojana. The Government of West Bengal also initiated a similar model called Ayushmati Scheme. In some remote and difficult areas such as Khunti district of Jharkhand and Dholpur district of Rajasthan, similar models are in operation.

**Other initiatives:** Free bus passes for Scheduled Castes / Scheduled Tribes and Below Poverty Line (BPL) pregnant women in rural areas have been launched in some states, including Andhra Pradesh, Uttar Pradesh and Haryana.

*Source:* Adopted from Operating Perinatal Referral Transport Services in Rural India, UNICEF, 2010

### 3.3 Rural ambulance services in Tamil Nadu

In Tamil Nadu 1,140,000 deliveries took place in 2006. Among these, 7% of deliveries were in HSCs, another 7% in PHCs, 56% in government hospitals and the remaining 30% in private hospitals. Although 96% of the total deliveries are institutional deliveries, more than one thousand maternal deaths occurred and the MMR was 90 per 100,000 deliveries, 79% of which were attributed to direct causes. The pressure was on the health system to provide timely, quality and affordable medical care for reducing maternal and infant mortality, emergency trauma cases, surgical procedures and specialist medical attention.

The lack of ERS was the cause of the loss of thousands of lives particularly in rural areas. To remove the affordability barriers to ambulance services in the poorer section of rural and urban areas, ambulance services were launched under the Tamil Nadu Health System Development Project (TNHSP).

The TNHSP initially partnered with non-government organizations to provide ambulance services in 15 districts but later partnered with an experienced organization due to various difficulties

encountered. TNHSP signed an MoU with GVK<sup>25</sup> -Emergency Management and Research Institute (GVK-EMRI) to provide emergency services for the state.

The ERS is fully funded by the Government of Tamil Nadu. The budget for the financial year 2013-14 (1st April 2013 to 31st March 2014) was Rs. 990,233,000 with the average expenditure per ambulance per month at Rs. 116,589.70.

All the ambulances procured by TNHSP were handed over to EMRI for retrofitting with the required specifications. On September 18, 2008, the 108 service was launched in Tamil Nadu with 385 ambulances, growing to 638 ambulances at present. The EMRI had empanelled 1,806 private hospitals until 31<sup>st</sup> March 2014.

Currently, the call center is operating from a building temporarily allotted for this purpose but it is expected that a dedicated call center at the Directorate of Medical Services campus will be operational soon. Meanwhile, EMRI employs 3,315 persons, of whom 141 are EROs, 1,459 are EMT, 1,552 are drivers, 56 are operation staff and 107 are support staff. The male/female ratio is 2733/582.

GVK-EMRI is run independently. An MOU was signed between GVK-EMRI, TNHSP and Tamil Nadu Health Society (nodal agency for NRHM in Tamil Nadu) detailing various parameters. TNHSP has a team under the Deputy Director that monitors performance on a daily basis. The Project Director (with TNHSP), who is also the Mission Director (with NRHM), reviews the performance on a monthly basis and uploads the performance report to the NRHM website. A transparent, accountable and working system is also in place.

### **3.4 Rural ambulance services in Karnataka**

The Janani Suraksha Vahini (a 102 ambulance services) precedes the Arogya Kavacha Scheme (a 108 ambulance services) in Karnataka. Janani Suraksha Vahini was part of Janani Suraksha Yojana (JSY), under which ambulances were placed in 176 Taluk hospitals for the transportation of emergency cases of pregnant women and children. The ambulances were placed in hospitals, community health centers, primary health centers and other suitable places in the area.

The Janani Express Yojana provided transportation to all expectant mothers for their institutional deliveries. Ambulances are also called for emergency situations during pre- and post-delivery periods. Moreover, eligible beneficiaries of the Deendayal Antyodaya Upchar Yojana and sick infants also benefited from the transportation facility for their casual medical treatment.

NRHM introduced emergency ambulance services in rural areas (108 services) to meet the transportation requirement for everyone during medical emergencies. EMRI was contracted to provide the 108 ambulance services. The 200 ambulances placed under the Janani Suraksha Vahini scheme were transferred to the 108 ambulance services.

#### **a) EMRI – 108 Ambulance Services**

For 108 ambulance services, the budget for the financial year 2013-14 was Rs. 9,056,760,000 and average expenditure budget per ambulance per month was Rs. 505,691.49. EMRI employs 2,726 persons, of whom 105 are EROs, 1,209 are EMTs, 1,288 are drivers, 56 are operations staff and 68 are support staff.

Currently, the 108 service in Karnataka has 517 ambulances. EMRI signed 2,295 memoranda of understanding with government hospitals and 1,128 memoranda of understanding with private hospitals to provide emergency medical care at hospitals.

An MOU was signed between GVK-EMRI and the Department of Health and Family Welfare of the Government of Karnataka. As in the case of Tamil Nadu, a performance report is uploaded to

<sup>25</sup> GVK is an Indian conglomerate with diversified interests across various sectors including energy, resources, airports, transportation, hospitality and life sciences. It runs various social initiatives under the GVK Foundation for the overall development of the society. GVK-EMRI attends to every emergency, be it a medical crisis, law and order situation or a fire disaster. This service is spread across 15 states and two union territories with over 8000 ambulances and over 37 000 employees. GVK, with its various developmental services aims to make a difference to the lives of people all over India.

the NRHM website on a monthly basis.

#### **b) Janani Suraksha Vahini – 102 Ambulance Services**

In 2012, Rs. 33,696,000 was budgeted for the ambulance drivers' salaries and mobile phone charges. A budget of Rs. 250 per referral transport under the JSSY<sup>26</sup> was allotted, or a total Rs. 5,000,000 for an estimated 20,000 referral transport for newborn children and neonates.

Many assessments for referral transportation under JSY, utilize existing ambulances available in the primary health care and secondary health care network. State governments were engaged to commit to maintaining the vehicles and utilizing existing ambulances. This fleet of ambulances has been absorbed into 108 services and the 108 services provides the referral transport for all cases.

### **4. Comparison of efficiency, effectiveness and impact of ambulance services in Tamil Nadu and Karnataka**

#### **4.1 Relevance**

Tamil Nadu significantly extended secondary health services in its rural areas through the establishment of eighty (80) Comprehensive Emergency Maternal Obstetrics and Neonatal Centers (CEmONCs) and 108 ambulance services. These services are supplemented by secondary hospitals at the Tehsil and District levels, and by government and private hospitals that have been selected to provide emergency medical care. All these have led to improved access and quality of care for expectant mothers and infants, which constitute over 50% of referral and emergency transportation in the state.

Karnataka is utilizing government ambulances available in government hospitals and in the primary health care network. The 102 services transport pregnant women, infants and children, both emergency and referrals. Karnataka provides Comprehensive Emergency Obstetric Care (CEmOC) services through its 197 FRUs<sup>27</sup>. Government and private hospitals have been chosen to provide emergency medical care. Karnataka's Janani Suraksha Vahini is considered as an innovative mechanism that effectively utilizes existing resources at hospitals and caters specifically to the rural population.

#### **4.2 Effectiveness**

It is estimated that rural women in the state of Tamil Nadu reach a comprehensive emergency obstetric and neonatal health facility within half an hour from their homes (World Bank, 2013). More than 99.5 percent of deliveries in the state now take place in medical institutions. Meanwhile, Karnataka increased institutional delivery from a mere 33.28% in 2006-07 to 97.7% in 2013-14 (The Hindu, 2013). The number of scheduled caste and scheduled tribe women availing of ambulance services and opting for institutional delivery has also risen significantly.

Table 2 shows that in Karnataka, 43% of medical emergency trips in 2012-13 and 39.5% in 2013-14 were pregnancy related, while in Tamil Nadu it was only 26% for the year 2013-14. The 108 service in Tamil Nadu transported about 27% for trauma cases in 2012-13 and 2013-14; in Karnataka, this was only 12% (2012-13 and 2013-14). Inter Facility Transfer (IFT) in Tamil Nadu increased to 37% from 33% in 2012-13. IFT in Karnataka is quite low at 5% in 2012-13 and 13% in 2013-14, but the increase is more than double.

<sup>26</sup> The Janani Shishu Suraksha Yojana (JSSY) is free and cashless assistance to pregnant women to encourage institutional delivery. This is to mitigate expenses incurred by families for transport, hospital and caesarian operation.

<sup>27</sup> Designated FRUs are CHC, Block PHCs and upgraded PHCs. First referral units have specialists, 24x7 Comprehensive Maternal and Obstetric Care, stabilize trauma patients, in-patient, basic imaging and laboratory services

**Table 2. Analysis of ambulance trips in Karnataka and Tamil Nadu for 2012-13 and 2013-14**

	States	Karnataka				Tamil Nadu			
	Reference Period	26 Mar 2012 to 28 Feb 2013		1 Apr 2013 to 31 Mar 2014		1 Apr 2012 to 31 Mar 2013		1 Apr 2013 to 31 Mar 2014	
	Details	No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%
A.	Total Medical Emergencies	536,676	100	603,762	100	634,364	100	790,793	100
A.1	Inter Facility Transfer of Ante Natal Mothers	10,469	1.95	34,903	5.78	160,160	25.25	115,179	14.56
A.2	IFT others	17,260	3.22	54,043	8.95	53,260	8.4	175,250	22.16
A.3	Pregnancy Related	228,199	42.52	238,461	39.5	160,160	25.25	207,492	26.24
A.4	Cardiac / Cardiovascular	23,147	4.31	29,076	4.82	31,907	5.03	44,985	5.69
A.5	Trauma (Vehicular)	50,149	9.34	57,463	9.52	147,290	23.22	174,248	22.03
A.6	Trauma (Non-vehicular)	14,590	2.72	15,869	2.63	24,883	3.92	35,466	4.48
A.7	Others <sup>28</sup>	192,862	35.94	173,947	28.81	56,704	8.94	38,173	4.83
B	Critical life saved	16,892	24.19	22,686	3.76	15,919	2.51	65,945	40.35
C	Total number of cases where victims' "vitals were not recordable"	n.a.				607	0.1	757	0.1
D	Total lives saved since start of 108 services	1 Nov 2008 to 28 Feb 2013	69,825	1 Nov 2008 to 31 Mar 2014	95,105	15 Sept 2008 to 28 Feb 2013	76,149	15 Sep 2008 to 31 Mar 2014	1,63,436

Source: Monthly reports submitted by respective 'Dial 108' services under NRHM monitoring requirements

In both states, rural areas largely utilize the 108 services. In Karnataka, rural areas account for 83.4% of ambulance dispatches. In Tamil Nadu, based on dispatches during May to July 2014, 75% were to rural areas. However, ambulance dispatches not utilized owing to delay in reaching the site or patients arranging their own transportation to reach hospitals needs to be reduced, particularly in rural areas. For example, there were 16,966 unutilized ambulance dispatches in 2013-14, 13,548 of which were rural (2.7% of total rural dispatches) and 3,418 were urban (3.5% of total urban dispatches). People, including those in rural areas, also depend on other modes of transportation and private ambulances for trauma emergencies (vehicular and non-vehicular)..

### 4.3 Cost Effectiveness

The table below compares the unit cost for 108 services in Karnataka and Tamil Nadu. Tamil Nadu has been more efficient in terms of expenditure compared to Karnataka. The average distance per ambulance in Karnataka and Tamil Nadu increased from 43 km and 42 km in 2012-13 to 48 km and 47 km, respectively, in 2013-14. The cost escalation is sharp in Karnataka at 16% compared to only 9% in Tamil Nadu. Tamil Nadu, which has 638 ambulances, operates at a cost 5% lower than that of Karnataka. The lower cost is attributable to the larger fleet of ambulance reducing the cost of running the call center, the handling of IFTs, and the provision of spare ambulances. Tamil Nadu has one ambulance per 204 sq. km compared to 371 sq km for Karnataka. Tamil Nadu also reports a 20% reduction in average cost per km in 2013-14.

<sup>28</sup> Other cases are accidental poisoning, acute abdomen, allergic reactions, animal attack, assault/violence, behavioural, diabetes, disasters, environmental, epilepsy, fevers/infections, fire/burns, hazmat, industrial, neonatal (up to 1 month), pediatric (1-12 years), respiratory, stroke/CVA, suicide attempt, unconscious and other conditions.

Table 3. Analysis of expenditure - Karnataka and Tamil Nadu

States	Karnataka				Tamil Nadu			
Reference period	26 Mar 2012 to 28 Feb 2013		1 Apr 2013 to 31 Mar 2014		1 Apr 2012 to 28 Feb 2013		1 Apr 2013 - 31 Mar 2014	
Total Expenditure	Rs. 591,945,000		Rs. 746,556,123		Rs. 725,156,000 *		Rs. 878,620,000	
Categories	No. of trips / cases	Unit Cost	No. of trips / cases	Unit Cost	No. of trips / cases	Unit Cost	No. of trips / cases	Unit Cost
Per trip	588,374	1006.1	653,144	1143.0	614,695	1179.7	827,526	1061.7
Per case	478,770	1236.4	620,728	1202.7	571,406	1269.1	790,793	1111.1
Per km	25,300,082	23.4	31,430,755	23.8	25,737,699	28.2	38,893,722	22.6
Average monthly expenses per ambulance	number of ambulances: 517	104,087	517	120,335	629	104,806	638	114,762
Average km per trip	43		48		42		47	

\* Budget realized up to the month of February 2013

#### 4.4 Efficiency

The utilization rate for ambulances in Karnataka in 2013 was 97.29%. Out of 517 ambulances, 13 were off the road as of 15<sup>th</sup> February 2013. Of the 13 ambulances, 12 were involved in major accidents and one required refurbishment. In 2013-14, 16 ambulances were off the road and of these 3 were involved in accidents, 7 were declared as total loss, 5 required refurbishments, and 1 required a major repair.

Tamil Nadu has replaced 10 ambulances so far and will replace 2 more. It is also utilizing its 51 spare ambulances across the district. In March 2014, out of 638 ambulances, 610 (95.5% utilization rate) were in service ferrying emergency cases to the hospitals. Out of 28 off the road, 2 were due for condemnation, 17 required refurbishment or met with major accidents, and 9 could not be operated due to manpower shortage.

In 2013-14, number of trips per ambulance is 1,309 in Tamil Nadu and 1,281 in Karnataka. The average number of trips per day is 3.5 in both Karnataka and Tamil Nadu. The average distance in km per ambulance per year is higher for Tamil Nadu at 60,962 km, than in Karnataka at 60,795 km.

The population covered by an ambulance in Tamil Nadu is about 118,261 and about 122,017 in Karnataka. With almost 50% of its population in urban areas and a higher density of population, Tamil Nadu had shorter distances between ambulances (about 20 kms), which improves the efficiency in reaching patients in rural areas. The state's extensive road network is also a contributing factor to efficiency. The radial distance covered by an ambulance, after accounting for breakdowns, is shorter for Tamil Nadu (about 8 km) compared to Karnataka (about 11 km).

In the case of Karnataka, lower density, geographical spread and connectivity pose as challenges in achieving efficiency. Efficiency can be improved by positioning ambulances at shorter distances and rationalizing the location of the FRU for stabilizing patients. While advanced life support (ALS) in ambulances is an advantage, in states where larger rural areas are covered, increasing the number of ambulances with ALS is essential.

#### 4.5 Impact

One of the key objectives of NRHM in introducing universal ambulance service was to ensure transportation in order to improve access to medical care for pregnant women, newborns, neonates and children. While the concept of ERS is picking up, pre-hospital care, care in transit, and emergency medical attention in hospitals remains a challenge.

Table 4 below compares the changes in MMR, IMR, U5MR, and NMR in the two states. As shown, both have reduced incidence substantially on all indicators.

**Table 4. Impact on Millennium Development Goals in Karnataka and Tamil Nadu**

Millennium Development Goals indicators	2012			Compounded Annual Decline (CAD)			Targets for 12th Plan (2012-17) and CAD%	
	India	Tamil Nadu	Karnataka	India	Tamil Nadu	Karnataka	Tamil Nadu	Karnataka
<b>Maternal Health</b>								
MMR (SRS 07-09)	212	97	178	-5.8	-4.4	-5.8	44 (-9.4)	80 (-9.5)
<b>Child Health</b>								
U5MR (SRS 2011)	55	25	40	-7.3	-11.4	-10.1	15 (-10)	17 (-15.6)
IMR (SRS 2011)	44	22	35	-6	-10.8	-8	13 (-10)	15 (-15.6)
NMR (SRS 2011)	31	15	24	-4	-10.6	0	10 (-10)	10 (-15.6)

Notes: MMR is from 04-06 to 07-09; U5MR: Under five mortality ratio; IMR: Infant mortality ratio; NMR is from 2008 to 2011; Targets are from latest current status to 2015.

Source: Approved NRHM State Programme Implementation Plan 2013-14 for Tamil Nadu and Karnataka

#### 4.6 Innovations

In both Tamil Nadu and Karnataka, the establishment and expansion of rural ambulance services has led to tangible improvements in various health indicators. Both states also introduced a number of innovative initiatives in improving the quality of rural ambulance services. Some of the major innovations which emerged are outlined below.

- Computerization of the Hospital Management System (HMS) and the Health Management Information System (HMIS) and integration of ERS in HMS and HMIS. To promote a holistic ERS focusing on lives saved, the system is planned to include geo-parametric information, hospital information, patient care, audit records and feedback from patients.
- Non-pneumatic anti-shock garment to arrest post-partum hemorrhage.
- Pilot baby warmers in ambulances to stabilize neonate hypothermia.
- Use of multi-para monitors instead of ventilators. Similarly, for specialized ambulances such as neo-natal ambulances and reduced vibration, EMRI collaborated with the Indian Institute of Technology, Chennai in the design of ambulances.
- Improved software for identifying the location of ambulances using GPS, allocation of vehicle, automated alerts, dynamic deployment (deploying an ambulance close to the incident spot), optimization of possibilities (depending on ambulance movements), and live tracking.
- Use of stochastic models. EMRI is working with McKinsey to optimize operations and resources using stochastic models. Google is also providing analytical expertise to ensure optimization.
- Launch of a 104 service. A 104 service provides health information to the caller and is hoped to reduce the load on 108 call centers, provide useful health information, promote prevention and a healthy life style, and allow effective ERS utilization in the long run.

#### 5. Conclusions and recommendations

The Emergency Response Service models discussed in this article provide a foundation to prepare the health system to move to the next level of ERS. The ERS models are suitable for replication across India, as well as in other countries, since they use simplified inputs, technology and protocols that can be adapted in resource-constrained settings. Currently, four agencies are sharing the responsibility of providing outsourced emergency ambulance services in various states. This provides opportunities for learning through healthy competition, innovation and experimentation. Lessons learned must then be shared, adopted and utilized for the overall improvement of the service. This section draws some general conclusions, while a more detailed set of recommendations is given in Annex I.

The 108 service is a stripped down or simplistic version of emergency response services. To its credit, this service has substantially improved the transportation of pregnant women, infant and children in need of medical care. However, it is not decisive that it has been able to save the lives of trauma patients associated with cardiac arrest, accidents or other complications.

Furthermore, the utilization of ambulance services in rural areas remains low owing to poor health-seeking behavior, ignorance and the tendency to disregard symptoms. There is also a need for more ambulances. The number of ambulances with advanced life support equipment is not sufficient and this results to deaths on the way to hospitals and health facilities. More ambulances, life-saving equipment and training can save more lives, particularly in rural areas.

Decreasing the distance covered by ambulances can also improve the efficiency, effectiveness and impact of the ERS. Currently, Tamil Nadu follows a norm of one ambulance covering a radius of 20 km. This means that it takes 30 minutes or more to locate the spot and reach the patient. At times, ambulances have taken close to an hour or more to locate a place in the assigned area.

One of the main learnings from the experiences of Tamil Nadu and Karnataka is the importance of quality assurance (QA). In both states, a QA process has been established and functional in a decentralized setting. The process oversees a variety of issues, ranging from checking the availability of medicines, consumables and disposables to an audit mechanism that checks the quality of patient care in the hospital or the condition of a vehicle. External experts are involved in training and refresher programmes, and quality auditors randomly check that pre-hospital care per protocol has been provided to the patient. In addition, surprise audits in the field are carried out by staffs attached to headquarters. All these processes help improve the ERS over time.

EMRI ushered in professional emergency ambulance services particularly benefitting rural areas and poor and disadvantaged communities. EMRI should move in the direction of providing holistic ERS and running emergency medical centers in hospitals. What sets the 108 services managed by EMRI apart is the infusion of professionalism, use of technology, introduction of management decision systems, and continuous improvement. Having achieved the scale and capabilities in rural ambulance services, it is time to experiment with systems linking pre-hospital care with the provision of emergency medical care in hospitals.

EMRI leadership has an undivided focus, passion, service motive and backing in the form of investments, and demonstrates sincerity, commitment and purpose as the driving factors. Elements of these are required to set up and run rural ambulance services in India or elsewhere.

Finally, it must be mentioned that political will is an important ingredient for successfully setting up and running the 108 ambulance services. To reduce mortality, particularly of women, children and infants, in rural areas, financing from state governments are needed to augment the resources for rural ambulance service available through NRHM.

### **Annex. Recommendations for rural emergency ambulance services**

#### **A. Information and communication campaigns**

1. Undertake appropriate communication campaign to discourage ineffective calls, which is about 65% of the calls landing at 108 call centers, in order to reduce load on the 108 call center.
2. Implement community outreach activities to encourage people to adopt prevention, timely intervention and healthy lifestyles in order to avoid acute emergency situations. Primary health care networks, with support from NAS, can take these messages to the communities.

#### **B. Access to ambulance (Basic Life Support (BLS) and ALS)**

1. Reduce the delay in reaching the location of patients to avoid patients adopting other means of transport. At present, this is 5%.
2. Maintain that one ambulance is available at all times by coordinating the movement of ambulances.
3. Experiment with specialized ambulances with advanced life support system to assist road accident victims, cardiac arrest and other life threatening conditions. The current one ALS per district is inadequate.

#### **C. Algorithm-based system for decision-making**

4. Develop an algorithm that learns from the type of emergency, road conditions, distance to specialty and multi-specialty hospitals, and performance of ambulance crew and medical personnel at hospitals.
5. Take into account acuity, time, distance and volume at the facility, and presence/absence of emergency medical personnel in the Patient Distribution System (PDS).
6. Use computer-aided dispatch systems to reduce dependence on the dispatch officers' decisions and thus improve efficiency and effectiveness.
7. Use of Electronic Ambulance Reporting Form (EARF), Electronic Patient Reporting Form (EPRM) and Ambulance Arrivals Board at emergency medical departments in hospitals.
8. Assign in the field medical personnel that are adequately trained in providing ALS and where required, utilize paramedics with appropriate training in the call center or at another facility to manage less critical calls.

#### D. Clinical protocols to improve ERS

1. Continuously improve the 108 ambulance services and care continuum (pre-hospital, emergency medical care and post emergency care in the hospital), increase the density of ambulances (1 ambulance per 50,000 people), and set up emergency medical centers in hospitals.
2. Harmonize emergency protocols at hospitals receiving patients and the protocol for pre-hospital emergency care. Since most of the patients opt for government hospitals, emergency medical centers should be established at government hospitals.
3. Reduce response time at emergency centers by setting up automatic alert systems at hospitals that are linked to PDS and computer aided dispatch modules.
4. Include trauma incidence and discharge survival rates in performance audits to correctly assess the quality of pre-hospital and emergency care at hospitals.
5. Adopt the Utstein style guidelines to consistently track and improve survival rates.
6. Include off-stretcher time as a performance indicator for the availability of emergency care at hospitals.
7. Devise protocols to improve ambulance turnarounds when emergencies build up at hospitals.
8. Adopt the practice of random audits at hospital within 24 hours of incidence to assess the quality of care provided, in order to improve the clinical governance process in ERS. Pre-hospital care should be extended to emergency care and subsequent care at the hospital (Clinical Performance Indicators).
9. Consider using an Electronic Patient Report Form to improve the care, audit and feedback processes.
10. Adopt a holistic approach to ERS by improving trauma care and life support services in ambulances.

#### E. Patient feedback system

1. Obtain independent feedback from a sample of persons who utilized the ambulance by asking for the patients' perception of (1) ambulance crew skills, tools used and pre-hospital care received, (2) care received at the hospital, and (3) the outcome.

#### F. Vehicle and navigation

1. Use a satellite navigation system as a back-up system to correctly locate villages and reach the patient in time.
2. Increase the number of ambulance with ALS (one in every block headquarters or more) and of appropriately trained medical personal to improve the survival chances of patients, particularly in trauma-related instances.
3. Experiment with the capability of the Mobile Medical Unit providing ALS, where feasible.
4. Experiment with the use of solar panels to power life-saving equipment in fully equipped ambulances with a view to progressively greening NAS in India. This can be considered for MMU as well.
5. Reduce dependence on ambulances to transport pregnant women for institutional delivery by using solar-powered vehicles. Free ambulances can then be used for patients and pregnant women with acute conditions.
6. Reduce vehicle breakdowns and repair time.
7. Reduce vehicle accidents through real-time tracking of driving-related issues, feedback, training, and performance monitoring.

## G. Data for monitoring

1. Consider aggregating data by gender, age, village, time, BLS, ALS, rural and urban.
2. Compile ambulance/team specific data for use feedback, performance assessment and determining the type of training required.

## H. Personnel

1. Set pay at par with industry standards to attract high quality human resource.
2. Conduct training and certification of personnel, with potential specialization in emergency medical provision and recognition.
3. Train individuals with a mix of technical, management and service motive skillsets.

## I. Branding

1. Position branding towards the provision of a comprehensive ERS with identified solutions. This is essential to induce the move towards a holistic ERS and increase the demand for the service.

## J. Political will

1. Garner political will for rolling out a comprehensive ERS systems, of which ambulance service is one of the components.

## K. In-depth study of innovations at EMRI

1. Conduct an in-depth study of initiatives, innovations and scaling up protocols adopted at EMRI to strengthen its capability to provide holistic ERS.

### References

- Amy J Kesterton, John Cleland and Carine Ronsmans (2010). Institutional delivery in rural India: the relative importance of accessibility and economic status. *Biomed Central*. 6 June. Accessed 8 July 2014.
- Anirudh Krishna and Kripa Ananthpur (2013). Globalization, Distance and Disease: Spatial Health Disparities in Rural India. A study funded by 3ie. Accessed 5 July 2014.
- Prakash, A Surya (2009). *Governments That Work - I: Primary Health Care Finally Takes Off in the States*. Available from <http://www.vifindia.org/article/2009/april/Governments-That%20Work-I-Primary-Health-Care-Finally-Takes-Off-in-the-States>. Accessed 5 July 2014.
- Chakraborty Lekha, Yadawendra Singh and Jannet Farida Jacob (2012). Public Expenditure Benefit Incidence on Health: Selective Evidence from India. Working Paper No. 2012-111. December 2012. National Institute of Public Finance and Policy. New Delhi. Accessed 5 July 2014.
- Department of Economic Affairs, Ministry of Finance, Government of India and The World Bank in India (2011). Improving Road Safety: Tamil Nadu Road Sector Project. *Innovations in Development*, issue 5.
- KPMG (2010). Health Care: Reaching out to the masses. Pan IIT Conclave 2010. Available from <http://www.kpmg.com/IN/en/Pages/default.aspx>. Accessed 5 July 2014.
- Krishna, A. and D. Bajpai (2011). Lineal Spread and Radial Dissipation: Experiencing Growth in Rural India, 1993-2005. *Economic and Political Weekly*, September 17, pp. 44-51.
- Government of India (2013). Report of the Committee for evolving a composite development index of states.
- Gupta Indirani (2009). Out of Pocket Expenditures and Poverty: Estimates from NSS 61<sup>st</sup> Round. Paper presented for consideration of the Expert Group on Poverty, Planning Commission. Institute of Economic Growth, New Delhi. Accessed 7 July 2014.

- International Institute for Population Sciences (IIPS) and Macro International (2007). Morbidity and Health Care. In *National Family Health Survey (NFHS-3), 2005–06: India: Volume I, Ch. 13*. Mumbai: IIPS.
- International Institute for Population Sciences and Macro International (2007). *National Family Health Survey (NFHS-3), 2005-06, India: Key Findings*. Mumbai: IIPS.
- IBEF India (2013). *India: Health Sector Report*. Available from [www.ibef.org](http://www.ibef.org). Accessed 7 July 2014.
- Live Mint (2014). Distance and institutional deliveries in rural India. Available from <http://www.livemint.com/Opinion/55N9wi8w2SO1IEE9MHPvaL/Distance-and-institutional-deliveries-in-rural-India.html>. Accessed 8 July 2014
- Ministry of Health and Family Welfare (2014). EMRI/Patient Transport Service – National Ambulance Services. Available from <http://nrhm.gov.in/nrhm-components/health-systems-strengthening/emri-patient-transport-service.html>. Accessed 8 July 2014.
- Murugan, A. (2008). Medical Tourism: Opportunities and Challenges in Tamil Nadu. Conference on Tourism in India – Challenges Ahead, 15-17 May 2008. Kerala, India: Indian Institute of Management Kozhikode.
- Nagaraj, R. (2010). Development Strategies and Poverty Reduction. In *Country Study: India*, R. Nagaraj, ed. Geneva: United Nations Research Institute for Social Development.
- National Health System Resource Centre (2013). *National Rural Health Mission Eleventh Five Year Plan (2007-2012)*. New Delhi: Government of India.
- Selvaraj S. and A. Karan (2009). Deepening health insecurity in India: evidence from national sample surveys since 1980s. *Economic and Political Weekly*, vol. 44, no. 40, pp. 55-60.
- The Hindu (2013). Bill to make rural service mandatory for doctors awaits Presidential assent. Available from <http://www.thehindu.com/news/national/karnataka/bill-to-make-rural-service-mandatory-for-doctors-awaits-presidential-assent/article5086361.ece>. Accessed 5 July 2014.
- The Hindu (2014). India lags behind BRICS on human development. Available from <http://www.thehindu.com/news/national/india-lags-behind-brics-on-human-development/article6244575.ece>. Accessed 5 July 2014.
- The Hindu (2012). U.N.: India likely to miss MDG on maternal health. Available from <http://www.thehindu.com/sci-tech/health/policy-and-issues/un-india-likely-to-miss-mdg-on-maternal-health/article3595095.ece>. Accessed 5 July 2014.
- The Times of India (2014). Life expectancy in India goes up by 7.9 years since 1990:UNDP report. Available from <http://timesofindia.indiatimes.com/india/Life-expectancy-in-India-goes-up-by-7-9-years-since-1990-UNDP-report/articleshow/38964081.cms>. Accessed 6 July 2014.
- Hemalatha, Karthikeyan (2013). For 10th year in a row, Tamil Nadu tops India in road accidents. *The Times of India*, online edition, 24 June. Available from <http://timesofindia.indiatimes.com/india/For-10th-year-in-a-row-Tamil-Nadu-tops-India-in-road-accidents/articleshow/20735444.cms>. Accessed 6 July 2014.
- Sinha, Kounteya (2011). Health budget may go up by 2%. *The Times of India*, online edition, 8 May. Available from <http://timesofindia.indiatimes.com/india/Health-budget-may-go-up-by-2/articleshow/8192054.cms>. Accessed 6 July 2014.
- World Bank (2014). GDP Ranking. Available from <http://data.worldbank.org/data-catalog/GDP-ranking-table>. Accessed 7 July 2014.
- World Bank (2013). *India: Improving Child and Maternal Health in Tamil Nadu*. Available from <http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:22888445~menuPK:14>

1311~pagePK:34370~piPK:34424~theSitePK:4607,00.html. Accessed 7 July 2014.

United Nations Environment Programme (2014). *Transport for a Changing World*. Position paper prepared by the Division of Technology, Industry and Economics. Nairobi: Transport Unit, UNEP. Accessed 24 July 2014.

United Nations Children's Fund (2010). *Operating Perinatal Referral Transport Services in Rural India*. New Delhi: UNICEF.