



# Identifying the Need for Pre-hospital and Emergency Care in the Developing World : A Case Study in Chennai, India

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## Abstract

**Objectives :** Increasing industrialization in the developing world has contributed to an epidemiological transition in disease pattern from infectious disease as a primary cause of morbidity and mortality, to more chronic illness such as heart disease and trauma. This study was done in order to assess the effectiveness of pre-hospital and emergency care as the health care needs of the population changes and to make recommendations to meet the growing need for organized emergency services in that community.

**Methods :** Sundaram Medical Foundation Hospital in the town of Annanagar, Chennai, India was our study site. Statistics describing the health status, demographic, and socio-economic profiles of the community were obtained from a published community survey. Information regarding availability of resources in the hospitals for management of trauma and cardio-vascular emergencies was obtained from unpublished survey results of the local hospitals. Retrospective data was obtained from trauma and ambulance registries regarding trauma related admissions, death and pre-hospital assistance.

**Results :** Data analysis revealed increasing mortality from trauma and cardiovascular etiologies. Hospital statistics showed that 1/3 of the annual hospitalizations were from trauma and acute coronary syndromes. Half the trauma victims had no formal prehospital intervention. Standard of care in the emergency departments varied considerably with less than half of them carrying defibrillators and only a third of them carrying defibrillators and only a third of them carrying intubation equipment.

**Conclusion :** As developing countries begin to urbanize and grow, so do their health care needs. The current system does not meet the needs of increased mortality from trauma and cardiovascular disease. We have suggested necessary changes for establishment of emergency medical services to meet the evolving health care needs. ©

## INTRODUCTION

As developing countries enter the twenty first century, non-communicable diseases are rapidly growing and adding to the existing burden of communicable diseases. What was once considered a health problem of the west is already an established epidemic in developing parts of the world. The health care system needs to reorganize in order to handle the rise in chronic illnesses and trauma.

Urbanization, better access to health care, improved medical treatment of infectious disease and health education has lead to longer life spans, while changes in diet pattern, decreased physical activity and increased

tobacco use predispose this population to development of coronary atherosclerosis. Current statistics indicate that cardiac diseases and stroke will be a major cause of death and disability in 2020.<sup>1</sup> Adding to the burden of cardiac diseases is a growing problem from road traffic accidents. These factors have contributed to the disease transition in developing countries from communicable diseases to long-term chronic health problems and trauma. Even though the epidemic is in its very early stages it is projected to emerge as a major threat to the developing nations.<sup>2</sup>

In this study we identified the city of Chennai, India as undergoing this transition in health status.. Chennai is a city in the state of Tamil Nadu and is the fourth largest city in India. The health care system in Chennai is dichotomized into Government funded hospitals, most of which hold affiliations with Medical Schools and private fee for service hospitals. There are approximately 111 hospitals and 18 privately owned ambulance services

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listed on the City's official website. There are many more unlisted "dispensaries" or "24 hour clinics" in Chennai available for urgent health care needs. At present, there is no residency training, board certification or specialty status for emergency medicine in Chennai.

During the year 2001 there were approximately five thousand road traffic accidents and more than six hundred fatal crashes in the city of Chennai.<sup>3,4</sup> Since a large number of casualties are from trauma, establishing trauma systems and improving ambulance response times and reducing transport times to specialized centers may improve morbidity and mortality.<sup>5-7</sup>

An increasing need for emergency and pre hospital care combined with strong interest from Sundaram Medical Foundation (SMF) a private hospital modeled after US community hospitals compelled us to perform a needs assessment of the system and formulate recommendations for development of an early pre hospital system in Chennai. We attempted to validate the changing disease pattern in the community, define the existing emergency and pre hospital structure and recommend changes to the existing system.

## SUBJECTS AND METHODS

### Study Design

This was a retrospective observational study conducted at SMF, a community hospital in the town of Annanagar, Chennai, India during the month of October 2003.

### Setting

SMF is a one hundred and thirty-bed hospital with sixteen thousand six hundred emergency department visits in the year 2001. The Emergency department (ED) currently has ten beds, one resuscitation area and one procedure room. They are the site for an international Emergency Medicine (EM) elective and work closely with AAEMI (American Academy for Emergency Medicine in India) a group focused on development of Emergency Medicine in India.

The data resources were the published results of an Annanagar health survey, data from trauma and ambulance registries of the hospital, and unpublished data of a citywide ED survey. We obtained the demographics of the community and the incidence of communicable and non-communicable diseases in the community from the Annanagar health survey. Data for trauma and trauma related visits to the ED, the severity of trauma and pre-hospital care of trauma patients were obtained from the ED trauma log. Number of ambulance calls for the month, site of calls, reasons for ambulance calls and time of calls were obtained from the ambulance log.

ED visits and hospitalization for cardiovascular related pathology were obtained from the ED admission registry. We also reviewed data regarding the training

level of physicians and equipment availability in emergency departments across the city, which was obtained from survey results of the community emergency departments. No patients were enrolled into the study as subjects. We received an exemption from the IRB (Institutional Review Board) of our Medical Centre for this study.

### Data Analysis

Data was extracted from the various log books by one of the authors (PR), entered and analyzed using Microsoft Excel.

## RESULTS

Demographic data of the community revealed the size of an average household to be four people, with less than one-fifth of the population over the age of sixty five. Approximately one tenth of the community were unskilled or semi-skilled workers. Almost the entire community used modern medicine for health care needs and more than one-third had health insurance. Prevalence of hypertension and diabetes in the community were 25% and 16% respectively. Even though annual incidence of Acute Myocardial Infarction (AMI) in the community is almost five for every thousand and matches the incidence of Malaria the annual incidence of stroke was noted to be very low. Trauma had an annual incidence three times that of Malaria with 50% occurring in the age group of 16-45 years Trauma accounted for an increasing number of ED visits from 1% in 1995 to 5 % in 2000. Patients with isolated head injuries were not included in the trauma log. During the study period, in October 2003, Trauma was responsible for 70% of all ED visits and 14% of deaths. No formal pre-hospital care was offered in 85% of the trauma patients.

Chest pain ranked among the top five reasons for ED visits and about half of the admissions to the ICU (Intensive Care Unit) were from ACS (Acute Coronary Syndrome). According to the ambulance registry, there was no documentation of formal pre hospital care offered to these patients.

Data from the ambulance log revealed an average of ≥ 3 trips/day for the single ambulance for emergency calls. This did not account for the critical care transports by the mobile ICU. One third of ambulance trips were within 5 km of the hospital and another one third of transports were for 5-15 km from the hospital. Ambulance calls peaked on Thursdays for unclear reasons, and between 0800- 1400 hours on all days except Sundays. In the majority of cases, when ambulances were used to transport patients to hospitals, there was no pre hospital care or treatment offered by qualified personnel. Ambulances were also commonly used to transport ED patients to outside laboratories or for imaging purposes with no trained medical staff on board. Call requests for ambulance were triaged by non-physician staff and ED

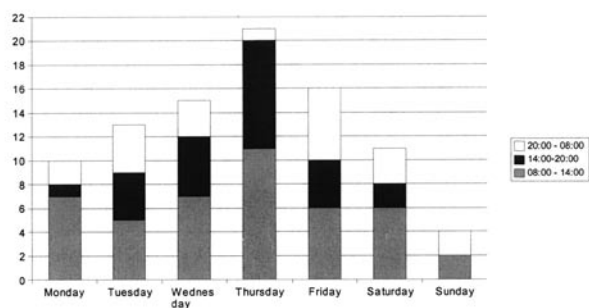


Fig. 1 : Distribution of ambulance calls by time of the day in October 2003.

house staff determined need for onboard physician.

Data was reviewed from the citywide survey of emergency departments performed in January 2000, around the city of Chennai. Trauma accounted for one fifth of ED visits consistently across all the hospitals. Although trauma is the most common diagnosis, only one in every eighteen hospital had their ED medical staff trained in ATLS(Advanced Trauma Life Support) and three in every eighteen hospitals had ACLS(Advanced Cardiac Life Support) trained medical staff. Other physicians were not certified in any other equivalent life support courses. There was tremendous variability in the availability of medical equipment in emergency departments. Only a third of hospitals receiving trauma patients had cervical collars and central line equipment. About three fourths of the hospitals in the city had resuscitation drugs, only half of them had defibrillators in the ED and only a third of hospitals had Bag Valve Mask and paralytics for Rapid Sequence Intubations.

### Limitations

There are several limitations to our study. Most critical of those being it is retrospective in nature there was a large amount of missing data for pre-hospital care, trauma and acute cardiac care related hospital visits. There is no mandatory reporting of trauma, head injury was not recorded in the accident registry and hence the available records may not reflect the extent of trauma related ED visits. There was no universal definition for the word "grievous" used to stratify trauma in the registry. This could have impacted estimating severity of trauma. Also, since there are several trauma receiving hospitals in the area, the reported hospital data maybe exposing only a small number of hospital visits. Ambulance registries did not always report the medical reason for ambulance visits and no documentation of cases requiring physician for pre hospital care was available. This provides us with almost no way of estimating the acuity and the need for pre-hospital care in this community.

There was no registry maintained for Acute Coronary Syndromes (ACS). It is likely that many cases of AMI (Acute Myocardial Infarction) during the study period were not captured leaving us with inadequate information on pre-hospital care in patients with

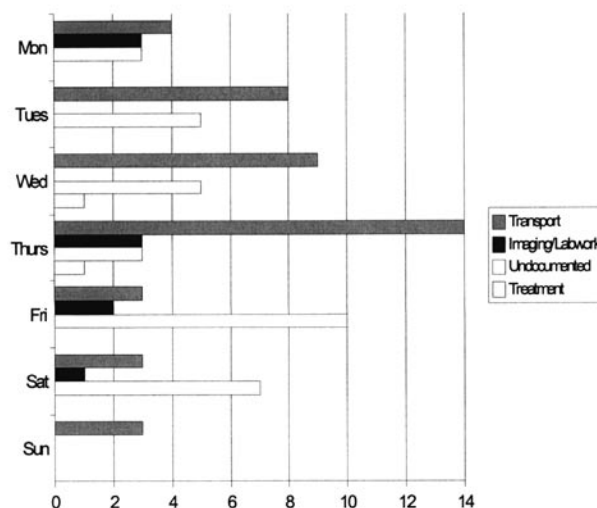


Fig. 2 : Reasons for ambulance calls by day of the week in October 2003.

AMI and out of hospital deaths due to lack of timely intervention.

Finally, demographics of this community may not represent all other communities. There were no comparable health survey statistics available from semi urban or rural communities. Statistics in the health survey were based on patient self-reporting and may not reflect the true level of disease prevalence in the population.

## DISCUSSION

Our study shows that there is morbidity and mortality from trauma and vascular diseases indicating a compelling need for emergency care and emergency medical services in developing countries. It is important for governmental organizations not only to continue public health measures but also establish emergency care and a pre hospital system. The existing systems are rudimentary with ambulances being used as transport vehicles. Emergency departments are staffed by physicians with no formal training. Changes should be made in stages to this basic system by building components on the existing infrastructure over time.

We identified the pre-hospital system in Chennai as a model for a simple pre-hospital system. We have proposed recommendations to the existing infrastructure to improve care for trauma and cardiovascular patients. Since these changes should be happening over time, we have stratified them as early, mid-phase and late phase recommendations. There is no evidence to support introduction of strategies in the order outlined in our paper. However, this has been built upon suggestions from physicians who have an extraordinary knowledge of the system.

### Early Phase Recommendations

1. Creating an Emergency Medical Care Call Center

: Sundaram Medical Foundation and a few other hospitals in Chennai have an emergency number for ambulance call requests. These numbers should be unified into one standard access number for ease of use by the community as in western systems which can develop into a dispatch center in the future.<sup>8</sup>

2. Levels of Care in trauma systems<sup>6</sup> : With the development of a pre hospital system, it may not be optimal for the providers to take patients to hospitals not equipped for acute management of these conditions. Hence, we recommend stratifying hospitals based on the level of care they can provide to trauma patients. There should be a focus on creating trauma centres as there is evidence to prove that fewer deaths occur in seriously injured patients when taken to trauma centre versus a non trauma centre.<sup>9</sup>

3. Training ED Physicians and Nurses : In addition to meeting state requirements for practicing medicine, all physicians, pre hospital providers and nurses staffing the trauma and cardiac centers should have a standardized training in acute cardiac life support, pediatric life support and trauma life support. Physicians and nurses need higher level of training in handling emergencies to staff emergency medicine departments. However, recognition of the specialty needs to be done at a national level.

4. Developing pre hospital system : Ambulances are stationed at each hospital site or in privately owned sites and are dispatched by the hospital/company to the site of call. This can be co-coordinated only if the status of the vehicle when in use is known to the call center. A system needs to be setup which updates the call center about the status of the vehicle availability.

Ambulances need to be stationed at locations of high volume traffic accidents to reduce response times. An ambulance registry needs to be created to help understand the nature of calls, severity of trauma and pre hospital care provided to patients. This along with trauma registry will help obtain prospective data and determine outcomes on patient morbidity and mortality with implementation of the system.

5. Training First Responders : First responders, being the front line medical care providers are key elements of any pre-hospital system. In the present system in Chennai, there are no defined pre hospital first responders. There are no defined response times for trauma or acute cardio vascular events in the system. Sundaram Medical Foundation proposed a novel idea of training the local motorized rickshaw drivers (auto-rickshaws) as first responders as they are available in large numbers in the city to provide immediate assistance. We suggest expansion of this concept to train police officers as first responders and offer training in first aid, defibrillation, extrication of trauma victims, immobilization and applying cervical collars and backboards. Since timely defibrillation

and early advanced life support measures has been shown to improve outcomes in out of hospital cardiac arrest, this needs to be prioritized during the system development.<sup>10-12</sup>

## SECOND PHASE

The next phase should be on training pre hospital advance life support providers. Some of the tertiary care hospitals have ambulances which function as mobile ICUs staffed by physicians and experienced critical care nurses. Similar training should be given to pre hospital providers and certification process established. Standards should be established for equipment carried by ambulance personnel. Curriculum for pre hospital provider training can be acquired from well developed EMS systems. Concurrently, nurses can be trained to provide advanced pre-hospital care until the early batch of providers gain expertise in pre hospital cardiac and trauma care. In the early stages of emergency medicine and pre-hospital development, knowledge can be gained through distance learning methodologies and use of telecommunications, particularly for advanced cardiac life support, trauma life support training in developing countries.<sup>13</sup>

In the next phase of growth, strong considerations should be given to development of dispatch centres, communication between dispatch centre and ambulances, pre-hospital provider and the receiving hospitals. Communication plays a key role in pre hospital medical care. This helps to alert the receiving facility about the condition of the patient and mobilize appropriate resources in trauma and cardiovascular diseases. Once dispatch centres are created, standardized dispatch protocols and training should be made available to the dispatchers.

The final stage of development should involve integrating emergency medical services in medical school curriculum, creation of quality improvement processes and research centers to help growth of this specialty. This will help to maintain an Emergency Medical system that will meet the health needs of the local community.

## CONCLUSIONS

Developing countries are faced with challenges of handling increasing morbidity and mortality from vascular diseases and trauma. This has led to an emerging interest in establishing EMS systems to handle these emergencies efficiently. As a first step in the development process, we have proposed short term plans to the existing health care infrastructure. With time and interest, we hope to see recognition of emergency medicine as a specialty nation-wide and establishment of EMS systems in the future.

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