Dissertation Title

"Study and Analysis of existing scenario of Ambulance Services across Hospitals in Bangalore and thereby designing an advance care ambulance to support specialized trauma centre of an upcoming 300 bedded hospital"

A dissertation submitted in partial fulfilment of the requirements
For the award of

Post-Graduate Diploma in Health and Hospital Management

By

Dr. Sonam Patni

International Institute of Health Management Research

New Delhi -110075

May, 2013

SAKRA
WORLD HOSPITAL

Date: 28/5/2013

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dr. Sonam Patni, student of PGDHM, (Batch 2011-2013), International Institute of Health Management Research, New Delhi has successfully completed her project on **"Study and Analysis of Existing Scenario of Ambulance Services across Hospitals in Bangalore and thereby designing an Advanced Care Ambulance to Support Specialized Trauma Centre of an upcoming 300 bedded Hospital"** from our hospital during her dissertation period of 3 months from 4th February to 28th May, 2013 under supervision and guidance of our medical administrator.

She was found to be sincere, dedicated and hardworking. She has shown a great passion towards learning during her dissertation work.

I wish her a successful career ahead.

Yours Sincerely,

For Takshasila Hospitals Operating Private Limited.

S.V.Kiran

Vice President - Human Resources & Operations

A Kirloskar + Toyota Tsusho + Secom Hospitals Japan venture

Sakra World Hospital : (A unit of Takshasila Hospitals Operating Private Limited)
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Certificate of Approval

The following dissertation titled **"Study and analysis of existing scenario of Ambulance services across hospitals in Bangalore and thereby designing an advanced care ambulance to support specialized trauma centre of an upcoming 300 bedded hospital"** is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a pre-requisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

Name	Signature
Dr. R. Bhalla	30 May 13
Prof. I. Bhattacharya	30/5/2013
Dr. Anandhi Ramachandra	

Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Sonam Patni**, a graduate student of the **Post- Graduate Diploma in Health and Hospital Management**, has worked under our guidance and supervision. She is submitting this dissertation titled **"Study and analysis of existing scenario of Ambulance services across hospitals in Bangalore and thereby designing an advanced care ambulance to support specialized trauma centre of an upcoming 300 bedded hospital"** in partial fulfilment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management**.

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

28/05/13

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Date - 28th May 2013

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FEEDBACK FORM

Name of the Student: Sonam Patni

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Area of Dissertation: Medical Administration & Clinical Quality

Attendance: A+

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Deliverables: A

Strengths: Hard working, Devoted to her work
Sincere.

Suggestions for Improvement:
Opportunity to improve on Analytical Skills.

Signature of the Officer-in-Charge/ Organisation Mentor (Dissertation)

Date: 28/05/13
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A journey is easier when you travel together. Interdependence is certainly more valuable than independence. This project report is the result of four months of training whereby I have been accompanied and supported by many people. It is a pleasant aspect that I now have the opportunity to express my gratitude to all of them.

The successful completion of any given task requires a lot of hard work and sincere efforts. Hard work and efforts are only the building blocks of an assignment, but the plinth has to be inspiration, suggestion, support and guidance.

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.

TABLE OF CONTENTS

ABBREVIATIONS

ACLS – Advanced Care Life Support

BLS – Basic Life Support

EMRI – Emergency Management Research Institute

EMT – Emergency Medical Technician

FRE – Fiber Reinforced Plastic

IT – Information Technology

NHSRC – National Health Systems Resource Centre

GPS – Global Positioning System

GIS – Geographic Information System

RTA – Road Traffic Accident

ECG –Electrocardiography

EMS- Emergency Medical Services

ICU-Intensive Care Unit

WHO-World Health Organization

RTI-Road Traffic Injuries

I.V.-Intravenous

HDU-High Dependency Unit

CCU-Coronary Care Unit

ECG-Electro cardiogram

NIMHANS: .National Institute of Mental Health and Neuro Sciences

MRI-Magnetic Resonance Imaging

Part I: Introduction

1.1 ORGANIZATION PROFILE:

About Hospital:

Sakra World Hospital is an upcoming Multi-Super specialty hospital, in Bangalore. It is the flagship of Takshasila Hospital Operating Pvt. Ltd, which is a joint venture between Kirloskar, Toyota Tsusho, and Secom Hospitals Japan. The 300-bed hospital will have medical technology from, both, Japan and India. It includes start of art ICUs and a high end trauma unit with a Mobile ICU. The hospital is fully equipped with high end Radiology and Imaging equipment, specialized Cath Lab and high end critical beds.

FOR THE FIRST TIME IN INDIA

Making an aggressive foray into Healthcare in India - Kirloskar, Toyota Tsusho, Secom hospitals, Japan come together to set up their first World Class Hospital in Bangalore. It is also the first time that an International Joint Venture Hospital chain is launched in India.

The first Kirloskar Hospital along with the Japanese partnership will be commissioned in Bangalore on July 1st. It would be a 300 plus bed facility with its core centres of excellence will be in Cardiac, Neurosurgery& Orthopaedics and would also have a strong Urology, Nephrology and Gastroenterology department. This Kirloskar Hospital along with the Japanese partnership will also have a very strong Trauma Centre to provide International standard of Emergency Care. Kirloskars Engineering and project experience has ensured that the Hospital construction and Project Management uses their valuable insights in engineering thereby creating a niche in Engineering Infrastructure& Planning. This ensures that the Hospital has a high quality construction and is completed within the deadlines with no compromise ever on quality, Ethics & Transparency in operations.

Sakra Promoters

- The Kirloskar Group is a 100 year old $ 1.20 billion engineering conglomerate driving critical industries. It is a century old pioneer in the areas of specialization like power, construction and mining, agriculture, industry and transport, oil and gas and environment protection, with a range of world-class industrial products and turnkey services.

Company is currently engaged in Healthcare, Investment & Realty Businesses. Healthcare is key focus area for the company and vision is to provide quality healthcare to the middle and upper middle class using best technology and processes. Mr Vikram Kirloskar and Mrs Geetanjali Kirloskar make an aggressive foray into the Hospital business by joining hands with SECOM & Toyota Tsusho

- SECOM Medical System is a 100% subsidiary of SECOM Co., Ltd. which is a top provider of Commercial and Home Security Service in Japan. SECOM also expands its business and has presence in nineteen countries. SECOM Medical System handles the healthcare business in SECOM and affiliated with 18 hospitals and 1 clinic in nationwide. SECOM Medical System's business varies from hospital management to home care service such as home-visit nursing and operating senior residences.
- Toyota Tsusho Corporation has been growing steadily together with the automotive business as the main axis. Toyota Tsusho Corporation was born after merging of two companies on April 1, 2006. Toyota Tsusho group, using the know-how of a global network and as the only trading company group that deeply involved in a idea of manufacturing, aim at a new trading company group that make flexible ideas and an adequate proposal.

MEDICAL MISSION

The SAKRA hospital is committed to advanced medical care through innovative and efficient services, creating an environment of continuous quality improvement and the expertise of the best physicians. We utilize the newer medical technologies, advanced clinical methods and develop protocols to improve our outcomes ensuring the good health of the community around us.

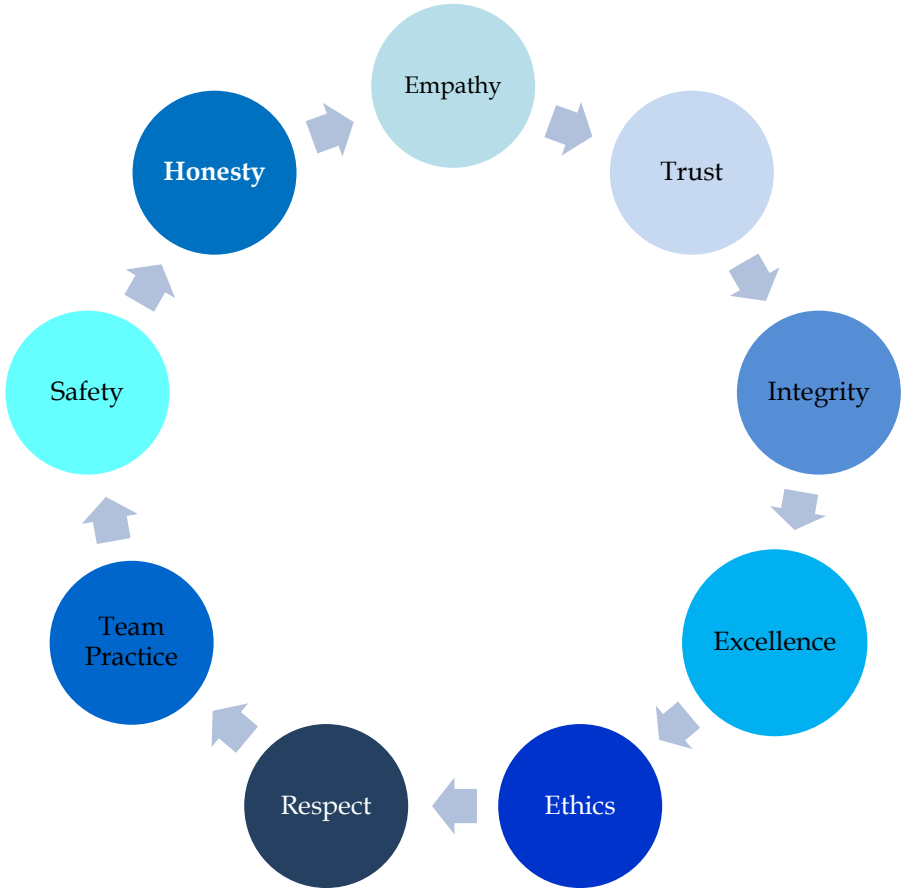
VISION

We commit to Medical care that enhances the Value of Human Life.

- To provide high quality medical care to India's large and growing middle and upper middle class, at affordable prices.
- Caring beyond the treatment to include complete after-care.

- Responsible for the patients health, well – being and continuous enhancement of his quality of life. Because we **'Value'** Life.

CORE VALUES



- **Integrity**

  To do what is right.
- **Honesty**

  To be true to the task for the best outcome.
- **Empathy**

  To be sensitive to the patient's need for care and prompt attention and to our employees motivation and respect.
- **Safety**

To protect and safeguard our patients from any harm and infection. Maintain the highest safety standards for a safe workplace for all.

- **Team Practice**

  Integrate medical & non-clinical functions. To enable both to work as a team. To deliver the best solution and care to all patients.

- **Trust**

  To create institution patients can trust. (Patients must believe that the medical solution and treatment offered is genuinely required and best suited to their case), In an ethical and reliable manner.

- **Respect**

  To institutionalise Respect, to families and colleagues.

  Respect for the patient & families.

  Respect within the team members, across hierarchy.

  Respect vendors and partners equally.

- **Excellence**

  Genuine Commitment to deliver the highest standard of surgery, post care, diagnosis & treatment with the most convenient and caring experience; using experienced and skilled personnel, processes that drive excellence, appropriate technology, best practices, collaborative effort and training & development.

- **Ethics**

  Ethical conduct of all Business & Clinical Practices. Not just meeting compliances, but exceeding them.

FUNCTIONAL ORGANIZATION

Mrs. Geetanjali Kirloskar-CHAIRPERSON

Mr. Toshimasa Yashima
MANAGING DIRECTOR

Mr. Kailasam Jayavelu
JOINT MANAGING DIRECTOR

Dr. Arjun Srivatsa
CHIEF OF MEDICAL SERVICES

Mr. Kiran S V
VICE PRESIDENT

Mr. Kentaro Totani
DIRECTOR & GENERAL MANAGER

BED MASTER:

Sakra world Hospital is going to be a 304 bedded hospital with 11 Operation theatres.176 beds will get operational in August 2013,and rest of 128 beds will be operational in Phase 2(March 2013).

Type	Phase I	Phase II	Total
CCU	**18**	**0**	**18**
Daycare	**4**	**0**	**4**
Deluxe	**12**	**21**	**33**
Economy	**22**	**0**	**22**
Emergency	**4**	**0**	**4**
HDU	**7**	**0**	**7**
ICU-1	**9**	**0**	**9**
ICU-2	**14**	**0**	**14**
ICU-3	**12**	**0**	**12**
ICU-4	**0**	**12**	**12**
Single	**19**	**80**	**99**
Suite	**2**	**9**	**11**
Trauma	**5**	**0**	**5**
Trauma ICU	**4**	**0**	**4**
Twin	**44**	**6**	**50**
Grand Total	**176**	**128**	**304**

Table 1: BED MASTER

SAKRA hospital 7 floor building, lower basement has the parking facility, upper basement has blood bank, MRD, laundry, Engineering offices, Pharmacy, Housekeeping, Doctors cafeteria, medical gas and parking.

GROUND FLOOR	1ST FLOOR	2nd-FLOOR	3rd FLOOR	4th FLOOR	5TH FLOOR
Emergency and Trauma	ENT Room	Neuro –ICU	Single Standard wing	Wing A(Twin sharing)	Wing-A(Suites)
EHC	Lab	Surgical-ICU	Rehabilitation	Wing B (Deluxe)	Wing-B(Deluxe)
Central reception	General OPD	Medical –ICU	Healing Garden	Wing C(single standard)	Wing-C(Single Room)
Neuro OPD	Cardiac OPD	Pediatric ICU	CSSD	Wing D(Single standard)	Obs-gynae
Ortho OPD	Cath Lab	Day care	Biomedical Deptt		
Radiology	Pre cath lab	Ortho-OT(2)	IPD billing		
CT scan(128 slice)	Physiotherapy	General-OT(4)			
BMD	Dialysis	Neuro –OT(2)			
USG	CTVS/Post Angio	CTVS OT(2)			
EMG	International patient lounge	CTVS-/Post op			
X-ray	CCU				
MRI(3 Tesla)					
Patient cafeteria and kitchen					
TPA and billing					
Pharmacy					

Table 2: DIFFERENT DEPARTMENTS IN HOSPITAL (FLOOR WISE)

This hospital has a unique ‘H’ Shaped design, inspired by Japanese hospitals. It allows:

- Free movement for patients
- Avoids un-easy turns and intersections
- Easy access to the central lifts
- Windows for all patient rooms.

Keeping privacy, infection control and affordability in mind, the in-patient rooms are customized without compromising on services. Room designs are flexible, to allow single rooms to be converted into twin rooms. This accommodates high demand for the twin category.

The Hospital has Isolation rooms in each ICU to provide extra care to patients with infection. Bedside facilities, such as oxygen supply, are kept after mapping even the future requirements, flexibility and minimum movement possible for the treating doctors and nurses. High end ICU ventilators for all ICUs are supported by devoted nurses for each bed. They ensure focused, intense & personalized care. We, at Sakra, want to have seamless communication between the doctors and patients. A facility of getting investigation reports online, registration through KIOSKS and queue management systems, will help reduce time for patients and family. IP TVs, in patient rooms, will provide all the entertainment with information exclusive to the patient.

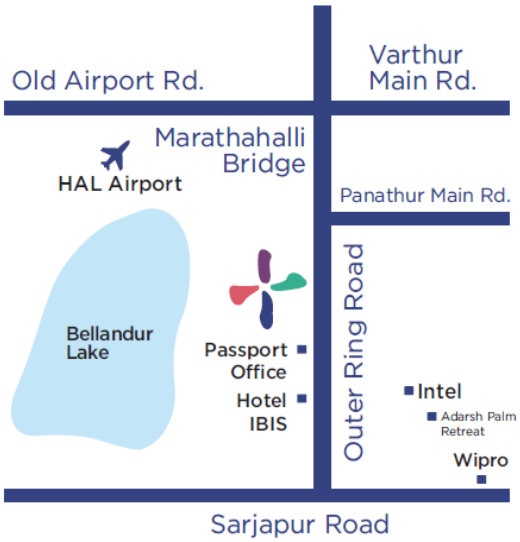
LOGO:

The brand and logo of Sakra World Hospital has derived from the word *Sacrum* which is the tail bone of the vertebral column & *Sakura*, flowering Cherry, National flower of Japan. **The logo is in the shape of cross which is a** symbol of many facets. It is a positive, sign of hope and recovery. It indicates that disparate paths and avenues can converge for the purpose of harmonious function. The Logo has 4 petals conjoined at the stem; the flower metaphor lends certain softness to the brand. A hospital brand also has essential qualities of care, nurturing and empathy. Hence the logo represents a coming together of strength and energies.The colours of the logo are coral, mauve, orchid blue & teal which symbolizes the amalgamation of Healing, calming and relaxing process. Each of the color has a meaning to it.

- **Coral** - Restores youthfulness, Brings you in contact with your feelings.
- **Mauve**-Brings sleep, Soothes mental and emotional stress, decreases sensitivity to pain.
- **Orchid Blue** –Represents elemental water and elemental air.
- **Teal**- Increases intuition and sensitivity while dissipating any sensation of stress.

LOCATION:

- Located in Devarabeesanahalli surrounded by SEZ & IT Co
- Around 40 Kms from Airport, around 12 Kms from Railway station
- No Established Healthcare units in the location



1.2 Involvements In The Organization

In the organization, I was placed in the operations (Medical Administration) department wherein, I was reporting to the DGM (Clinical Quality and Medical Administration).Apart from handling the Medical Administration activities, I was also actively involved in the IT Department where I was involved in the HIS Integration of various clinical modules(Operation Theatre, ICU, Doctor's work bench etc). Apart from all this I had also participated in the marketing activities at the time of logo unveiling of the hospital.

1.3 Report on Managerial Tasks Undertaken

(A) Within Medical Administration

i. Mapping of the requirements of the hospital including furniture and fixtures, consumables as well as signage of the entire hospital.
ii. Identification and mapping of various bio-medical waste management bins to be used in the hospital.
iii. Apart from mapping, mock review and verification of the same on ground was also carried out for the entire hospital on day to day basis (project planning & designing phase).
iv. Formulation of administrative SOP's for the various clinical departments(Operation Theatre, ICU, Daycare)
v. Formulation of care-pathways which will be utilized to streamline care delivery in the hospital.
vi. Periodic site visits to observe latest developments(Wall chasing, Furniture Installation)

(B) Within IT (HIS)

i. Formulation of work flow processes for the various clinical departments of the hospital.
ii. Participated in formulation of FRD's (Functional Related Documents) for the clinical departments of the hospital.
iii. Active participation in the HIS Integration for the clinical modules (OT, ICU, Nursing, Laboratory, Radiology, Blood Bank, OPD, IPD, EHC etc).
iv. Mapping of LAN as well as other IT related requirements of the entire hospital as well as verification of the same on ground.

1.4 Reflective Learning's

i. I have learnt the art of leadership as I have actively participated in many discussions that took place for the streamlining of the processes in the hospital

ii. Stress endurance, Crisis management and working on restricted and defined time lines are among the most acquired qualities.

iii. I have learnt to work as a team, dealing with all the nuances which crop up, and brainstorming to resolve the issues.

iv. I have experienced the in depth nuances which occur during the project development phase, the rigorous planning, and on-time implementation strategies which are the building blocks of a successful project like ours.

Part II: "Study and analysis of existing scenario of Ambulance services across hospitals in Bangalore and thereby designing an advanced care ambulance to support specialized trauma centre of an upcoming 300 bedded hospital."

2.0. Introduction

- India, by virtue of statistics, is a country that needs high-quality ambulance services nationwide. It is one of the most disaster-prone areas in the world; almost 57% of India's land mass is vulnerable to earthquakes, 68% to drought, and 12% to floods[1]. Cardiovascular diseases are major cause of mortality and disease in the Indian subcontinent, causing more that 25% deaths. Trauma related death occurs in India every 1.9 minutes[2]. The ratio of Road Traffic Accidents in the world is 0.75 accidents for 1000 vehicles while in India it stands at a staggering 16 accidents per 1000 vehicles (21.3 times higher than the world average[3]. The World Health Organization (WHO) has projected that by 2020 road crashes will be a major killer in India, accounting for 546,000 deaths[4].
- India needs organised and dedicated ambulance service in order to cater to patients who are in dire emergency
- Importance of pre-hospital care?

  The concept of "the Golden Hour" and "the Platinum ten minutes" has laid an importance on the Emergency medical services all over the world. Patient who receives prompt medical treatment from trained professionals and is transported to nearest health care facility within 15-20 minutes of an emergency has greatest likelihood of survival and this time period lasting from a few minutes to first hour following injury or emergency is known as golden hour or golden period[5]**.** Out of all accidents leading to fatalities 30% of victims die due to delay in transportation or during transportation that reflects the need for speedy and prompt response after accident [3]. Over 80% of accident victims do not achieve access to medical care within one hour of the incident.[6]
- BANGALORE:

  Bangalore has about 30,000 emergency cases per month, out of which only 10% are serviced by ambulances[7]. The IT boom has made Bangalore city to grow at an unimagined speed. There was sudden over-night demand for every kind of infrastructure. The city of Bangalore has recorded unprecedented motorization, infrastructure expansion and increasing mobility of

people in the last decade, this change is likely to continue in the coming years. Consequently there has been an increase in road crashes, deaths, injuries (RTIs) and disabilities. In addition, greater reliance on motor vehicles also results in many direct and indirect health effects leading to some non communicable diseases (cardiac diseases)

- We are living in an era where the emphasis on preventing damage is more than ever, and that is how the provision of pre-hospital care has gained momentum to ensure that lives are not lost due to avoidable circumstances.

AMBULANCE: The term 'ambulance' comes from the Latin word 'ambulare' meaning to walk or move about which is a reference to early medical care where patient were moved by lifting or wheeling. The word originally meant a moving hospital

An ambulance is a vehicle for transportation of sick or injured people to, from or between places of treatment for an illness or injury, and in some instances will also provide out of hospital medical care to the patient.

TYPES OF AMBULANCE:

a) **Patient transport ambulance:**

This is most common type of ambulance. The purpose of these ambulances is simply to transport the patient to, from or between places of treatment. These vehicles are not usually equipped with life support equipments, and are usually crewed by staff with less qualification than the crew of other ambulances.

A vehicle that is used for making non emergency calls such as

- Scheduled visits to a physician's office for treatment, routine physical examinations.
- Transport to local hospital for physiotherapy, radiology and radiation appointment.
- Non-emergency patient transport
- Hospital discharges

b) **Basic Life Support (BLS):**

BLS ambulance is one that provides transportation and capable of providing basic life support to the patients who do not require extra support or cardiac monitoring.

It is equipped with equipment and staff needed for such basic services as control of bleeding, splinting fractures, treatment for shock, oxygen administration, and CPR (cardiopulmonary resuscitation) capabilities.

BLS ambulances are staffed by at least two people, one of whom is certified as experienced nurse paramedic.

c) **Advanced Life Support (ALS):**

- Ambulances that provide transport to patients who need a higher level of care than a regular ambulance (BLS) can provide.
- They are well equipped with tools and equipment similar to that which is found in a hospital emergency department or critical care unit and have equipments like defibrillator, ECG, cardiac monitor, portable ventilator, suction machine, resuscitation kit, electrocardiogram, emergency medicines and pulse oxymeter.
- ACLS Ambulance are well-equipped and staffed by highly trained paramedics and capable of providing treatment of life-threatening medical emergencies through the use of techniques such as endo- tracheal intubations, administration of drugs or intravenous fluids, cardiac monitoring, and electrical therapy by a qualified person..
- ACLS certified employees are able to administer pharmaceuticals to resuscitate a patient experiencing a drug overdose, heart attack, or other type of medical trauma. BLS does not allow the provider to administer IV drugs—they may only assist patients with taking their medications
- Essentially Design of Advanced life support ambulance and Basic life support ambulance will be similar. The differences are in the medical equipments and staff available in the ambulance.

PROBLEM STATEMENT

Organized ambulance services are scanty in India and even if they exist, their existence is no more than merely patient transport vehicles. Most casualties occur when patient fails to reach within golden period. This happens because of non availability of ambulances, shortage of manpower, not well equipped ambulances to cater to specific needs, lack of professionally trained personnel, lack of integration of ambulances and call centers.

Need for well equipped ambulances

It has been noted that although there is moderate availability of ambulances in Bangalore most of them are not very well equipped with all the life saving equipments. Providing care with the appropriate equipments is even more important than merely providing care. Administering the right treatment at the right time can reduce the mortality manifold. That is how the concept of "Golden Hour" has come into limelight

Need for paramedic staff

There is a dire need of trained paramedics to handle emergency case management on-site, in-transit, and in hospitals. It is crucial to have such staff trained and certified in rescue, resuscitation, evaluation, monitoring and transportation. Without having this element intact even the most well equipped ambulances would serve merely as patient carrying vehicles.

Lack of integration of ambulances with Information Technology

There is a lack of integration of technology with the day to day functioning of ambulances. For a quick response system the ambulance services should be very well integrated with the technology. As soon as the patient call is received it at the call centers it should trigger the ambulance in no time which would help save lives by initiating timely treatment. Because of the ever growing population, the integration of these services with technology has become the need of the hour to promote efficiency and effectiveness of the ambulance services.

❖ REVIEW OF LITERATURE

- "Study of Emergency Response Service – EMRI Model" by National Health Systems Resource Centre (NHSRC), Ministry of Health & Family Welfare, Government of India; 2009[8]

  Studied 108 models of EMS in India:

  The most widespread Emergency Response Model in India is the 108‟ Emergency service managed by EMRI (Emergency Management and Research Institute) across ten states. EMRI began operations in Andhra Pradesh on April 2, 2005 with a fleet of 30 ambulances across 50 towns of the state. It is responsible for handling medical, police and fire emergencies through the 108 Emergency Service. Presently EMRI has its operations in 10 states with 2,601 Ambulances in Andhra Pradesh (752 ambulances), Gujarat (403 ambulances), Karnataka (408 ambulances), Tamil Nadu (385 ambulances), Goa (18 ambulances), Madhya Pradesh (55 ambulances), Rajasthan (164 ambulances), Assam (280 ambulances), Meghalaya (28 ambulances), and Uttarakhand (108 ambulances).The "108 Ambulance Service" is a Public Private Partnership model between state governments and Emergency Management and Research Institute (EMRI) and the service provides complete pre-hospital emergency care from event occurrence to evacuation to an appropriate hospital. This study observed that EMS for India is not a strict centralized system, but a loose conglomeration of state initiated systems, with a common set of monitoring and governance tools for comparability and transparency across the country

- Can IT Improve Emergency Health Services in India?[9]

  (Sanjeet Singh and R.S. Uppal, BBSB Engineering College) The study evaluates the emergency health services in India with the special reference to Punjab. The study suggests the possible ways to improve the emergency. The study evaluated that how the GPS system works and how can the health sector utilize IT to make the emergency health better in India, specially the ambulance services. It explained how when network car's wireless device is installed in ambulance, the vehicle transmits information over a wireless network, information is then processed by data centre, then fleet operator receives real time performance updates and real time driver productivity.

- National Patient Safety Agency and the Helen Hamlyn Research Centre: Designing future ambulance transport for patient safety:[10]

  The year-long study was initiated to investigate how the safety of patients and ambulance staff could be improved through better design of vehicles and equipment. The report suggests safety criteria for inclusion into future NHS ambulances in England and Wales, leading to a standardized approach to the design and procurement of vehicles suitable for the safe provision of an increasing range of services.

  - **Research into ambulance design**

  The study found lack of consistency in the equipment, consumables and interior layout of emergency vehicles, which impacts on safe systems of work and the efficiency of clinical care. It also reflected that no guidelines specifically related to clinical or support workforce issues exist. Information was obtained from international literature, UK and US incident reports, and through a series of consultative workshops involving a wide range of stakeholder representatives. This was used to identify design challenges, which were validated via a questionnaire. Feedback revealed a strong desire for standardization in the design of vehicles and equipment to deliver national consistency, reduce risk, improve the working environment, ensure better, patient-centered care, and increase value for money through more efficient procurement.

  Recommendations

  Working space and layout: Stretcher should be able to move sideways if required for clinical Access. Paramedic seating to be adjustable, forward and backward, and laterally – also in height and rotationally – to maximize reach while wearing belt/safety harness

- All equipment to display via common monitor(s) with simple switching between display modes
- Modularized storage systems with integrated power supply and communications/data Transmission.
- Standard integrated ceiling unit incorporating equipment, lighting, monitor, oxygen, suction, Communications, etc
- Vehicle engineering: Modified suspension to reduce noise and vibration and improve ride while maintaining vehicle stability handling and road holding

- Patient experience: Child-friendly interior décor. User-friendly warning and informative signage/graphics

  A three-stage design involving standardization, modularization and innovation, was established to facilitate change planning and implementation.

❖ RESEARCH QUESTION

- What is the current scenario of ambulance services in Bangalore with special focus on the response time, catchment area and service utilization?
- Is there a difference between the perception of service providers and expectations of the users?
- Does a well equipped ambulance staffed with adequately trained manpower have an impact on delivery of effective medical care?

❖ GENERAL OBJECTIVE

- To identify and analyze the existing scenario of ambulance services across hospitals in Bangalore and design an ideal advance care ambulance model complementing high end trauma centre of an upcoming 300 bedded hospital in Bangalore.

❖ SPECIFIC OBJECTIVES

- To understand and compare ambulance services provided by various health care providers in Bangalore
- To understand public perception towards the ambulance services
- To identify key components in an advanced life support ambulance to provide timely and effective services.
- To make recommendations for an ideal ambulance based on this understanding

2.1. **METHODS AND DATA**

a. Study Design – Cross-sectional Analytical study design

b. Sampling

- Method of sampling – Convenient Sampling
- Source of sample – Various secondary/tertiary healthcare providers across Bangalore city, Karnataka
- Sample size – From 12 Hospitals of Bangalore (4:1 ratio)

  48 Patients / Relatives

  12 Ambulance Service Providers / Ambulance Managers

c. Data Collection Technique & Tool

Technique – Quantitative research Technique

Tool – Questionnaire designed for Service Providers (ambulance managers) & Patients/Relatives

Method of Data Collection – The study was conducted in the Emergency & Trauma department of 12 well known hospitals across Bangalore City. The data was collected in two parts, in the first part the data for the service care providers was captured while in the second the feedback of the patients/relatives who have had an experience with the ambulance services of the respective hospitals was collected.

d. Methodology

The study undertaken was a cross sectional analytical study wherein various hospitals across Bangalore were selected to study the ambulances with special focus on catchment area, response time, number of equipments, type of services offered, number of patients catered/day. The scope of the study was vast from studying and comparing different ambulances to recommending the best practices for new ambulance of an upcoming 300 hundred bedded hospital in Bangalore. The study included the perspective of not only the managers (ambulance service providers) who are closely dealing with the ambulances on day to day basis but also the patients and relatives who are affected by these services.

For this purpose two questionnaires were designed separately for the managers and the patients/relatives covering almost all the key identifiers/features of these services. The hospitals were selected on a convenient sampling basis. 12 hospitals from varying locations across Bangalore City were identified. A Sample of 4 patients and 1 manager were taken from each of the 12 hospitals i.e. 4:1 ratios, accounting to a total of 48 patients and 12 managers. Such data was then collected, collated and analyzed (Microsoft excel version 7) to understand features which are usually available in the ACLS ambulances, and the requirements of the patients/relatives and thereby design an ACLS Ambulance by combining all prioritized requirements, along with identification of exclusive features and including the same to design "A Mobile ICU Unit/ACLS Ambulance" for a 300 bedded hospital.

ORGANIZATIONS INVOLVED IN STUDY

List of hospitals visited for data collection

1. **M.S Ramaiah Memorial Hospital**

   M.S Ramaiah College housed in an area of 65 acres was started in the year 1979 and since has grown as an institution of recognition and repute both in India and abroad. The main college building is a spacious structure; "Vidya Soudha" has a total floor area of 3 lakh square feet with an adjoining teaching hospital with 1050 beds. The hospital has the state-of-the-art facilities to deal with any kind of investigations. It is the established "centre of excellence" promoting holistic health care, relevant research and innovations. It has Round-the-clock Emergency Services with Transport and Resuscitation unit connected by Wireless and Hotlines and Retrieval within the Golden hour, comprehensive Pre-anesthesia check, and anesthesia services with state-of-art Equipments, acute pain services, coordinated emergency and critical care services.

2. **Manipal Hospital**

   Manipal Hospitals has a special significance in the overall healthcare industry of India and particularly in South India. **Manipal Hospital,** situated on HAL Airport Road, Bangalore is a landmark destination for quality and affordable healthcare. The 600 bed centrally air-

conditioned hospital is the leading quaternary care multi super specialty referral centre in Karnataka, with 56 specialties. Manipal hospital has been ranked among the top 5 hospital in "INDIA'S MOST CARING HOSPITALS" survey. This was an all India survey conducted by the ministry of consumer Affairs, Government of India. The hospital was adjudged **Best Hospital in Bangalore** by The Week Magazine, consecutively for the past six years. The Consumer Voice Awarded Manipal Hospital as the **Most Recommended Hospital in India**. With a team of some of the best doctors in the world, an attentive staff, state-of-the-art equipment, the hospital provides specialized medical services at affordable costs. The Accident and Emergency department handles any life threatening and serious medical emergencies round the clock. There are currently two advanced life support ambulances which run under the guidance of this Department to provide emergency access to health care.

3. **St. John's Hospital**

St. John's Medical College Hospital is a tertiary medical service centre with 1200 beds. It offers specialty and super specialty services, including state-of-the-art diagnostic facilities to ensure the delivery of holistic patient care. Started on December 8, 1975, St. John's Medical College Hospital now has 24 full-fledged departments to provide specialty and super specialty services. Well equipped to provide comprehensive, affordable and quality health care to its patients with all facilities under one roof, St. John's is now a major referral centre in the Country.

4. **National Institute of Mental Health and Neuro Sciences (NIMHANS)**

National Institute of Mental Health and Neuro Sciences is a multidisciplinary Institute for patient care and academic pursuit in the frontier area of Mental Health and Neuro Sciences. It has established state-of-the-art diagnostic and therapeutic facilities in neurological disorders with special reference to genetically transmitted disorders and is the nodal centre for the Country in Research and Development.

5. **Chinmaya Mission Hospital**

Chinmaya Mission Hospital (CMH) has earned the reputation of the 'Friendly Neighborhood Hospital' and located at Indira Nagar, in the cosmopolitan city of Bangalore, India. Serving all

cross-sections of society and surpassing all language barriers, this multi-specialty hospital offers its best with the help of nearly 100 consulting specialists. CMH offers 24-hour emergency care and x-ray, laboratory, pharmacy, and ambulance services. The five well-equipped operation theatres, ten beds in the Intensive Care Unit (ICU), five beds in the Step-down ICU, and six beds in the post-operative ward, all have continuous monitoring facilities. The maternity ward has facilities for round-the-clock fetal monitoring and handling complicated deliveries.

6. **Hosmat Hospital**

the Hospital for Orthopedics, Sports Medicine, Arthritis & Trauma, is a 150-bed specialty hospital in central Bangalore, India. It also includes Hosmat Joint Replacement Centre and Hosmat Neurosciences. It is currently undergoing expansion to 500 beds, which would make it the largest specialty hospital of its kind in Asia. Initially known as the 'accident hospital', later it was in the news as a centre for knee transplantation procedures. Hosmat is equipped with the state of the art and round the clock facilities all of which are imperative for attending to emergency patients.

7. **Saint Philomena Hospital**

The Hospital also has a well-developed X-ray Lab with modern equipment, an Intensive Cardiac Care unit, a bustling Outpatient department, as well as a 24-hour Pharmacy, Trauma care, Casualty, C.T. scan and Laboratory facilities. Out of 400 beds in the Hospital, one-fourth are provided free of cost to needy patients. Private rooms in the Hospital have all the facilities boasted by other Hospitals, although they cost a fraction of what private Hospitals charge their patients.

8. **Mallaya Hospital**

"Individual care to deliver the best results – that is what hospital focus at every step". With the 360-degree care, patients experience the concept of Total Quality Management. Malaya hospital is well known for its clinical skills, friendly ambience and motivated staff; patients who admit here leave with delight and fondle the memorable moments of their stay. The hospital has over 220 beds capacity with Super specialty wing fully operational, located at the epicenter of city's business district, the hospital is conveniently accessible. Casualty and

emergency services in Malaya Hospital provide immediate therapeutic and diagnostic care on emergency basis round the clock. The Emergency room is an eight bedded unit and is strategically located. Round the clock Ambulance facility is available. Facilities to cater all acute emergencies are available in the ambulance which is equipped with medical and paramedical staff.

9. Vikram Hospital

Vikram Hospital is determined to be beneficial to the society in providing the correct and reliable medical service. It is one of the largest private hospitals in South-of-Karnataka in India offering primary, secondary and tertiary healthcare services to patients. **The 225 bed flagship hospital on Millers Road, Bangalore** has world-class equipments and infrastructure making it the best multi-super specialty tertiary care hospital providing medical excellence. The Hospital has the largest number of ICU beds (63 beds), 18 Medical Intensive Care Units (MICU), 27 Surgical Intense Care Units (SICU), 18 Intensive Cardiac Care Units, 12 Dialysis beds, 10 world-class Operation Theatres and two most advanced Cath Labs and a pharmacy to help create the best synergy and excellent patient-centric care. Vikram Hospital Emergency Care Centre is open to patients of all ages--infants to seniors – 24 hours a day, 7 days a week. From minor cuts and sprains to severe symptoms of stroke or heart attack, the hospital Emergency Department treats patients quickly and efficiently and is committed to provide the best medical care.

10. Bhagwaan Mahaveer Jain Hospital

It is a super specialty hospital situated in Karnataka with a charitable approach, engulfed within a corporate ambiance, in a judicious mix. It is Bangalore's best hospital for poor, with a team of well qualified doctors, trained nurses and paramedical staff. The world class Jain hospital believes in social service, with a vision to help poor and needy, conducts free plastic surgery camps, eye camps, asthma camps and free polio limb correction camps every year.

11. Columbia Asia Hospital

Columbia Asia Referral Hospital is a comprehensive super specialty facility situated in the upscale Hebbal locality of Bangalore. It is a multi-specialty 90 bedded hospital, and was the first branch of Columbia Asia hospital in India. Like any other hospital, will have internal medicine, general surgery, orthopedics, neurology and pediatric surgery, state-of-the-art diagnostic facilities including radiology, labs and so on. A Columbia Asia hospital are clean, efficient, affordable and accessible and is focused on creating most positive experience on the patients.

12. Fortis Hospital

The Fortis Hospital Banerghatta is a centre of excellence in Orthopedics and Neuroscience with additional focus on Cardiac Sciences, Minimally Access Surgery and Oncology. It is a hub where some of the best medical professionals provide quality medical treatment catering to the special needs of patients and their families.

2.2 ANAYSIS AND FINDINGS

1. PATIENT/ATTENDANT QUESTIONNAIRE

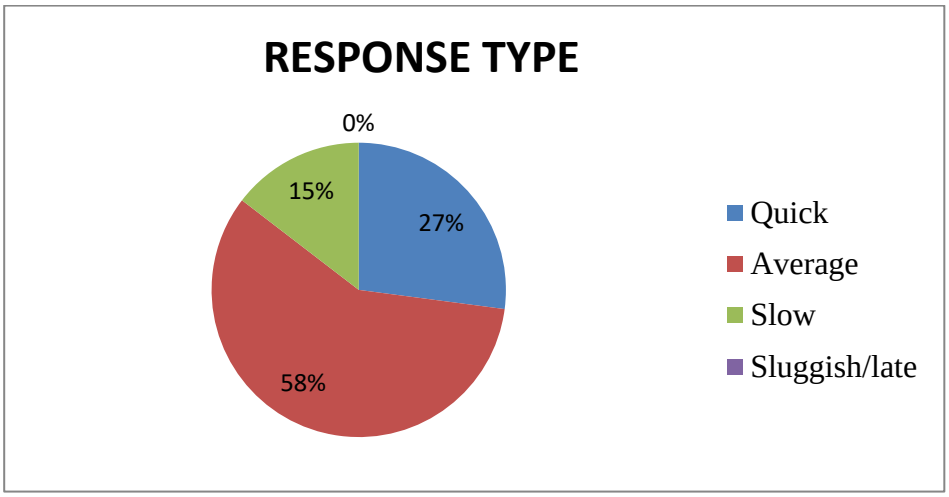


FIGURE 1: RESPONSE TYPE

Figure no.1 shows that 58% (28 out of 48) people categorized the response of ambulance to be average, while 27% (13 of 48) people categorized it as quick and 15% (7 of 48) said it was slow. It is of note that none of the patient/relative has rated it to be sluggish/late.

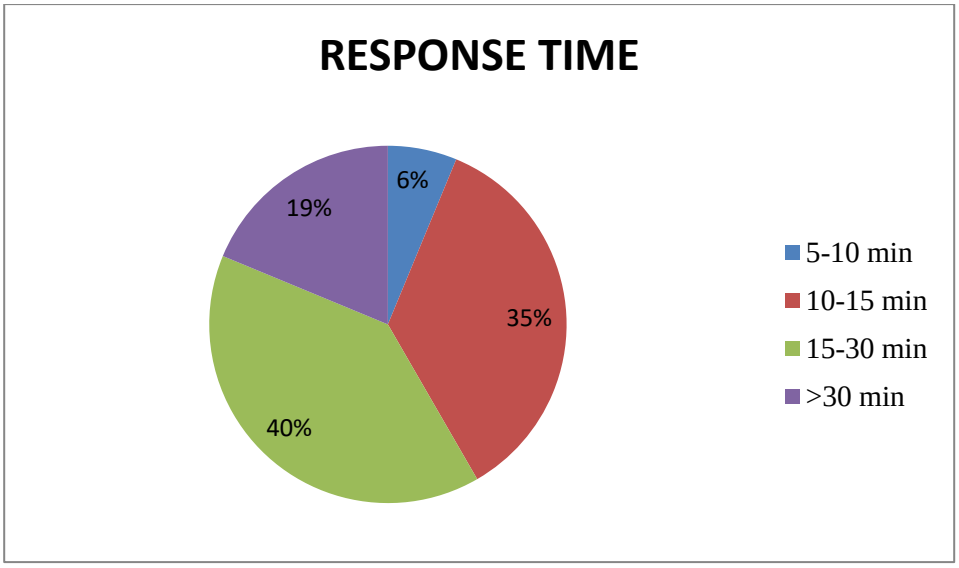


FIGURE 2 : RESPONSE TIME

It is clear from figure 2 that 40% (19 of 48) people said that the ambulance took 15-30 minutes to reach after the call, only 6% (3 of 48) said that it took 5-10 minutes, 35% (17 of 48) said it took 10-15 minutes to reach, 19% (9 of 48) said that it took more than 30 minutes.

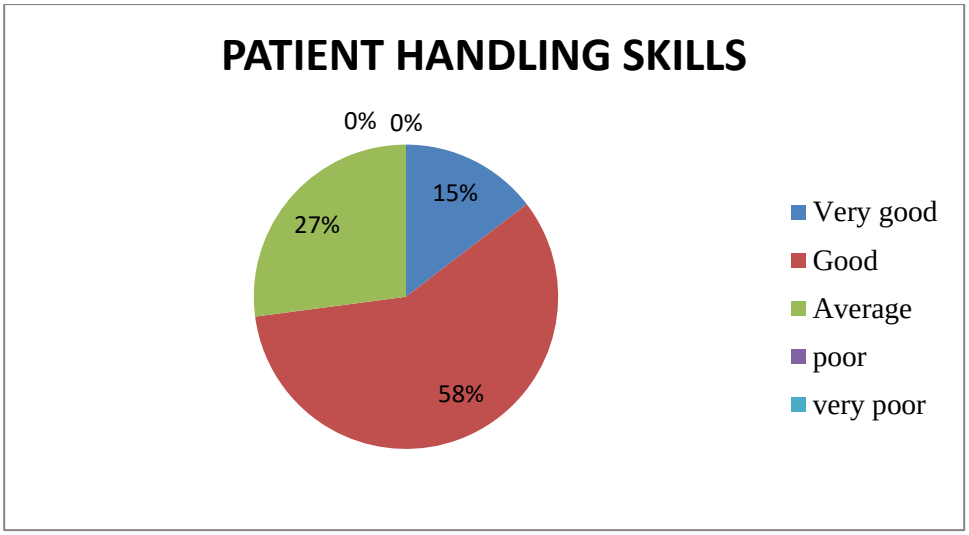


FIGURE 3 : PATIENT HANDLING SKILLS:

Figure 3 shows that 58% (28 of 48) people replied that the ambulance service provider displayed good patient handling skills, 27% (13 of 48) say they had average patient handling skills, while only 15% (7 of 48) said that the patient handling skills was very good

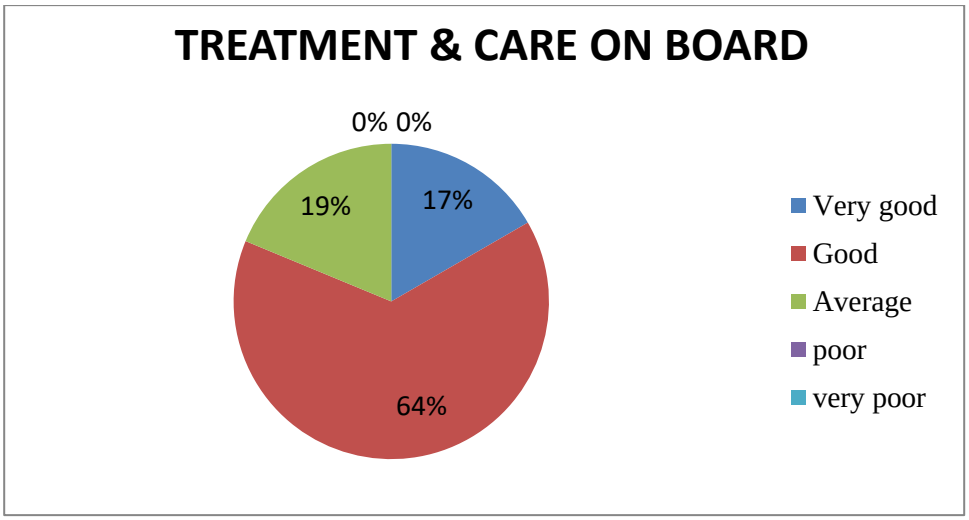


FIGURE 4 : TREATMENT AND CARE ON BOARD

Figure 4 shows that 64% (31 of 48) people said that the treatment & care provided on board was good, 19% (9 of 48) said it was average while only 17% (8 of 48) said that these services were very good.

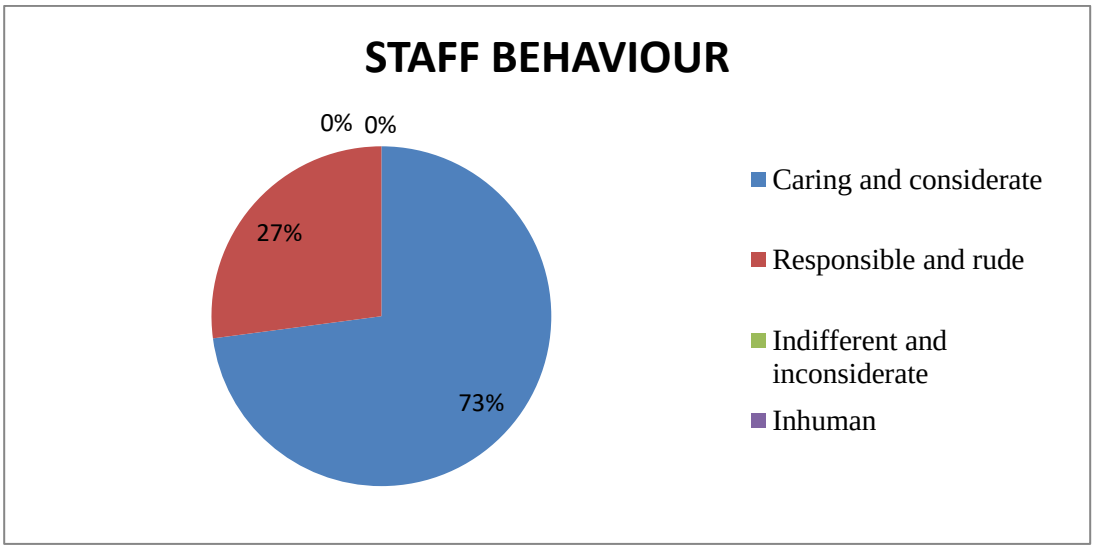


FIGURE 5: STAFF BEHAVIOUR

It is clear from figure 5 that 73% (35 of 48) people said that the behaviour of staff was caring and considerate while 27% (13 of 48) said they were responsible but rude. None said that they had an inhuman or indifferent attitude.

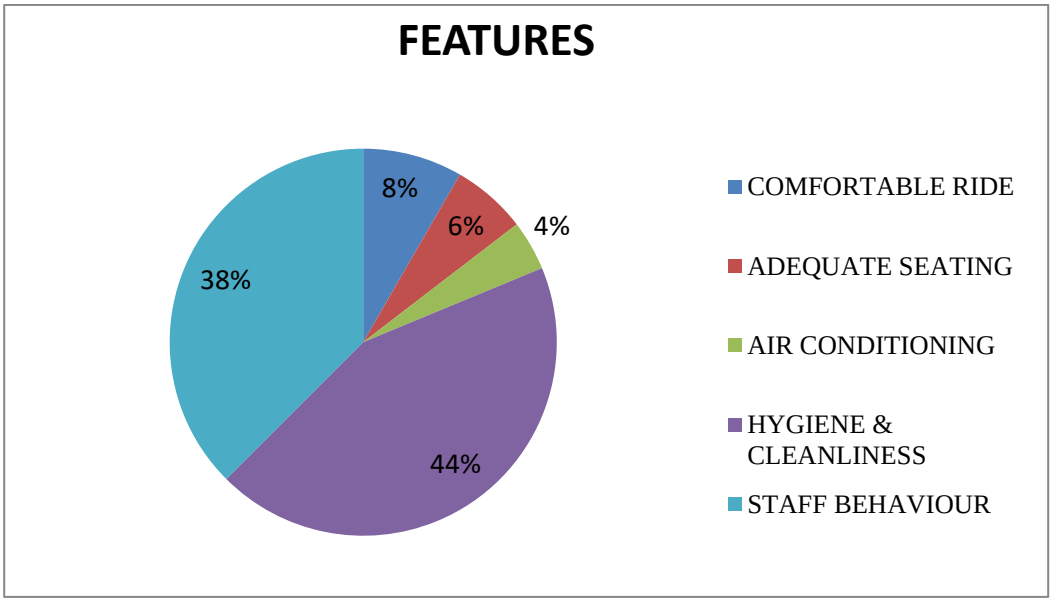


FIGURE 6 : FEATURES

Figure 6 shows that the most preferred criteria 44% (21 of 48) for the patients was hygiene and cleanliness followed by staff behaviour 38% (18 of 48). The less preferred options were comfortable ride 8% (4 of 48), adequate seating 6% (3 of 48) and the least preferred was air conditioning 4% (2 of 48).

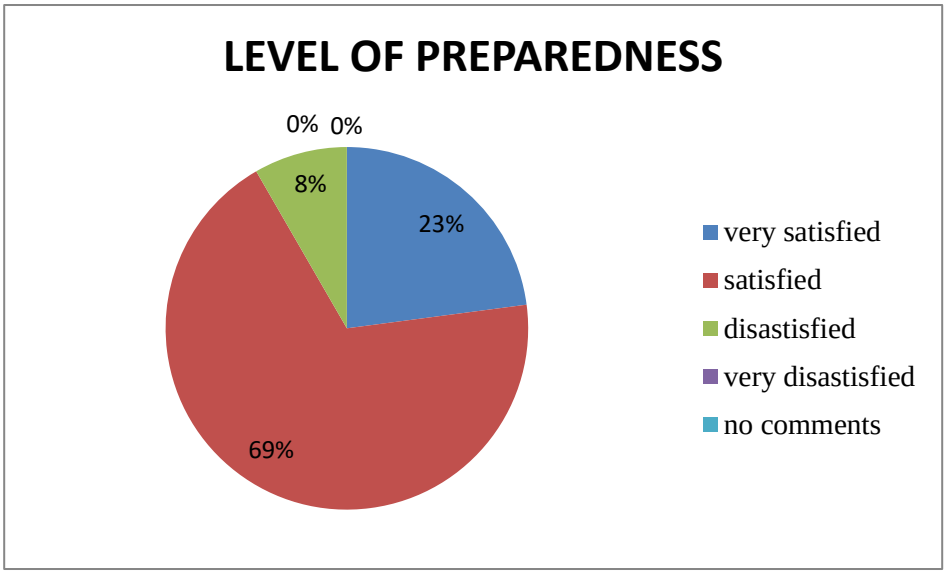


FIGURE 7 : LEVEL OF PREPAREDNESS

Figure 7 shows that 69% (33 of 48) people said that they were satisfied with the level of preparedness at the hospital, 23% (11 of 48) were very satisfied and only 8% (4 of 48) were dissatisfied.

ANALYSIS OF AMBULANCE SERVICE PROVIDER QUESTIONNAIRE

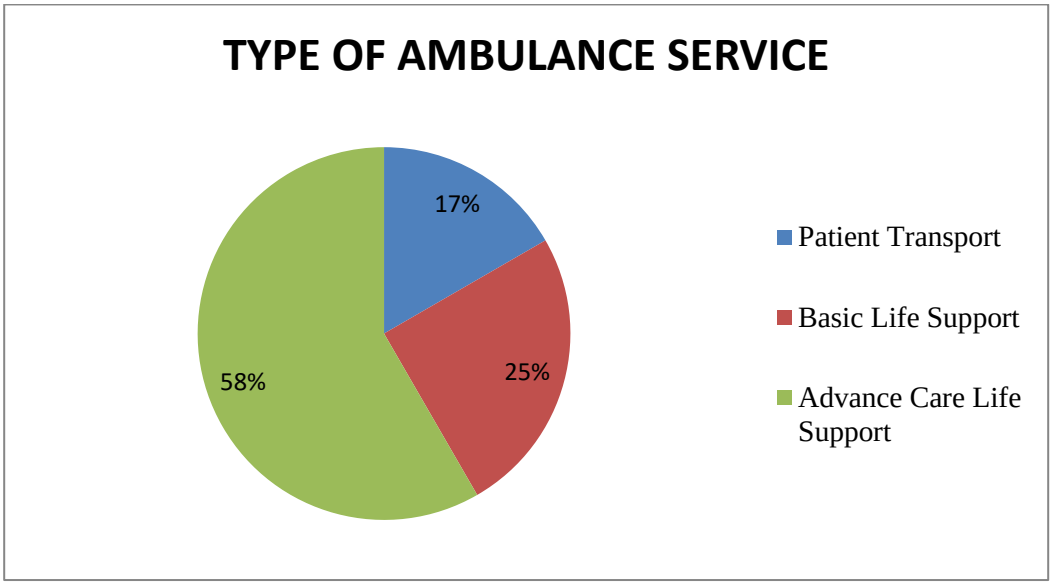


FIGURE 8 : TYPE OF SERVICE

Figure 8 clearly shows that out of 12 hospitals, 2 (17%) ambulances are used for patient transport, 3 hospitals (25%) utilize them for basic life support, and 7 ambulances (58%) are being used for advanced life support services.

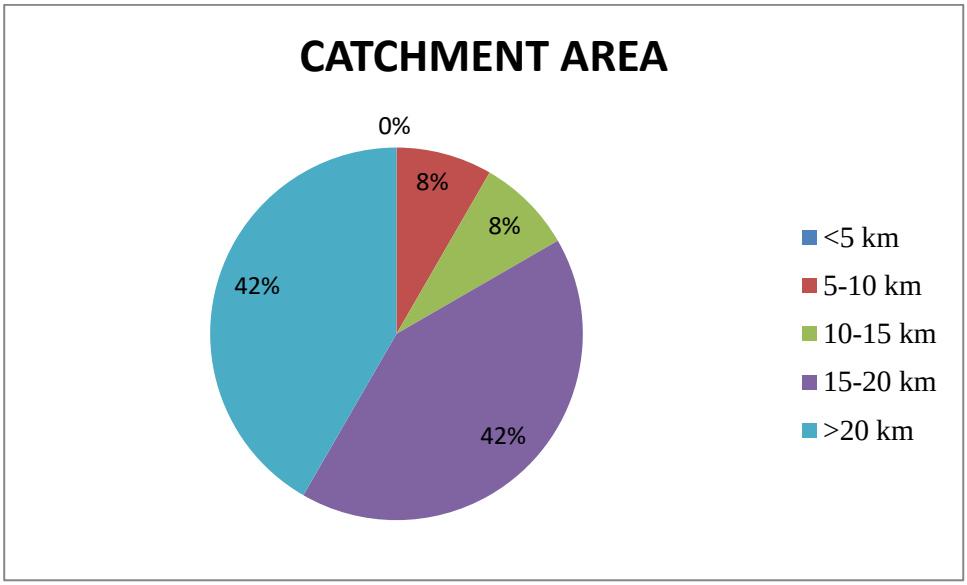


FIGURE 9 : CATCHMENT AREA

Figure 9 demonstrates that out of 12 ambulances, only 5 (42%) cover more than 20 km radius and beyond, another 42% (5) ambulances cover 15-20 km radius.2 other ambulances have catchment area of 10-15 km and 5-10 km radius respectively.

It implies that ambulances have a good catchment area

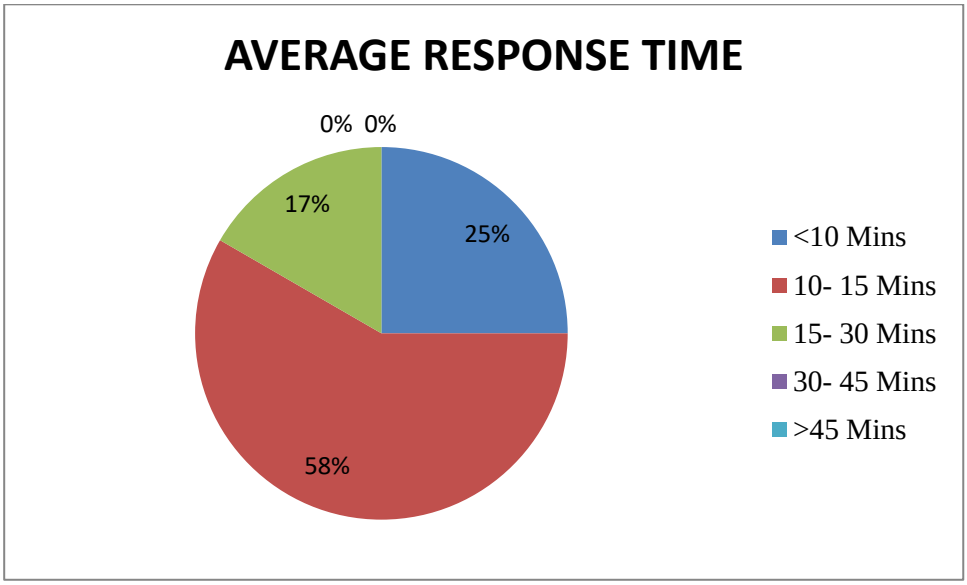


FIGURE 10 : AVERAGE RESPONSE TIME

Figure 10 shows that out of 12 ambulances 7(58%) ambulances reach the concerned place(site of emergency) in average 10-15 minutes of receiving the call .3 ambulances(25%) reach in <10 minutes, and 2 (17%) take 15-30 min to reach the emergency site. Therefore ambulances claim to have a good response time

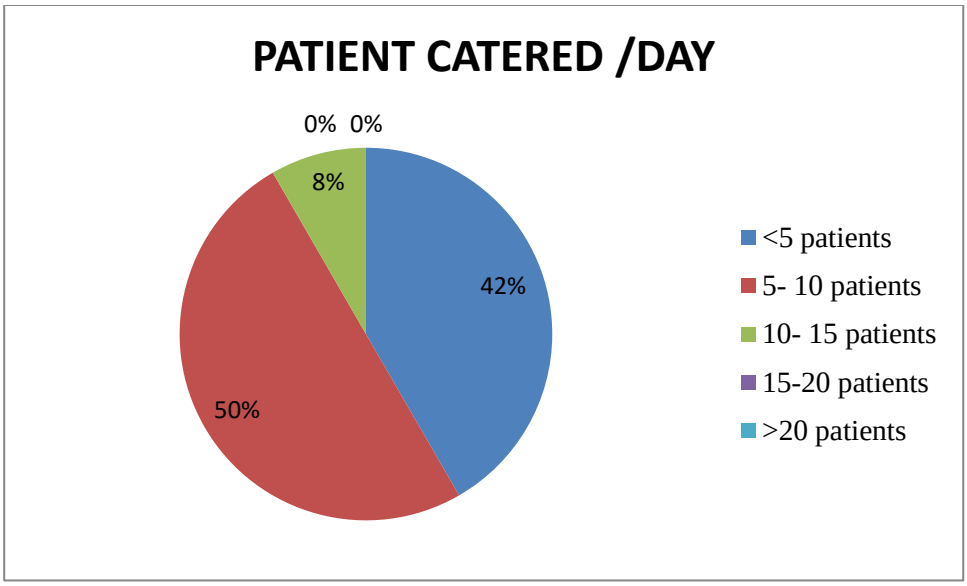


FIGURE 11 : PATIENT'S CATERED/DAY

Figure 11 shows that 6 ambulances (50%) cater to 5-10 patients/day.5 ambulances (42%) cater to <5 patients/day. Only 1 ambulance (8%) caters to 10-15 patients in a day. None of the ambulance catered to >15 patients in a day

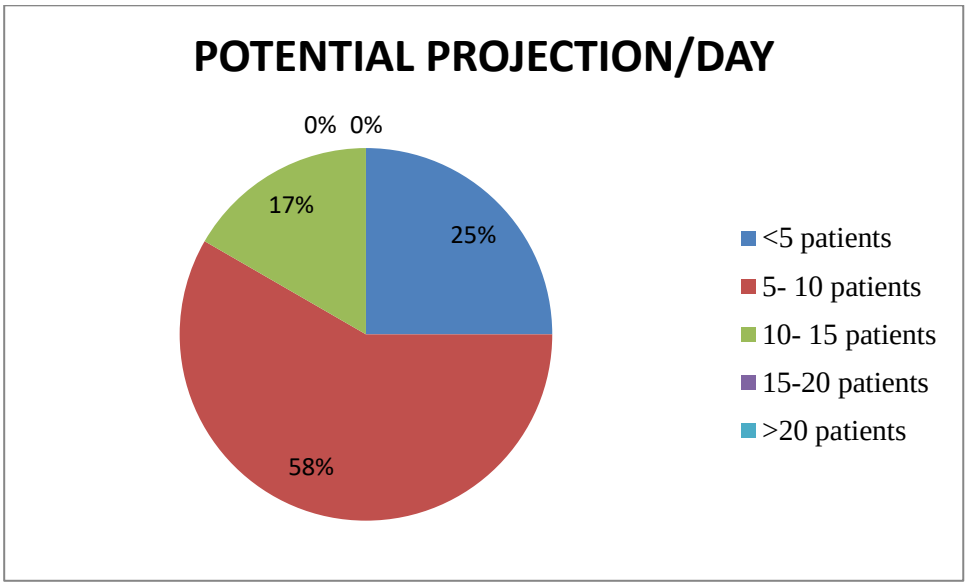


FIGURE 12: POTENTIAL PROJECTION/DAY

Out of 12 ambulance mangers only 2(17%) believe that they can cater to 10-15 patients in a day.7(58%) think that they can cater to 5-10 patients in a day another 25%(3)can cater < 5 patients in a

day through their ambulance. None of them believe that they have the potential to cater to more than 15 patients in a day.

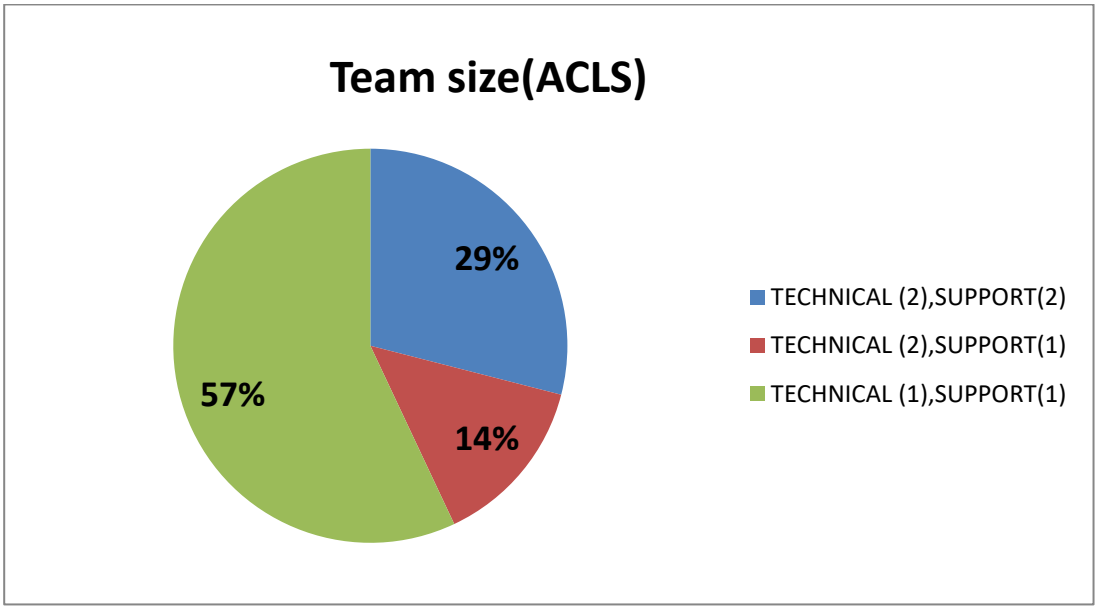


FIGURE 13: AMBULANCE TEAM SIZE

Figure 13 shows the status of ambulance team size. It can be seen that only (29%) have adequate manpower to manage ACLS ambulance i.e. 2 technical and 2 support staff.

TOTAL HOURS OF OPERATION: It was observed that all 12 ambulance operate for 24 hrs/day for all 7 days in a week

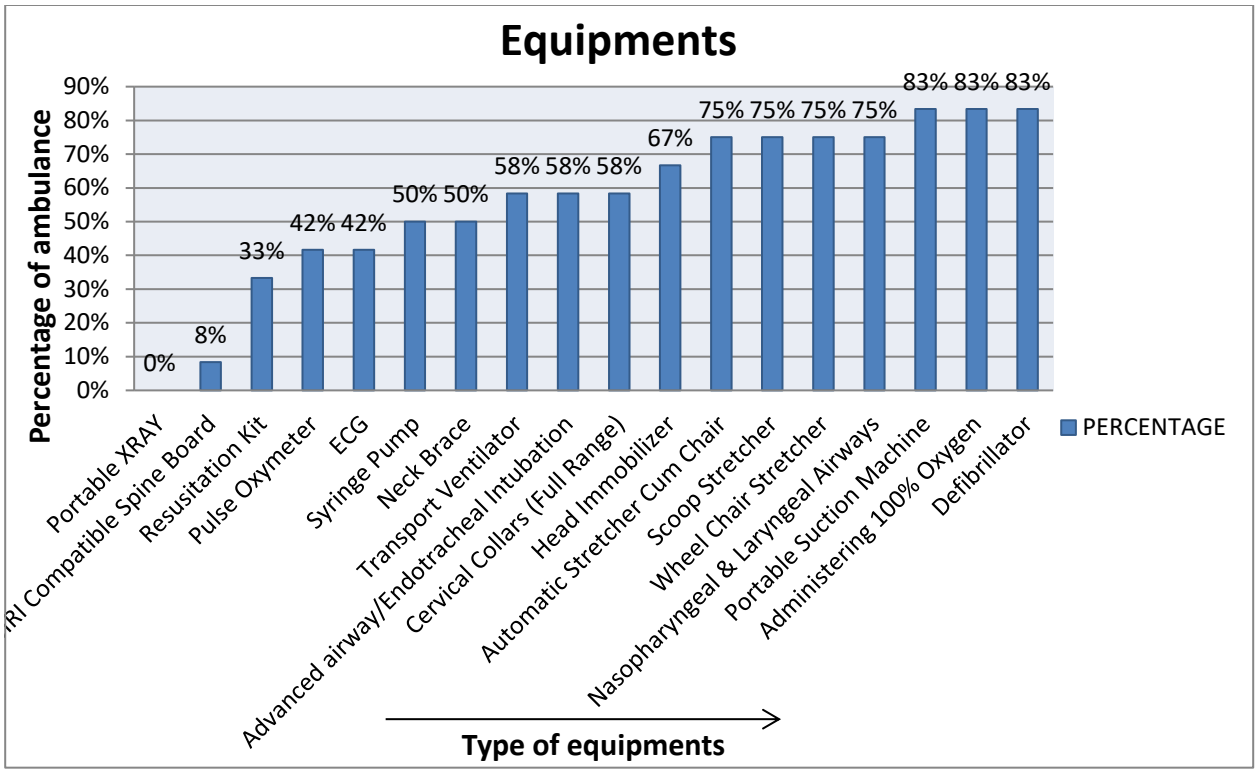


FIGURE 14: EQUIPMENTS AVAILABLE

Figure 14 shows that the most common equipment was portable suction machine, defibrillator and equipment for administering 100% oxygen. Three of them were found to be present in (83%) ambulances (ie.10).Next common equipments were automatic stretcher cum chair, scoop stretcher, wheel chair stretcher, nasopharyngeal and laryngeal airways. They were present in 75% (9) ambulances. Head immobilizer was present in 67% (8) ambulances

Transport ventilator, cervical collars, advanced endotracheal equipment were present in 58% (7) ambulance. Neck brace and syringe pump were present in 50 % (6) ambulances. Only 42% (5) ambulances had syringe pump and ECG. Resuscitation kit is only present in 4 ambulances (33%).Only 1 ambulance(8%) has MRI compatible spine board. None of the ambulance had portable X-ray

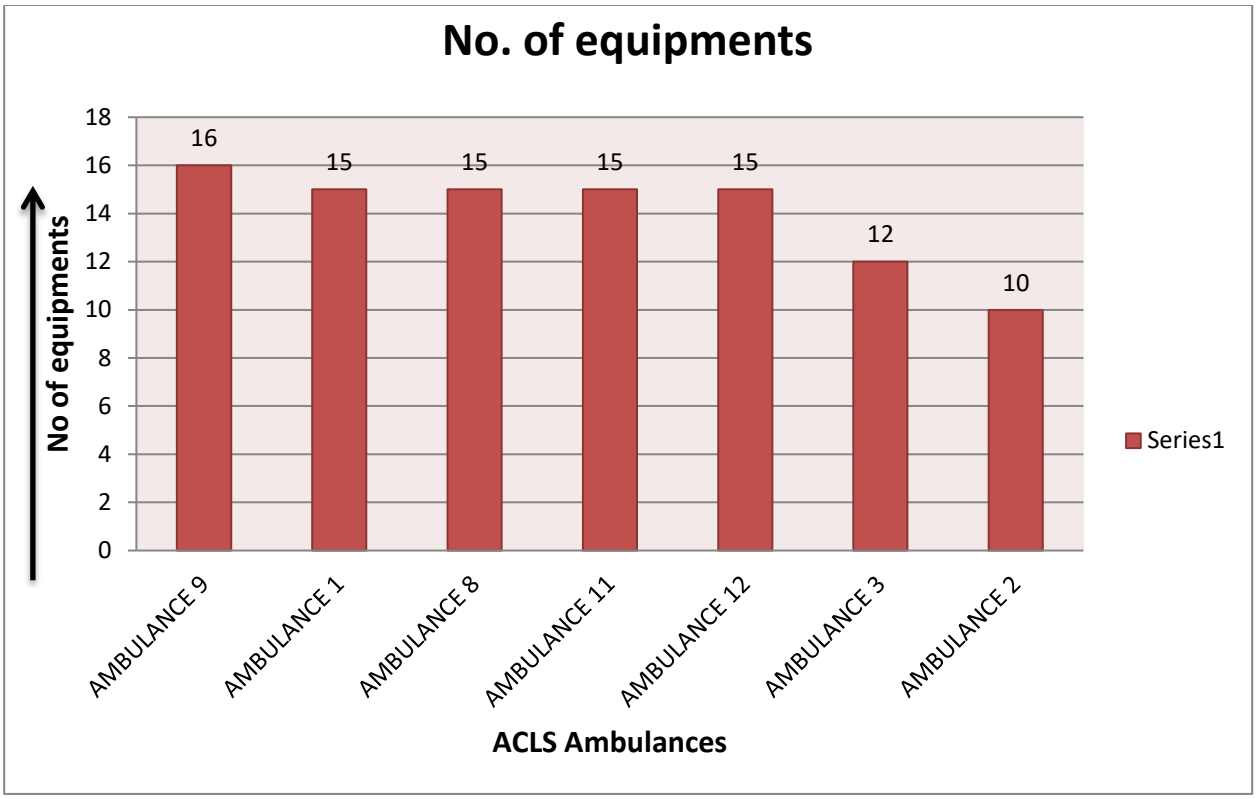


FIGURE 15: NUMBER OF EQUIPMENTS IN AMBULANCES

Figure 15 shows that out of 7 ACLS ambulances only 1 (ambulance 9) has 89 %(16 equipments out of 18 mentioned) 4 other have 83% (15 equipments). Ambulance 2 had the least amount of equipments (10 out of 18)

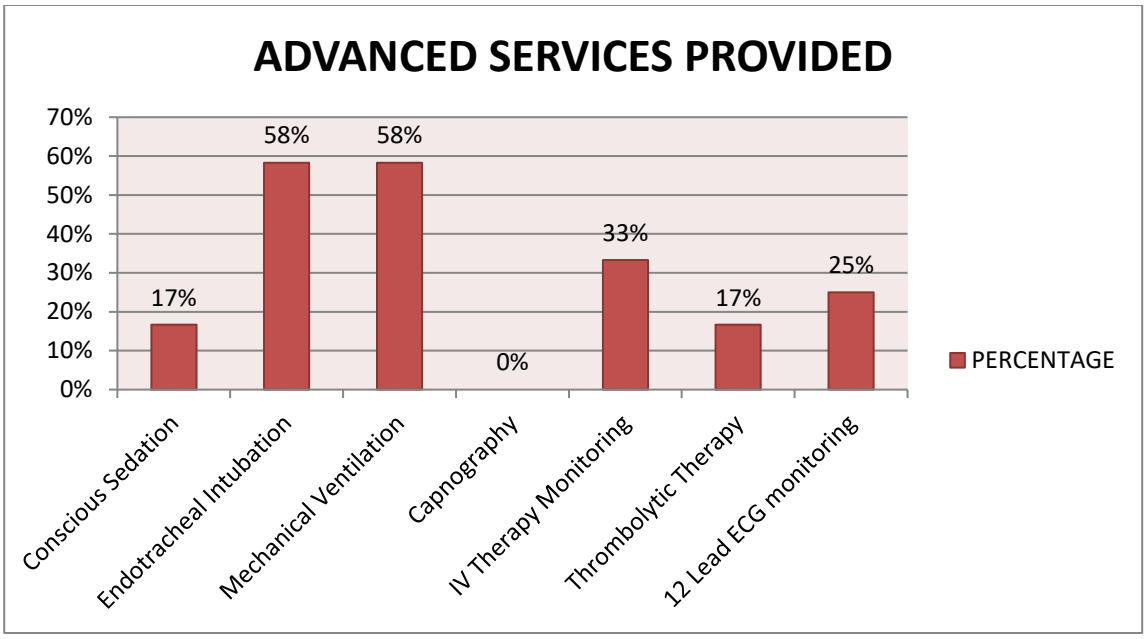


FIGURE 16: ADVANCED SERVICES PROVIDED

Figure 16 shows that endotracheal intubation and mechanical ventilation are most common advanced services offered.7 ambulances are offering these 2 services I.V therapy monitoring is offered by 4 ambulances. Just 3 ambulances offer 12 lead ECG monitoring. Least offered services are Conscious sedation and thrombolytic therapy (provide by 2 ambulances only).Capnography is not offered by any of the ambulance

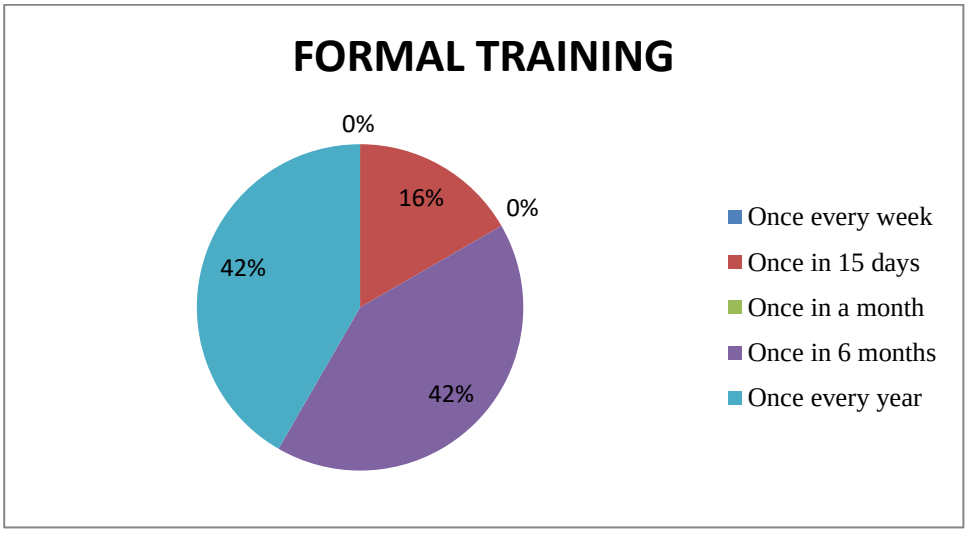


FIGURE 17: FORMAL TRAINING

Figure 17 shows that only 17%(2) hospitals give formal training to ambulance personnel once in 15 days,42%(5) give training once in 6 months and another 42%(5) provide training once every year

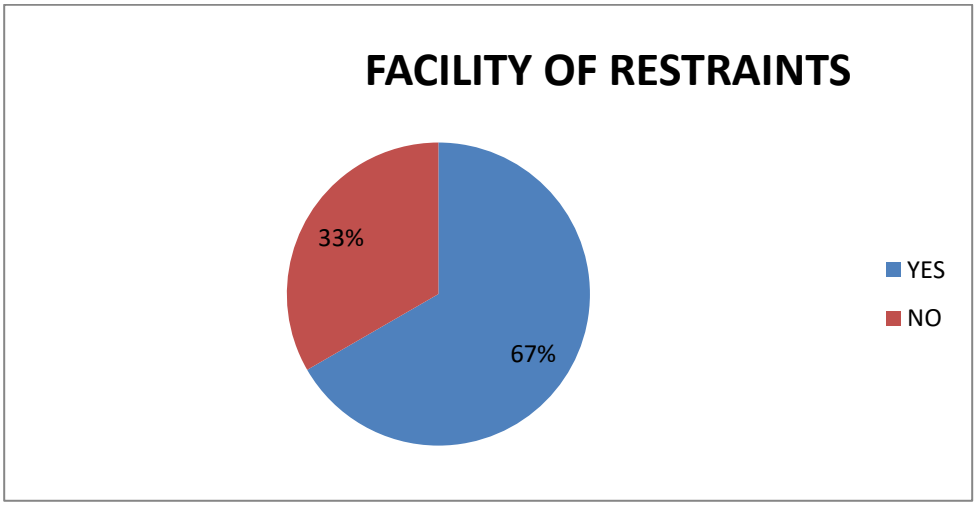


FIGURE 18: FACILITY OF RESTRAINTS

Figure 18 shows that facility of restraints for relatives, attendants are present in 8 (67%) ambulances.

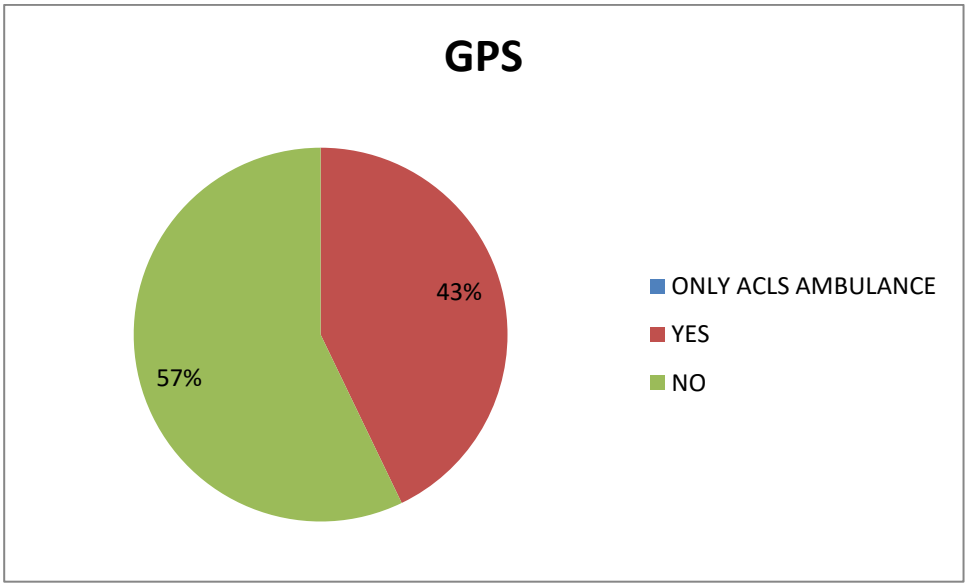


FIGURE 19: GLOBAL POSITIONING SYSTEM

Figure 19 shows that only 43% (3) ambulances out of 7 had automatic vehicle locator and GPS enabled tracking while such services were absent in other 4 (57%) ambulances. It was observed that none of the ambulances had the facilities of telemedicine and video conferencing.

STANDBY AMBULANCE: When asked about any provision in case the ambulance breaks down in middle of journey, 11 hospitals replied that they have the provision of stand by ambulance or they outsource the same while 1 did not have any such provision.

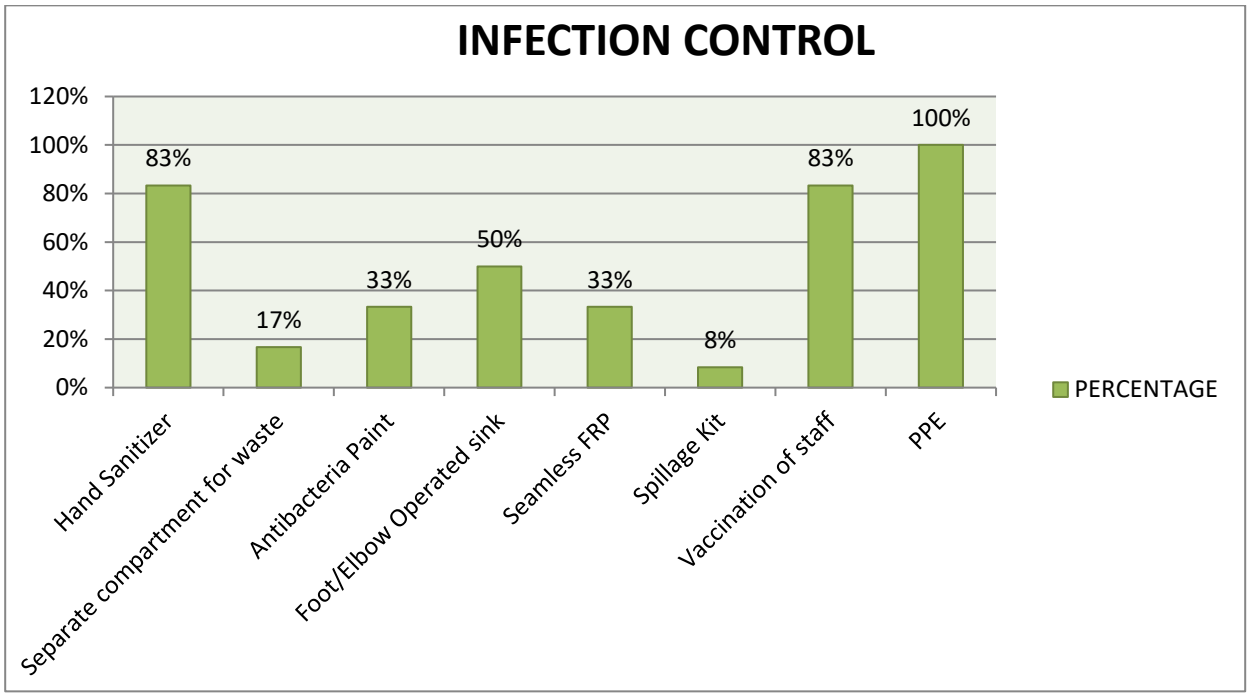


FIGURE 20: INFECTION CONTROL PRACTICES

Figure 20 shows that Personal protective equipment was the most common infection control practice being observed in all 12 ambulances. Next common are hand sanitizer and staff vaccination being observed in 10 ambulances.6 (50%) ambulances have foot operated hand wash. Antibacterial paint and seamless FRP was present in 4 ambulances. Only 2 ambulances had separate compartment for waste and only 1 ambulance (ambulance no 8) had spillage kit.

2.3 DISCUSSION

- Most of the patients/relatives who had experienced the ambulance services rated these services as average (58%) and very few had experienced a quick service (15%), a major group of people19(40%) reported that the ambulance took around 15-30 minutes to reach after the call, while many (35%) replied that it took around 10-15 minutes to reach.
- It is of note that 58% of the people covered felt that the ambulance service providers had good patient handling skills and 65% also rated treatment provided on board as good.
- However, it is of note that 73% people said that the behaviour of ambulance staff was caring and considerate, at the same time 27% people felt that the ambulance staff was responsible but rude.
- It is interesting to observe that the most preferred criteria according to 44% people was hygiene and cleanliness followed by staff behaviour (38%). The less preferred criteria's for selection of ambulances were comfortable ride (8%), adequate seating (6%) and air-conditioning (4%).
- 69% people said that they were satisfied with the level of preparedness of the hospital.

- It was observed that 58% (7 of 12 hospitals) claimed to have Advanced Care Life Support ambulances, while the remaining hospitals had either Basic Life Support or Patient Transport Vehicles in their hospitals.

- However after a thorough analysis it was seen that 89% of the equipments that are required in an ACLS ambulance was present with only 1 of 7 hospitals, while 4 had 83% of equipment availability.

- 86% of the ACLS Procedures are performed by just 1 of the 7 hospitals, while the remaining hospitals provide 40-50% of the services that should ideally be provided in the ACLS Ambulances.

- It is striking that only 1 of the 12 hospitals is following 75-90% of the infection control protocols while such practices are lacking in the others.

- After observing their services it was seen that 8% (1 of 12 hospitals) cater to 10-15 patients in a day while 17% (2 of 12 hospitals) find themselves potentially capable of providing service to these many patients in a day.

- It is also of note only 17% (2 of 12 hospitals) provide training their staff once in 15 days (i.e. twice a month) while 42% (6 of 12 hospitals) provide such training either once in 6 months or even once in a year, which is inadequate training when ACLS Ambulances are considered.

- 83% (10 of 12) hospitals had 8 hours shift of staff while 8% (1 of 12) have 12 hours and 6 hours shift, in which only 17% (2 of 12 hospitals) have adequate manpower (i.e. 2 support and technical staff each) to manage the ACLS ambulances.

- It was also observed that 92% (11 of 12 ambulances) have the availability of a stand by ambulance to transport the patient in case if the ambulance breaks down midway, 1 hospital was seen to have no such provision. It can be strikingly observed that only 25%(3) hospitals had GPS and automatic ambulance locator enabled ambulance

- 3 of the 12 ambulances providing ACLS Services identified that they can cater more patients than they are covering currently. This may be because of lack in manpower or lack in equipments. It was also seen that ambulance 9 has maximum number of ACLS equipments that is 16 out of 18, as well as maximum infection control practices in place. Yet the number of advanced services rendered was only half of the required. One possibility of this deviation could be deficiency of manpower (1:1) and deficiency of training (yearly). Ambulance 3 which claims to be an ACLS has 2:1 manpower with a 12 hour shift which might result in staff fatigue as a result of which it is catering to less than 5 patients per day. An interesting observation was that ambulance 4 covers more than 20 kms, where response time is 10 to 15 minutes but according to patient it takes more than 30 minutes. Performance of ambulance 11 can be improved by increasing the manpower. This ambulance caters to less than 5 patients but projects to cater 5 to 10 patients in a day. It is also offering 4 advanced care services and provides training every 15 days, but only manpower should be looked into. Noticeable

discrepancy with the response time as mentioned by ambulance manager and as experienced by relative or attendant in almost all the ACLS ambulances. A positive observation was that 75% patients considered that satisfactory treatment and care provided on board (17% - very good; 58% - good). In this context even the managers believed that in only less than 25% cases patients could not be saved on board (en-route). Hygiene and cleanliness was the most preferred feature of the ambulance followed by caring and considerate behaviour of staff, on the contrary no hospital follows all the infection control practices

.

2.4 CONCLUSION

It can be concluded that effective ambulance services can only be provided by right personnel in the right place at the right time with the right equipment (CHAIN OF SURVIVAL).

Our study has revealed that currently the ambulance services are highly fragmented in Bangalore. The hospitals that claim to have ACLS ambulances either have acute shortage of trained and professional manpower or there is remarkable shortage of equipments.

Some ambulances had the best of equipments in place; while some had adequate manpower and IT Integration. But none of them was able to deliver the best of ACLS Services because of dearth of one or the other. Best of ambulance services can be delivered only when real time information can be relayed to the professionally trained manpower for timely intervention, and deliver care and treatment with the best of equipments, which will result in a synergistic effect of all.

2.5 RECOMMENDATIONS

i. It has been found that the ambulance services in Bangalore are fragmented, thus it should be designed in a manner that all the components are efficiently and effectively utilized.
ii. All the equipments for providing advance care life support in the ACLS ambulances should be in place to counter the deficiencies in delivering patient care.
iii. Adequacy of manpower should be ensured to manage the ambulance services. A proper combination of technical and support staff should be deployed so that they complement each other and deliver appropriate care in the best possible manner.

iv. Apart from having the adequate number of staff, timely and formal training sessions on advanced care life support (CPR, endotracheal intubation, ventricular defibrillation etc) workshops and hands on trainings should be undertaken periodically.

v. They should also be trained on general conduct and behavior. Qualities like empathy and compassion should be instilled in the staff. The ambulance staff shift should be adjusted in a way that stress and fatigue factor does not set in.

vi. Hygiene and Cleanliness should be given due importance. Infection control should not be limited to mere existence of Hand sanitizers and PPE's; instead it should go much beyond it. Separate compartments for general and biomedical waste for proper segregation of waste should be incorporated in the ambulances.

vii. Seamless, easy to clean fiber reinforced plastic internal paneling with antibacterial paint should be used in the ambulance.

viii. GPS enabled ambulances should be encouraged to ensure quick response, timely interventions.

ix. Patient and staff safety should be ensured by provision of dynamic harness and seat belts.

x. Response time should be monitored on regular basis for every visit. Checklists for ensuring availability of equipments, consumables and medicines should be ready before hand.

xi. Regular and surprise audits to identify deviations from ideal practices.

xii. Feedbacks from patients/attendants in emergency department should be taken to access their satisfaction levels.

2.6 LIMITATIONS OF THE STUDY

a. A major limitation of the study was the sample size of hospitals.

b. Confidentiality was another limitation. The hospitals covered hesitated to reveal their exact data because of confidentiality issues.

c. The managers had a biased opinion about their hospital ambulances which was a hindrance in the evaluation of the data.

2.7 PART B

Designing Ideal ambulance for a 300 bedded hospital to complement high end trauma centre

Real solutions to generate real change:

This report describes an innovative approach to the design and development of the emergency ambulance, to produce an ambulance interior that provides better treatment to all patients, matched to their specific healthcare needs, state of art medical equipments, professionally trained manpower, integrated with best technology and therefore capable of delivering the 'right treatment, in the right place, at the right time'

1. FABRICATION OF AMBULANCE:

Salient Features:

CHALLENGE	DESIGN RECOMMENDATIONS
1.Deviations from specifications for body structure, vehicular design and interior chambers The height and width specifications are very important for ensuring adequate space for moving the patient in and out	Minimum Patient Compartment[11] Length:2700 mm(floor to ceiling) Height:1500 mm Width:1500 mm
2.Hygiene and cleanliness Ambulances are prone to getting dirty and contaminated in use. There is a need to create a seamless finish to avoid dirt traps and to simplify the cleaning process. This has the added benefit of making surfaces quicker to clean, so there is less 'off the road time' cleaning vehicles. It also reduces the likelihood of infection through contamination. Improved design will lead to fewer healthcare-acquired infections	1. Seamless, easy to clean Fibre reinforced plastic (FRP) internal panelling in patient's cabin.[12] Driver & patient cabins partition in FRP with sliding glass window for communication. 2. Interior Painting with Anti Bacteria Paint[12] 3.Stainless Steel wash basin with foot operated water source provided with soap dispenser, sanitizer and tissue dispenser 4.Two Stainless Steel waste bins (approx. size 10 Ltrs. each) separately for Biomedical & other wastes 5. Aesthetically matching homogenous waterproof antibacterial vinyl flooring. Anti Static Flooring

Interior design changes for patient safety: 1.Layout of the patient treatment space/Working space Space and layout including access to equipment and both sides of the patient, space to accommodate paramedics and relatives and to move around. In existing ambulances, only one side of the patient is easily accessible because the stretcher's clamped to the wall.	1. Centrally positioned stretcher, which allows the clinician all-round access (360° access) to the patient to give safer, more efficient treatment.[10] A large one stretcher, to manage bigger patients and the demographic trend towards increasing obesity.
2.Working wall Clever use of space and innovative design can enhance an ergonomic work area, well designed to place cardiac monitors and advanced equipments[10]. The positioning of the medical equipment and the doctor or paramedics with respect to the patient is also crucial.	All of the equipment and supplies should be fixed on one side of the vehicle on a simple, carefully designed, 'Working Wall' to position everything ergonomically
3. Volumetric space distribution Gross inadequacies in the volumetric space distribution were found. For example, the doctor's seat was found almost always adjacent to the patient instead of facing him/her. The seating space is narrow, with gas cylinders and monitors crowded inside in a totally unscientific manner[10]	Executive doctor seat at the head end of the patient facing patient 3-4 Person fixed Attendant seat with storage facility with Belts Installing a lay-down space -A simple but very effective addition is a small fold-out table for the attendant /staff to use as a lay-down space for items in use, instead of laying them out on the patient
4.Standardisation of equipment place When equipment is in the wrong place, it causes bending over the patient to dispose of soiled items in the bins and things dropping out of the cupboards onto the patient. [10]The right equipment stored in the right places safer, more efficient treatment	Standardised equipment mounting systems - Integrated mounts for Critical care Equipments like ventilator, Defibrillator, Monitor, Syringe pump etc.
5. Securing staff and relative in transit	Dynamic harness and seat belt so that paramedic and relatives can be secured.
6.Powerful siren	4 Beacon light bar with Variable Sirens, and public address system.

7.Electric supply	• Extra heavy duty ducted air-conditioning system coupled with vehicle engine with automatic digital control panel and temperature display in patient cabin • Integrated AC & DC supply inside the vehicle provided by additional Batteries integrated with 240V AC Inverter • Inverter of 800VA capacity (superior quality) with additional backup battery & facility for charging from both 220 V AC & Vehicle alternator. • Additional 135 Amps 12 V Alternator for running Air Condition and charging of Inverter batteries.
8.Storage space for medicines	Medicine Cabinet with partitions & drawers Overhead cupboard covered with sliding glass for storage.

3. EQUIPMENTS:

Medical Equipments:

Standardization of equipment – It was observed that some of the equipment was missing, batteries were discharged or spares unavailable. Standardization will reduce the number of adverse incidents and equipment failures, and instances of missing or unserviceable equipment. Overall maintenance costs will be reduced and vehicle downtime will be minimized. In addition to BLS supplies, ACLS is equipped with state of the art life saving equipment including 12-lead cardiac monitors with defibrillation and external pacemaker capabilities, intravenous medication transfusion pumps, pulse oxymeters, ventilators, automated non-invasive blood pressure monitors and life saving drugs.

TYPE OF EQUIPMENT	**FEATURES**
A. Ventilation and Airway equipment	
1.Transport ventilator 	• Should be wall mounted, light weight, robust and user friendly • Separate control for inspiratory and expiratory time and flow rate • It should be able to deliver respiratory rate ratio of up to 1: 2 • Equipment should be complete with carry bag, patient circuit, pressure regulator for the oxygen cylinder and relief valve. (Transport Ventilator Kit) • Should have airway pressure monitor • Should have a disconnect alarm. (Visual and audible) [12]
2.Portable suction Apparatus 	• Mobile, electronic membrane suction pump for removal of secretions, blood and solid food particles from emergency patients. • The pump should have a sturdy housing, which is easy to clean and having storage for the suction hose. • It should have a stable and ergonomic handle. • The pump should be chargeable via both 230V and 12V.

	• It should have rechargeable Nickel-Cadmium (2.8 Ah) batteries.[12] • LED display for indicating charge level of rechargeable battery. • It should operate for at least 30 mins at maximum suction on full charge.[12] • Suction capacity at 12 V should be more than 20 L/min with maximum vacuum of more than 75 kPa.[12] • Weight of the entire unit should not be more than 6 kgs.
3.Portable and fixed Oxygen equipment with key wrench and trolley	• Jumbo D type oxygen cylinder -2 in no.s • Changeable from outside the vehicle with separate lockable door • Gas capacity-7000 lts[12] • O2 Gas delivering control panel and standard O2 Gas outlets, Oxygen regulator with 2 stage regulation for better patient safety near doctor seat for easy accessibility
4.AMBU Resuscitation bags(adult and paediatric)  5. Pocket mask with one way valve 	AMBU resuscitation bags(Adult and paediatric)hand operated ,self re-expanding bag with oxygen reservoir, clear mask, valve

6.Intubation equipments  	**Laryngoscope with blades** • Standard equipment in metal with 3 standard size curved blades and one extra large blade (Adult & Child).[12] • Handle should have comfortable grip. • Good quality light source • Endotracheal tubes and connecting tubes[12]
7.Airways 	• Nasopharyngeal • Oropharyngeal[11] • (adult, child and infant sizes)
B.MONITORING AND DEFIBRILLATION	
1.Multi Parameter Monitor	Integrated Multi Parameter Monitor with the following parameters: NIBP – Adult and Paediatric SpO2 - Adult & Paediatric Respiration Rate [12]
2.Automatic external defibrillator	Defibrillator • Wall mounted transport defibrillator Cum cardiac monitor of reputed brand. • Compact , portable., lightweight

	• Facility for automatic external defibrillator (AED) and Manual Defibrillator • ECG monitoring and synchronized cardio version. • Should have 12 lead interpretative ECG and synchronized cardio version[12]
C.INFUSIONS:	
1.Syringe Infusion Pump 2.I.V. lines 	• Must provide alarm for wrong loading of syringe such as flanges out of slot; disengaged plunger, unsecured barrel etc. • Should have comprehensive alarm package including: Occlusion limit exceed alarm, Near end of infusion prealarm & alarm, Volume limit pre-alarm & alarm, KVO rate flow, Low battery prealarm and alarm, AC power failure, Drive disengaged and preventive maintenance[12] • Flow rate programmable from 0.1 to 200 ml/hr or more [12]
D.IMMOBILIZATION DEVICES:	
1.Head immobilization device 	Minimal interference with X-ray,MRI,or CT scanning Waterproof coating -easy to clean and prevents bacterial growth within components.Should not absorb blood or body fluids,easily sanitized between uses

2.Cervical collars 	• Two nos. of reputed make & quality • Should be adjustable to 4 different sizes. [12] • Should have pre-moulded chin support, locking clips and rear ventilation panel, enlarged trachea opening.[12] • Should be high-density polyethylene and foam padding with one piece design enabling efficient storage where space is limited • Should be X-ray lucent and easy to clean and disinfect .
3.Lower extremity traction devices	
4.Upper and lower extremity immobilization devices	
D.STRECHERS AND SPLINTS	
1. Automatic Loading Stretcher 	• The loading and unloading of stretcher should be completely seamless • Adjustable height & backrest and the stretcher so that it can be used for shifting a patient within a hospital • Patient platform should be made of polyethylene, mould-resistant and lightweight. • Length Min. 1970 mm, Width minimum 570 mm • Weight less than 40 Kg, able to carry 160 Kg load capacity Minimum
2.Spine board 	• X ray and MRI compatible. • High density polyethylene-single piece • Rigid and light • The Length of the stretcher can be adjusted to fit the height of patient • Gross Weight – 9.2 Kg. • Load Bearing – 150-180 kg.[12]

3.Scoop stretcher 	• Should be light, safe and reliable • Made from lightweight and composite thermally treated Aluminium • Dimensions(approximately) • Net weight:<10 kgs • Weight bearing:150-180 kg[12] • Double hinged, interlocking pieces so as to allow operator to gently scoop up a patient without having to roll them, decreasing movement to cervical spine.[12] • Head section- recessed to maintain proper cervical alignment[12]. • Adjustable height options to accommodate different height patients
4. Wheel chair stretcher 	• The loading and unloading of stretcher should be completely seamless • Foldable lengthwise and width wise • Weight not more than 8 kg • Carry weight:150- 170 kg[12]
5.Pneumatic splints 	Set of 6 Adult sizes with carrying case [12] □ Hand & wrist □ Half arm □ Full arm □ Foot and ankle □ Half leg □ Full leg • For dislocated shoulders, suspected fracture of arms, legs and joints or infant immobilization[12] • Kit should include three splints(small,medium,and large),compact vacuum pumps, repair kit and carrying case[12] • Should be washable and reusable

	• Should be supplied with the appropriate pump required to inflate the splints
E.COMMUNICATION	Two way radio communication between EMT, dispatcher and Physician or cellular phone[12]. Efficient communication between the emergency medical technicians and the ambulance control room located in emergency area regarding patient's status and other information. This helps the emergency team at the hospital to be fully prepared to receive the patient and make all necessary arrangements in advance
F. MISCELLANEOUS:	• Sphygmomanometer • Stethoscope • Digital thermometer • Heavy duty scissors • Flashlights with extra batteries and bulbs • Restraints (seat belts, air bags) for patient, crew and family members • Fire extinguishers

4. MEDICINES

List of emergency drugs[11]

1. Inj.Adrenaline
2. Inj.Atropine
3. Inj.Calcium carbonate
4. Inj.Dopamine
5. Inj.Dobutamine
6. Inj.Noradrenaline
7. Inj.Nitroglycerine
8. Inj.Sodium carbonate
9. Inj.Hydrocortisone
10. Inhaler Beclomethasone
11. Inhaler Salbutamol
12. Inj.Furosemide
13. Inj.Diazepam/Midazolam
14. Inj.Deriphyllin
15. Inj.Phenytoin sodium
16. Inj.Avil

17. Inj.Metrochlorpropamide
18. Inj.ondansterone
19. Inj.Kcl
20. Inj.Lignocaine (2%)
21. Inj.Amiadorone(50 mg/dl)
22. Inj.Magnesium sulphate 25% 2 ml
23. Inj. Mannitol 20%
24. Inj.Morphine/Inj.Pethidine
25. Inj.Noradrenaline
26. Inj.Naloxone Hcl
27. Inj.Fentanyl
28. Bacteriostatic water for injection
29. Inj.Sodium Valproate
30. Inj.Voveran
31. Inj.Paracetamol

LIST OF CONSUMABLE ITEMS[11]:

S.No	Name of Item
1.	Cotton
2.	Bandage(a)15 cm(b)10cm(c)6cm
3.	Savlon
4.	Betadine
5.	Leucoplast
6.	Pain spray
7.	Mistdress Spray
8.	Vinodine spray
9.	Coolex spray
10.	Face mask(disposable)
11.	Surgical gloves
12.	LMA disposable
13.	Wide bore needles
14.	Disposable L.P. needles
15.	Syringes ABG(2 & 5 ml)
16.	3 way stop cork
17.	Extension I/V lines
18.	Disposable suction pumps
19.	ECG electrodes
20.	Lighted stylets of different sizes
21.	Mini tracheostomy kit
22.	Facemask with nebulizer
23.	Pressure infusion bags
24.	G.V. Paint
25.	I.V.fluids

26.	Micro drip set and drip set
27.	Nasogastric tubes
28.	Burn pack:Standard package,clean burn sheets
29.	Triangular bandages
30.	Dressings:Sterile multi trauma dressings(various large and small sizes)
31.	Gauze rolls sterile(various sizes)
32.	Elastic bandages(various sizes)
33.	Adhesive tapes:various sizes
34.	Cold packs
35.	Waste bin for sharp needles
36.	Disposable bags for vomiting etc
37.	Teeth guard
38.	Sample collection kits

LABELLING OF SUPPLIES AND MEDICATIONS:

During the observation sessions most of the ambulances did not include any labeling to assist users in performing their tasks, forcing staff to open multiple drawers to search for supplies. Labeling of supplies and medications in the ambulances is useful in many ways

1. Labeling helps reduce search time and uncertainty when trying to locate a particular item
2. Assists in maintaining standardization
3. Reduces the time required to restock the vehicles

STOCK CONTROL:

Improved stock control, using treatment packs tailored for specific clinical procedures, will reduce operational costs and enhance patient care.[10] Presently ambulances are often overstocked by crews – the 'just in case' scenario. Modular treatment packs, simply replaced at the end of the shift by 'make-ready' staff, will reduce off-the road-time for restocking.[10] Personnel will be more aware of stock levels and equipment availability, and the waste caused by carrying unnecessary stock will be reduced, freeing up more space inside the ambulance for the effective delivery of clinical care.

5. TECHNOLOGY INTEGRATION

Ambulance is probably one of the most essential vehicles people rely on in times of need. Emergency response centers / Call centre supported by technology including integration with
Automatic vehicle location and tracking system, GIS and GPS to locate the ambulance and hospital nearest to victim.
GPS based ambulance tracking system are definitely one of the most functional upgrades many ambulances across the globe have used to better modernize ambulances. Live tracking can help

ambulances quickly arrive to the scene of an accident, navigate back to hospital and provide medical staff the knowledge of the exact moment when a patient will arrive. Improved technology integration will also improve communication by establishing robust links to receiving hospitals, through a standard interface used to send patient data instantaneously. It will provide better access to patient records and specialist clinician input. The transportation should be coordinated by a state-of-art emergency call response centre, which is operational 24-hours a day

KEY BENEFITS:

- Live tracking of ambulance
- Improved response times
- Attend to emergency on time
- Better planning and customer service
- Effective fleet monitoring
- Accurate vehicle status updates
- Maximized productivity
- Optimize routes to patient locations
- Alerts on Over speeding, accident detection
- Re-route the ambulance to the nearest hospital

Revolutionize the ambulance: The new ambulance's Communications and Monitoring System to provide much better road navigation, enables video links(via video conferencing), discussion with hospital colleagues and specialists. It also sends vital signs and handover information directly to the hospital whilst en route

6. MANPOWER:

- Emergency medical personnel are people engaged in provision of emergency medical services and include paramedics, emergency medical technicians, and emergency care support workers.

❖ **Technical staff**(Paramedics, Emergency medical technicians(EMT)
Trained technicians or paramedics provide first aid to the patient ie pre hospital care, performs life saving measures and shift the patient to appropriate facility. They should demonstrate skill in use of ambulance equipment and supplies, skilled in endotracheal intubation, intravenous infusion and ventricular defibrillation etc. Ambulance personnel deployed should have necessary prescribed qualifications and should be trained in advanced care life support(ACLS).

- When physician or paramedical person is present he should assume a subordinate role and give full cooperation.
- Effective service requires proper attitudes and conduct in work, showing responsibility, skills obtained by experience and training, acting within limitation of capabilities, avoiding undue haste and mishandling.
- General conduct: Show concern for victim, teamwork efficiency, giving reassurance to victim, relative

- **Need for standardized training:** Training of people on board the ambulance is not standardized which results in poor handling of patients on board. All ambulance crew should receive proper training in managing medical emergency patients

❖ **Support Staff**

The ambulance driver should be a professional fully familiar not only with the city road map but also like a pilot should be able to contact the nearest alternate hospital in case of extreme midway emergency.

Driver- exercise emergency privileges properly, prevent accidents, engage in safe driving practices, make proper use of sirens and lights

Staff also need to ensure that they follow good infection control procedures (eg: hand cleaning and safe disposal of waste) to prevent the spread of contamination and the risk of healthcare-acquired infection

❖ **Staff at call centre**: Availability of qualified personnel for dealing with the nature of call for managing reception and sorting of calls. They should be

- Capable to provide appropriate advice, instruction on what to do until the first responder will reach the emergency patient if an intervention is needed.
- He/she should ask
  - Caller name
  - Caller number
  - Patient name
  - Location address where ambulance is required
  - Alternate contact number
  - Type of emergency(medical/fire/accident)
  - Nature of Injury/episode
- Capable to decide the level of the response required
- Deciding the type of ambulance(basic or advance life support)
- As the response team gets alerted of an emergency they are able to quickly deploy the ambulance.

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2.9 Annexure

2.9.1 QUESTIONNAIRE (PATIENT/ATTENDANT'S)

Q1. What do you think about the response of the ambulance? Was it?

a) Quick
b) Average
c) Slow
d) Sluggish/Late

Q2.How long did it take for ambulance to reach the site of emergency?

a) 5-10 minutes
b) 10-15 minutes
c) 15-30 minutes
d) >30 minutes

Q3. What do you think about the patient handling skills of ambulance staff when they reached your place?

a) Very good
b) good
c) Average
d) Poor
e) Very poor

Q4.What do you feel about the treatment and care provided to you on board by ambulance staff?

a) Very good
b) good
c) Average
d) Poor
e) Very poor

Q5.How did you find the behavior of ambulance staff/care giver?

a) Caring and considerate
b) Responsible but rude
c) Indifferent and Inconsiderate
d) Inhuman

Q6.Thinking about your journey in the ambulance, rate the following in order of your preference:

a) Comfortable, smooth ride ☐
b) Adequate Seating for relatives/attendant ☐
c) Air conditioning of ambulance ☐
d) Hygiene and cleanliness ☐
e) Courteous behavior of staff ☐

Q6.How satisfied were you with level of preparedness at the hospital?

a) Very satisfied
b) Satisfied
c) Dissatisfied
d) Very dissatisfied
e) No comments

2.9.2 QUESTIONNAIRE

FOR AMBULANCE SERVICE PROVIDER

Q1.What type of service does your ambulance provide?

a) Patient transport
b) Basic life support(BLS)
c) Advance care life support(ACLS)

Q2.What is your catchment area?

a) <5 km radius
b) 5-10 km radius
c) 10-15 km radius
d) 15-20 km radius
e) >20 km radius

Q3.What is the average response time for your ambulance?

a) <10 min
b) 10-15 min
c) 15-30 min
d) 30-45 min
e) >45 min

Q4.How many patients do you provide services to, in a day?

a) <5 patients
b) 5-10 patients
c) 10-15 patients
d) 15-20 patients
e) >20 patients

Q5.How many patients do you think (on average) can be covered by an ambulance in a day?

a) <5 patients
b) 5-10 patients
c) 10-15 patients
d) 15-20 patients
e) >20 patients

Q6.What is your ambulance team size?

a) Technical Staff ☐
b) Support staff ☐

Q7.What is the number of hours/shift for ambulance workers? ☐

Q8.What are your total hours of operation? ☐

Q9. In how many cases you felt like you could not save patient's life enroute after being picked by the ambulance?

a) <25%
b) 25-50%
c) 50-75%
d) 75-99%
e) 100%

Q10 .Please indicate what equipment would be available at scene of emergency/accident?

1. ☐ Transport ventilator
2. ☐ Portable suction machine
3. ☐ Advanced airway and endotracheal intubation equipment
4. ☐ Equipment for administering 100% oxygen therapy
5. ☐ Defibrillator
6. ☐ Pulse oximeter
7. ☐ Syringe pump
8. ☐ ECG
9. ☐ Resuscitation kit
10. ☐ Automatic loading stretcher cum chair
11. ☐ Scoop stretcher
12. ☐ MRI compatible spine board
13. ☐ Wheel chair stretcher
14. ☐ Head immobilizer
15. ☐ Full range of Cervical adult and pediatric collars
16. ☐ Nasopharyngeal and Laryngeal airways
17. ☐ Neck brace
18. ☐ Portable x-ray

Q11. Out of the following which all services does your ambulance provide?

a) ☐ Conscious sedation
b) ☐ Endotracheal intubation

c) ☐ Mechanical ventilation
d) ☐ Capnography
e) ☐ I.V. therapy monitoring
f) ☐ Thrombolytic therapy
g) ☐ 12 lead EKG monitoring

Q12. Is formal training in the use of all this equipment undertaken by ambulance staff members?

a) ☐ Yes
b) ☐ No

Q13.How frequently do the ambulance staff receive ACLS training?

a) Once every week
b) Once in 15 days
c) Once in a month
d) Once in 6 months
e) Once every year

Q14.Does your ambulance has facility of restraints for safety of relative and staff?

a) ☐ Yes
b) ☐ No

Q.15. Is your ambulance equipped with an Automatic Vehicle Locator and Global Positioning Satellite system to track the vehicle throughout transport?

a) ☐ Yes
b) ☐ No

Q.16.Does your ambulance offers these facilities?

a) Telemedicine ☐
b) Video conferencing ☐

Q17.Is there a system to take over the sick, in case the ambulance breaks down in the midway?

a) ☐ Yes
b) ☐ No

If yes what...

Q18.How do you ensure adequate Infection control. Please indicate the measures you follow?

a) ☐ Hand sanitizer
b) ☐ Separate compartments for Bio medical waste and general waste
c) ☐ Interior painting with Anti bacteria paint
d) ☐ Foot/elbow operated sink and hand wash
e) ☐ Interior paneling fabricated with seamless Fiber Reinforced Plastic(FRP)
f) ☐ Spillage kit
g) ☐ Vaccinations (DPT,BCG,MMR,Hepatitis B)
h) ☐ Personal protective equipment