

**PROPOSAL FOR DESIGNING, DEVELOPMENT, AND
IMPLEMENTATION OF EMERGENCY MEDICAL
SERVICES IN A SOUTH ASIAN COUNTRY**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree
of Master of Business Administration (MBA)

in

Hospital and Health Management

by

Dr Nidhi Sharma

Under the Supervision and Guidance of

Dr Sheenu Jain

2022

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Proposal for designing, development, and implementation of emergency medical services in a South Asian country** is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

(Signature)

Name of Student : Dr Nidhi Sharma

Date

CERTIFICATE

This is to certify that **Dr Nidhi Sharma** in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur has successfully completed her internship **at IQVIA Consulting and Information Services India Pvt. Ltd.** during April 11, 2022, to July 10, 2022.

Place:

Delhi

Date:

Preceptor/Head of the Organization

Name of the organization

CERTIFICATE

This is to certify that dissertation titled **Proposal for designing, development, and implementation of emergency medical services in a South Asian country** is a record of the research work undertaken by **Dr Nidhi Sharma** in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Dr Sheenu Jain
Faculty Guide
IIHMR University, Jaipur
Date

Dr (Col.) Mahendra
School Dean
IIHMR University, Jaipur
Date

ABSTRACT

The Emergency medical services in low income and less developed countries need much more attention in terms of infrastructure, training skill and manpower. This study is based on the proposal that is created for a country in south Asia which wants to create an EMS information system of its own.

The objectives of the study were to create a holistic emergency medical service system which will have features such as Designing, developing, upgrading, and maintaining a digital emergency medical service (EMS) information system software which will automatically locate the patient and match them with the nearest ambulance; dispatch the paramedic team as and when needed; and provide medical advice that can be taken until paramedics arrive. The EMS information system should have at least following functions: computer telephony integration, computer-aided dispatch function, call monitoring and call recording, and real-time ambulance tracking and monitoring. The EMS information system should connect EMS call center, health facilities, sea and land ambulances, police departments, fire departments and other stakeholders who are involved in emergency medical health services. Installation and operationalization support for Global Positioning System (GPS) devices, walkie talkies and tablets in the ambulances.

The methodology included secondary research to understand the present case scenario of the country and review various papers based on EMS system. The key results of this study were development of the proposed plan which included 9 stage model for implementation of EMS system which included project initiation, development of EMS system, Prerequisite software and hardware installation, Interface build and fitment, Beta testing, super user testing, User acceptance testing, pre go live and post implementation review and support.

This research can be used by various other less developed or underdeveloped countries as all countries are striving for achieving universal health coverage.

KEYWORDS: EMS, GPS, Beta testing, User testing

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ABBREVIATIONS

ABBREVIATION	FULL FORM
EMS	Emergency Medical Service Information System
GPS	Global Positioning Devices
HMIS	Health Medical Information System
KPI	Key Performance Indicators
SOP	Standard Operating Procedures
UAT	User Acceptance Testing
WHO	World Health Organization
RMS	Records Management Systems
GIS	Geographical Information Systems
AVL	Automated Vehicle Locator
CAD	Computer Aided Dispatch
USAID	United States Agency for International Development
MDPS	Medical Priority Dispatch System
IAED	International Academics of Emergency Dispatch
HEOC	Health Emergency Operation center
UCAD	Unified Computer Aided Dispatch
SME	Subject Matter Expert
SRS	System requirement Specification

CHAPTER 1: INTRODUCTION

Emergency Medical Services, more commonly known as EMS is a system for providing emergency medical treatment that is activated when injury, trauma, or disease that requires the patients or responders to receive prehospital care.

Emergency medical services (EMS) is a system of coordinated care and response involving many people and organizations. Every day, a complete EMS system is prepared for all possible emergencies.

Each element of the complex EMS system plays a crucial function in providing emergency medical care in a coordinated and seamless manner. Each of the components listed below makes up an EMS system:

- Organizations and agencies (both private and public)
- Networks for communications and transportation
- Hospitals, trauma centers, trauma systems, and specialist care facilities
- Treatment facilities
- Highly qualified individuals such as physicians, nurses, and therapists; administrators and government representatives
- A well-informed public that is aware of what to do in case of a medical emergency

To maintain and improve the health and safety of the community, EMS is integrated with other services and systems. EMS functions at the nexus of healthcare, public health, and public safety, as seen in the diagram below.

1.1 Existing Situation:

- The country is a low-lying island nation comprised of close to 2000 islands with some naturally formed atolls
- Presence of 187 inhabited island with health centers having multiple access points
- No usage of tech intervention aids like walkie-talkies, GPS enabled vehicles, tablets for Emergency Response System

- CAD system to be procured by USAID in future
- Local telecom in process of installing primary rate interface
- Use of MDPS system to be developed in future by IAED
- 10 ambulances operational currently in the capital
- Current triaging of COVID -19 patient done by HEOC medical team
- 100 land ambulances in existence with expansion plans in the number 190-200.
- Current ambulances include basic life support facility, but no other ambulances are available in there
- 190 hospitals can be integrated in the EMS framework
- Health services is currently delivered by a four-tier referral system serving to island, atoll / regional and central level services.

1.2 Need for Automated EMS system:

The automated EMS system requires some of the components which must be included in the EMS system some of such requirements are as follows:

- ***Computer Telephony Integration***

The country is facing issue such as delay in establishing location of place where accident or incident occurs and the additional data such as history taking, etc are not being taken and there for computer telephony integration is required and this can be responded as we will have records management system which will provide relevant data to incident call and caller ID and will verify the location of caller.

The Hassle-free, informed, and accurate incident establishment will be achieved when computer telephony integration will be done in EMS system.

- ***Computer Aided Dispatch Function***

The issue that country is facing is availability, estimation and dispatch of ambulances which are in close vicinity of the place where any incident or

issue arises. The GIS will provide requisite geospatial data and AVL functions which will help call center to correctly identify the response vehicle

- ***Call Monitoring and Recording***

The call monitoring and response system will provide a PIS which will provide the telemetry functions for consultation to patient until the patient is transferred to the nearby facility and the continuum of response will be carried which will in turn lead to value based continual of patient monitoring.

- ***Medical Triage***

This function is very important aspect of EMS system as triage of patient as identification of criticality of patient is very important so that proper care must be taken and for this purpose there will be a set of structured questionnaires, standard operation protocols patents will be evaluated based on the MPDS determinants by IEAD and the dispatch of most qualified respondents or paramedic staff according to the criticality of the patient

- ***Real Time Ambulance Tracking & Monitoring***

Real time tracking and monitoring of ambulances is very important and therefore they must be GPS enabled so as transmitting of data to call center and hospital is very important and this can be achieved by UCAD system which will help in better triaging of emergency responses.

- ***Dissemination of medical advice until paramedics arrive***

The prehospital care is required as life saving measures must be taken until the medical help arrive as saving life of the people is very important and therefore prehospital care training is required.

- ***Integrated framework for patient transfer***

An integrated framework for patient transfer is very important so a standard protocol is followed and reaching out to remote areas will be easy and safe as there are various ambulance systems such as air, land, and sea therefore an integrated framework should be followed.

1.3 Problem statement:

- Health services in the country is currently delivered by a four-tier referral system serving to island, atoll / regional and central level services
- Inadequate staff at National Call Center for handling EMS
- Delayed Response to Emergency Calls during the Pandemic
- Lack of Coordination between health facilities, sea and land ambulances, police departments, fire departments and other stakeholders
- Inability to locate and dispatch nearby paramedic team and vehicles

1.4 Result to be delivered:

Designing, Development and implementation of Emergency medical services for a country in South Asia which required the following as the output:

- Designing, developing, upgrading, and maintaining a digital emergency medical service (EMS) information system software which will instantly find the patient and connect them with the closest ambulance, dispatch the paramedic crew as and when necessary, and offer pre-paramedic guidance.
- The EMS information system should have at least following functions: computer telephony integration, computer-aided dispatch function, call monitoring and call recording, and real-time ambulance tracking and monitoring.
- The EMS information system should connect EMS call center, health facilities, sea and land ambulances, police departments, fire departments and other stakeholders who are involved in emergency medical health services.
- Procurement, support and installation of required IT software and IT hardware for the digitalization of the EMS and the automation of the call center to improve the efficiency of responding to emergency calls, assessing the situation of patient for better medical triage, locating and dispatch nearby paramedic team and vehicles, and coordinating with recipient health facilities for timely transfer of COVID-19 patients or those with other health emergencies.
- Installation and operationalization support for Global Positioning System (GPS) devices, walkie talkies and tablets in the ambulances.

1.5 AIMS:

- Development of a holistic EMS model for achieving universal health coverage.
- Implementation of Emergency medical response system for effective prehospital care and training to paramedic's staff.

1.6 OBJECTIVES:

- Detailed strategy and work plan of EMS system development and procurement plan of required software and hardware.
- Development and testing of beta version of the EMS system created.
- Digitalization of the EMS and automation of the call center.
- Procurement and installation of IT Hardware and software.
- Digitalization of EMS information system by installing Global Positioning System (GPS) devices, walkie talkies and tablets for ambulances.

CHAPTER 2: Review of Literature

The review of literature is done to get an idea from different research papers of what is happening on a particular topic in different parts of world and how those studies can help us in creating a new holistic EMS system for this South Asian country. The following research papers gave a new approach so as how and what we can incorporate in approach and methodology for the country for which this proposal is being created.

We get a holistic idea new concept such as capsule ambulance, the internet speed which serves better for EMS like 4G or 5G, what are different key pillars for EMS system, how we can educate the and train different professionals etc.

The following table gives a detail of authors, study location, sample size, methodology and salient features.

Table 2. 1: Literature Review

Author (Years)	Study Location	Sample Size	Methodology	Salient features
Jitesh V. Kulkarni (2022)	India	Literature Review	Proposal	In emergency, it is mandatory that patient reaches the health facility in time so that their lives are saved. Traffic is a major problem in metros and Because of traffic ambulances reach destination or hospital taking longer time. Milliseconds of time frame is important for a patient who is suffering from severe injury or trauma. Therefore, to save patients life a new concept of capsule ambulance is introduced.
Yunkai Zhai, Xing Xu, Baozhan	--	--	tested the suggested fix in the test environments	When compared to the 4G network, the recorded peak 5G unloaded downlink rate is 18 times higher, while the observed peak 5G unloaded uplink rate is 9 times higher.

Table 2. 1 Continued

Chen, Huimin Lu, Yichuan Wang, Shuyang Li, Xiaobing Shi, Wenchao Wang, Lanlan Shang, and Jie Zhao (2021)			to guarantee the effectiveness and caliber of the ambulance service	The report examines the benefits of 5G-enabled smart ambulances and provides helpful advice for building 5G networks, growing businesses, and optimizing networks for smart ambulance services.
Sarandis Mitropoulos Ionian University, Lefkada, Greece, and Christos Mitsis, Petros Valacheas and Christos Douligeris (2021)	Greece	Country of Greece	According to an agile system methodology, eEKAB was created.	To providing healthcare to patients, eEKAB is built on three key pillars: "On-Time Incident Reporting," "On-Time Arrival at the Incident," and "Transfer to the Health Center." Through this, the overall time for EMS procedures is reduced, and as a result, administration of EMS is made simpler by improved geographical and human resource distribution. It is a very useful application for ambulance drivers since it decreases the time it takes for an ambulance to respond and reach a patient's location and considerably improves the overall

Table 2. 1 Continued

				effectiveness of the prehospital medical care system.
Tanveer-Yadgir (2021)	UAE	97 participants	A cross-sectional study was conducted to collect data from the public using an online survey	The demand for emergency ambulance services and the larger health system is growing as they are being used more frequently, which could compromise access, quality, safety, and outcomes. Numerous variables can be responsible for this rise, therefore precise identification of the key demand drivers will be necessary for focused initiatives to lower utilisation. Although summoning an ambulance is still quite difficult, it is the global community's first choice in cases of medical emergency. Despite the fact that there may be multiple reasons to avoid contacting an ambulance, this study highlights the fact that roughly 35% of participants thought ambulance services were being abused. By completing the healthcare system approach and implementing the public health initiatives, we can alter the public's opinion of the situation. In order to reduce the workload of ambulance services, train the community to recognize medical emergencies, promote the culture of health prevention, and spread knowledge about when to call an ambulance, "public health education initiatives" can be used in conjunction with

Table 2. 1 Continued

				ambulance services and public health. Additional investigation is required to create policies, practices, and partnerships that will improve ambulance service.
Justin J. Boutilier and Timothy C.Y. Chan (2020)	Dhaka and Bangladesh	Field research in Dhaka and Bangladesh	These statistics are used to forecast travel times between any two points on the road network for various hours of the day and days of the week, as well as to estimate the demand for emergency medical services in an LMIC context. We provide a thorough analysis into three policy-related topics using our	We demonstrate how a fleet of compact ambulances could greatly outperform conventional ambulance vans. Due to the additional routing flexibility provided by more nimble vehicles over a bigger road network, they can handle almost three times as much demand while cutting the median average response time by roughly 10% to 18% throughout the whole week and by 24% to 35% during rush hour. Hospital-based and private ambulance providers in Dhaka and other urban areas of developing countries can benefit from practical insights for emergency response optimization.

Table 2. 1 Continued

			prediction-optimization methodology, a simulation model, and real data.	
Kim-Borg, Breanna wright, Liz Sannen, David Dumas (2019)	Australia	3108 participants	Phase of formative research to guide mass media campaign creation and later campaign evaluation.	The purpose of this study was to determine whether using a Behaviour change strategy to address this issue would be beneficial by first changing attitudes and raising awareness of and information about ambulance use in the state of Victoria. In particular, this study aimed to assess how much the Victorian public saw ambulances as an emergency service both before and after the promotion.
Amber-Mehmood Armaan_Ahmed-Rowther (2018)	Low- and middle-income countries	50 variables describing core components of system capacity	hospital on-site review for best resource verification Based on a survey or interview	to provide a tool to evaluate the pre-hospital EMS system using the World Health Organization's (WHO) framework for health systems. This tool could help academics, policy makers, and administrators apply rigorous PEMS assessment techniques and use the data to establish and track benchmarks for the health outcomes that are impacted by an organized EMS system. This application offers a thorough framework for health systems while also allowing LMICs to define their own goals, benchmarks, and track their own success by concentrating

Table 2. 1 Continued

				on various PEMS components.
Zhi-Hai Zhang Hai Jiang (2014)	Not mentioned	30 EMS candidate stations	Deterministic model that considers the box and ellipsoidal uncertainty sets for the model's uncertain parameters.	To the best of our knowledge, we are the first to create a reliable counterpart strategy to address the bi-objective EMS design issue, where the associated uncertainties are difficult to express through probability distribution functions because of the dearth of data. The location of the EMS stations and the number of emergency vehicles at each station can be optimized using the model in order to discover Pareto-optimal solutions for costs and response times.
Judy Lowthian, Peter A Cameron Johannes U Stoelwind er (2011)	Australia	297 papers reviewed	A search of online databases, search engines, peer-reviewed journals and audit reports was undertaken	The demand for emergency ambulance services and the larger health system is growing as they are being used more frequently, which could compromise access, quality, safety, and outcomes. This growth may be caused by a variety of sources, and targeted attempts to decrease utilisation will necessitate a precise identification of the key demand drivers. The demand for emergency ambulance services and the larger health system is growing as they are being used more frequently, which could compromise access, quality, safety, and outcomes. Numerous variables can be responsible for this rise, therefore precise identification of the main demand drivers will be necessary for focused initiatives to reduce utilisation.

CHAPTER 3: METHODOLOGY

3.1 STUDY DESIGN:

The study design is analytical /explorative study design in which we are giving a solution in form of proposal to low-income country to design and develop the EMS system based on requirements and deliverables required by the country.

3.2 SETTING:

The country where study is conducted is an island group in which the healthcare system is divided as island, regional and central. The EMS system is very fragmented as they require land, sea, and air ambulances. The country is less developed and therefore they require financial assistance for the development of EMS system

3.3 STUDY POPULATION:

The population of the country on which the study has been carried out is 5,59,366 and as the desired system is healthcare related so more focus is given to the healthcare staffs such as hospitals, public and private partners, NGOS, ambulance drivers, paramedics, etc. but this proposal will affect the overall healthcare structure and infrastructure of the country.

3.4 DURATION OF STUDY:

The proposal must be submitted within a time frame of 52 weeks in which the ground intel, procurement, complete operation and exit management of the project must be delivered.

3.5 SAMPLE SIZE:

As it is a qualitative study so it will be benefiting the 5,59,366 population of the country as well as it is an island group so the tourists arriving to the country will also be benefited.

3.6 SAMPLING TECHNIQUE:

Inclusion of all participants and stakeholders involved in the emergency medical services.

3.7 DATA COLLECTION PROCEDURE:

Initial phase for developing the proposal the secondary research on the country was conducted to know the population, the human resources, the healthcare system i.e., private, public, NGO and others affecting it over that location. We have also created phase 1 in the

proposal in which we are talking about the schemes that we will deliver to the country after they accept our proposal in which ground reality and requirements by all stakeholders will be evaluated during first few weeks of the proposal.

So, following Approach and methodology was formulated for the country.

The Approach is divided into four segments which are Discovery, Implementation, Technological intervention, and post implementation stage. All these must follow a particular timeline of 52 weeks and must deliver following outputs in those weeks.

The details are as follows:

DISCOVERY PHASE

(Timeline: 0-8 weeks)

INITIAL OUTLINE

- Review of existing guidelines, SOPs and existing COVID-19 and emergency response system- based on population.
- Prevalence study and existing response times for various emergencies.
- Analysis of the current human resource and development of training material.
- Analysis of the current IT infrastructure.

EXECUTION STRATEGY

- Detailed strategy and work plan for designing of EMS system.
- Review of existing facilities – Total number of ambulances, types available and geographical constraints.
- Estimation of Land/sea/air ambulances pathways and interpolation of health institutions for adjusted connectivity.
- Assessment of Training and Capacity Building for the EMS.

DELIVERABLES

- Inception Report

IMPLEMENTATION PHASE

(Timeline: 9-16 weeks)

INITIAL OUTLINE

- Identifying all the interfaces and integration components for the EMS System.
- Assessment of current gap in EMS system such as computer aided dispatch, computer telephony integration, call monitoring.

EXECUTION STRATEGY

- Development of EMS system as per workplan.
- Pre-requisite hardware and software assessment
- Interface build and fitment into central EMS Coordination Mechanism.
- Development of Beta version of EMS system

DELIVERABLES

- Interim Report
- Handover of system design specifications

TECHNOLOGICAL INTERVENTION PHASE

(Timeline: 16-28 weeks)

INITIAL OUTLINE

- Analysis of Software and Hardware Requirement for the Proposed EMS System.
- Gap Assessment based on desired functional need of EMS System.
- Preparing the UAT and Training material for the End Users.

EXECUTION STRATEGY

- IT software and hardware procurement for digitalization and automation of call centers procured and installed.
- Installation of GPS devices, walkie talkies and tablets in the ambulances.

- Developing, testing and deployment of beta-version of the digital EMS information system and draft final report based in inputs.
- Providing end user training.

DELIVERABLES

- Draft Final Report
- Handover of training content manual

POST IMPLEMENTATION PHASE

(Timeline: 28-52 weeks)

INITIAL OUTLINE

- Establishing Baseline through KPI of EMS:
- On time incident reporting
- On-time arrival at the incident
- Transfer to the health-center.
- Identifying Initiatives/ Interventions for better use of the EMS information system.

EXECUTION STRATEGY

- Establishing coordination among various health facilities, land and sea ambulances, police departments, fire departments etc.
- Operational support for service delivery and training of paramedics.
- Assessment and evaluation of the performance of the EMS information system software conducted and remaining gaps addressed through system upgradation.

DELIVERABLES

- Revised SOPs, manuals, guidelines, and EMS functional document
- Final report

CHAPTER 4: RESULT

The consultancy firm adopts 9-Stages of Implementation Methodology for its project implementations and assign only qualified team members comprising both onsite and offsite teams (onsite duration - if required and to be determined,) thus ensuring that all the implementation activities in the methodology are duly and diligently followed with overall alignment to the activities and tasks on hand.

The firm understands that every implementation differs, therefore, the methodology includes high-level activities and procedures leaving room for flexibility at the task levels while allowing the Implementation team to customize the process based on the needs of the project. The 9-Stage Implementation Methodology is summarized below:

Table 4.1: Area of work and Deliverables

S. No.	Area of work	Deliverables	Timeline
1	Project Initiation and Discovery Session	- Discovery Session attended by core project team members, identification of key stakeholders to develop key insights of the project and facilitate transition - Developing a framework for a robust communication paradigm comprising of rules and procedures for securing and communicating approvals, guidelines for implementation, escalation hierarchy etc.	5 WEEKS
2	Development of EMS System	Designing and Development of EMS System	4 WEEKS
3	Pre-Requisite Software and Hardware Installation	- Awarding of contract for procurement - Placement of components in place - Collection of configuration data and installation of base software	6 WEEKS

Table 4.1 Continued

		Sequential installation and review of satisfactory domain performance	
4	Interface Build and Fitment into central EMS Coordination Mechanism	- Procurement of Hardware and software according to SRS documents - Installation and operationalization of EMS digital system - Procurement of hardware and software for automation of call center	4 WEEKS
5	Beta testing of the EMS System	- Smooth roll-out of EMS system with well-established and well-connected system module - Assessment and evaluation of the performance of the EMS information system software and identification of the remaining gaps - Performing stress testing of the developed EMS system	3 WEEKS
6	Super User Training	- Training of super user personnel in the configuration and administration aspects of the application - Workflow training of super users for gap analysis - Compilation of training schedules and course material for future reference	5 WEEKS
7	User acceptance Testing	- Testing, piloting, and upgradation of EMS as per government request. - Integration of EMS with other HMIS system	5 WEEKS

Table 4.1 Continued

		Workflow of EMS system is properly established on field	
8	Pre-Go Live System & Operational Readiness	- Review, Update, support strategy and communication process during Rollout - Distribute the support resources over required locations - Manage Support calls, logs and issues tracking - Daily system rounds for monitoring users and their feedback - Install fixes as per the EMS system requirement	6 WEEKS
9	Post Implementation Review and Support	- Project monitoring and maintenance report - Document handover - Knowledge transfer and successful sign off	14 WEEKS

Detailed Description of all stages:

4.1 Stage 1: Project Initiation and Discovery Session

This stage will be used for understanding the ground reality and taking forward the project according to the need assessment and gap identification of the present EMS system.

- Conduct a visionary workshop with all stakeholders**

This step will be used to have discovery sessions with core project team members to identify the key stakeholders from ministry, doctors, ambulance drivers, paramedics etc to develop a key insight of the project and facilitate transition.

A stage wise workshop will be organized with key Stakeholders. The key objectives of this workshop will be:

- Develop key insights about the requirements of the project.
- Facilitating transition.
- Developing a framework that helps in developing a robust communication paradigm that will comprises of rules and procedures for securing and communicating approvals, guidelines for implementation, escalation hierarchy etc.
- Communicate change and facilitate transition.

- **Assessment of current status-People, Process and Technology**

The team will study the existing facilities and existing solution with objectives to:

- Gain insights about existing set-up in terms of deployment of equipment, manpower, technology and associated interventions for deployment and training.
- Identifications of sites for pilot roll-out – Facility assessment will help in identifying sites having good network connectivity, good patient foot fall, infrastructure readiness at site etc. This will help in selecting ideal site for pilot roll-out.
- Defining roll-out strategy on basis of site readiness – Sites which are most ready will be taken up for implementation first and sites where significant efforts are required to make them implementation ready will be taken later.

- **Change Protocol Establishment**

Developing a framework for a robust communication paradigm comprising of rules and procedures for securing and communicating approvals, guidelines for implementation, escalation hierarchy etc.

Communicate change and facilitate transition.

- **Identification of area specific paramedics and clinical staff to form a repository**

A repository consisting of area wise database wherein information related to paramedics and clinical staff is stored

- **Identification of ambulances and creating a repository**

The ambulances will be identified as per the MPDS determinants standards, and a repository will be made for the EMS consisting various ambulances with different intervention capabilities

- **Integration with other systems facilitation**

Integration study for EMS pillars consisting of Records Management Systems (RMS), Geographical Information System (GIS), Automatic Vehicle Location (AVL) and Caller ID for verifying location of incoming call

- **Prevalence Research**

Secondary research conducted to analyze the current health status of the population. Their requirements mapped and most common medical emergencies identified and correlated with the MPDS and questionaries protocol for action established.

Assessing the current state for designing the functional requirement documents and defining the key performance indicators are important and those must be done in this stage only.

The key performance indicators identified for this project are as follows:

- Timely Identification of ambulance
- On Time arrival of paramedics
- Dissemination of appropriate medical advice
- Timely transfer to health facility

The Functional requirement specifications for the project are as follows:

- Current state analysis

- Requisite analysis for SRS
- Beta testing for functionality review
- Super user and user accepting testing
- Training and capacity building

4.1.1 Design of EMS Workflow

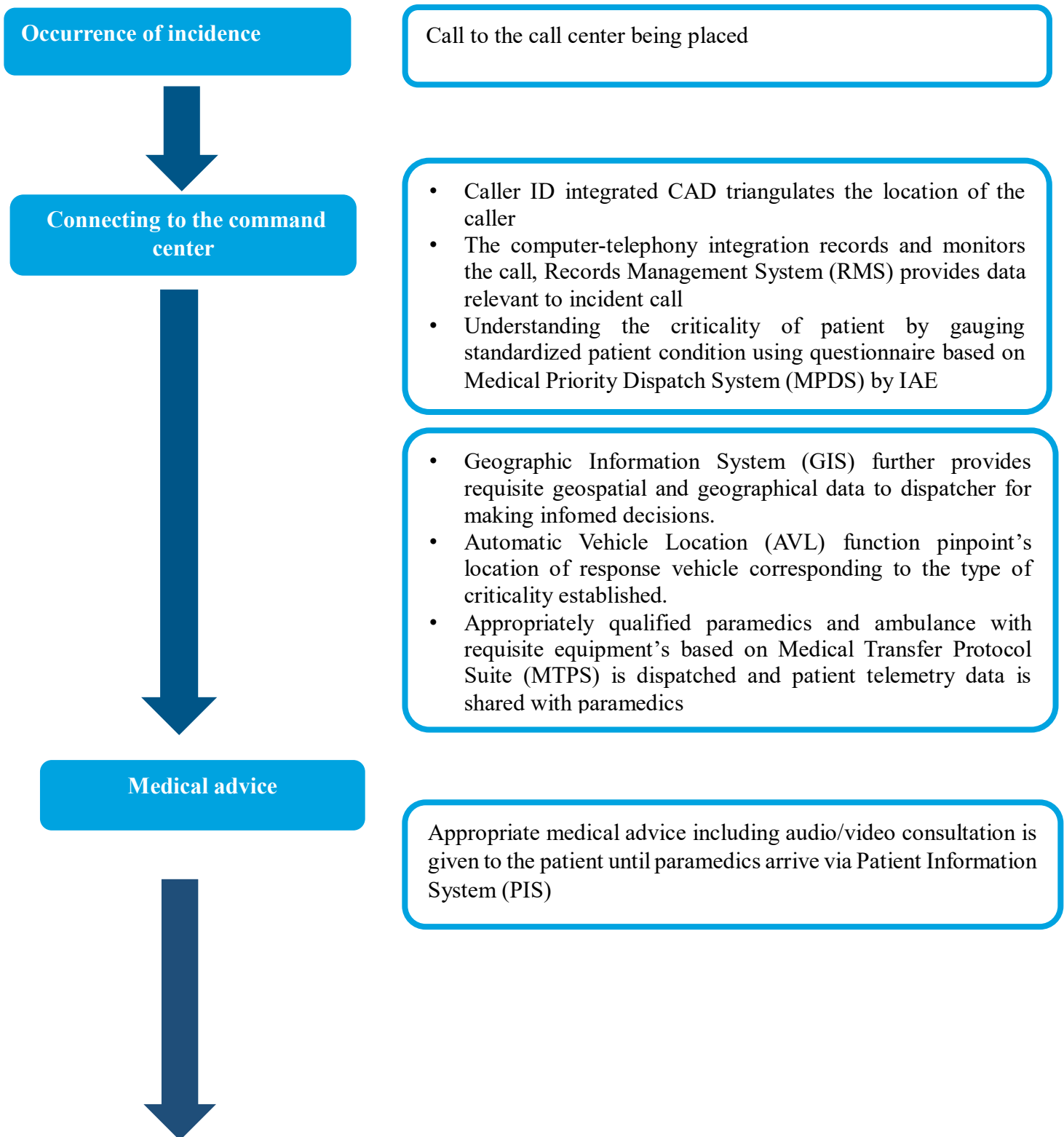


Figure 4.1: Workflow Diagram

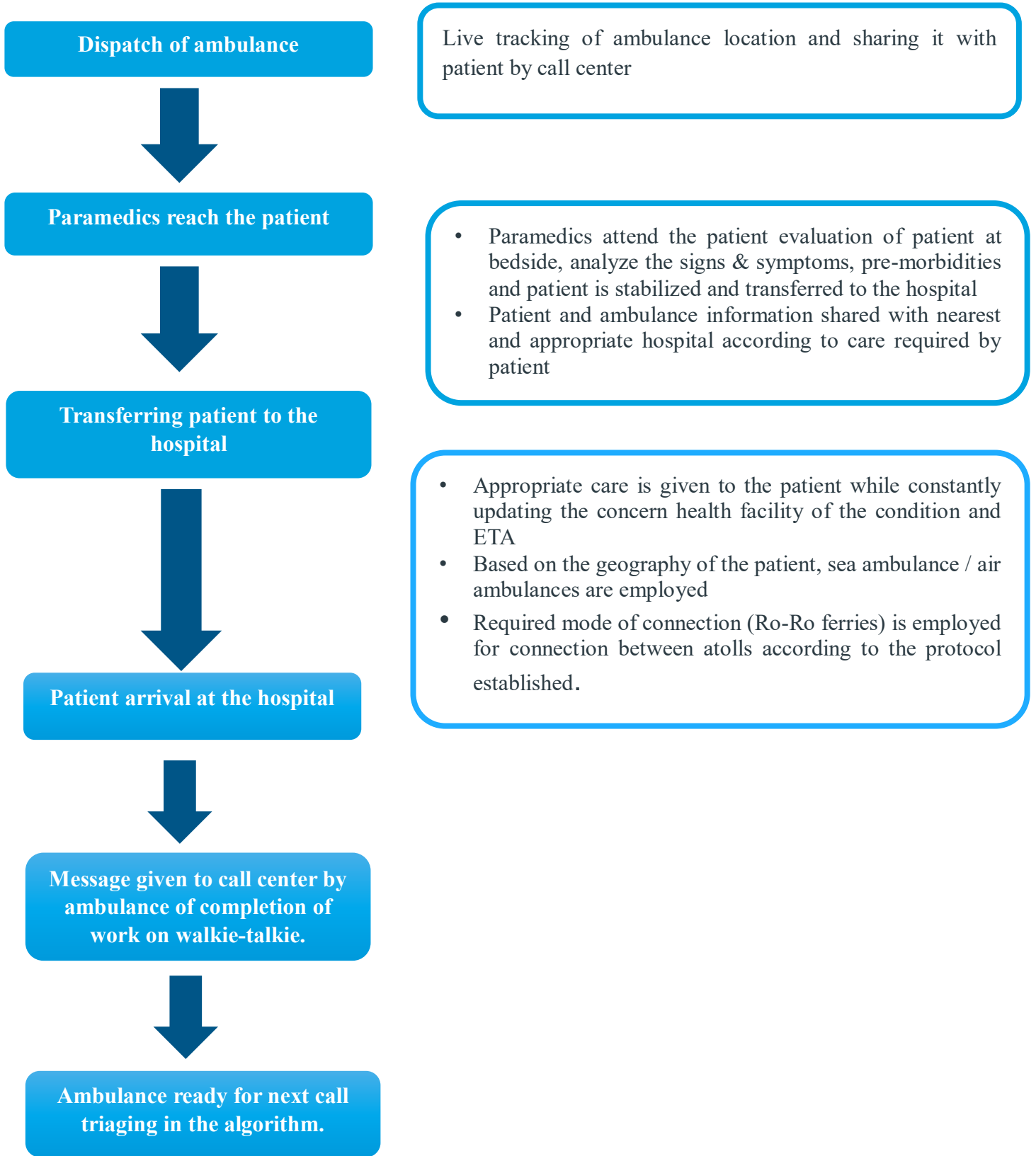


Figure 4.1 continued

4.2 Stage 2: Development of EMS System

The development of EMS system will be on the following lines:

- Based on requirements, design and develop the digital emergency medical service (EMS) information system software that will which will instantly find the patient and connect them with the closest ambulance, dispatch the paramedic crew as and when necessary, and offer pre-paramedic guidance.
- Procure and support the installation of required IT software and IT hardware
- The team will support the installation and operationalization of Global Positioning System (GPS) devices, walkie talkies and tablets in the ambulances

The application build/configuration will commence after the design specifications signoffs and received the configuration data from the stakeholders. These development activities will be conducted offsites.

The interface build and configuration will commence after the design specification and integration model signoffs. These development activities will be conducted offsites.

This stage also ensures that the solutions and interface components are tested and validated before releasing the application for any user training or user acceptance testing (UAT). To ensure the quality of the application build, various testing, including Unit Testing, System Testing (Functional), Interface Testing and an end-to-end system integration testing (SIT) and validation are conducted by the implementation teams. As part of the SIT, the implementation team will conduct a demonstration of the application to stakeholders using various test scenarios.

On Quality and Assurance (QA), there will be conduction of planning meetings with the Solution team, implementation team and the QA team to plan for the effective and successful testing.

- **Unit Testing** is to ensure that the configuration data received from stakeholders matches to the application requirements. This testing is conducted in parallel with the

build/configuration activities and is performed by QA team assisted by the Implementation Consultants.

It is to ensure that the configuration data developed matches to the CAD application requirements.

- **System Testing (Functional)** is the standalone functional testing of the application, conducted after the configuration of the application. This testing is conducted in parallel with the Build/Configuration activities. This testing is performed by consultancy team assisted by the solution team.
- **Interface Testing** is conducted after completing both the interface build / configuration and the unit & system testing activities. This interface testing will be based on the interface design specification, covering the deliverable aspects of the interfaces. This testing is performed by QA team, implementation team and application team.
- **System Integration Testing** is conducted after the successful completion of the above testing. The SIT consists of two parts:
 - End-to-end testing of the integrated application covering the application functionalities and the interface touchpoints.
 - A demonstration of the application to stakeholders, after the successful completion of the part 1. The implementation team will adopt various scenarios (based on the Test Scripts) as guidelines and walkthrough the application using the Start-End processes.

The various outcomes of this will be as follows:

- Building of the entire EMS Application.
- Testing, planning the scenarios built for various types of testing.
- Reassessing, troubleshooting, and coordinating the fitments of EMS with the stakeholders.

4.3 Stage 3: Pre-Requisite Software and Hardware Installation

Procurement of the hardware components will commence after the contract has been awarded, and planning to be installed in accordance with the overall project schedule to meet the various milestones.

Technical team will begin the software installation and the necessary configurations once the hardware and the necessary components are in place and the necessary components are installed in the command center and GPS devices, walkie-talkie and tablets installed in ambulances.

The main activities during this stage are the installation of the base software (software that is not customized) at stakeholder's environment, collection of configuration/customization data from stakeholders, build/ customization of the application and the interface components.

Once the Hardware Components have been installed, their Integration must be validated against other components in the System such as Mobile Devices, Mobile Terminals, Pagers etc.

The base software will be first installed on the non-Production domain during the earlier phase of the project and on the Production domain before the Pre-Go Live stage. Before these activities, the Implementation Consultants will conduct review meetings with the respective infrastructure teams to ensure that the domains meet the recommended specifications and pre-requisites. The base software installation could be done onsite or offsite activity, based on stakeholder's IT & Security policies to permit remote access to the environments.

The Installed System will be monitored for the performance as any Emergency Response System have to be reviewed in all the real scenarios as well as building various Simulations and Mock Drill exercises.

4.4 Stage 4: Interface Build and Fitment into central EMS

Coordination Mechanism

Hardware and software procurement will be done according to SRS documents which will be based on the following criteria:

- which will instantly find the patient and connect them with the closest ambulance, dispatch the paramedic crew as and when necessary, and offer pre-paramedic guidance.
- After that digital EMS information system installed and started operating there will be establishment of interoperability between the EMS information system and other relevant health information systems to ensure the seamless patient information sharing and referral services. The installation and operation of GPS, walkie talkie and tablets for ambulances will be done so as the proper communication through GPS, walkie –talkie established among different stakeholders of EMS system
- Automation of call center procured and installed
- Coordinated EMS system as per WHO guidelines

4.5 Stage 5: Beta testing of the EMS System

Beta version of digital EMS information system will be developed and tested along with testing with for interoperability with other associated existing information systems.

Selecting pilot testing sites based on:

- Network connectivity
- Patient footfall
- Infrastructure readiness
- Skilled Manpower
- Testing in selected sites

- Identification of challenges, shortcomings, and their cause-and-effect analysis for their redressal
- Customization and tweaking of systems as per the identified challenges
- Testing and documenting the final stages before final roll-out
- Smooth roll-out of EMS system with well-established and well-connected system module.
- Assessment and evaluation of the performance of the EMS information system software and identify the remaining gaps
- Performing stress testing of the developed EMS system

The data migration will also be carried during this stage and During Data Migration, which runs in parallel to the software stages, our Solution Manager will review and discuss with Client Subject Matter Experts/Core-users and Solution Architects of other solutions on the configuration data that needs be collected for our application. After these discussions, The firm submits the finalized Data Collection Templates (DCT) for data collection, and Client provides the data requested, per the Project Schedule.

Data Migration involves a systematic approach and follows the ETL (Extract, Transform and Load) methodology. It includes the following sequence of steps:

- Migration planning
- source data preparation
- Data mapping
- Migration development
- Trial
- User acceptance

Close coordination with Client's users will be required.

The various steps for data migration are detailed below:

- **Migration Planning** - This phase helps plan administrative, clinical, and financial for migration to by defining objective, strategy, stakeholders, planning, and execution process.
- **Source Data Preparation** - During this phase data to be migrated from source is prepared for migration with tasks such as defining data quality expected, error and exceptions resolutions, data cleansing etc.
- **Data Mapping** - This phase offers insight into gaps between source and destination data sources w.r.t. schema, types, constraints, rules, default constants etc.
- **Migration Development** - Migration phase executes all migration readiness stages such as data conversions, reconciliations, and tests preparation.
- **Trial & User Acceptance** - Trial migration would be executed to compare results with expected objectives and data quality metrics. If any optimization measures are adopted. With approved outcome, rest of data is migrated.

4.6 Stage 6: Super User Training

The super user trainings are the trainings given to the super testers who test the whole system functionality. The following are the steps which will be conducted during this stage of the project:

- Super user personnel are trained in the configuration and administration aspects of the application
- Workflow training for super users for gap analysis
- Compilation of training schedules and course material for future reference
- Adopting Train-the-Trainer training approach
- Application Administration training is provided to those trainees who are identified by MOH as super-users / application administrators

- Application Functionality training provided to ensure trainees are fully educated in the functional aspects of the application

The firm will assign relevant trainers to conduct training on the application to ensure that the users can use the solutions efficiently, per the functional role and responsibilities. Adopting Train-the-Trainer training approach, respective administrative / super-user training will be conducted first, which is training a representative group of super-users (trainers), who then leads and trains the remaining end-users based on the Client's training policies. The firm trainers will also support the Client's trainers based on the project schedule established. Then the training agenda will be provided by the firm.

Firm follows the Train-the-Trainer training approach, our firm believe the approach will help the Clients towards their continuous learning strategy and programs for its staff. The Client will identify their Trainers based on their training capabilities and their level of participation in the project. These Trainers will be assigned to trains the end-users prior to the Pre-Go Live preparations or for new users joining the organization. Training is classroom-based and covers two major areas:

- Application Administration.
- Application Functionality

The training agenda and schedules will be supplied to stakeholder in advance to plan and arrange for the training sessions. As part of the training planning, firm trainers will closely work with the firm project team, solution team and stakeholder's project team to ensure that all the training requisites are met, and expectations are discussed and understood to plan for a successful training.

The Application Administration training is provided to those trainees that are identified by stakeholders as super-users / application administrators. The purpose of the Application Administration training is to ensure that the trainees are fully trained in the configuration and

administration aspects of the application. Each trainee will receive a set of configuration / administrator-based tasks that needs to be completed in the configuration-area of the application, to ensure that the trainee is confident and aware of the concepts.

The purpose of the Application Functionality training is to ensure that the trainees are fully educated in the functional aspects of the application, its interactions with other applications and the role-based functionalities. The training will be based on the design specifications and the trainees will receive hand-on opportunities during the training sessions. Each trainee will receive a set of role-based tasks that needs to be completed in the application, to ensure that the theoretical knowledge can be translated to practical knowledge.

The trainees will be requested to complete a classroom-based assessment to assess their application / solution competency. Our trainers will also distribute training evaluation forms to evaluate the training sessions, topics, and the training environments. Training manuals will be provided during the training sessions.

4.7 Stage 7: User Acceptance Testing

This testing is done so that we can find the system which is developed is running accurately. The following are the steps which are taken during these stages:

- End-to-end testing of the solutions and rectification of any defects if identified
- Test scripts submission to stakeholders as a guideline for testing
- Based on final developed test scripts and scenarios UAT will be performed by stakeholders SMEs and core -users
- Based on the set of required scenarios test scripts will be produced by firm which will consist of workflow scenarios, process steps, expected outcomes and application behaviours

The tester can document the status with priority indicator and the severity associate with each issue

- Testing, piloting, and upgradation of EMS as per stakeholder's request.
- EMS system is working in accordance to test script

- Integration of EMS with other HMIS system
- Workflow of EMS system are properly established on field

During this stage, stakeholder's SMEs and core-users will perform the end-to-end testing of the solutions, assisted by firm's implementation team. If defects are identified, it is prioritized and planned for correction. Firm will submit test scripts to stakeholder as a guideline for testing. If required, stakeholder can create additional test scripts and test scenarios.

The purpose of UAT is to confirm that the application is functioning as per the agreed requirement specifications and is conducted after the Internal QA and the Train-the-Training stages. The UAT is performed by stakeholder's SMEs and core-users base on their final developed test scripts and scenarios, UAT will be assisted by firm's implementation team.

Firms' implementation team together with the solution team will develop the test scripts based on the requirements test scenarios. stakeholder's SMEs / core users can re-create additional test scripts and test scenarios in collaboration with the business users. The test scripts produced by firm will consist of workflow scenarios, process steps, expected outcomes and application behaviors based on the set of required scenarios. The tester can document the status with priority indicator and the severity associate with each issue.

Below is the firm's- Standard Severity Level indicator suggested for the UAT.

Defect Priority

- **Priority 1:** Showstopper issue – cannot Go Live with this defect.
- **Priority 2:** Defects that are affecting a frequently used area of software.
- **Priority 3:** Usually can be corrected by re-configuring the software.
- **Priority 4:** Defects that are affecting a less frequently used area of software

After UAT User trainings are also conducted and in these User training there are two components which are included as follows:

- Capacity Building Plan
- Details of training content

The capacity building plan will include the following steps:

- Training need assessment – In this stage development tool to assess knowledge level of users will be assessed.
- Develop training material – the training material will be developed as per the guidelines and demand request of the stakeholders.
- Capacity building of the stakeholders – There are different stakeholders in this project, and they all require different needs to be fulfilled. The introductory and refresher training will be given to the call center staff, the paramedics, ambulance drivers and other people who are involved in this system.

The details of training content are as follows:

- Specific training material to be conducted for the staff such as call center staff, ambulance drivers paramedics and others.
- Training contents will also be developed for the healthcare professionals, hospitals, and others.
- Draft of the final training content will be shared before final development for reviews and feedback

Training methodology and handholding support

- Training Handbook: This book will include the details of how the whole EMS system works
- Facilitator Guide
- Audio-Visual Content
- Presentation and Operational Training
- Training Handouts
- Group Discussion on Case Studies
- Pre & Post Training Assessment

- Training Schedule
- Support in Training Activity
- Setting up the new EMS Infra
- Monitoring Day to Day Operations
- Conducting Assessments
- Providing Feedback & Guidance

4.8 Stage 8: Pre-Go Live System & Operational Readiness

During this stage the following steps will be carried out which will help for operational readiness of the EMS system

- Regular Pre-Go Live meetings are conducted to verify that all the necessary preparations and the readiness of the system to ensure for a successful Live operation of the project.
- Infrastructure & application readiness reviews will be conducted to review the integrated system.
- Assessment and evaluation of performance of EMS and addressing remaining gaps.
- During implementation phased roll out and go live will be followed by on-the-job user trainings.
- Implementation of IEC strategy

It is very import to spread project awareness and motivation among users and patents. The firm along with key stakeholders will develop IEC (Information, Education and Communication) strategy and plan. Following channels will be included under IEC strategy –

- Radio Announcements

- Newspaper articles on ePIS project
- Public announcements
- Television ads
- Social Media (Facebook, Twitter etc)

The outcome of this stage will be as follows:

- Review and Update support strategy and communication process during Rollout with stakeholders
- Distribute the support resources over required locations
- Manage Support calls, logs and issues tracking
- Daily system round for monitoring users and their feedback
- Install fixes as per the EMS system requirement

4.9 Stage 9: Post Implementation Review and Support

The day when the solutions are deployed on site and commissioned with live data in the production environment. The firm will deploy the implementation team to provide handholding support to the end-users during the Go Live.

The firm will be proposing five (5) days (to be finalized) of onsite support to stakeholder, based on the Centralized Command Centre (CCC) method, located within stakeholder premises. The firms project manager will be assigned to the CCC.

In line with the implementation methodology, the below summarizes the activities of the project.

For smooth functioning of the project post implementation, the monitoring and support activities will be escalated to ongoing assistance which will be provided through periodic reports, MIS, and call center support.

To provide necessary support to end users and stakeholders a mechanism will be placed to monitor the project implementation immediately after the pan roll out. This will include supervision calls, back check, and real time data validation on the servers by making calls to the end users.

Our team will continuously monitor the system performance and will resolve all the issues pertaining to the solution during the project duration. Test scenarios will be designed to test all major aspects of the system such as core functionality, integration with legacy systems, system performance at peak load, custom objects developed, etc. All the bugs and bug fixes will be captured in separate log document. The log documents shall be analyzed at regular intervals to identify and address security and performance issues in a timely manner. Project monitoring reports shall be prepared and provided on a periodic basis.

- **Monitor roll-out**
- **Security audits** will be performed, and security audit reports will be prepared and shared with the key stakeholders
- **Impact assessment and outcomes assessment**
- **Support and maintenance of the deployed solution** will be ensured b IQVIA team
- **Transition management/Change management**
- **Conducting refresher trainings**

Efficient management of change will decrease the associated fear and negativity in the mind of the end user. Refresher training is an important component of change management which we shall leverage to not only align all users with the change deployed (e.g., new features or best practices), but also to ensure users are influenced positively and gain a sense of belonging as the system transitions. Trainings will be conducted facility wise through classroom sessions or through on the job training.

Handover & Exit Management

Our firm will support in establishing a transition team along with creation of a transition plan. Assessment will be conducted on the extent to which targets were achieved in terms of meeting original scope of work with project team, production support, and operational staff. The transition plan shall include the following activities:

- **Project monitoring and issue resolution**
- **Conducting refresher trainings** if required
- **Exit management:** Assessment of project handover documents and team
- **Conduct knowledge transfer sessions** for the local team
- **Handover of source code, data base design and any information related with solution design, development and implementation and project management**
- **Validation of documents** handed over for system design, user manual and solution details
- **Submission of closure report**

At the end of the contract period, the firm will document all risks faced during the transition stage and mitigation measures in advance to ensure smooth transition without any service disruption. Our aim will be to ensure that the exit plan facilitates the project to become self-sustaining and provides no reduction in the benefits provided to all beneficiaries.

4.10 Key deliverables of the project

The EMS project must submit some of the deliverables at different time frames and these key deliverables are as follows:

- **Inception report**

This report must be delivered at 8 week and following activities must be covered before finalizing and submitting this report:

- Review of existing facilities i.e., the total number of ambulances present in that country, The various types of ambulances present in the country such as land, sea and air ambulances, the various geographic

constraints that are present in that country which can create a hurdle during implementation of the project.

- Defining the project plan and governance structure as both are crucial steps and must be completed so that we know what we are delivering and to whom and if they want any changes that can be incorporated during this phase only to avoid and clash.
- Mapping of key stakeholders is also important as in healthcare projects there are various members who are involved such as public sector, private sector, NGO's, hospitals, healthcare professionals, paramedics, ambulance drivers, call center staff etc. as they will also have to give their inputs for carrying forward the project.

- **Interim report**

The interim must be delivered 16 weeks of start of the project. This report can only be delivered after completion of following activities

- Plan for revised SOP, manuals and guidelines as the country might be having any existing guidelines or manuals or they might require the firm to follow some of the international guideline and therefore the firm will access the client need as well as existing documents and will come up with a holistic and new document consisting of SOP's, guidelines, etc.
- System design specification for EMS information system as the creation of whole system has to be done there will be creation of dashboards, websites and other app, etc and for creating all this we have to design a SRS documents which will give a holistic approach of the design of these internet of things and if any changes are required it can be directly communicated with the developer team so as it will be easy for developer team as well as the stakeholders.
- Training plan upgradation process as in the inception report we have identified various key stakeholders so now we can understand the level of training module that we have to create for them such as should it be beginner level, intermediate level or high level and do we have

to make different manuals for different stakeholders such as different for call center staff, different for healthcare professionals, different for ambulance drivers, etc.

- Capacity building plan as this project has different stakeholders therefore the capacity building plan will also be different for them based on their understanding of the project.
- Analysis of the current human resources and formulating capacity building plan as after implementation of this project we must hire new people who will support the project at different levels, and they must give different sought of training.
- Formulation of workplan and drafting of strategy and procurement plan for hardware and software must be submitted as major chunk of revenue will be used for this and therefore proper assessment of this is crucial at this point to figure out the financial requirements of the project.

- **Beta version of digital EMS information system developed and tested**

The development of this version is required to test the operation of EMS system and if any kind of update is required it can be done during this phase as well as the interoperability of developed EMS system can be checked with other existing information system. This also must be completed during 16 weeks of start of project. The following activities must be done to provide this output:

- System integration testing performed as the developed EMS system must be integrated with other systems such as HMIS system, ambulatory modules, etc to have a smooth process and workflow of the plan.
- User acceptance testing completed during this phase as super users must test the platform and relate the lag or problems which may can, and they must resolve it.

- Data migration and integration plan finalized: As finalization of EMS system must be done and during this stage, we must complete all data migration in this phase.

- **Draft final report**

The final report draft must be submitted during 28-week time of the project and following activities must be done before this:

- Revised SOP, manuals, guidelines, and EMS functional document
- Develop training plan
- Inventory Details of Pre- Requisite Software and Hardware for EMS Information System
- IT software and IT hardware for the digitalization of the EMS and the automation of the call center procured and installed.
- Digital EMS information system installed and started operating.
- Global Positioning System (GPS) devices, walkie talkies and tablets for ambulances installed and start operating.

- Assessment and the performance of EMS information system software

The assessment and performance of EMS system software will take place and the following activities must be performed during this phase and must be developed for 52 weeks

- Pre-Go-Live system and operational readiness analyzed
- System-wide data collected and analyzed for issues and fixation

- **Final report**

The final report is the final document which will be handed over after 52 weeks and the following activities must be performed

- Feedback and Debug Report of UAT attached
- Data Migration and Integration report submitted
- Transition plan and steady state handover details
- Knowledge sharing plan and capacity building plan for all the independent functions

4.11 The workplan for EMS System

The implementation of this project requires a couple of activities which were also covered in above section. Therefore, to show all the activities in a time frame of 52 weeks a Gantt chart was prepared, and it was divided in four phases with each having different activities being planned to deliver all the deliverables in time.

TABLE 4.2: Phase wise Activities

No	Activity
1	Kick off meeting
	<i>Deliverable: Inception Report</i>
Phase-1 Diagnostics & Action plan formulation (0 - 9 weeks)	
2	Diagnostics, Need & Gap assessment of Emergency Medical Service Information System (EMS)
3	Roadmap preparation and action plan
4	Designing of Next Gen EMS
Phase-2 Implementation (9 - 16 weeks)	
5	Development of EMS System
6	Pre-Requisite Software and Hardware Assessment
7	Training content Preparation
8	Capacity building plan
9	Interface Build and Fitment into Central EMS Coordination Mechanism
10	Beta Testing of EMS System
11	Handover: System Design Specifications
	<i>Deliverable: Interim Report</i>
Phase-3 IT Software and IT Hardware for the Digitization of EMS (16 - 28 weeks)	
12	Pre-Requisite Software and Hardware Procurement
13	Pre-Requisite Software and Hardware Installation
14	Installation of GPS Devices, Walkies Talkies and Tablets for Ambulances
15	Training to EMS call center staffs, emergency medical technicians, health care workers and other related stakeholders
16	Handover: Training Content Manual
	<i>Draft Final Report</i>
Phase-4 Assessment & Evaluation of EMS Information System (28-52 weeks)	
17	User Acceptance Testing
18	Pre-Go Live System & Operational Readiness
19	Go-Live
20	IT & Web support (Trouble shooting)
21	Regular Quality assurance and concurrent monitoring
22	Technical and operational support to EMS Command Center & Emergency medical technicians, health care workers and other related stakeholders

TABLE 4.2: Continued

23	Need based refresher training, update stakeholders about revision
24	Maintenance and upgradation of EMS Information Systems
25	Dissemination of Best practices & Lesson learnt document
26	Develop & submit project completion report
27	Knowledge transfer & Exit
	<i>Deliverable: Revised SOPs, manuals, guidelines, and EMS functional document</i>
	<i>Final Report</i>

1) Phase 1 – Diagnostics and Action plan formulation

The first deliverable for the EMS system is the submission of the inception report which must be delivered during eighth week of start of the project.

During this phase various activities will be performed before delivering the inception reports which are as follows:

- Diagnostics, need and gap assessment of emergency medical service information system: This will help in assessment of current situation and will be carried for 3 weeks of time frame.
- Roadmap preparation and action plan: The road map and action plan will be delivered in 4 months.
- Designing of EMS system: The designing will be done in 2 weeks of time frame.

Table 4.3: Phase 1 Activities

No	Activity	MONTH 1				MONTH 2			
		W1	W2	W3	W4	W5	W6	W7	W8
1	Kick off meeting								
Phase-1 Diagnostics & Action plan formulation (0 - 9 weeks)									
2	Diagnostics, Need & Gap assessment of Emergency Medical Service Information System (EMS)								
3	Roadmap preparation and action plan								
4	Designing of Next Gen EMS								
	<i>Deliverable: Inception Report</i>								

2) Phase 2 – Implementation Phase:

This phase is where most of the implementation phase of EMS will be taken care of as in the first stage designing of EMS was complemented so now implementation and procurement must be taken care of and at the end of this phase Interim report which is one of the key deliverables that must be delivered which has to be delivered during 16 weeks of time frame.

In this phase following activities must be carried out:

- Development of EMS system
- Pre-requisite software and hardware assessment
- Training content preparation
- Capacity building plan
- Interface build and fitment into central EMS coordination mechanism
- Beta testing of EMS system
- System design Specification handover

Table 4.4: Phase 2 Activities

No	Activity	MONTH 3				MONTH 4			
		W 9	W 10	W 11	W 12	W 13	W 14	W 15	W 16
Phase-2 Implementation (9 - 16 weeks)									
5	Development of EMS System								
6	Pre-Requisite Software and Hardware Assessment								
7	Training content Preparation								
8	Capacity building plan								
9	Interface Build and Fitment into Central EMS Coordination Mechanism								
10	Beta Testing of EMS System								
11	Handover: System Design Specifications								
	Deliverable: Interim Report								

3) Phase 3: IT Software and IT hardware for the digitalization of EMS system:

This phase will have the deliverable as draft final report and the activities that will be followed during this phase are as follows:

- Pre-requisite software and hardware procurement
- Pre -requisite software and hardware installation
- Installation of GPS devices, walkie -talkies and tablets for ambulances
- Training to EMS call center staffs, emergency medical technicians, healthcare workers and other related stakeholders
- Training content manual will be handover during this phase

Table 4.5: Phase 3 Activities

No	Activity	MONTH 5				MONTH 6				MONTH 7				
		W 16	W 17	W 18	W 19	W 20	W 21	W 22	W 23	W 24	W 25	W 26	W 27	W 28
Phase-3 IT Software and IT Hardware for the Digitization of EMS (16 - 28 weeks)														
12	Pre-Requisite Software and Hardware Procurement													
13	Pre-Requisite Software and Hardware Installation													
14	Installation of GPS Devices, Walkies Talkies and Tablets for Ambulances													
15	Training to EMS call center staffs, emergency medical technicians, health care workers and other related stakeholders													
16	Handover: Training Content Manual													
	<i>Deliverable: Draft Final Report</i>													

4) Phase 4 – Assessment and evaluation of EMS information system

During this phase final report has to be delivered as end result and following activities will be performed which are as follows :

- User acceptance testing
- Pre-go live system and operational readiness
- Go live
- IT and web support
- Regular quality assurance and concurrent monitoring
- Technical and operational support to EMS Command Center & Emergency medical technicians, health care workers and other related stakeholders
- Need based refresher training, update stakeholders about revision
- Maintenance and upgradation of EMS Information Systems
- Dissemination of Best practices & Lesson learnt document
- Develop & submit project completion report
- Knowledge transfer & Exit
- Revised SOPs, manuals, guidelines, and EMS functional document

Table 4.6: Phase 4 Activities

No	Activity	MONTH 7				MONTH 8				MONTH 9				MONTH 10				MONTH 11				MONTH 12				
		W 2 8	W 2 9	W 3 0	W 3 1	W 3 2	W 3 3	W 3 4	W 3 5	W 3 6	W 3 7	W 3 8	W 3 9	W 4 0	W 4 1	W 4 2	W 4 3	W 2 4	W 4 5	W 4 6	W 4 7	W 4 8	W 4 9	W 5 0	W 5 1	W 5 2
	Phase-4 Assessment & Evaluation of EMS Information System (28-52 weeks)																									
17	User Acceptance Testing																									
18	Pre-Go Live System & Operational Readiness																									
19	Go-Live																									
20	IT & Web support (Trouble shooting)																									
21	Regular Quality assurance and concurrent monitoring																									
22	Technical and operational support to EMS Command Center & Emergency medical technicians, health care workers and other related stakeholders																									
23	Need based refresher training, update stakeholders about revision																									
24	Maintenance and upgradation of EMS Information Systems																									
25	Dissemination of Best practices & Lesson learnt document																									
26	Develop & submit project completion report																									
27	Knowledge transfer & Exit																									
28	Handover: Revised SOPs, manuals, guidelines, and EMS functional document																									
	<i>Deliverable: Final Report</i>																									

CHAPTER 5: DISCUSSION

The EMS system as required by this country was containing some of the outputs that the firm had to deliver at the end of this project which was including following details:

- Design, developing, upgrading, and maintaining a digital emergency medical service (EMS) information system software which will instantly find the patient and connect them with the closest ambulance, dispatch the paramedic crew as and when necessary, and offer pre-paramedic guidance.
- The EMS information system should have at least following functions: computer telephony integration, computer-aided dispatch function, call monitoring and call recording, and real-time ambulance tracking and monitoring.
- The EMS information system should connect EMS call center, health facilities, sea and land ambulances, police departments, fire departments and other stakeholders who are involved in emergency medical health services.
- Procurement and support the installation of required IT software and IT hardware for the digitalization of the EMS and the automation of the call center to improve the efficiency of responding to emergency calls, assessing the situation of patient for better medical triage, locating and dispatch nearby paramedic team and vehicles, and coordinating with recipient health facilities for timely transfer of COVID-19 patients or those with other health emergencies.
- Installation and operationalization of Global Positioning System (GPS) devices, walkie talkies and tablets in the ambulances.
- Ensure that the EMS information system and associated IT hardware will properly fit in the central EMS coordination mechanism which will be developed by WHO.

All the above outputs were delivered in this proposal by providing some of the key deliverables within the timeframe required by the stakeholders of the country within 52 weeks of start of the project. These all were achieved by following activities which included

The following:

- Design and develop the digital EMS information system software for the EMS call center which will instantly find the patient and connect them with the closest

ambulance, dispatch the paramedic crew as and when necessary, and offer pre-paramedic guidance.

- Improve the interoperability between the EMS information system and other relevant health information systems to ensure the seamless patient information sharing and referral services
- Test, pilot and upgrade the EMS information system as per the government's request
- Assess and specify the detailed requirement of IT hardware for the operation of the EMS information system and the automation of the call center, Supporting COVID-19 Response and Vaccination Program
- Lead the procurement of IT hardware for the operation of the EMS information system and the automation of the call center
- Designing and conducting user trainings of the EMS information system to EMS call center staffs, emergency medical technicians, health care workers and other related stakeholders
- Assess the current emergency medical service in the country and identify gaps that could be addressed by the adoption of EMS information system
- Support the design and development of EMS information system software which should properly address gaps identified in the assessment and ensure that the EMS information system software can improve the efficiency of responding to emergency calls, assessing the situation of patient for better medical triage, locating and dispatch nearby paramedic team and vehicles, and coordinating with recipient health facilities for timely transfer of COVID-19 patients or those with other health emergencies
- Support the installation and operationalization of GPS devices, walkie talkies and tablets in the ambulances
- Coordinate with WHO and MOH to ensure that the EMS information system software will properly fit in the central EMS coordination mechanism developed by WHO
- Design and conduct user trainings of the EMS information system to EMS call center staffs, emergency medical technicians, health care workers and other related stakeholders

- Assess and evaluate the performance of the EMS information system software and identify the remaining gaps for health IT developer consultants' further system upgradation

As the firm provides a 9 stages phase development and implementation of EMS system the proposal includes all the components which are required by the country such as computer telephony integration, computer-aided dispatch function, call monitoring and call recording, and real-time ambulance tracking and monitoring. The procurement and installation and hardware will also include the other outputs that the firm wants such as Global Positioning System (GPS) devices, walkie talkies and tablets in the ambulances and therefore this proposal full fills all the requirements of the country provided.

CHAPTER 7: CONCLUSION

The firm provided a holistic approach to a real time problem that a country is facing of EMS system as the country on which this study is carried out is a low income and less developed country and therefore the resources which are available in this country is limited and therefore the amount of ambulances are very minimal and they would require to acquire the ambulances from other developed countries as well as the country is an island country so all types of ambulances are required by the country such as land , sea and air ambulances .

The approach and methodology that the firm suggest for the problem statement stated by the country will develop a new EMS system which will be based on the international standards as required by the country.

If this proposal is selected by the country the EMS system which is running with just 10 ambulances in this country will drastically scale up to 100 ambulances and the whole population of the country will be benefited with this as the following things will be achieved

- Achievement of universal health coverage will be supported with this EMS system
- Preparing the country for future disaster situations, pandemics, endemic situations, etc.
- Saving life of lakhs of people by developing the infrastructure and saving the golden hour period of the patients which is the most crucial time for the patient and many people lose their life as they are not transferred to hospital in correct time frame.
- Training and education of local healthcare professionals and providing employment for them.
- The whole healthcare as well as other departments of the country such as police, fire etc will also be strengthen as in this project the integration of all these departments will be present so call center can help in coordinating with these different departments.
- Standardization of EMS system will be present as international standards are being followed so in future also integration, development and changes in the system would be easy to adopt.

- Development and integration of such a system will also help the country in tourism as the country is island group and most of the revenue of country comes from tourism industry so having such a robust EMS system will help country in tourism.

7.1 RECOMMEDATIONS

The report exhibits a thorough understanding of EMS systems and the medical services that they provide. It proposes the creation of an effective, feasible, and innovative EMS information system to improve countries current emergency health care system. The excellent applicability of EMS in real-life running was demonstrated through an evaluation and statistical validation.

Earlier studies by Jitesh V. Kulkarni (2022) discussed the importance of the conservation of the golden hour and how important every second is in reaching to the hospital.

Yunkai Zhai, Xing Xu, Baozhan Chen, Huimin Lu, Yichuan Wang, Shuyang Li, Xiaobing Shi, Wenchao Wang, Lanlan Shang, and Jie Zhao in their study in 2021 further identified and tested the proposed solution in the experimental settings to ensure the performance and quality of the ambulance service.

Study by Kim-Borg, Breanna wright, Liz Sannen, David Dumas (2019) talks of the ICE for the improvement of the attitude and perception of the native population. The same will have to be inculcated for better uptake and usage of the facilities.

Amber-Mehmood, Armaan_Ahmed-Rowther (2018) in their study showed the way to gauge and develop a tool for assessment of the pre-hospital EMS system using the World Health Organization (WHO) health system framework. The same was done.

This tool could enable researchers, policy makers, and administrators alike to apply rigorous methods of PEMS assessment and use the information to set up and monitor benchmarks of health outcomes impacted by an organized EMS system.

This study for the implementation of EMS Information system in South Asian Country showcases the need assessment and gap analysis after due diligence of the current landscape in terms of geography, incidence of emergent situations, existing facilities, human capacity in terms of skills. The plan was then designed for the implementation of the system and training of the personnel and this study can be implemented in other low-income countries.

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ANNEXURES

ETHICAL CONSIDERATIONS: As this is a proposal for a country whose details and the firms who is giving the proposal have been masked to avoid any ethical and legal conflict.

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