DESIGN OF EMERGENCY MEDICAL SERVICE INFORMATION SYSTEM IN PHILIPINES

Dissertation Submitted to

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for the partial fulfillment for the award of the

degree of Master of Business Administration

(MBA)

in

Hospital and Health Management

by

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Under the Supervision and Guidance of

Dr. Neetu Purohit
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2022

DECLARATION BY STUDENT

I hereby declare that this dissertation titled DESIGN OF EMERGENCY MEDICAL SERVICE INFORMATION SYSTEM IN PHILIPINES 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 Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Rushi S Joshi

18/06/2022

Internship Completion Certificate

CERTIFICATE

This is to certify that Rushi S Joshi 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 his internship at IQVIA Consulting and Information Services India Pvt. Ltd. from April 11, 2022, to July 03, 2022.

Place:
New Delhi

Date:
29/6/2022

Anurag Saxena (Director, Digital Health and PPG, AMESA Region)

Certificate from Faculty Guide and School Dean

CERTIFICATE

This is to certify that dissertation titled DESIGN OF EMERGENCY MEDICAL SERVICE INFORMATION SYSTEM IN PHILIPINES is a record of the research work undertaken by **Rushi S Joshi** 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 his/her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide: Dr. Neetu Purohit,
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Abbreviations

ADB: Asian Development Bank

EMS: Emergency Medical Service Information System

GPS: Global Positioning Devices

HMIS: Health Medical Information System

KPI: Key Performance Indicators

MOH: Ministry of Health, Maldives

MOF: Ministry of Finance, Maldives

SOP: Standard Operating Procedures

UAT: User Acceptance Testing

WHO: World Health Organization

RMS : Records Management Systems

GIS : Geographical Information Systems

AVL : Automated Vehicle Locater

Abstract

Introduction

A system that offers emergency medical care is called emergency medical services, or EMS. The primary objective of EMS once it is called in response to an incident that results in serious illness or injury is patient emergency medical care (s). When emergency vehicles or helicopters are observed responding to emergency occurrences, EMS is most immediately identified. Nevertheless, EMS offers much more than a trip to the hospital. It is a system of coordinated emergency medical care and response encompassing 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.

Objective

This study encompasses on how to investigate current state analysis of a country with regards to its goal and how technology impacts the delivery of prehospital emergency care, with the goal of improving the quality of services and lowering the risk of early patient termination.

Methodology

The EMS, a pilot emergency medical information system that simulates the primary services, is described in this study. The EMS was created using an agile system development technique. From a technological standpoint, the features and technology were chosen primarily to create dependable and user-friendly interfaces that will appeal to a wide range of users. For providing health care to patients, EMS relies on three key pillars: "On-time Incident Reporting," "On-time Arrival at the Incident," and "Transfer to the Health Center." According to the literature analysis, there are just a few emergencies medical services (EMS) systems that incorporate all the criteria. It enables for easier EMS administration by offering a better allocation of human resources and a better geographical distribution of ambulances,

which minimizes the total time of EMS processes. The evaluation revealed that it is a very useful application for ambulance drivers since it reduces ambulance response time to the patient's location and contributes greatly to the prehospital medical care system's overall performance. In addition, the survey confirmed the importance of EMS implementation on a greater scale than the pilot programme. It's worth noting that the younger ambulance drivers were more enthusiastic about the application's goal.

Results

The designing of an EMS system is an intricate process, with highest level of understanding of the country it is being designed for. Hence, the current state analysis of Philippines is done. The results of which are utilized for need assessment and gap analysis. In Philippines, it was found that, there was no usage of tech intervention aids like walkie-talkies, GPS enabled vehicles, tablets for Emergency Response System and Traditional way of managing emergency response 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, capacity building and IEC, inability to locate and dispatch nearby paramedic team and vehicles.

In response to this, the facilities that were offered were designed in a customized way. The computer-telephone integration which automatically detects the caller location is done, and a questionnaire establishes the criticality of the patient. Medical advice is then given which serves as the major catalyst in the survival of the patient. The criticality established is used to dispatch the right ambulance to the patient which is nearest to the patient’s vicinity.

The current skills, infrastructure is also determined and accordingly inculcated to form the basis of the designing of the program. The designed EMS system will be put across the country in stages and gauged over a period of 12 months.

1: INTRODUCTION

Elements of EMS system:

Organizations and agencies (both private and public), Networks for communications and transportation, Hospitals, trauma centres, trauma systems, and specialty care facilities, Facilities for rehabilitation, Experts with extensive training, Both paid and unpaid prehospital staff like therapists, doctors, and nurses, Government representatives and administrators, a well-informed populace that is aware of what to do in case of a medical emergency.

In order to maintain and improve the health and safety of the community, EMS is integrated with other services and systems. EMS operates at the intersection of health care, public health, and public safety, as seen in the diagram below. In EMS systems, various resources, and principles from each are combined. Since EMS providers serve the community, they frequently spot problems and challenges relating to public health before anybody else. When a patient enters the emergency room through EMS, it frequently signals the onset of serious health issues. EMS personnel frequently collaborate with their public safety counterparts in the law enforcement and fire services since they respond to a variety of situations and hazards. However, providing emergency medical care is their main duty.

EMS organizational structures, as well as who delivers and pays for the services, differ greatly amongst communities. Prehospital care can be delivered by commercial for-profit businesses, fire departments, hospitals, public health agencies, autonomous government organizations, and non-profit organizations like the Rescue Squad. The fundamental elements of an EMS System, however, are the same regardless of vendor.

2: REVIEW OF LITERATURE

Tittle, Year and Location of the study	Author	Salient Features
Vitality of the Golden Hour, 2022, India	Jitesh V. Kulkarni	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.
Importance of user acceptance testing with regards to network speeds, 2021,	Yunkai Zhai, Xing Xu, Baozhan Chen, Huimin Lu, Yichuan Wang, Shuyang Li, Xiaobing Shi, Wenchao Wang, Lanlan Shang, and Jie Zhao (2021)	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. 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.
Pillars of EMS, 2021, Greece	Sarandis Mitropoulos Ionian University, Lefkada, Greece, and Christos Mitsis, Petros	To providing healthcare to patients, EMS is built on three key pillars: "On-Time Incident Reporting," "On-Time Arrival at the Incident," and "Transfer to the Health Center."

	Valacheas and Christos Douligeris (2021)	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 effectiveness of the prehospital medical care system.
Utilization of ambulance Services and Drivers of demand, UAE, 2021	Tanveer-Yadgir	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 ambulance services and public health. Additional investigation is required to create policies, practices, and partnerships that will improve ambulance service.
Efficiency of compact ambulances and the effects of it, (2020), Bangladesh	Justin J. Boutilier and Timothy C.Y. Chan	Demonstrated 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.
Comparison and understanding of the induced behavior change of ambulance perception, 2021, Victoria, Canada	Breanna wright, Liz Sannen, David Dumas	The purpose of this study was to determine whether using a Behavior 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.
WHO framework evaluation foe benchmarking performances in EMS systems, 2018, Low and middle-income countries	Amber-Mehmood Armaan_Ahmed-Rowther	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 on various PEMS components.
Deterministic model for consideration of the box and ellipsoidal uncertainty sets for positioning of ambulances according to usage, 2014	Zhi-Hai Zhang Hai Jiang	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.
Demand and growth of ambulance services in the new age world, 2011, Australlia	Judy Lowthian, Peter A Cameron Johannes U Stoelwinder (2011)	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 utilization.

3: Research Question and Objectives

3.1 Research Question

What is the procedure to determine the pain areas and steps to design a customized Emergency Medical Service Information System in the Philippines?

3.2 Objectives

- To design an integrated emergency medical service information system in Philippines.
- To understand the existing on ground realities of the country with regards to geography, existing facilities, existing transport infrastructure.
- To develop the plan for the system, plan to train the personnel, and plan to implement the system.
- To understand the current health care system of the country.

4: METHODOLOGY

4.1 Research Design

It was an **observational study** wherein a comprehensive study of the existing scenario is gauged with respect to:

Health system, Infrastructure (roads, ro-ro jetties for cross island transfer), Existing facilities (hospitals, health professionals, ambulances, health equipment's), Protocols for health emergencies, Legislation governing health, determine the number of health facilities and number of ambulances including number of air ambulances, sea ambulances and land ambulances, understand the types of ambulances available with respect to type of medical emergency and supposed equipment's needed, understand the skill set of the people involved in the healthcare system and develop training material based on system to be developed, understand the system requirements for procuring the same.

The observed pain areas (gaps and deficiencies) found are used to design an EMS information system and a plan is designed on how to put in in motion in stages.

4.2 Study Setting

The study was conducted in the 7000+ islands of Philippines with initial study starting in Luzon and Mindanao with study initially being conducted in the capital city of Manila. The existing response system was gauged along with all the resources put in place. The parameters that are checked includes, response times, incident reporting times, on-time arrival. Conservation of golden hour is studied with the existing system and the pain areas (deficiencies) are understood. For the pilot project, user interface testing and user acceptance testing, adequate places with proper IT infrastructure, network and other resources is done.

4.3 Research Procedure

4.3.1 Current Scenario in Philippines (Pain Areas)

Overview

The Republic of the Philippines is a low-lying island nation comprised of close to 7641 islands. Presence of 2000 inhabited island with health centers having multiple access points.

Resources

No usage of tech intervention aids like walkie-talkies, GPS enabled vehicles, tablets for Emergency Response System. Also, CAD system to be procured by USAID, Local telecom in process of installing primary rate interface, Use of MDPS system to be developed in future by IAED

Existing Facilities

Ambulances operational currently in the capital are 171, current triaging of COVID -19 patient done by HEOC medical team, 1065 land ambulances in existence with expansion plans in the number 1900-2000, current ambulances include basic life support facility, 900+ hospitals can be integrated in the EMS framework.

Health Framework

Health services in Philippines currently delivered by a four-tier referral system serving to island, atoll / regional and central level services.

Problem Statement and Gap Areas understood

Traditional way of managing emergency response 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, capacity building and IEC, inability to locate and dispatch nearby paramedic team and vehicles.

5: RESULTS

5.1 Need Assessment for Automated EMS Response System

Need Assessment based on the existing situation in Philippines is essential to understand the pain areas and to have a focused area of design initiation. Here, the understood essentialities understood include the lack of access to a system which enables determining the location of the patient automatically, which lengthens the determination of the exact location of the patient. Secondly, the availability of an ambulance in the immediate vicinity which can help conserve the golden hour of the patient by transferring him to the hospital at the earliest. Thirdly, understanding patient criticality is paramount. This enables the deliverance of essential medical advice before the ambulance arrives that can be the difference between the patient's survival and death. This information is gauged by the call centre executive based on a pre-mediated questionnaires along with the help of a medical advice expert in the call room. This establishes the patient criticality, and the advice is thus given. An important aspect of determining the patient criticality is the dispatch of right medical ambulance with the right facilities, e.g., ambulance with basic life support, critical life support etc.

The table below discusses about these needs, and an assessment is done about the solutions that will be inculcated in the design of the EMS information system.

1)

Challenges	Delay in establishing location of help and additional data	Availability estimation and dispatch of ambulance in the vicinity	Continuum of responses	Understanding patient criticality
Need	Computer Telephony Integration	Computer Aided Dispatch Function	Call Monitoring and Recording	Medical Triage

Response	Records Management System (RMS) provides data relevant to incident call and caller ID verifies location of caller	GIS provides requisite geospatial data and AVL function pinpoints location of response vehicle	Patient Information System (PIS) provides the telemetry functions for consultation to patients until transfer to facility	Structured questionaries, SOP's for patient evaluation based on MPDS determinants by IEAD and dispatch of most qualified responders appropriate to the criticality
Shifts	Hassle-free, informed, and accurate incident establishment	Conservation of the golden hour of the patient	Value based continual patient monitoring	Situation credited response figures

Table 3.2

2) (Continuation of the above table)

Challenges	Lack of information of ETA	Pre-help patient care	Connecting remote areas
Need	Real Time Ambulance Tracking & Monitoring	Dissemination of medical advice until paramedics arrive	Integrated framework for patient transfer
Response	Better triaging of emergency responses	Organized, preempted medical	Reaching remote areas with protocol for land/air/ sea ambulance and ro-ro ferries for land ambulances

		advice until help arrives	
Shifts	Better triaging of emergency responses	Life saving measures until paramedics arrive	Unhindered patient transfer

Table 3.3

With the advent of the digital age, it is only right that the healthcare is more personified with regards to its efficiency and on-time care. Ambulances are a critical part of the conservation of the golden hour after the calamity to the patient. Ambulances with the right medical equipment's onboard post judgement of the criticality of the patients and approaching the whole scenario in the shortest time possible for the conservation of the golden hour is vital. Hence, emergency medical system comes in the play wherein technology and health combine to form a network of holistic caretaking.

Many countries have Emergency Medical Service (EMS) Information System to cater to this. The EMS system will reduce the total response time and be effective with regards to reduction of operating cost of accident management system, ambulance fleet handling system and system for informing doctors and clinics.

This will help ambulance drivers reach the location accurately on time. The nearest ambulance will be dispatched.

Few factors which are important in this system are:

Timely Incident Perception: Call centre personnel should be able to gauge the criticality of the situation

On-time Incident Reporting : Accurate incident reporting to the paramedics in the ambulance as well as health facilities for preparation beforehand.

On-time arrival at the incident, On-site care, medical care during transportation,

Connection between doctors and paramedics for emergent care vis-à-vis transportation, Mapping application to notify nearest ambulance in the initial phase.

Computer Aided Dispatch (CAD) function, Mobile data terminals (MDT), and Geographical Information System (GIS) integrate to form a holistic network.

The CAD technology is a mix of hardware and software that offers data input, recommends resources/vehicles/modes of transportation, alerts, detects, and monitors the course of these resources before, during, and after an alarm, and keeps an alarm file for further research. Call center operators in the most contemporary CAD systems receive emergency calls through systems like E911, which is used in the United States. This system has automatic number recognition and location detection and is connected to a computer. It enters the caller's phone number and address into the CAD system automatically, saving the time it takes to process the help request. All of this information about the occurrence is retrieved and entered into the CAD. When the CAD system has enough data to decide.

By giving critical information to EMS, GIS has been utilized to improve prehospital medical treatment systems. Using GIS data, historical event data is evaluated to identify staffing and resource requirements, as well as the best placement for an ambulance. GIS also gives dispatch center operators a comprehensive image of ambulances and other units, as well as their capacity to respond to emergency situations. GIS has been combined with global positioning systems (GPS) to give CAD functions with a significant advantage, namely the capacity to identify ambulances and ensure that the most appropriate and closest available ambulance is dispatched to the incident.

MDTs are widely installed inside vehicles and receive messages from a control center, which are shown on their screens. They supplement, and in some cases replace, traditional radio communications between the driver and the control center operator. MDTs can send the vehicle's location, the number of passengers, the engine condition, and other data automatically.

There are two types for system. Franco-German Model for this system is stay and stabilize before shifting patient, this is done in various European countries.

This is done by doctors in ambulance, doing assessment and providing care.

Another method is Scoop and run philosophy wherein the patient is transferred as quickly as possible. Countries such as India employ this method.

Countries who do this work more closely with the police and fire dept.

With regards to the timeline, The Pregame encompasses the architecture of the system which is based on the components in the backlog. Other factors are also collected and integrated.

The developmental phase controls the unexpected variables.

Dispatchers, call takers, and 911 operators use computer-aided dispatch (CAD) systems to prioritize and record incident calls, determine the status and location of responders in the field, and efficiently dispatch responder personnel. Through their mobile data terminals (MDTs), radios, and cell phones, emergency responders in the field can receive messages started by CAD systems. A geographic information system (GIS), an automatic vehicle locating (AVL) system, a caller identification (ID) system, logging recorders, and different databases may also connect with CAD systems. A unified CAD (UCAD) system facilitates communication across many agencies and jurisdictions by interacting with various organizations and/or computer systems that support law enforcement, fire, and EMS.

Overview of Technology - To improve the deployment of responder personnel, a CAD system manages data from numerous other responder systems. The needs and specifications of the agency, as well as the current systems that the agency would like to integrate, define the size and complexity of the CAD system. Installation of servers, computers, and software is required for CAD implementation, along with connecting to several other existing systems. CAD systems are typically found in a public safety answering point or central dispatch centre (PSAP). CAD servers interact with call centre computers/phones, cell phones, MDTs installed in cars, two-way radios, and fax servers with the help of dispatchers. This gives field workers and dispatchers a variety of communication choices.

Most CAD systems can incorporate information from the following systems: records management systems (RMSs), GIS, AVL, and caller ID. RMS provides data relevant to the current service call. GIS provides numerous types of geographical and geospatial data; AVL pinpoints the location of response vehicles, which allows the CAD system to help determine the most suitable unit for response; and caller ID verifies the exact location of an incoming call and/or incident.

The National Incident-Based Reporting System (NIBRS), the Jail Management System (JMS), the License Plate Reader System (LPR), and the National Crime Information Center are just a few of the local, state, and federal criminal justice databases that can interface with CAD systems for relevance to response (NCIC).

Operation -Usually, when a dispatcher receives a call, the CAD system shows the caller's location so that the dispatcher can log any extra pertinent information. The dispatcher makes two-way radio, phone, and/or MDT connections with the proper agency and the nearest staff

to react. The dispatcher records the status of the call's response from beginning to end. For later retrieval, logging recorders can save data like the start and end times of calls.
A CAD system also offers the dispatch centre with data such as emergency personnel's log-on and log-off times, the timing of all communications, case numbers for inquiries, emergency personnel's assignments, and incident reports and archives.
The project will be implemented in stages as shown after due diligence of the existing scenario, resources and designing of the EMS Information system.
Beta testing, training for users will enable acceptance of the personnel involved.

Capacity building with evolved training materials prepared after ground intel will showcase better productivity.

The project spans 12 months with Go-Live in the eight months, the strength of the project will be on the intel gathered, customized design as well as competence of the people involved.

The integration of various human resources, existing skill levels, existing infrastructure, understanding gaps was vital to customize an emergency response system for the Philippines.

5.2 Focus area for strengthening of EMS Information system

The macro-level determinations of factors translating to current scenario and pain areas are vital to be understood. This enables change to be brought about holistically in an integrated and inter-connected system wherein action in an arena often translates to a ripple effect in others. The major pillars of the pain areas and the includes in the design of the EMS system is understood and explained below.

1) Governance & Policy:

Comprehensive protocols & guidelines review, Implementation of existing policies & standards, Initiation of coordination links between public and private hospitals and between the 4 - tier health system for EMS sensitization, Monitoring parameters to measure performance across all levels and verticals**.**

2) Human Resources:

Capacity building for paramedics and call center personnel for holistic, coordinated response, Accountability and ownership from personnel at all levels, Perception of personnel and citizens towards digitalization and sensitization for the same, Dynamic roles envisaged for the integrated response of the fire and police personnel in the EMS framework.

3) Technological Intervention:

Implementation of a holistic, integrated system for digitalization of EMS and automation of call centers for a robust healthcare responsiveness, Installation and operationalization of GPS, walkie-talkies in ambulances, Design, development, and procurement of IT hardware-software.

4) Process:

Testing, piloting of the EMS information system, Benchmarking of the response, Addressing the bottlenecks and protocols for contingencies, User training of the system and workflow with responsibilities. Workflow plan to have a coordinated response in the varied geography of Philippines.

5.3 Understanding the scope of work through DMAIC tool

DMAIC tool is used to understand the action of determinants that will help design the EMS information system.

a) Define:

Comprehensive review of reports and documents, Overview of the existing Covid-19 emergency response plan, Review of National Health Policy and disaster plan review, redefining of guidance documents, SOP's according to WHO and International standards, Develop and Review of current process, roles and responsibilities of relevant stakeholders, Study of medical priority dispatch system of international academy of Emergency Dispatch.

b) Measure:

Diagnostics and Need Assessment, mapping key stakeholders across the verticals, Integration assessment of CAD, call monitoring and computer telephony integration, Introduction and testing of beta software, Collecting the initial response time in the pilot and embedding required changes in the change management process.

c) Analyze:

Performance Evaluation of Automated EMS System and Integration with other components, Real time monitoring through the variables of Integrated response structure through various first responses and other components, Response Time, Coordination bottlenecks, Human resource integration, downtime in person hours due to automation, Analysis of the operationalized GPS among other components in mobile units and at coordination call centers.

d) Improve

Continuous Quality Assessment of EMS, Developing of training material and sensitization programs, Enhancing the Patient satisfaction by working on feedback, Capacity building of all stakeholders for usage , automation, coordination across all verticals.

e) Control:

Actionable insights through reports, Corrective Action, Facility specific corrective action, Fortnightly and monthly action plan, Track the timeline to ensure its completion, Trigger /Action generated for any deviation.

Deliverables:

A. Reviewing and updating of existing SOPs, manuals and guidelines
B. Training Content and Capacity Building Sessions
C. Improving of real time EMS system based on feedback and issues
D. Better Integration of Hardware Components and other Health Systems.

5.4 Approach for determinants for design of EMS Information System

A. Discovery

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, 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

B. Implementation

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, 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

C. Technological Intervention

Gap Assessment based on desired functional need of EMS System, Preparing the UAT and Training material for the End Users, 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

D. 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, Post Implementation Support, 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

5.5 Steps involved in the design of EMS Information System

S. No.	Area of Work	Deliverables
1.	Project Initiation and Discovery Session	• Discovery Session attended by core project team members, identification of key stakeholders from ADB, MOH, MOF and WHO 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.
2.	Development of EMS System	• Designing and Development of EMS System
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 • 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
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

S.No.	Area of Work	Deliverables
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
7.	User acceptance Testing	• Testing , piloting and upgradation of EMS as per government request. • Integration of EMS with other HMIS system • 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 with MOH • 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
9.	Post Implementation Review and Support	• Project monitoring and maintenance report • Document handover to MOH and ADB. • Knowledge transfer and successful sign off

Table 3.3

5.6 Stage-wise plan on design and installation

Stage 1: Project Initiation and Discovery Session

Conduct a visionary workshop with all stakeholders: Discovery Session attended by core project team members, identification of key stakeholders from ADB, MOH, MOF and WHO to develop key insights of the project and facilitate transition. 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. and communicate change and facilitate transition. Identification of area specific paramedics and clinical staff to form a repository: A repository consisting 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 corelated with the MPDS and questionaries protocol for action established.

Key Performance Indicators Gauged:

Timely Identification of Ambulance, On-time arrival of paramedics, Dissemination of proper medical advice, Timely transfer to health facility

Design of EMS Workflow System

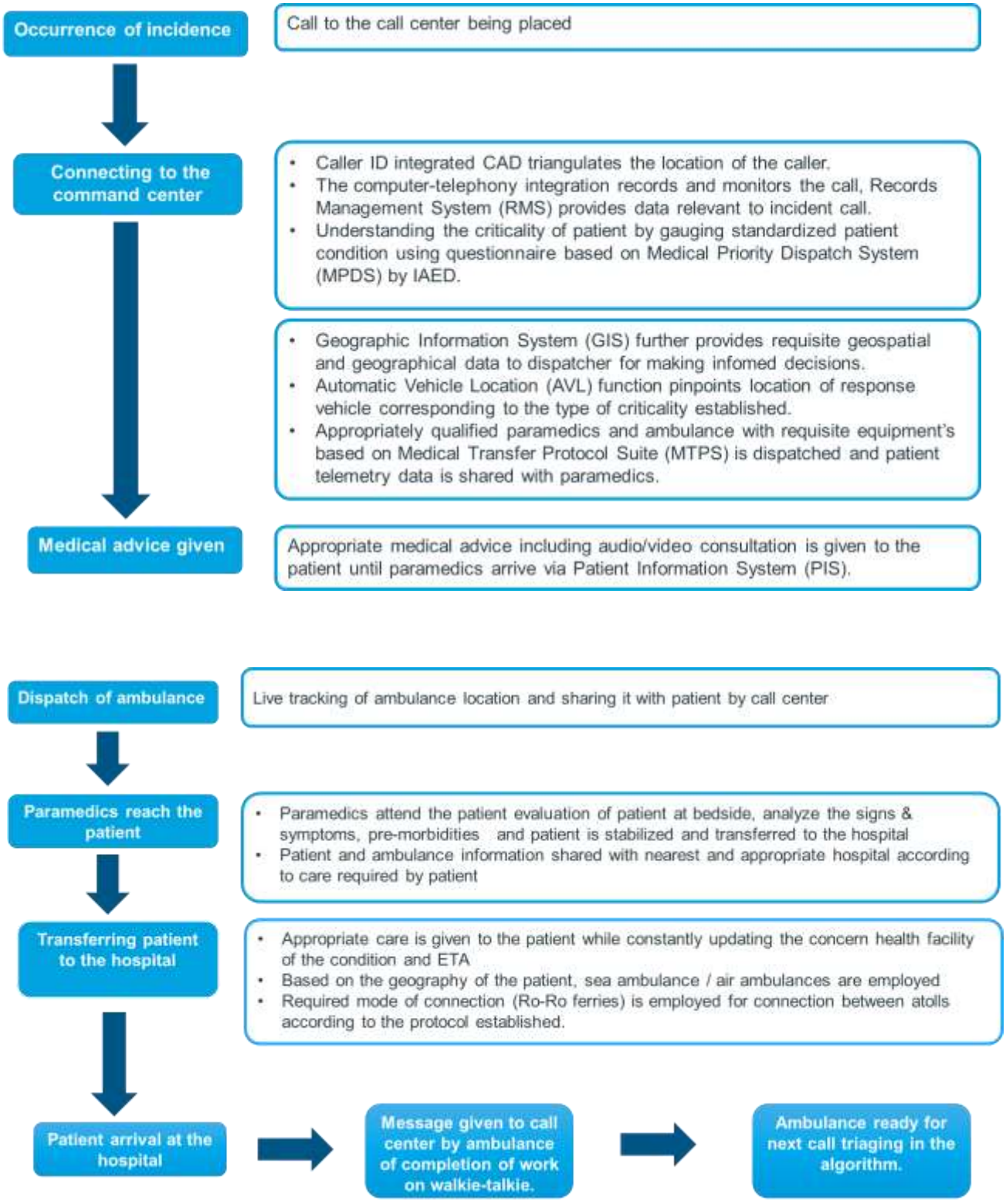

Figure 3.1

Stage 2: Development of EMS System

Process	Result
The application build/configuration will commence after the design specifications sign-offs.	Building of the entire EMS Application
The interface build and configuration will commence after the design specification and integration model signoffs.	Test plans and scenarios built for various types of testing
The solutions and interface components are tested and validated in this stage before releasing the application for any user training or user acceptance testing (UAT).	Reassessing, troubleshooting, and coordinating the fitments of EMS with WHO EMS coordination mechanism

Table 3.5

Tests for development of EMS includes:

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

System Testing: It is the standalone functional testing of the application, conducted after the configuration of Consisting of testing of Computer Telephony Integration, CAD function, call monitoring and recording and Real time tracking.

Interface Testing: It is conducted during the fitment for the functional testing of the WHO coordination mechanism.

System Integration Testing: It is conducted after the successful completion of the various tests mentioned and is done for testing integration and interoperability sequence. Various functional system tests along with workflow testing from call placement to triaging to reaching hospital.

Stage 3: Pre-Requisite Software and Hardware Installation

Approval from MOH, MOF & ADB for the Procurement of Hardware: Procurement will be done after the approval has been taken from MOH & ADB. **Installation and Configuration of Hardware Components:** Technical team will begin the hardware installation and the necessary configurations once the hardware and the necessary components are installed in Command Center and GPS Devices, Walkie Talkies and Tablets installed in Ambulances. **Integration and Testing of Installed Hardware 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. **Review of Performance of Installed Components:** 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.

Stage 4: Interface Build and Fitment into central EMS Coordination Mechanism

Fitment	**The procured software will fulfill following goals:**
Hardware and software procurement according to SRS documents	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
Digital EMS information system installed and started operating.	Establishment of interoperability between the EMS information system and other relevant health information systems to ensure the seamless patient information sharing and referral services

Installation and operation of GPS, walkie talkie and tablets for ambulances	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

Table 3.5

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.

The integrated testing will lead to:

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.

Stage 6: Super User Training

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.

Process:

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

Stage 7: User Acceptance Testing

End-to-end testing of the solutions and rectification of any defects if identified, Test scripts submission to MOH as a guideline for testing, based on final developed test scripts and scenarios UAT will be performed by MOH SMEs and core -users, Based on the set of required scenarios test scripts will be produced by IQVIA will consist of workflow scenarios, process steps, expected outcomes and application behaviors, The tester can document the status with priority indicator and the severity associate with each issue.

Outcomes:

Testing, piloting, and upgradation of EMS as per government 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.

Stage 8: Pre-Go Live System & Operational Readiness

Verification: 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. **Performance Assessment** is for Assessment and evaluation of performance of EMS and addressing remaining gaps**. Integrated System review** is for review of Infrastructure & application readiness. **Implementation** plan will be in a phased roll out and go live followed by on –the –job user training. **Information broadcast** for implementation of IEC strategy.

Stage 9: Post Implementation Review and Support

Includes:

Project monitoring and issue resolution, handover of: Data base design and other information related to project design development and implementation, validation of documents, handing over of system design, user manual and solution details, exit management, submission of closure report, project monitoring and maintenance report, document handover to MOH and ADB, knowledge transfer and successful sign off.

Stage 10: Training Need assessment & Capacity Building

Ongoing keeping in view evolution in EMS system & expected attrition and on-boarding of new human capital.

Capacity building plan

Includes:

Training need assessment for developing tools to assess knowledge levels, Develop training material for Training content as per latest guidelines, Capacity building of key stakeholders for introductory & refresher trainings to all National Call Center Staff, Paramedics Staff, Ambulance Drivers and other Stakeholders involved in the System

Details of training content

Specific training content to be developed for National Call Center Staff, Paramedics Staff, Ambulance Drivers, Training content as per latest national/ international guidelines to be developed for healthcare professionals, Draft training content to be shared before final development for review & feedback.

Training methodology and handholding support includes:

Training Handbook, 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.

5.7 Gannt Chart for the implementation of the project

No	Activity	Month 1				Month 2				Month 3				Month 4			
		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16
1	Kick off meeting																
	Deliverable: Inception Report				D1												
Phase-1 Diagnostics & Action plan formulation (1 - 9 weeks)																	
2	Diagnostics, Need & Gap assessment of Emergency Medical Service Information System (EMS)																
3	Roadmap preparation and action plan																
3.1	*Designing of EMS*																
Phase-2 Implementation (9 - 16 weeks)																	
4	Development of EMS System																
5	Pre-Requisite Software and Hardware Assessment																
5.1	*Training content*																
5.2	*Capacity building plan*																
6	Interface Build and Fitment into Central EMS Coordination Mechanism																
7	Beta Testing of EMS System																
	Deliverable: System Design Specifications																D2
	Deliverable: Interim Report																D3
Phase-3 IT Software and IT Hardware for the Digitization of EMS (16 - 28 weeks)																	
8	Pre-Requisite Software and Hardware Procurement																
9	Pre-Requisite Software and Hardware Installation																
10	Installation of GPS Devices , Walkies Talkies and Tablets for Ambulances																
11	Training to EMS call center staffs, emergency medical technicians, health care workers and other related stakeholders																
	Deliverable: Training Content Manual																
	Draft Final Report																
Phase-4 Assessment & Evaluation of EMS Information System (28-52 weeks)																	
12	User Acceptance Testing																
13	Pre-Go Live System & Operational Readiness																
14	Go-Live																
15	IT & Web support (Trouble shooting)																
16	Regular Quality assurance and concurent monitoirng																
17	Technical and operational support to EMS Command Center & Emergency medical technicians, health care workers and other related stakeholders																
18	Need based refresher training, udpate stakeholders about revision																
19	Maintenance and upgradationof EMS Information Systems																
20	Dissemination of Best practices & Lesson learnt document																
21	Develop & submit project completion report																
22	Knowledge transfer & Exit																
	Deliverable: Revised SOPs, manuals, guidelines, and EMS functional document																
	Final Report																

No	Activity	Month 5					Month 6					Month 7				Month 8				
		W17	W18	W19	W20	W21	W22	W23	W24	W25	W26	W27	W28	W29	W30	W31	W32	W33	W34	
1	Kick off meeting																			
	Deliverable: Inception Report																			
Phase-1 Diagnostics & Action plan formulation (1 - 9 weeks)																				
2	Diagnostics, Need & Gap assessment of Emergency Medical Service Information System (EMS)																			
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7	Beta Testing of EMS System																			
	Deliverable: System Design Specifications																			
	Deliverable: Interim Report																			
Phase-3 IT Software and IT Hardware for the Digitization of EMS (16 - 28 weeks)																				
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9	Pre-Requisite Software and Hardware Installation																			
10	Installation of GPS Devices , Walkies Talkies and Tablets for Ambulances																			
11	Training to EMS call center staffs, emergency medical technicians, health care workers and other related stakeholders																			
	Deliverable: Training Content Manual											D4								
	Draft Final Report											D5								
Phase-4 Assessment & Evaluation of EMS Information System (28-52 weeks)																				
12	User Acceptance Testing																			
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21	Develop & submit project completion report																			
22	Knowledge transfer & Exit																			
	Deliverable: Revised SOPs, manuals, guidelines, and EMS functional document																			
	Final Report																			

No	Activity	Month 9								Month 10								Month 11								Month 12			
		W35		W36		W37	W38	W39		W40	W41	W42	W43		W44	W45	W46	W47	W48		W49	W50	W51	W52						
1	Kick off meeting																												
	Deliverable: Inception Report																												
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21	Develop & submit project completion report																												
22	Knowledge transfer & Exit																												
	Deliverable: Revised SOPs, manuals, guidelines, and EMS functional document																											D6	
	Final Report																											D7	

Table 3.6

5: DISCUSSION AND CONCLUSION

5.1 Discussion

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 Philippines's current emergency health care system. A thorough analysis of the literature is conducted, followed by a presentation of the adopted new technologies and their architecture. 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.

Amber-Mehmood, Armaan_Ahmed-Rowthe (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.

Study by Kim-Borg, Breanna wright, Liz Sannen, David Dumas (2019) talk 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.

This study for the implementation of EMS Information system in Philippines 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.

5.2 Conclusion

The continued rise in utilization of emergency ambulances is placing increasing demands on ambulance services and the wider health system, potentially compromising access, quality, safety, and outcome. A variety of factors may contribute to this increase and targeted strategies to reduce utilization will require an accurate identification of the major drivers of demand. In case of medical emergency, the ambulance services are the first choice for the global community, however calling an ambulance still a huge dilemma. This study emphasizes the problems of the current state problems in countries (Philippines here) and the gaps in infrastructure, skills etc.

The need assessment coupled with gaps gives us a comprehensive view of the pain areas. The procurement of the hardware, software design based on customized pain areas are an important facet of the study. User Acceptance testing and piloting is essential for efficient roll out that will be effective as well.

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