Transformation Towards Cost-effective and Intelligent E-Health Systems: A Regional Study

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Abstract- Provision of an effective health facility is one of the basic needs of every human being. Availability and access to such facilities reflect the social and economical growth of any country. The rapid increase in population and the resultant health-related issues are considered among the big challenges. At the same time, the exponential growth of innovations through Information Communication Technologies (ICTs) are forming new dimensions in the healthcare system. E-health is a dire need especially for remote areas in developing countries like Pakistan but inadequate communication infrastructure and lacking the awareness of technology are the major hurdles yet to be addressed. Many research-based healthcare solutions have been presented in the literature to overcome such hurdles but it is still required to utilize the Viable System Model (VSM) approach for a better outcome. The proposed model would significantly reduce the workload of the overburdened fields of healthcare and emergency medical services (EMS). Moreover, the inclusion of IoT and artificial intelligence techniques in the proposed model would make significant improvements in the form of real-time monitoring of the patients and appropriate estimation of the required resources at each level of the model respectively. In comparison with the e-Ilaj telemedicine system especially, the study presents a VSM based e-health model that would overcome such hurdles by covering the future aspects like availability, accessibility, and reliability of the healthcare services at the doorstep.

Keywords- E-health, Viable System Model (VSM), Emergency Medical Services (EMS), Information and Communication Technologies (ICTs), Teleconsultation, Internet of Things (IoT), E-Ilaj Telemedicine System, Telehealth, Cost-effectiveness, Artificial Intelligence.

I. INTRODUCTION

E-health is one of the most prominent services and being referred to as the utilization of Information and Communications Technologies (ICT) in the healthcare sector. The term "e" stands for electronic and "health" is used in terms of substantial, psychological, and as a resource for living a healthy life [1]. It refers not only to the nonexistence of disease but the capability to recover from illness and other problems regarding health. Genetics, surrounding environment, associations of doctors and patients are keen factors for good health. The major concern of e-health is towards providing health facilities and deliverance of relevant data through the network infrastructure and information technology [2]. Diagnosis of patient's diseases, crucial health data attainment, and analysis of the disease, support of public health workers, teleconsultation, management of patient's health and research in a specific domain are services provided by e-health to the community along with crucial healthcare throughout diverse activities. There are huge differences in healthcare and health services between the developing and the developed countries. The emphasis of the developing countries is on facilitate the citizens with quick admittance to healthcare and escalating the eminence of health at the same time as the objective of developed countries is on plummeting communal subsidy for healthcare [3]. Different developing countries such as Pakistan contain huge remote populations, but do not have the availability of appropriate medical facilities. It is important to provide health facilities in such circumstances to the citizen of remote areas. Pakistan is a progressive country where health facilities are not satisfying the need of remote areas. Pakistan has only 01 physician for every 1000 patients [4]. The sector of health is mostly not fully formed not only due to inadequate resources of government but also in the use of frequent ICT for remote communities. However, the e-Ilaj telemedicine system has been introduced in Khyber Pakhtunkhwa (KPK), one of the four provinces of Pakistan to get better the eminence services of healthcare delivery for the citizen in remote areas [5]. Traditionally, when a person has some health difficulty, he/she goes to the hospital to see a doctor. The doctor needs to carefully check the patient's body

state to decide the possible kind of disease or health trouble. During this process, the doctor may need to handle images, medical records, etc. [6]. The proposed e-health model has been able to handle work automatically and plays a significant role in getting rid of the traditional system of health in remote areas which will provide people with health services at the doorstep. Accessibility of a sufficient community health model in the remote region is yet inadequate which impacts the quality of health for people when they become sick [7]. Literacy rate, internet services, technology awareness helps to implement the e-health model in developed countries due to the facilities of internet service and information technology. It is difficult to facilitate the citizen of remote areas with satisfying health services [8]. Therefore we need to transform towards the e-health model to diagnose diseases and recommend treatment by checking patients online by using optimal utilization of resources. By exploring the intensive literature, to identify the proposed model of e-health from existing literature, to propose a comprehensive model for the e-health system in Pakistan based on a Viable System Model (VSM) and Validation of the proposed model are the key objectives of the research. What kind of e-health solutions could be considered to provide quality services of health to the citizen of remote communities in Pakistan? Why VSM has been used to make vibrant the proposed model? These are essential questions for the conduction of research. The survey, field observations, interviews, and focus groups play a vital role in the completion of this research by gathering data and providing appropriate solutions to the problems. The proposed model has been created by using the mix-mode methodology, which is a combination of qualitative and quantitative methods. It can be safely stated that the VSM is the only way to be implemented for achieving a country's objective by fulfilling its desired requirements. Consequently, hospitals and basic health units (BHU) are not supposed to work in parallel, except collaboration amongst different components [9]. Management is functionally controlled through operation management by securitized progress and by giving surety coordination the stream of invention among management and services consumers [10]. Operation management is capable to inspect precedential progress. The role of future aspects is related to recommendations or innovations in the health system. The stability between the present and future has to construct the conclusion on which is the greatest alternative as of future aspects if the further possessions are necessary. All components discussed above may be performed by a single staff member or collective efforts of all members. Responsibility can distinguish and turn into further particular the diverse characteristics of the VSM in wide innovative sectors. VSM has been playing a vital role in the proposed e-health model to

provide health services to the citizen of remote areas at their doorstep. The coordination component establishes a link between the BHUs and the e-health setup at different levels i.e. at District Headquarter (DHQ) Hospital, Teaching Hospitals, Provincial Capital, and Capital of the country where the aim is to make available the mainly required services of health through the development process of the current e-health system in Pakistan. Through understanding the framework and structures of the health sector it is easy to make the proposed model vibrant by using coordination and covering future aspects as well which is an essential phase of VSM. The e-health system has been extremely precious in helping to discover the health system from the perspective of future direction. Operation management enables the database administrators to precisely comprehend their latent contribution to the health system. In the proposed model, the management and stability between the present & future endeavors have been demonstrated as corresponding to the other design approaches approved in the research. It will be extremely helpful to the e-Health as it considers the auxiliary expansion of the health system by using future aspects of VSM. A consistent description of e-health [11] allows investigating the complicated relationship of communication, control, and organizational structure of the health system in remote areas of Pakistan.

A. Significance of the Study

The proposed model has a key role to play in improving the healthcare system, especially social development which is dependent on the health system of any country. The VSM based e-health model has been introduced to provide quality healthcare services to people in remote areas of developing countries like Pakistan. It is a comprehensive model from all aspects that would improve the various important factors including the environment, operation, and coordination components of the VSM striving for optimal resource utilization. The novel approach presented in the proposed model would result in a cost-effective and very efficient way for the delivery of healthcare services in remote areas. The scarcity of specialist (consultant) doctors would be specially managed through the networked shared healthcare resources comprising of doctors, paramedical staff, and other facilities. Moreover, the artificial intelligence techniques adopted through the proposed model would make the management capable of making wise decisions based on prediction & estimation about the required resources as well as future planning. This study would also be taken as an important step leading towards further research in e-health with persistent pace.

B. Limitations of the Study

The limitations of the study are as follows:
1. The proposed model has been constrained due to

the deficient infrastructure of Information and Communication Technologies (ICTs) and technology awareness in remote areas of Pakistan.

2. Shortage of doctors and paramedics in remote areas where people do not have access to healthcare due to inadequate staffing at the Basic Health Units (BHUs).

C. Delimitations of the Study

The delimitations of the study are as follows:

I. The proposed model is VSM based which plays a vital role in the operation and environment management as well as future aspects for innovations and maintenance.

II. Developed and developing countries have been studied to formulate the proposed model but only developing countries have been considered as Pakistan is also a developing country where people in remote areas are in dire need of a vibrant e-health system.

II. LITERATURE REVIEW

E-health helps to establish a connection between medical informatics and the communal system of health. The main concern of e-health is to providing health services and delivery of data or improved through the help of the internet and Information Technology (IT). As per the classification of the World Health Organization (WHO) and International Telecommunication Union (ITU) the electronic health model can be considered as an automated medical testimony used to confine, accumulate, and split information between healthcare sources in society, sustaining the deliverance of healthcare services [12]. Interview based study on e-health has been conducted in India, which has been released after collecting and analyzing data after sampling [13]. E-health model in India is specifically for those population who has no access to the up-to-date health model and seems challenging toward profitable initiatives wherever the major concerned population is poor [14]. Concerning the generous group, mostly those citizens that are not capable to earn their income are more often than not incapable to impact millions of beneficiaries. Finance is one of the biggest challenges in the health model of India. There is an alarming situation in increasing the medical cost because this might create the service of health outside the range of the poor population. Therefore, the health model of India may need other efforts to situate the health programs on a stronger economic grip [15]. Improved infrastructures, the mandatory obligation for medical staff in hospitals, and the substitution of paperwork data with a centralized record system for data gathering are cited steps by the author to improve the health model in India [16]. The e-health model in Australia will make sure health information is automatically completely obtainable to the concerned person at the accurate position and time to allow conversant care and cure the pronouncement of the end user [17]. It enables the health sector to further efficiently activate as an organized model ensuring the replication of service deliverance. It provides end-users with electronic admittance to the information required to enhance supervise and manage their delicate health result. It permits a multi-tasking group of experts to remotely negotiate and swap over data and endow with improved synchronized healthcare services throughout the field of care. It provides the user of the system an assurance with the purpose of their health information is controlled in a protected, classified, and firmly proscribed approach. It enables remote access to proper healthcare services for patients located in rural areas [18]. The e-health model in developing countries like Bangladesh is emergent and the infrastructure of IT has not been established comprehensively to recover its eminence of service. There is almost 160 million population in Bangladesh and just about 96,000 chronicle medical experts are available [19]. While 70% of entire inhabitants belong to the remote area, 75% of medical experts are enthusiastic in metropolitan areas which implies an efficient proportion of 1 doctor and 47,000 patients [20]. The majority of the remote areas' hospitals and health units are unsatisfactorily operational along with short-staffed. Through the rising apprehension and outbreak of diabetes (disease) throughout the country, proper identification and anticipatory actions are one of the essential healthcare approaches. So far citizens of remote areas might be given poor treatment due to the lack of proficient medicinal services [21]. The Bengal government has prioritized healthcare as the main concern in their health funds and initiate efforts to accomplish a sustainable objective. A severe problem may be raised regarding the awareness of the service beneficiary in the direction of cited services [22]. However, it is not proved to likely deliver an adequate and effective level of healthcare, prognosis, and treatment. This is due to the huge and extensively spread population; be deficient in medical infrastructure and services in remote areas [23]. China's health transformation stays positively precise however not regulatory on approach [24]. Within dispersed governance formation, the Chinese state evades the concern of dependence on municipality administration support for the general neutrally intention, leaving the exhaustive intent for health services. Such intent includes the allocation of budget in the health sector, utilization of resources in an optimal way, take on responsibility, indispensable remedies list, and relevance of medical care are answerable just before the ministry of health rather than local government [25]. Identify the significance of IT to medical models, china's state designs medical transformation with e-health as an essential aspect [26].

The government of China has become conscious about the lack of appropriate laws and regulations to support regional collaborative medical service (RCMS) model development which also reflects many other difficulties as well. Experiment-based studies have been conducted in some cities of china like that Xiamen, Beijing, and Dalian, to implement the RCMS model, and achieve the required results. China's new medical model contains some high-quality medical information technology solutions for unavoidable challenges and opportunities [27]. East Asian countries of the world like Japan, Singapore, Taiwan, and Hong Kong have taken some imperative programs to execute a centralized model in their public health known as e-health Record (EHR) moreover in the vicinity and countrywide, on the other hand, the purpose of implementation of EHR has not yet been entirely realized [28]. The day by day rapidly increasing cost in healthcare and seeking different methods to manage them comprise turn into the most vital health strategically problem for the urbanized world. Malaysia is also moving towards that aim and is still doing lots of efforts to approach the best in implementation of EHR models, lifetime health record (LHR) model on every stage of community healthcare services. Every initiative of LHR's development has been illustrating some problems including the integration of efforts, re-engineering of processes, funding for healthcare services, citizens, law, and regulation; as discussed in [29]. A significant analysis of the Malaysian health model is ended by a case study with the cooperation of the ministry of health Malaysia (MOHM). The increasing cost of healthcare is also a basic problem in East Asian countries. The analysis described above was conceded through the collation of the ICT dissection of MOHM. They had interviews and discussions, archival of documents methodology for completion of research [30]. Uganda is also a developing country where numerous e-health and mobile health (m-health) models are not able to overcome the encountered problem and most were not sustainable. The implementations of e-health in Uganda are compromised due to prior scheduling phases of requirement along with the estimation of preparedness [31]. Essential initiatives have been taken in Uganda on e-health; health information models and mobile applications [32]. Moreover, numerous ICT infrastructure improvements, decreasing the cost of network bandwidth will contribute to the potential realization of further e-health models. The e-health model in Uganda enables teleconsultations and Tele-education behavior. Though, execution should escort to a sustained model which entails validation and secure strategies based applications, an accomplished and a familiar workforce. Auxiliary study on the expansion and utilization of e-health keenness method related to Uganda is mandatory, and responsiveness of necessitates to accomplish measurement of e-health

preparations throughout the forecasting of e-health programs desires to be raising [33]. The telehealth program of Brazil has been introduced among the major intention to be eligible staff for the family health policy, intensification Primary Healthcare (PHC). The Brazilian telehealth program has been designed through the focal point on tackle the acknowledged breach in the Brazilian health model. Improvements in quality and achieving a better quality of PHC are the aim of the telehealth program [34]. The purpose of this effort is to classify a novel impression namely Formative Second Opinion (FSO), to portray the method for creation and to explain its formation and the amount of FSOs are available. The FSO is considered to counter the majority of often raised queries of health specialized functioning at the Brazilian Unified Health Model (SUS) in Brazil [35]. The forecasting and execution of the Brazilian E-Health strategy are still to be approached by integration with the Brazilian telehealth Program. Examine the prospect of pertaining the e-health estimation device to the Brazilian telehealth plan, in an attempt to broadly estimate what has been attained and what are hurdles yet need to be resolved in amplification the Brazilian e-health model [36]. The e-Ilaj model launched in Khyber Pakhtunkhwa in 2018, created for the people of Federally Administered Tribal Areas (FATA) of Pakistan. However, e-Ilaj was suspended due to some managerial crisis after FATA's merger in Khyber Pakhtunkhwa [37]. The e-Ilaj was able to work at a certain specified time and was supposed to provide healthcare to a limited number of people [38]. The proposed model would augment the research work presented in [39] by following the suggested methods for providing healthcare services at a basic level resulting in the reduced burden on the EMS. Therefore, based on the literature it can be safely stated that none of the developing countries in the world has a VSM based model that can provide a comprehensive and vibrant health system to the people in remote areas. In [40] the concept of the e-governance layer in the IoT based e-health System has been coined which may also be considered in the proposed model in this study. The literature reviews the health system of developing and developed countries, but the implementation of the proposed model will be needed in developing countries because developed countries are already prosperous in terms of health systems.

III. METHODOLOGY

The methodology for the study is based on the comparative analysis of the existing models, vast field exposure of the authors, expert opinion, findings from state of the art literature, and community feedback regarding various relevant aspects that have been considered. Resultantly, a novel e-health model has been proposed to achieve better efficiency, service

delivery, and usability along with an improved level of resource utilization. The study suggested very unique and cost-effective solutions for the existing challenges for the delivery of e-health services in remote areas of developing countries.
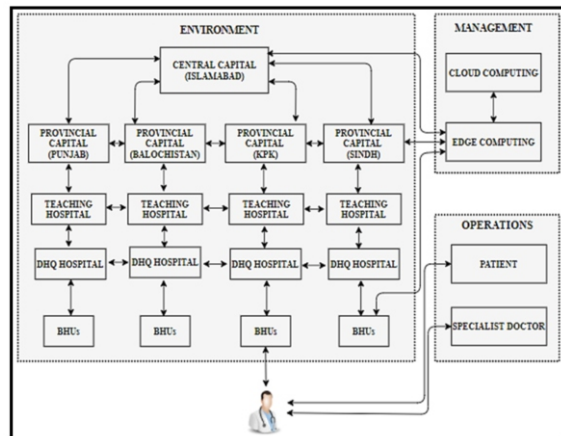

Fig. 1. Proposed VSM based E-Health Model

The proposed e-health model is a tremendous way to get rid of the traditional health system by providing satisfactory health services in remote areas of Pakistan. The proposed model depicted in Fig. 1 contains three components: Environment, management, and operation. The entities of the proposed model are interlinked to each other and exchange data by using edge and cloud computing technologies to have a secure and dependable mechanism for data sharing and other services. The essential entities of the proposed model as depicted in Fig. 1 are stated as follows:

1. Patient from Remote Community
2. Specialist Doctor
3. Doctor at BHU
4. Central Capital Level E-health Setup
5. Provincial Capital Level E-health Setup
6. Teaching Hospital Level E-health Setup
7. DHQ Hospital Level E-health Setup
8. BHU Level E-health Setup
9. Edge Computing
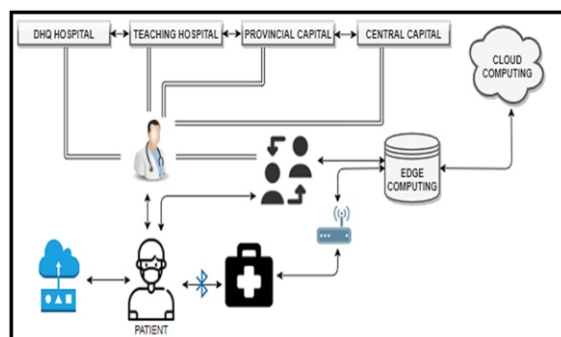10. Cloud Computing

Fig. 2. Components of the Proposed Model

The entities listed above are described in detail through the execution steps of the model depicted in Fig. 2. Now let us explain the cooperative comprehensive implementation of the proposed model. Patients from remote areas will visit the BHU in their union council where the doctor will diagnose the disease. If there is some hindrance in the disease diagnosis, the BHU doctor will consult the specialist doctor at the DHQ hospital immediately via wireless connection and ask for a consultation to get health services. In case, if the BHU doctor is unable to get contacted with a specialist doctor at DHQ hospital, then the BHU doctor will have the option to be connected with the higher-level of the e-health setup i.e. the specialist doctor available at the teaching hospital, and so on.

The proposed model would ensure the availability of the required specialist doctor through any specified level of e-health setup, even any BHU doctor may get services from the provincial capital e-health setup of other provinces or the central capital (Islamabad) if required as per the situation. After diagnosis & other required processes, all the relevant patient records along with the prescription and findings of the doctors would be stored in the database that would be connected to edge computing as well as through cloud computing as per the requirement. Subsequently, if the treatment of some patients is continued then the medical record would be updated accordingly that would be accessible at each of the e-health levels in the model. The countrywide network would be set up all over Pakistan through the WWAN with real-time delivery of healthcare services. The required data would be easily accessible at each and every level with minimum latency through edge computing as well as with analytical features through cloud computing. Firstly, the health department will register doctors from all over the provinces and from the central capital. All the doctors will be allocated an exclusive identity which is recognized merely to the health department and doctors. The inclusion of artificial intelligence techniques at different levels would play its significant role in resource requirement prediction & estimation. Such prediction & estimation may be regarding the required number and field of the specialist doctors, paramedical staff, and other facilities at each level of the e-health setups. The proposed intelligence mechanism would be done keeping in view the needs regenerated from the medical record of the patients even based on their geographical distribution and various other aspects, etc.

● *Communication Infrastructure*
The model is comprised of devices such as sensors, mobile-based units, etc. which are connected through the Wide Area Network (WAN), Local Area Network (LAN), and Wireless Wide Area Network (WWAN) at different levels in the model. This will assist the doctor in diagnosing the patient and also helpful for BHU's

doctor to consult with any of the available specialist consultants in the system. All the medical records would be stored in the database accessible at each e-health level i.e. from BHU to the central capital e-health setup. Each and every level of the e-health setup would be connected to edge computing as well as to cloud computing for ensuring minimum latency and reliable access to data.

- *Patient from Remote Community*

The patient belongs to the remote area, the areas where quality health services are not in access. Such remote areas do not have proper health infrastructure and citizens do not have technology awareness for which people there are deprived of better health facilities.

- *Specialist Doctor*

The specialist doctor in the proposed research is an experienced practitioner in the medical field, serving at DHQ, Teaching hospital, Provincial capital, and federal capital. The doctor at the BHU will have access to all the specialist doctors who will assist in timely diagnosis and rapid treatment of the disease.

- *Doctor at BHU*

The doctor of BHU plays a vital role in making the proposed model successful. The doctor available at the BHU will diagnose the patient's disease and may consult with the doctors available at DHQ hospital, Teaching hospital, Provincial Capital, and/or Federal Capital e-health setup as and when required. It is also the responsibility of the BHU doctor to store patient's data carefully in the data center of BHU.

- *BHU & other Higher Level E-health Setup*

BHU is the first level of healthcare considered to be the basic facility for providing health services [41]. Each Union Council in Pakistan has a BHU which has 2 beds and 10,000 to 25,000 people are served with health services through it. The role of BHU in our entire study is like a backbone. There are about 10000 BHU and Rural Health Centers (RHCs) in Pakistan. A BHU provides healthcare to 10000 people while RHC provides healthcare to people ranging from 30000 to 45000 [41]. This is a huge gap that needs to be filled because remote areas are more backward than rural areas and people of those areas do not have access to well-equipped operational hospitals located in urban areas. However, providing the best healthcare for these people is the basic responsibility of the state.

In the hierarchy of government health facilities in Pakistan, after RHC there comes Tehsil Headquarter (THQ) hospital, DHQ hospital, and then Tertiary/Teaching hospital. However, in most cases, Specialist/Consultant doctors are available at DHQ hospital. In the proposed VSM based E-health model all the health facilities having Specialist/Consultant doctors have been utilized in addition to the Provincial Capital Level & the Central Capital Level health facilities.

- *Edge Computing*

Edge computing in the perspective of the proposed model is meant for the realistic geographic distribution of data. Computing performing at close to the basis of the data, instead of relying on cloud storage at one of a huge data centers to accomplish all the work is known as edge computing. It does not indicate that the cloud will be useless rather, the cloud will come into our access. All data from the BHU's data center will be stored on edge and cloud at the same time. All the data from the edge to the data center of the cloud and BHU will be accessible.

- *Cloud Computing*

The word cloud in the context of the proposed research is stands for a service model in which data is maintained, managed, backed up remotely, and made accessible to users over a network. All the patients' data in the proposed research would be permanently stored on the cloud and access to such protected data would be considered only in certain circumstances such as investigation of patient's death etc. or otherwise all data will be accessed from the edge storage of data. The target population of the proposed model is related to remote areas where people have nothing to do with the use of technology. So providing a new e-health system in an area where there is no infrastructure is particularly difficult, but it can be easy to implement the proposed model by changing people's behavior or making them aware of the technology. VSM mainly has three components: Environment, Management, and Operations. The operation contains the patient and specialist doctor who are the key entities of the proposed model. The management consists of the data center of BHU, edge, and cloud storage. The environment has a whole hierarchical structure that covers the entire system of e-health. However, these components of VSM are linked to each other such that the three components depend on each other.

IV. VALIDATION

To validate the proposed model, a comprehensive survey was conducted to have the expert opinion from the professionals from different fields in the scope of the study. The opinions of the health professionals of the department were particularly important to finalize the results. After examining the experts' views especially from the health department, it can be anticipated that the proposed model would significantly improve the quality of the healthcare system in Pakistan. The expert opinions of health professionals at various BHUs, THQs, and some remote areas of Pakistan have been found in support of the proposed e-health system.

In addition to it, the praising remarks by the medical officer of Mansehra also authenticated the proposed model in comparison with the e-Ilaj system in Khyber Pakhtunkhwa which remained suspended there due to some technical and management issues. Some of the important findings have been noted in the form of the responses to the survey conducted through many domain experts as responders about the proposed model. Such findings are hereby presented in Fig. 3, Fig. 4, Fig. 5, Fig. 6, Fig. 7 & Fig. 8 regarding the proposed model's Practical Implementation & Provision of Quality Health Services, Usefulness for E-Health Management in Pakistan, Adequacy to Cover Electronic Environment Aspects, Usability, Ability to Cope with Future Changes in Smart Environment, and Reflection of the Study Objective; respectively.
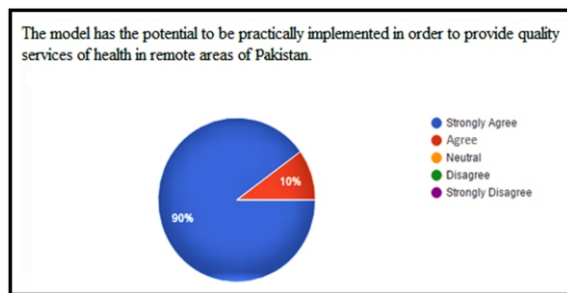

Fig. 3. Survey Response regarding Practical Implementation & Quality of Health Services

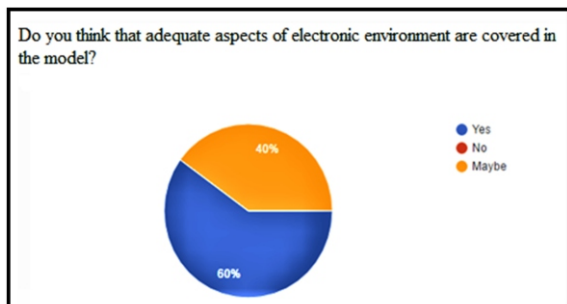Fig. 4. Survey Response regarding Usefulness for E-Health Management in Pakistan

Fig. 5. Survey Response regarding Adequacy to Cover Electronic Environment Aspects
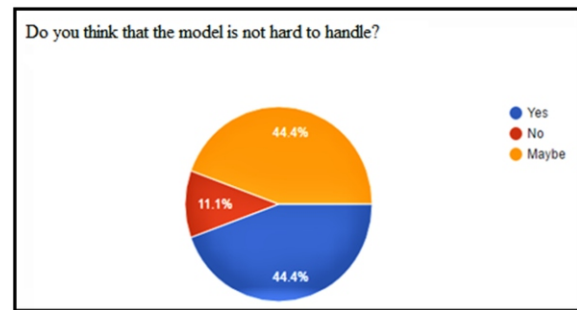

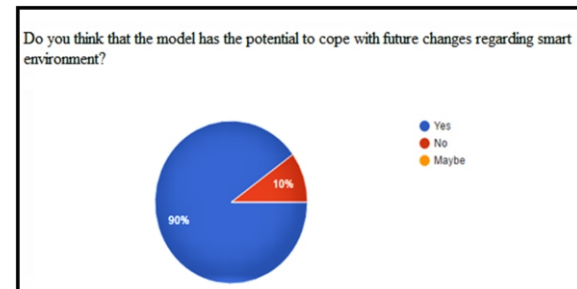Fig. 6. Survey Response regarding Usability of the Model

Fig. 7. Survey Response regarding Ability to Cope with Future Changes in Smart Environment
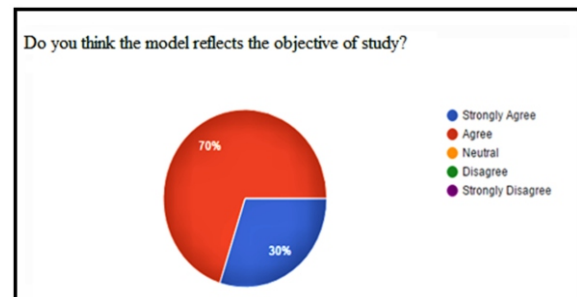

Fig. 8. Survey Response regarding Reflection of the Study Objective

The proposed model is aligned with the real hierarchical treatment mechanism being followed by the health centers in Pakistan. Furthermore, the Punjab Emergency Service (PES) publically renowned as Rescue 1122, which is a leading emergency service in Pakistan also follows such a mechanism while responding to emergencies as well as patient referral calls for shifting the patients from one health facility to another.

V. CONCLUSION

Like other developing countries Pakistan also has a dire need to have such an e-health system that may be able to provide quality health services in its remote areas with minimum resources. The proposed VSM based e-health model presented a unique idea to get optimal outcomes from the minimal resources,

especially through maximum utilization of the specialist doctors available at different levels. The basic patient-doctor interactive mechanism at BHU would be connected up to the central capital e-health setup with a specialized facility in such a way that it may be able to provide quality health services at the basic level even in remote areas. The doctor at BHU would be able to seek consultation from any of the specialist doctors available at any of the upper-level setup of the e-health model. The e-health setup at each level of the proposed model would be connected to the edge computing to get a prompt response as well as other required resources from the higher level through the cloud computing. After reviewing the models described in the literature, it is concluded that developing countries have an inadequate level of ICT infrastructure and technology awareness. In the proposed model the designated specialist doctors available at the DHQ, teaching, the provincial capital, and central capital level hospitals would be rendering their services 24/7 without any interruption. The addition of IoT and artificial intelligence techniques in the proposed model would have a great impact on having real-time cost-effective treatment & monitoring of the patient with better resource allocation & rational decisions respectively. In the proposed model Pakistani healthcare perspective has been especially focused mainly in comparison with the e-Ilaj telemedicine system to avoid respective flaws as well as to provide better healthcare services by adopting IoT & artificial intelligent techniques.

VI. FUTURE DIRECTIONS

One of the key future directions is to practically implement the proposed model in Pakistan for achieving the goal of optimal resource utilization & to make intelligence-based rational decisions and wise planning accordingly. It may be taken as a stepwise mechanism that would not only work at the government level but would also incorporate the non-governmental organizations (NGOs) in the proposed model. In addition to it, the proposed model may be further expanded through the inclusion of EMS & other such services in it.

VII. DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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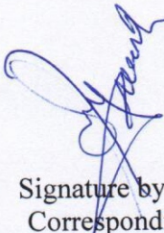
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