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A Methodical Review of e-Health Systems Developed for Indian Healthcare Sector

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Abstract

Objectives: The gradual popularity of e-Health systems across the globe has emerged the need of extensive analysis for the identification and rectification of related issues. So that. High quality e-Health systems could be invented for the improvement of communal health. Hence, the main objective of this paper is to point out some of the challenges, opportunities and gaps related to e-Health systems which are identified during this study. **Methods/Statistical Analysis:** The authors have utilized methodical approach for this review study. For this purpose, Kithchenam's theory has been taken as a base. Furthermore, nineteen studies have been utilized as a sample for this analysis. In addition to this, content based analysis technique has been employed for analyzing the e-Health systems by authors. Moreover, the methodology employed in this study can be modified based on the requirement of other researchers. **Finding:** The methodical analysis of literature reveals the existence of various challenges and opportunities related to e-Health systems. Besides this, some of the major gaps related to Indian e-Health systems has been identified and highlighted in this study. In addition to this, Authors have also identified mother and child care domain as a less progressive one as compare to other domains such as hospital & record management, teaching and learning and remote consultancies. According to findings, presence of work has not found in the area of mother and child care especially in case of India. In this way, it can be said that findings of this study save the time and efforts of other researcher by providing basic information related to existing e-Health systems and gaps to assist them in future work. **Application/Improvements:** The study has identified and highlighted few challenges, opportunities and gaps related e-Health systems that would be applied for system development in near future. So that, more reliable, user oriented and demand specific systems could be invented in near future.

Keywords: Child Care, e-Health, Health Services, Mother Care, Remote Consultancy, Telemedicine

1. Introduction

Information and communication technologies have conducted number of innovations and developments in various fields. In this perspective, e-Health has been a front line development in healthcare sector. It refers to electronic systems developed for management and organisation of medical resources. The deployment of e-Health systems has made healthcare delivery fast, approachable and affordable for remote patients. This has increased significance of e-Health Systems in terms of decision making processes about individuals' health, digitization of medical records and management of healthcare resources across the globe. In addition to this, consistent utilization of e-Health systems are reducing medical errors; increasing the administrative efficiencies; decreasing paper work and expanding the accessibility of health care services in a reasonable cost. The increased popularity and utilization of e-Health system is the motivation to deploy these systems in developing countries (like India) where the resources are limited. For this purpose, development of new e-Health systems and modification in the existing ones are required for satisfaction of social needs. Hence, the review of literature

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on e-Health system has been conducted to identify its role and status in India. This research paper focuses on the use of methodical research approach in context to e-Health systems and brings out the various challenges and opportunities related to the same.

1.1 Brief of Objectives

The main objective of this paper is to present various challenges and opportunities of e-Health systems identified during analysis of available literature on e-Health. In addition to this, the paper aims to provide fundamental knowledge on the available e-Health systems which are recently developed for Indian healthcare sector. Furthermore, gaps identified in this research paper can be taken up appropriately as a part of future research work in this domain.

2. Review of Literature

The review of literature confirmed that e-Health systems are emerging as a field of research in India. Although a lot of steps are taken in this direction by the researchers, but still, a limited work is found on the e-Health systems with respect to India. Hence, this study has utilized available literature from various relevant sources to bring out the challenges in the current scenario and to discuss various opportunities of e-Health system in Indian context. The following sub section specifies the research methodology and process opted for current review of the literature.

2.1 Research Methodology and Procedure

This paper has utilized a systematic research procedure to review literature on e-Health. For this purpose, In[1] systematic review procedure has been utilized in this study. The review process as elaborated in Figure 1 was started with exploration of reputed academic databases (IEEE, Google Scholar Research Gate and Willey) related to e-Health by using different keywords like "e-Health", "Telemedicine", "e-Health Systems", "e-Health Services", "e-Health Challenges" and "e-Health Systems for India". Later on, collected literature was refined by using title and abstract basis exclusion technique. In the final phase, selected literature has analyzed and the findings are represented in a tabular format.

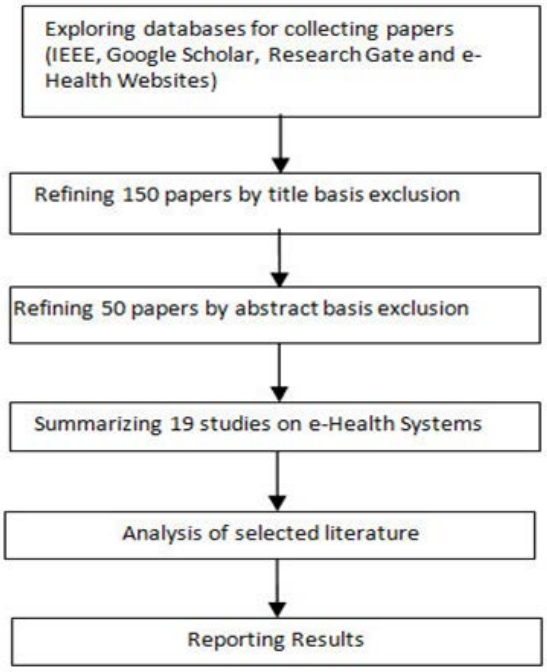

Figure 1. Research methodology and procedure.

Findings and Discussions section of this paper is the foremost area of this review process. The key elements of selected studies[2–12] have noted down in order to attain information (such as name, type, services and deploying locations) of different e-Health Systems developed for Indian healthcare sector. Besides this socio-technical aspects have also considered in this review to provide a generic body of knowledge related to the literature. In addition to this, review study has faced number of problems during the review process. One of the major problems was that selected literature was not clearly providing details (like different modules, techniques and weaknesses) of different e-Health Systems. Therefore, the information about Indian e-Health Systems is presented "as it is" in the Table 1.

3. Findings and Discussion

After humanizing the available literature, nineteen studies were found relevant to contribute in current review context. The list of solutions, their names, services and

Table 1. e-Health systems developed for Indian healthcare sectors

Sl. No.	Systems	Initiators	Services	Deployed Location	Ref#
E-Health Systems Developed for Remote Medical Consultancy					
1	E-Clinic	Naandi Foundation	Provides medical consultancy and services to cancer patients.	Malwa, Punjab.	(2)
2	Health NET	21 Century	Provides good quality health care services to all segments of society especially to poor's in remote areas.	Goa	(2)
3	Child Health Monitoring System	Intel	This system provides check-up facilities to needy urban children.	Chandani Chowk, New Delhi	(2)
4	Hello Doctor 24*7	MKCG Medical College, Orissa	Provide healthcare information to rural public in form of teleconsultation.	Orissa	(2)
5	School Health Monitoring System.	Tata Consultancy Services and Intel	Provides health education and learning to teachers and students of the school.	St. Philomena Girls Higher School, Trivandrum.	(2)
6	HealthCare Solution.	Hewlett Packard (HP)	System deals with the management of patients.	Maharashtra	(2)
7	Neonatology	All India Institute of edical Sciences (AIIMS).	Provides time critical information regarding newborn care to healthcare professionals.	Global	(3,4)
8	Telemedicine	Government of India, Apollo Telemedicine Networking Foundation (ATNF)	Doctors can share expert knowledge required during treatment. Sharing of medical tools or equipments is provided by this solution. It also provides training to health workers or staff located in distant areas.	Uttaranchal, Uttar Pradesh, Orissa and Karnataka	(5,6,7)
9	Virtual Medical Kiosk	E Health Access Pvt. Ltd.	It will provide secure environment for interaction between doctors and patients for medical consultancy.	Hyderabad and Andhra Pradesh,	(8)
E-Health Systems for Training and Learning					
10	Newborn Care	World Health Organization (WHO) and All India Institute of Medical Sciences (AIIMS).	It provides e-Learning facility to health workers or professionals.	Global	(8)
E-Health Systems for Hospital and Record Management					
11	Hospital Information System (HIS)	Wipro	System provides different services related to hospital and record management such as patients' registration, digitalization of patients records.	Six hospitals of Delhi Municipal Corporation.	(9)
12	India HealthCare Projects	CMC Ltd.	It provides the facility of data compilation and report generation.	Andhra Pradesh	(9)
13	Electronic Medical Record (EMR)	Tata Consultancy Services and Intel	Collect and saves medical records of patients. Provides medical history of patients.	Tamil Nadu	(10,11)
14	REFID-TIRM (Individual Tracking and Record Management System)	IEEE	Maintains the history of infants and vaccination.	Ahemdabad	(12)

deployed locations are given in the Table 1. The results of literature review presented a set of studies aimed to reveal the presence of different e-Health systems and their services for serving patients and medical professionals of the country[2-12]. Moreover, the review also shows the importance of e-Health solutions in terms of diagnosis, consultancy, managing health affairs and patients of remote areas.

The analysis of Table 1 provides motivation for performing further analysis to identify the gaps in previous work and to suggest some areas for future research work. For this purpose, studies selected for current review have been divided into different categories such as Remote Consultancy; Training and Learning; Hospital and Record Management; Challenges and Opportunities, to analyze the current status of e-health services in India. After that, result has been planned through analyzing available systems on services provided by them and presented in Figure 2.

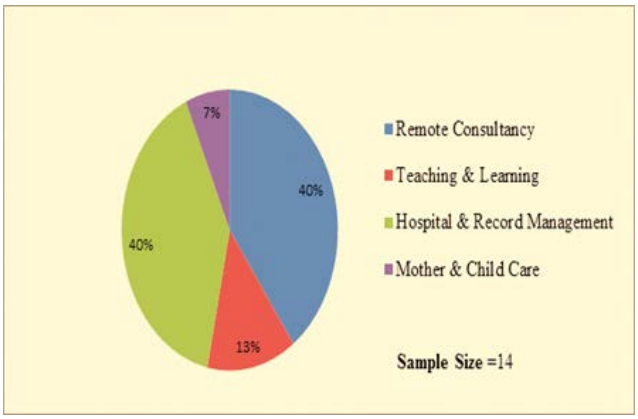

Figure 2. e-health initiatives in India.

The analysis of Figure 2 shows that significant work in the area of remote consultancy, hospital and record management, teaching and learning; but very rare of the work has been found in the area of mother and child care services. Furthermore, some of the existing work meant to summarize challenges and opportunities[13–19] of e-Health Systems, which are mentioned in Table 2 and Table 3 respectively.

The study of Table 2 and Table 3 reveals the presence of various challenges and opportunities related to e-Health systems which are identified during the review of available literature. Hence, the review represents some of the challenges as key challenges of e-Health systems and these are user acceptance, privacy and security of data and confidentiality[15]. Hence, this knowledge can be further explored to design new methods/approaches for the minimization of challenges and to maximize opportunities in e-Health.

4. Research Gaps

The analysis of literature on e-health systems developed for Indian healthcare sector has reported the presence of some gaps in previous work, which are explained as below:

- Different kind of e-health system has been found for providing services like hospital management, health monitoring, tele consultancy and record keeping; but the rarity of work has found in the area of mother and child care.
- More detailed studies including weaknesses, threats and benefits related to e-Health systems are required to develop more acceptable systems.

Table 2. Challenges of e-health systems

Challenges
Security, privacy, and confidentiality are major concerns in e-Health solution due to its significance.
Insufficient accessing ratio is another challenge, which comes in the way of e-Health Systems.
Users especially patients are not well aware regarding e-Health Systems
Illiteracy of patients is another important obstruct in the case of Indian e-Health Systems.
Unavailability of internet connectivity in rural and remote areas.
Lack of supportive infrastructure (like high band width special equipment), funds, basic knowledge of computer among health workers, uniformity in clinical protocols, training for health care professional, patients knowledge about technology, employment of appropriate technology, quality control mechanism integration between systems and organizations.
High cost of deployment, fears to technology failure usability issues and changing the mind set of users such as patients and medical professional regarding e-Health Systems also impacted the success rate of e-Health.
Implementation of 36 different official languages, serving large population and area are challenging issues of e-Health in India.

Table 3. Opportunities in e-health systems

Opportunities
Increases health awareness of the general public, utilization of new technologies, availability of remote health professionals, availability of staff exchange programme, collaboration and international exchange of experience.
Provides new careers requiring professional skill for delivering information and communication technology literacy.
Delivers enhanced medical services in the remote areas.
Reduces hospitalization rate, waiting time, travel cost of patients.
It also saves time and money of doctors and patients.
Provides facility of e-Learning for professional development.
Provides the facility of generating medical history of patients and patient-doctor communication.
Addressing the ignored diseases of different countries.
Improves patient treatment and follow-ups, healthcare assistance to remote location, diagnosis from primary care, patient's satisfaction and quality of life.

- Studies related to collection and inclusion of users' feedbacks regarding previous systems and demand or expectations from new one is also required to satisfy social needs.
- Performance analysis of different e-Health systems has also emerged as an important gap in available literature.
- Problems related to data loss, data corruption, data integrity and data confidentiality issues are identified as important gaps during review process.
- Developing solution to reduce the identified challenges in current e-Health systems is itself a challenge which requires attention of researchers.

Thus, all these gaps would be taken up later as part of analytical studies (including analysis, survey and case studies of existing e-Health Systems) so that the same can be addressed.

5. Conclusion

This paper highlighted some findings based on review of literature in context of e-Health. Out of the various findings, the main finding is that e-Health has a potential for healthcare sector. In addition to this, e-Health systems are emerging as an important tool in different fields of healthcare with the aim of enhancing communal health. The presence of different studies related to e-Health systems, challenges and opportunities have found in this literature review. But there is no study found in relation to minimize challenges and to maximize opportunities. Moreover, different challenges of e-Health Systems mentioned in Table 2 constitute a major concern for future research. Hence, this paper contributes literature by 1. Providing review study on e-Health Systems developed for Indian healthcare sector, 2. Underlining the studies about services, challenges and opportunities of e-Health, and c) provides some gaps and direction for future work in the field of e-Health. This paper can be treated as a pedestal to provide a preliminary study for researchers interested in conducting studies on Indian e-Health Systems and wants to improve current systems. Thus, the study will save the time and efforts of other researcher by providing information related to existing e-Health Systems and gaps to assist them in future work.

6. Future Work

From the review of literature, authors identified few gaps in context to different areas such as mother and child care, training and learning, collection and utilization of user's specification in development phase, performance analysis challenges and opportunities. Hence, these are the thrust areas to get further explored as a future work. To meet the objectives, more analytical studies are required for developing acceptable systems to satisfy the need of society and healthcare sector as well. Furthermore, survey based study can also be explored for collecting user's (especially patients) point of view to make user friendly systems.

7. References

1. Kitchenham B. Procedures for performing systematic reviews. UK: Keele University; 2004. p. 1–33.
2. Mahapatra SC, Das RK, Patra MR. Current e-governance scenario in healthcare sector of India. E-Governance Scenario in Healthcare Sector of India; 2011. p. 121–7.
3. Neonatology. Available from: https://play.google.com/store/apps/details?id=com.itdcs.neonatology
4. WHO Collaborating Center for Training and Research

in Newborn Care. Available from: http://www.newborn-whocc.org
5. Apollo Telemedicine Networking Foundation (ATNF). Available from: http://healthmarketinnovations.org/sites/default/files/Apollo%20Case%20Study.pdf
6. Sharma AK. Telemedicine: A new technology in waiting. Indian Journal of Public Health. 2011 Oct; 55(4):286–88.
7. Kalpa S. Health IT in Indian healthcare system: A new initiative. Research Journal of Recent Sciences. 2012 Jun; 1(6):83–86.
8. Virtual Medical Kiosk. Available from: https://www.businesswireindia.com/news/newsdetails/ehealth-access-launches-virtual-medical kiosk/33561
9. Sharma MK, Vaisla KS. E-health for rural areas of Uttarakhand under e-Governance service delivery model. IEEE Proceedings of 1st International Conference on Recent Advances in Information Technology (RAIT); 2012. p. 1–5.
10. Accenture. Delivering e-health care in India. Proceedings of National Conference on e-Governance; Kochi. 2014. p. 1–28.
11. The current status of e-Health initiatives in India. Available from: http://ehealth-connection.org/files/conf-materials/Current%20Status%20of%20eHealth%20Initiatives%20in%20India_0.pdf
12. Zalzala A, Strettle V, Chia S, Zalzala L. RFID Individual Tracking and Records Management: Solutions for Slum Communities. IEEE Technology and Society Magazine. 2015 Mar; 34(1):45–55.
13. Fitzgerald G, Piris L, Serrano A. Identification of benefits and barriers for the adoption of e-health information systems using a socio-technical approach. IEEE Proceedings of 30th International Conference on Information Technology Interfaces (ITI); 2008. p. 601–6.
14. Ghuman BS, Mehta A. Health care services in India: problems and prospects. Proceeding of International Conference on the Asian Social Protection in Comparative Perspective; Singapore. 2009. p. 1–15.
15. Hussein R, Khalifa A. Telemedicine in Egypt: SWOT analysis and future trends. German Medical Science. 2012 Jul; 8(1):1–16.
16. Hong Y, Patrick TB, Gillis R. Protection of patient's privacy and data security in E-health services. IEEE Proceeding of International Conference on Bio Medical Engineering and Informatics, (BMEI); 2008 May. p. 643–7.
17. Ramakrishnan N, Keller BJ, Mirza BJ, Grama AY, Karypis G. Privacy risks in recommender systems. IEEE Internet Computing. 2001 Nov; 5(6):54–62.
18. Srivastava S, Agarwal N, Pant M, Abraham A. A secured model for Indian e-health system. IEEE Proceedings of International Conference on Information Assurance and Security (IAS); 2013. p. 1–4.
19. World Health Organization. Telemedicine: Opportunities and developments in member states: Report on the second global survey on eHealth, WHO Global Observatory for eHealth Series. 2009; 2:1–96.