

Redefining Electronic Health Records (EHR) and Electronic Medical Records (EMR) to Promote Patient Empowerment

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Abstract— Powered by technological changes like big data, cloud computing, and Internet of Things, healthcare information is accessed and owned and the patient has become evolving within the healthcare environment. This affects the relationship between healthcare provider and customers, and between patients. Digital medical and health data are considered as a building block for electronic health development. Many literatures use both terms EHR and EMR interchangeably with no clear distinction in terms of scope and dimensions. The aim of the research is to examine the distinct role of EHR from EMR in order to promote patients' empowerment. While, patient empowerment in e-health will enhance patients' satisfaction, improve their health literacy, and involve patient in the process of health decision making.

Keywords-E-Health; Electronic Medical Records (EMR); Electronic Health Records (EHR); Empowerment

I. INTRODUCTION

The utilization of Healthcare Information Systems (HIS) in the healthcare sector is often referred to as electronic health or e-health. In accord with HIS, e-health was introduced in the healthcare industry to improve information access and flow, as well as the efficiency and effectiveness of patients' care. Similar to any other sectors, healthcare organizations are also in the midst of high intense completion. It is important to keep the customers happy by prioritizing their wants and needs in order to build a good patients-healthcare organization relationship and one of the service is empowering patients in healthcare activities. For instance, patient's empowerment may be able to generate own health data and integrated with his or her mobile health systems. Since many healthcare organizations treat their patients as an object of treatment rather than partner of healthcare including health and medical decision. Empowering patients in the healthcare processes will be likely to contribute to the patient's satisfaction because they will actively involve in the health treatment activities but also decision making. Interestingly, the advancement of technology like big data, Internet of Things, cloud computing, and 5G networks are supporting patient empowerment [1]. The development of Web 2.0 also facilitates patients to generate content to accommodate both patient-health providers and patient-patient interactions. Web 2.0 provides a platform where customers collectively contribute in providing content, applications and collective contributions of all users [2], [3].

Digitalization of healthcare services were started from transformation of paper-based health/medical data into paperless of electronic medical/health records. Electronic Medical Records (EMRs) and Electronic Health Records (EHRs) are foundations in building e-health or mobile health systems [4]. EMRs are medical data in the form of digital that is easy to store, update, and exchange between healthcare institutions anywhere and anytime [5]. [6] explained EMRs as the digital medical data that composes of reports about patients' medical conditions, histories, checkups reports, medicines and medical treatment. In addition, EMR systems can include patient records and management, electronic medication histories, and even costing and payment systems [7], [8]. Therefore, health information systems (HIS) needs new mechanisms in drawing customers' interests to medical or health records. In order to support the idea of empowerment and customers' participation, the concept of object-oriented design can be used to offer systems flexibility for medical and health information.

This study emphasizes emerging technological adoption in other sectors that takes into account projections for healthcare sector. This process did not attempt to reinvent the wheel; instead, it is an assemblage and the arrangement of the best parts available. The conceptual model can be used by a healthcare organization as an alternative roadmap in planning in adopting empowerment from distinguishing between EHRs from EMRs.

II. LITERATURE REVIEW

Digital health or e-health or mobile health encompasses multidisciplinary knowledge, many topics on e-health have been partly viewed from different domains of expertise. It is a challenge to assemble all interrelated disciplines together. Those domains of expertise are technological, people (culture), and processes (strategies, effects, and outcome). E-health/m-Health refers to technology (ICT), people, processes and strategies used for clinical, educational, research, and administrative purposes connected to the networks in support of health and medical related activities. [9] defines e-health as an emerging field at the intersection of healthcare, ICT, and business process, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide using ICT. The goals of e-health include the desire to increase efficiency in health care, improve quality of care, increase commitment to evidence-based medicine, empowerment of patients and consumers, and the development of new relationships between patients and health professionals [10]. From a global perspective, e-health can be used to disseminate health information as well as to ensure that the most current information is used to improve people's health [11].

The early adoption of the Internet in healthcare services has enabled patients to seek health information, which they can also use to communicate with each other online in support groups, and potentially communicate with their healthcare providers. Many researchers state that effective physician-patient communication is important for patient satisfaction, treatment adherence, and health outcomes [12]–[14]. Electronic patient-centered communication, using e-mail or Web-based technology, has the potential to enhance physician-patient interactions by providing asynchronous, self-documenting communication of patient questions and physician advice [15]. Committee on Quality of Health Care in America [16] stated that patients should receive care whenever they need it and in many forms, not just face-to-face visits, but also access to care should be provided over the Internet, by telephone, and by other means.

In contrast, EHRs have also been one of the hot research topics in the field of health informatics [17]. In fact, EHRs are a superset of EMRs [4], [18]. According to International Organization for Standardization [19], the EHR means a repository of patient data in digital form, stored and exchanged securely, accessible by multiple authorized users. It contains retrospective, concurrent, and prospective information and its primary purpose is to support continuing, efficient, and quality integrated health care.

A considerable amount of literature has been published on EHRs and EMRs, and yet the issue of patients' empowerment in relation to EHR and EMR has been addressed in small-scale investigations. Data (records) ownership and accessibility in



EHRs or EMRs has drawn attention to provide an in depth analysis of the work of EMRs/EHRs showing its relevance to contemporary healthcare services in this study. A small-scale study reports that customers have access to the contents of the records. In many cases, EMR or EHR are not intended for customers' accessibility.

III. DIGITAL MEDICAL RECORDS

Deploying EMR systems are definitely enhance the quality and quantity of healthcare services to the public such as promoting effectiveness of retrieving patient records, efficiency in serving patient, clarity in managing medical records, reducing medical errors, simplifying report to view long continuum of patients' medical histories. From the perspective of healthcare staffs, EMRs systems will significantly reduce doctors' and nurses' workload especially in dealing with a large amount of patients medical records, removing data redundancies [20], [21]. Categorizations of EMRs are "(1) Combining computer systems in various departments, functions, and/or systems within a hospital including outpatient/inpatient, emergency physician, nursing information system, ICU system, examination/checkups information system, and pharmacy information system. (2) Support different organizational activities in a hospital such as clinical diagnosis, medical education, medical research, and operation/management. (3) Save data with diversified formats, including words/figures, videos, and audios. (4) Embed the necessary medical documentation standards and clinical guidelines to support medical professionals while recording data into EMRs." [22].

While, EHRs are patient data in digital form stored and exchanged securely, and accessible by multiple authorized users for supporting continuity, efficient and quality integrated healthcare [19]. [23] reviewed the different types of EHR terms commonly used in literatures. These are Electronic Medical Record (EMR), Electronic Patient Record (EPR), Computerized Patient Record (CPR), Electronic Health Care Record (EHCR), Personal Health Record, Computerized Medical Record, Digital Medical Record, Clinical Data Repository, Electronic Client Record, Virtual EHR, and Population Health Record. Another term is Personal Health Records (PHR). PHR is a personal health records in the form of digital including patient's own health record and any digital format of health data from other healthcare providers or smart health devices. Patients decided parts of their medical information that is shared with their providers or healthcare plan [4].

IV. DISCUSSION

As both terminologies discuss the same context of patients' data, it is important to define and distinguish between EMR and EHR. [23] mentioned that the meaning of EHRs needs to be determined explicitly because it has many functions and includes many kinds of data.

EMRs contains patient's health data managed by a healthcare organization containing health records for long term

and aggregate health data generated by one or more encounters in any care delivery setting stemming from the interoperability of multiple providers. It can compose demographics, health history notes, problems or symptom, laboratory data, immunizations and radiology reports [24].

Patients' health data in digital form with the objectives to improve efficiency and effectiveness of healthcare business processes by means of ICT and healthcare technologies. EHRs are designed to be accessed by everyone including people beyond the clinical activities to reach out to other healthcare providers for information sharing [25].

The research shift from a traditional view where patients are solely considered as recipients of care to partners of care so that customers can participate actively in the process of healthcare and health decision making which is related to their own well-being. To make customers as partners, tools and strategy in managing relationships with their customers (patients) needs to be set up by healthcare organizations.

The model extends the role of patients (customers) into three distinct functions as individual, social, and medical. Each module composes sub-modules representing holistic approach of digital health data. The advantage of the modular approach is extendible so that new entities can be easily embedded in the future need of healthcare organizations.

Figure 1 in summarizes the proposed model. It consists of Personal, Medical and Social. Personal module is also namely Personal Daily Life (PDA). It is module that managing data that is generated primarily by patient. Secondly, Social's module is also attributed as Social Network Activities (SNA). The module will manage any important and relevant data about health and medical gathered from unstructured data format especially from social networks data. Medical's module refers to medical data consisting from checkups, outpatient (O/P), and inpatient (I/P). In the traditional e-health or m-Health system, normally medical's module is referred to EMRs.

Details of modules and sub modules are highlighted in this section. Personal module composes of sub modules; Profile or Identify of patients (ID), health habits of patient (HB), patient's exercise data (EX), spiritual/emotional data (SE), individual health plan like health insurance (if any) (HP), personal health Account (AC), etc. Secondly, Social composes of any health activities generated from social media interaction relating to his healthcare news or issues retrieved from social media. Social module consists of conversation among patients with similar health problem (CS), knowledge management (KM) for retrieving concerned health issues, and resolution (RS) for patient to get the answer from other patient. Finally, Medical module composes of sub modules such as checkups data (e-appointment (EA), examination (XM), treatment (TM), and e-prescription (EP), I/P treatment data, and O/P treatment data. For instance, XM consists of chronic disease (cc) and non-chronic disease (NC). Chronic diseases consist of some chronic categories of diabetes (DA), cancer (CA), obesity (ob), etc.



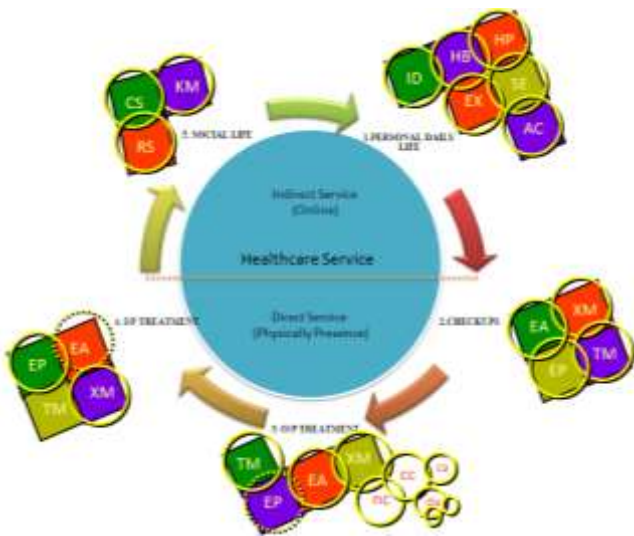


Figure 1. Summary of the proposed method

The proposed framework highlights the three dimensions of digital health. Each module generates the data. Since it produces data, it can help to understand about process of empowerment. What are the criteria for authorization for such sharing? What is the level of control that they can perform an action for a specific shared-object?

It indicates that m-Health or e-health is a comprehensive healthcare processes into personal, medical, and social aspects of services. Literally, the framework can define empowerment for each module or sub module depending upon the needs of healthcare organization. For instance, the yellow circle line indicates that data produces from this sub module can be empowered or accessed by patient while no circle means only healthcare organization can produce or access the sub module. Furthermore, the yellow dashed circle indicates partial access to the patients.

In summary, the architecture is developed based on the modular approach and it becomes a central notion of how the research proposes a holistic approach to customer interactivity in e-health. Each module communicates with another module by sending messages that will invoke methods to respond. Modules take advantage of having the data and business logic, which is encapsulated within them to interact with legacy applications [26]. This makes the system more flexible as it takes advantage of the concept of modularity in software development [27].

V. CONCLUSION

The proposed systems empower customers (patients) for each activity to generate and control data and conversations that in turn contribute in distinguishing the concept of Electronic Medical Record (EMR) from an Electronic Health Record (EHR) in e-health systems. The model depicts the differences of both terminologies that cannot be used interchangeably either in the literature as well as in the application. According to the model, EMR is a mere subset of EHR. The EMR helps healthcare organizations in managing

medical records to improve efficiency and effectiveness in the process. EMR generates static medical data/record/information, which views the patient as recipients of care. While, the EHR can accommodate the broader scope of health activities like personal or social. Accommodating social module through Web 2.0 into the healthcare setting builds upon the open access model, mutual trust, support for commons, promote health through collaboration, and improve healthcare through conversation and sharing. It empowers customers (patients) in generating dynamic health information. It brings the promise of interactivity of patients towards the systems and at the same time engages them as an active participant in the healthcare process.

REFERENCES

- [1] M. Anshari and Y. Alas, "Smartphones Habits, Necessities, and Big Data Challenges," *J. High Technol. Manag. Res.*, vol. 26, no. 2, pp. 177–185, 2015.
- [2] T. O'Reilly, *What is Web 2.0 Design patterns and business models*. O'Reilly Media, 2005.
- [3] K. C. P. Low and M. Anshari, "Incorporating Social Customer Relationship Management in Negotiation," *Int. J. Electron. Cust. Relatsh. Manag.*, vol. 7, no. 3/4, pp. 239–252, 2013.
- [4] W. W. Stead, B. J. Kelly, and R. M. Kolodner, "Achievable Steps Toward Building a National Health Information Infrastructure in the United States," *J Am Med Inf. Assoc.*, vol. 12, no. 2, pp. 113–120, 2005.
- [5] S. Ebadollahi, A. R. Coden, M. A. Tanenblatt, S.-F. Chang, T. Syeda-Mahmood, and A. Amir, "Concept-based electronic health records: opportunities and challenges," *Multimedia*, pp. 997–1006, 2006.
- [6] R. H. Dolin et al., "HL7 Clinical Document Architecture, Release 2," *J. Med. Informatics Assoc.*, vol. 13, no. 1, pp. 30–39, 2006.
- [7] K. Larkin and A. Kelliher, "Designing Flexible EMR Systems for Recording and Summarizing Doctor-Patient Interactions," *CHI Ext. Abstr.*, 2011.
- [8] M. Anshari, M. N. Almunawar, S. A. Lim, and A. Al-Mudimigh, "Customer relationship management and big data enabled: Personalization & customization of services," *Applied Computing and Informatics*. 2019.
- [9] L. Bednarčíková, M. Petřík, T. Tóth, M. Michalíková, S. Krajňák, and J. Živčák, "Informatics in health care," in *ICCC 2008 - IEEE 6th International Conference on Computational Cybernetics, Proceedings*, 2008.
- [10] C. J. Austin and S. B. Boxerman, *Information systems for healthcare management* (6th ed.). Chicago: Health Administration Press, 2003.
- [11] S. Y. Kwankam, "What e-Health can offer," *Bulletin World Health Organ*, pp. 800–802, 2004.
- [12] W. Levinson, D. Roter, J. P. Mullooly, V. T. Dull, and R. Frankel, "Physician-patient communication. The relationship with malpractice claims among primary care physicians and surgeons," *J. Am. Med. Assoc.*, vol. 277, no. 7, pp. 553–559, 1997.
- [13] G. S. K. SH, W. J. Jr, Y. EM, and F. HJ, "Patients' participation in medical care: effects on blood sugar control and quality of life in diabetes," *J. Gen. Intern. Med.*, vol. 3, no. 5, pp. 448–457, 1988.
- [14] M. N. Almunawar, M. Anshari, M. Z. Younis, and A. Kisa, "Electronic Health Object: Transforming Static to Interactive and Extensible Healthcare Systems," *Inq. J. Heal. Care Organ. Provision, Financ.*, vol. 52, 2015.
- [15] B. Kane and D. Z. Sands, "Guidelines for the Clinical Use of Electronic Mail with Patients," *J. Am. Med. Informatics Assoc.*, vol. 5, no. 1, pp. 104–111, 1998.



- [16] I. of M. (US) C. on Q. of H. C. in America, *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington (DC): National Academies Press (US), 2001.
- [17] R. Haux, E. Ammenwerth, W. Herzog, and P. Knaup, "Health care in the information society. A prognosis for the year 2013," *Int. J. Med. Inform.*, vol. 66, no. 1–3, pp. 3–21, 2002.
- [18] M. Anshari and M. N. Almunawar, "Designing Role of Online Health Educators in Healthcare Services," *J. Evidence-Informed Soc. Work*, vol. 12, no. 2, pp. 220–236, 2015.
- [19] "Health Informatics — Electronic Health Record — Definition, Scope and Context," ISO/TR 20514. 2005.
- [20] M. Anshari and M. N. Almunawar, "Tracking Future Path of Consumers' Empowerment in E-Health," *Int. J. E-Health Med. Commun.*, vol. 6, no. 3, pp. 63–76, 2015.
- [21] R. Hillestad et al., "Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. PG - 1103-17," *Health Aff.*, 2005.
- [22] I. C. Chang, Y. C. Li, T. Y. Wu, and D. C. Yen, "Electronic medical record quality and its impact on user satisfaction - Healthcare providers' point of view," *Gov. Inf. Q.*, 2012.
- [23] K. Häyrynen, K. Saranto, and P. Nykänen, "Definition, structure, content, use and impacts of electronic health records: A review of the research literature," *Int. J. Med. Inform.*, vol. 77, no. 5, pp. 291–304, 2008.
- [24] TMA(TexasMedicalAssociation), "EMR or EHR? What's the Difference?," 2010. [Online]. Available: <http://www.texmed.org/template.aspx?id=5278>. [Accessed: 18-Aug-2012].
- [25] P. Garrett and J. Seidman, "EMR vs EHR – What is the Difference? Health IT," 2011. [Online]. Available: <http://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference/>. [Accessed: 03-Sep-2012].
- [26] R. Orfali, D. Harkey, and J. Edwards, *The essential distributed objects survival guide*. J. Wiley, 1996.
- [27] A. Dwivedi, R. K. Bali, N. Wickramasinghe, and R. N. G. Naguib, "Using Object Oriented Technologies to Build Collaborative Applications in Healthcare and Medical Information Systems," *Health Information Systems: Concepts, Methodologies, Tools, and Applications*. 2010.

