A SYSTEMATIC REVIEW OF THE CASE STUDIES INVOLVING HEALTH MANAGEMENT INFORMATION SYSTEM (HMIS) IN DIFFERENT COUNTRIES

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Abstract

This paper reviews some of the case studies involving Health Information Systems (HISs) and their enabling technologies in different countries. The review aids in achieving the objectives of HIS systems of improving the global quality of health care, attaining increased coordination between health care providers and consumers, promoting the use of guidelines and policies, and improving the speed of simultaneous access and distribution of medical records and other resources. This systematic literature review aims to synthesize the best available evidence on the effects of HMIS interventions on patient care, hospital management and other associated economic outcomes. The good news is that information systems have great potential to reduce healthcare costs and improve outcomes. The bad news is that it has become harder than ever for the researchers to explore the role of IS in the delivery of healthcare in its diverse organizational and regulatory settings. Hence, some recommendations for future IS research focusing on the implications of technology-driven advances have been provided in the final section of this paper. The recommendations mainly deal with three important areas: social media, evidence-based medicine, and personalized medicine. Further, with the help of the available case study findings, a conceptual frame work has been proposed in this paper.

Keywords: Health Information Systems, Health Management Information System, social media, evidence-based medicine and personalized medicine.

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1. Introduction

Health Information Technology (HIT) is an enabling technology that encompasses various hardware and software systems used for storing, processing and exchanging medical information. Such systems transform the traditional health care delivery by bringing information when it is needed and where it is needed; thereby, improving the quality of health care and reducing the cost of delivery (Ortiz and Clancy, 2003). Numerous health care related software systems are in use these days under various names such as Computer Patient Record (CPR), Patient Medical Record (PMR), Computerized Medical Record (CMR), Electronic Patient Record (EPR), Electronic Medical Record (EMR), Digital Medical Record (DMR), Patient Medical Record Information (PMRI), Personal Health Record (PHR), Electronic Health Record (EHR), Picture Archiving and Communication (PACS), Medical Diagnostic Imaging Support (MDIS) and many more (WHO, 2004).

The importance of healthcare to individuals and governments and its growing costs to the economy have contributed to the emergence of healthcare as an important area of research for scholars in business and other disciplines. Information systems (IS) have much to offer in managing healthcare costs and in improving the quality of care (Kolodner et al. 2008). Research anchored in the healthcare context must begin by reflecting on what is distinctive about healthcare and how such distinctions could or should inform the theorizing process. Distinctiveness of the context gives way to new theory or theoretical extensions that hold greater promise to explain IS phenomenon (e.g., adoption and impacts). One of the striking features of the healthcare industry is that the level of diversity that can be seen among the patients who are entering the hospitals. (e.g., physical traits, and medical history), professional disciplines (e.g., doctors, nurses, administrators, and insurers), treatment options, healthcare delivery processes, and interests of various stakeholder groups (patients, providers, payers, and regulators). The healthcare industry is so diverse that it makes the research as eclectic as possible and also spans many disciplines, including economics, public health, business, epidemiology, sociology, and strategy. In addition to the embedded role of information technology (IT) in clinical and diagnostics equipment, IS are uniquely positioned to capture, store, process, and communicate timely information to decision makers for better coordination of healthcare at both the individual

and population levels. For example, data mining and decision support capabilities can identify potential adverse events for an individual patient. They also contribute to the population's health by providing insights into the causes of disease complications. In spite of its importance, the healthcare domain has been underrepresented in leading IS journals. However, interest is increasing these days, as demonstrated by the proliferation of healthcare tracks in IS conferences, special interest groups, and announcements of special issues among leading journals.

A systematic literature review uses explicit, thorough methods to identify, select, appraise and synthesize a set of research studies on a well-defined topic. This methodology makes the findings of a systematic review less vulnerable to the biases of a single researcher than those of a narrative review. Systematic reviews aid decision-makers by sifting through an enormous literature to find the high-quality studies and to synthesize them. In the initial stage, this paper will discuss some of the concepts and background literatures relevant to the review. Electronic Health Records (EHR) have been used as a reference material in this paper. This article forays into the current status of Health Information Systems (HIS), their enabling technologies and similar products and services that exist in the healthcare arena. This research work will also assess the scope, functionality, security, and interoperability of the considered systems. Work done in this direction will aid in achieving the objectives of HIS systems. The quality of the health care can be greatly improved through the computerized support of various functions. This work will also help in improving all of the basic functions of HIS such as scheduling, patient information capturing and retrieval, diagnosis, decision support, protocol consultation, care plan management, drug management, scheduling for surgery processing, patient education, quality assurance, and financial transactions. This work will also help in attaining increased coordination between different health care providers and consumers, promoting the use of guidelines and policies, and improving the speed of simultaneous access and free distribution of medical records and resources.

The available individual information systems in the hospitals should be integrated with a nation-wide system. Such integration would provide secured coordinated-access and efficient processing of health information. This article is a step towards developing such a system. The structures and functions of the existing systems are also looked into in this paper. Special

attention has also been devoted to the general requirements of HIS including: scope of content, information capture, report generation, information representation, decision support, security and confidentiality, performance, interoperability and adherence to software engineering principles. The rest of the paper is organized as follows: section 2 deals with the definitions related to integrated electronic health records management system; section 3 deals with the background study and review of literature; section 4 provides a description of the proposed theoretical framework; and finally section 5 briefs about future trends and conclusion.

2. Background study:

The use of a unique national Medical Record Number (MRN) is a critical issue for any Health Information System (HIS). It provides accurate and efficient access to the patient medical information whenever and wherever it is needed. Elhadi, et al., (2007) stated that the system had been designed with compliance of the main elements of e-security: confidentiality, integrity, and availability. The system was isolated physically from the Internet and it did not allow the use of removable storage such as USB memory and CDs within the Health Net. Medical Audit was found to be vital for the measurement of the quality of care given to the practice population. Medical audit required standard setting, data collection, comparison with standards, review of data and standards. There has always been a need for a unified referral information system in which patient care records can be shared among hospitals over the Internet.

Anderson, Scrimshaw, Fullilove, Fielding, and Normand, (2003) stated that culturally competent healthcare systems have the potential to reduce racial and ethnic health disparities. Staff members who reflect the cultural diversity of the community served should be recruited and retained. Efforts should be taken to use interpreter services or bilingual providers for clients with limited English proficiency. Cultural competency training for healthcare providers, use of linguistically and culturally appropriate health education materials, and culturally specific healthcare settings should be encouraged at the service environments.

Robson, et al., (2007) stated that mandatory interventions resulted in increased Occupational Health and Safety Management System (OHSMS) implementation over time; It

also brought about intermediate effects like increased health, environment and safety (HES) awareness; improved employee perceptions of the physical working environment and the psychosocial environment; and increased workers' participation in HES activities. Recruitment of workplaces to both intervention and controls was found to be a challenging task. Many workplaces were not willing to make a commitment to a large intervention like an OHSMS.

Fichman, Kohli, and Krishnan, (2011) stated that physicians' rejection of technology is a serious problem that can lead to poor quality of care, medical errors, and low patient satisfaction. Archival data helped to examine the efficiency and quality effects of IS avoidance at three levels: the individual user level (physician), the shared group level (healthcare team, including paraprofessionals and administrators), and the configural group level (which accounts for the positions of individuals in the team). A perfect coordination should exist between public health policy makers and healthcare providers so that they could engage and disengage during any kind of disease outbreak.

2.1 Review of literature

Every action had to be planned, organized, coordinated and controlled in an information management system. Kivinen & Lammintakanen, (2013) found out that management information system enabled more comprehensive use of information and thereby helped in the decision making process. Information management processes greatly helped in knowledge creation, sharing and use. They also helped to meet the future challenges of effectiveness, increasing needs and demands of patients and decreasing availability of staff resources. There were four sub-categories in the "usage of management information system". They were system quality, information quality, use and user satisfaction and development. Most of the generated information was used for the human resource management. Automatically generated patient satisfaction and feedback information assisted in evaluating the quality of daily work.

In Tanzania, the Health Management Information system (HMIS) data were found to be incomplete and inaccurate. D.O.Simba and M.A.Mwangu, (2005) found out that the public sector

health facilities had a relatively high completeness rate and hence the use of HMIS data for decision making could be restricted to public sector facilities only. The services provided by the private sector health facilities were said to be minimal and further, most of the private facilities denied access to valuable information. Inadequate data from private health facilities would undermine the public–private partnership agenda. Moreover, the government should consider the interests of the private sector and only then, it could effectively determine the allocation of resources.

Damtew, (2009) stated that use of information at the site where it was collected helped health care providers and managers to monitor their performance. The peripheral level health workers and the community volunteers used their local knowledge and different improvisation techniques to accomplish their tasks. These health workers acquired the necessary knowledge and skills from their work experience. Further, the local work space also played an important role in their learning process.

Technology enactment is defined as the process by which organizational forms, both affecting and being affected by existing institutional arrangements, influences the adoption of IT. Bernardi, (2009) stated that the effects of information technology in relation to public sector reforms could be better understood by situating IT-enabled organizational change in the actual institutional context of a public organization. The enacted technology can send feedback that directly creates changes into the organization and indirectly into policy institutions. Health records information officers played a key role to promote new information processing practices encoding the institution *of* decentralization and accountability across the whole health system. Localized policy discourses could also help to determine the role of IT in building an interface between informal and formal governance systems characterizing most African Governments.

Hamre and Kaasbøll, (2008) stated that the work which the system supported should always be perceived to be important and only then system adoption would take place. Gasser's theory of integration of computing and routine work was also applied to address the secondary and supportive nature of HMIS computing work. It was found out that HMIS staff members could be easily motivated towards primary work. Here, primary work means addressing the specific agenda of the work situation. HMIS Managers always played a crucial role in the

functioning of the system. Moreover, a proper medical understanding would increase data quality and decrease errors.

Kimaro and Nhampossab, (2007) stated that the sustainability of Health Information System depended on the technical features and physical infrastructures. Any lack of technical approach would lead to instability of the information system. Socio-technical aspects played an all important role in information system. Integration of such aspects into the organizational structures would lead to stability. They would also enable easy execution of routine activities. Health services mainly include curative and preventive activities. These activities are hampered by scarce resources. The main aim of HIS is to overcome the scarcity and bring about better care. Further, extra attention should be given to users' needs, evaluation, feedback generation and future improvements. Information generation and sharing of knowledge within the sustainability strategy framework would also add to the stability of health systems.

The important case study findings are summarized in the two tables given below:

Table 1:

Authors (year of publication)	Country	Method	Industrial sector	Number of organizations in analysis	Type of data	Number of workplaces in analysis
(Kivinen & Lammintakanen, 2013)	*Finland*	qualitative case study	health care	one specialized health care	usage of management information system and implementation	Altogether 13 front-line, middle and top-level managers were interviewed. So 3
(D.O.Simba & M.A.Mwangu, 2005)	Tanzania	descriptive analyses - *qualitative research*	health care	public and private organizations, so 2	documenting the available records, available HMIS-related documents (registers and data books), daily recorded data; monthly	The municipal medical officer, other members of the council health management team(CHMT), the research

					reported data, data reported quarterly, data reported annually	coordinator. So 3
(Bernardi, 2009)	Kenya	qualitative research method.	health care	the central Division of Health Management Information Systems HMIS), the Kenya Expanded Programme of Immunisation (KEPI), and the Division of HIV/AIDS. So, 3	technological innovation and information system performance	health records information officers (HRIOs) and medical management and technicians, doctors and other medical professionals. So 4
(Hamre & Kaasbøll, 2008)	*Malawi*	Interpretive research (Qualitative method)	healthcare	health programmes and HMIS issues. So 2.	health worker attitudes were identified as an important factor affecting the functioning of HMIS. health worker motivation studied in developing countries; the secondary and supportive nature of computing work; and commitment and motivation in IS use.	health managers, HMIS managers and supervisors, HMIS clerks, and other health workers with HMIS related duties..So 5
(Kimaro & Nhampossab, December 2007)	Mozambique and Tanzania	Qualitative method	health care and Information Technology (IT)	donor, vendor (software development agency) and health	health system in general and its sustainability	health managers and health workers linked to the

				organization. So 3		MoH. (Ministry of Health).So 2

Table 2:

Authors (year of publication)	Research design	Execution quality	Intervention	sample size	Findings
(Kivinen & Lammintakanen, 2013)	semi-structured interviews, the data were analyzed using inductive content analysis using ATLAS.ti computer program, The credibility of the research was enhanced by researcher triangulation and peer debriefing	the results aptly reflected the theoretical aspects introduced previously and thus validate the credibility of the study. So, Greatest	The interviewees were purposefully selected from one specialized health care organization, Altogether 13 front-line, middle and top-level managers were interviewed. The two themes discussed were information availability and information use	13 front-line, middle and top-level managers	The connection between information culture and information use was recognized and the managers proposed numerous ways to increase the use of information. The implementation and use of management information system was not planned as an essential tool in strategic information management
(D.O.Simba & M.A.Mwangu, 2005)	Data were analysed using EPI Info software. Frequency and cross tabulation were	The few private health facilities that had all the required data denied researchers access to the	various data categories, such as outpatient, laboratory and maternal and child health,	All public (23) and parastatal health facilities (5) were selected; In addition, a random sample	This study found that the average data completion rate was 64.2%. The completion rate was found to be

	done and descriptive analyses were used in interpreting the data	valuable information. So Fair	were included. Data were tracked retrospectively according to the frequency of reporting as follows: past four weeks for daily recorded data; past four months for monthly reported data; past four quarters for data reported quarterly; and past four years, for data reported annually. A pre-test was done to check the relevance of the data collection tools	of 41 private health facilities, representing 25% of all private health facilities, was selected. Altogether, 69 facilities	higher for government facilities (71.6%) than for private facilities (54.8%). Further analyses showed that the lack of data was more pronounced among private facilities (66.7%) compared to government facilities (9.5%)
Bernardi, 2009)	longitudinal case study	This sample allows the researcher to have a diversified and comprehensive view of the evolution of the information system. So good	Possible informants were selected based on their earliest dates of employment. The sample includes not only the health records information officers (HRIOs), but also the medical management technicians	14 HRIOs, 6 medical doctors, 1 IT officer, 3 other medical professionals.	Health records information officers played a key role to promote new information processing practices. Institutional enablers at the macro-policy level help to fully exploit the innovation potential of computerisation

(Hamre & Kaasbøll, 2008)	Research subjects' statements about own behaviour in combination with researcher's observations served as the main material for analysis. Findings were finally categorised according to Machungwa and Schmitt's six clusters of motivational themes. (1.Growth and advancement opportunity;2. Work nature, 3.Material and physical provisions,4. Relations with others, 5.Fairness in organisational practices, 6.Personal problems)	The Ministry of Health in Malawi helped pick two districts for our study; one known to perform well on HMIS, and the other amongst the poorer performers. So Good	The participants in our studies were chosen based on their involvement with HMIS in addition to their geographical location and availability. In total ,35 interviews, some of which were group interviews, and 13 direct observations of different meetings over a period of 11 weeks from August to October, 2006 were conducted	Two districts. So 2	Motivation and demotivation should not be considered as merely opposites. Absence of demotivating factors will not necessarily lead to increased efforts, but rather prevent low morale and at best probably only produce neutral feelings about the job.
(Kimaro & Nhampossab, December 2007)	The action research approach engaged in interventions such as conducting training programs, participating in the design of a new HIS, and	Good	The data collection methods applied included group discussions, analysis of documents, interviews (mostly unstructured), and workshops	2 countries Mozambique and Tanzania. So 2	The system should focus on users' needs, whose evaluation and feedback provides the basis for future improvements to the system. The developer needs to study,

	making presentations to the ministries of health. Document analysis helped to determine information about donor's policies and developer's strategies and their relationships with the MoH. The issues surrounding the design of the HIS approach were also analyzed mainly through document assessments and exploration of the HIS software		with health managers and health workers linked to the MoH. A questionnaire was also used to guide the interviews with health workers in order to explore their views about the health system in general and its sustainability		interact and understand users' needs through involving them in the development process. During the requirements capturing, design and development of IT, the socio-technical consideration need to be incorporated into the process to create a balanced system that meets organisational needs

3. Conceptual frame work:

The conceptual framework proposed in this study based on the review of literature is depicted in Figure. 1. The review includes interventions directed at developing a HMIS in one or more workplaces. It therefore includes studies of extra-workplace initiatives arising from legislation, or voluntary programs arising through the government, its agencies, insurance carriers, groups of employers, etc. It also includes studies of workplace-level initiatives, through

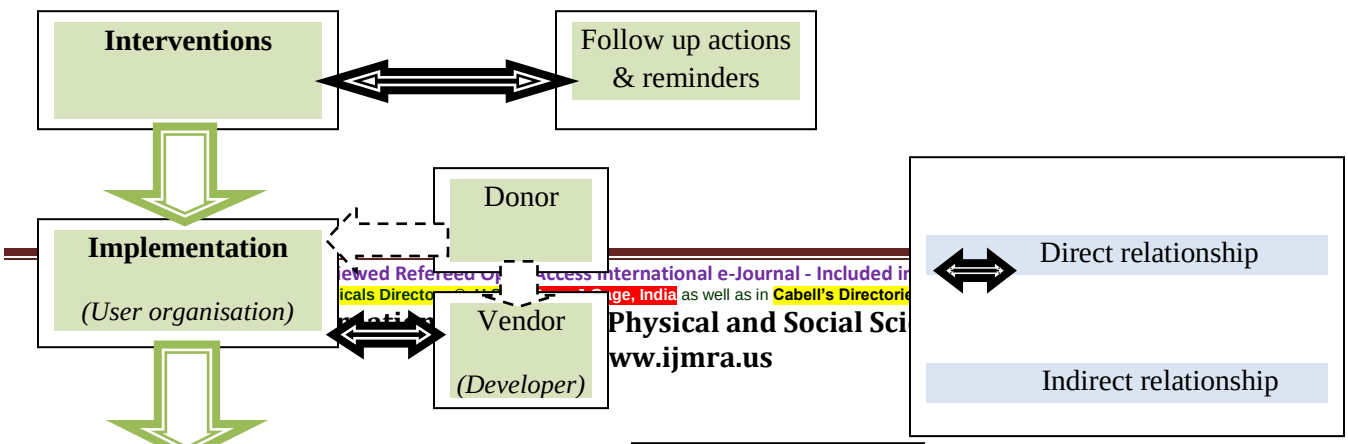
which a workplace may attempt to improve its HMIS, using either a scheme developed externally or internally. Interventions also include follow up actions and reminders that are duly undertaken by the respective user organization.

The implementation phase involves the user organization, donor and vendor (developer). The user organization should work to develop both strategic and operational organizational needs. Reliable data sources should be created and infrastructural resources should be utilized in an optimal manner. Any user organization should cultivate a habit of information dependence and use and further, it should plan for institutionalization of IT processes through organizational change. New organizational changes should be encouraged and such changes can be brought about by skill building and capacity adaptation process. When it comes to technology adoption, user participation is a must and such participation can be enabled by decentralizing the decision making process. The technology management team should concentrate on long-term IT support and such support can be earned by participating in the mobilization of resources process. Duplication of efforts and resources should be avoided by the user organization and proper due importance should be given to the integration processes. Regular evaluation and assessment of IT is a must and only then, the technology will reach the potential users.

In this proposed theoretical framework, the implementation phase is influenced by two factors: one is the donor factor and the other is the vendor factor. Donors are the one who provide funds to the user organization while vendors are the one who sell technology to the user organization. Donors have an indirect relationship with both the user organization and vendor. Vendors can also be called as developers and they are said to have a direct relationship with the user organization for they are the main technology providers. Donors usually promote long-term funding policies and strategies to ensure full institutionalization of processes. The donors have full control over the top level managers and aid workers. When it comes to management, the bottom-up strategy comes into play. Local human capacity building is done through expertise, experience sharing and training. The developers or vendors are expected to follow an iterative, incremental and flexible strategy for system development. The technology should be designed in a simple and user friendly manner. Technology institutionalization can be brought about by involving top and bottom level users in the adoption processes.

Intermediate HIS outcomes are mainly secondary outcomes. Planning and facilitating HMIS training helps to achieve the desired secondary outcomes. In short, they can be called as potential proxies for final HIS outcomes. Apart from training and facilitating conditions, the intermediate outcomes also deal with employee knowledge, beliefs, values or perceptions; employee behaviors and workplace productivity. Final outcomes are identified by considering the ultimate purpose of HMIS interventions. However, the ultimate final outcome is the establishment of a sustainable Health Information system. Here, motivational and de-motivational potentials are of prime importance. The respective health workers and managers should be motivated to the fullest extent and only then, the user organization can dream about a sustainable information system. The final outcome will be the economic outcome. Economic outcomes include information system adoption, hospital growth, doctor – patient relationship, improved patient care at an affordable price, donor profit and vendor initiatives (innovativeness). The donor or the user organization takes care of the long term funding policies. The funding policies formulated by the donor indirectly influence the economic outcomes. Hence, the major factor that contributes to the development of sustainable HIS is the alignment of the interests, roles and responsibilities of the actors involved in the process (the donors, developers and top and bottom level workers). Effective collaboration between these actors is fundamental to sustain the changes achieved in the long run.

Figure 1: Conceptual framework



4. Future trends and conclusion:

The health sector has a lot to offer and gain through the adoption and use of information technology. Enabling technologies in health care can provide efficient access to the much-needed health services. A qualitative synthesis of five case studies was done in this paper. Each of the case studies was found to be unique and they had their own heterogeneous study characters. The review's synthesis of the evidence showed mostly favourable results. There were a few null findings, but no findings of negative effects. These days, major technological advances are opening new vistas of IT-driven healthcare practices. The present day IS researchers are expected to leap into the future and concentrate on three important modern healthcare facilities. The three healthcare delivery facilities are: (1) social media in healthcare, (2) evidence-based medicine, and (3) personalized medicine.

5.1 Social Media in Healthcare

The intersection of healthcare and social media represents a promising space for future IS research. Social media communities have been particularly active in the healthcare domain and they have their own peer production characteristics (Kane et al. 2009). In healthcare sector, there exist strong appropriation mechanisms to substitute for monetary compensation or bring about motivation and absolute participation. The strong appropriation mechanisms mainly involve the following activities: a) willingness to share personal healthcare information, b) desire to make a social contribution, c) increase one's social standing through regular updates. Individuals are more willing to share personal healthcare information through social media. A large pool of potential contributors is readily available in the web these days and such a scenario exists due to knowledge diversity and self motivation. The social media users get equal opportunities to effectively aggregate their diverse medical experiences. Moreover, effective aggregation in the emerging social media platforms happens through information filtering and knowledge synthesis.

5.2 Evidence-Based Medicine

Evidence-based medicine (EBM)—"the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (Sackett et al. 1996). EBM is an idea that goes back decades but has been gaining increased attention among researchers and in the popular press as a tool to address concerns about healthcare costs and quality (Carey 2006). EBM stands in contrast to anchoring decisions on personal habits, tangible and intangible incentives unrelated to care, or medical traditions that have little or no empirical validation. The marked variation across geographic locations in how clinical interventions get prescribed for the same conditions shows that factors other than evidence influence medical decision making (Timmermans and Mauck 2005). The rise in digital storage of personal medical information gives researchers opportunities to discover new kinds of treatments for different diseases. By using digital technology, new kinds of mathematical healthcare modeling and simulations can be enabled in the blink of an eye. This implies that the future healthcare arena can become the bearer of a cornucopia of serve ices from integration (use of electronic records and healthcare analytics tools) to personal assistants and research.

5.3 Personalized Medicine

Personalized medicine means using knowledge about an individual's unique physiological makeup and medical history to tailor medical care most appropriately to that individual. It promises to allow earlier and more precise diagnoses, cheaper and more effective treatments, and minimization of treatment side effects (Glaser et al. 2008). The IS tools should be integrated with the available electronic medical records (EMR) systems. Such integrations provide rich profile data and help the practitioners to identify the best candidates for particular medical interventions.

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On the whole, the health policymakers should allow the market to pick the technology. Consumers (patients) should also have a say in the appropriate level of usage and needs. Privacy and security standards should also be considered while designing the healthcare policies and systems. Hence, policymakers should let the health care industry propose security and privacy standards. Only then, optimal amount of protection can be offered to the patients.

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