INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION & MANAGEMENT

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    INTRODUCTION

    REVIEW OF LITERATURE

    NEED/IMPORTANCE OF THE STUDY

    STATEMENT OF THE PROBLEM

    OBJECTIVES

    HYPOTHESES

    RESEARCH METHODOLOGY

    RESULTS & DISCUSSION

    FINDINGS

    RECOMMENDATIONS/SUGGESTIONS

    CONCLUSIONS

    SCOPE FOR FURTHER RESEARCH

    ACKNOWLEDGMENTS

    REFERENCES

    APPENDIX/ANNEXURE

    It should be in a 8 point Calibri Font, single spaced and justified. The manuscript should preferably not exceed ***5000 WORDS***.

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BOOKS

*   Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
*   Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio" Ohio State University, Nigeria.

CONTRIBUTIONS TO BOOKS

*   Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

*   Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

*   Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

UNPUBLISHED DISSERTATIONS AND THESES

*   Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, KurukshetraUniversity, Kurukshetra.

ONLINE RESOURCES

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WEBSITES

*   Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

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ELECTRONIC HEALTH RECORD IMPLEMENTATIONS AROUND THE WORLD

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ABSTRACT

The United States Congress is promoting the use of electronic health record systems by almost every health care provider. The main reason is the access, sharing and exchange of health information between health-related information technology systems and devices. Other countries are also moving on the same direction. Therefore, a systematic review for an exploratory study was made to find similarities and differences between six countries (United States, Canada, European Union, Australia, Japan, and Kuwait). The most common barrier among countries was the training and learning required. Access to information and reduction of errors was the most common benefit identified. Finally, a comparison is made on the interoperability vision of those countries.

KEYWORDS

healthcare, electronic health record, interoperability, benefits EHR.

INTRODUCTION

There were some changes in information technology during 1980's, which lead to an increase in the level of interest in policies and lately helped in the development of electronic medical record (Berner, Detmer, & Simborg, 2005). Approximately two decades later, the United States Congress approved a new legislation that seeks to computerize medical records by 2014 and later on they identify some incentives to healthcare providers with the purpose of taking the challenge of migrating from a paper-based record to an electronic record system (Hoffman & Podgurski, 2011). On 2008, the National Alliance for Health Information Technology (NAHIT April 2008), defined key terms in this new technology systems so that people know what they are talking about. Definitions were given as follows: an EMR (electronic medical record) is an electronic record of health-related information on an individual that can be created, managed, and consulted by authorized clinicians and staff within one health care organization. An EHR (electronic health record) is basically the same as an EMR, but also has the ability to exchange information interoperably between many healthcare organizations. In addition to the new legislation, in the United States there is a Privacy Rule in regards to a patient's record that healthcare providers must follow. Some concerns regarding HIPAA Privacy Rules are related to patient's privacy rights which will be affected by the implementation of an EHR and for research purpose there may be a concern for what can they do with data available in such systems (Fetter, 2009). At the same time, other countries like Canada, United Kingdom, Spain, Japan, Australia, Denmark and New Zealand has also been pursuing the goal of implementing an EHR by legislations on each of them with the same purpose. The focus on this paper will be to evaluate different countries experiences on the implementation of such systems and relate those experiences with the legislation and the interoperability vision available in each country.

LITERATURE REVIEW

Different terms have been used for the same concept for a patient's electronic record, such as Electronic Care Record, Patient Care Record, Electronic Medical Record, Electronic Health Record, among others. In respect to this paper, the term used from this point and beyond will be EHR, as defined in the introduction section as a patient's electronic record with the ability to exchange information interoperable between many healthcare organizations. The Institute of Electrical and Electronic Engineers (IEEE) defined interoperability as "the ability of two or more systems or components to exchange information and to use information that has been exchanged". From the definition, it is known that an EHR possess the ability to exchange information interoperable with other systems. On one side, complexities of the U. S. health care system had been addressed by Hollar (2009). He stated that electronic health records promise to improve industry standards on health care, at least in countries who seek for a nationally-accepted system. One study presented that accessibility is a factor which negatively influences the use of systems like EHR. This is caused by the thought that you need to have many computers available at all times in order to have access to the patient's records (Ilie, Slike, Parikh & Courtney, 2009). For the purpose of comparing healthcare industry in regards to electronic health records on different countries, we will present each of the countries' legislations, regulations, standards and interoperability status on each of them. In the results section we will summarize our findings.

EUROPEAN UNION (EU)

In Europe governmental bodies have been the driving force behind the development and implementation of EHRs (Durmortier and Verhenneman, 2011). The EHR initiative in United Kingdom (UK) was referred as United Kingdom's National Programme for Information Technology (NPfIT) for the National Health Service (NHS), a $10 billion project to develop the infrastructure for the national electronic health record over a ten-year period. The NPfIT receives its funding from Department of Health (DoH), not from the businesses it serves (Currie and Guah 2006). The development of the Web services architecture will provide an IT platform to facilitate inter and intra organizational data networks. It can provide universal interoperability of geographical location, system hardware, operating systems, or programming languages (Currie and Guah 2006). The main implementation issues were: Quality of technology and Cultural issues. Among the cultural issues are differences in political objectives, poor communication, issues of security and confidentiality, time lag between technology implementation and user training and the Top Down approach for IT adoption and diffusion (Currie and Guah 2006).

The automation of physician's offices in Denmark commenced early as the mid 1980s. By 1990 began the MedCom project. It was a nonprofit company and the sole provider of all healthcare related electronic services in Denmark. The mission of MedCom is to contribute to the development, testing, dissemination and quality assurance of electronic communication and information in the healthcare sector with a view to support coherent treatment, nursing and care. MedCom develops messaging software as well as infrastructure and services to facilitate the secure exchange of healthcare messages (Protti, 2008; D'Agostino and Woodward, 2010). At European level, the epSOS project (European Patient Smart Open Services) develops an interoperability framework for exchanging Patient Summary, ePrescription and eDispensation for mobile patient. It received 122 million in funding from E.U. over three years with the goal of enhancing the safety and quality of care for citizens who require assistance while traveling or living in another E.U. country, (Brosky, 2008). No matter how ahead is Europe,

the international and European standards are not yet widely adopted. They still have issues to pay attention such as: Quality savers issue- the roles, responsibilities and obligations of suppliers and healthcare providers have to be clarified (Digital agenda, Work Program 2011- ICT).

AUSTRALIA

In Australia the national EHR system was initiated following the House of Representatives 'Health On-Line' report (Slipper & Forrest 1997). Australia's health ministers established the Health Information Management Advisory Committee (NHIMAC) in 1998. The National Electronic Health Records Taskforce was established as a subcommittee of NHIMAC in 1999. The Taskforce produced 'A Health Information Network for Australia' (2000), which included a recommendation for a national approach to the implementation of EHRs. Responsibility for the development of the national EHR was assigned to the National e-Health Transition Authority (NEHTA), which had been established by Australian Federal, State and Territory governments to develop essential foundations for eHealth, (Showell, 2011).   In 2009, Commonwealth, state and territory health ministers announced the introduction of an individual health identifier for all Australians. In 2010 Federal Budget included an allocation of $446.7 million over two years as initial funding for the introduction of a personally controlled electronic health record (PCEHR), which is to include a patient summary, (Showell, 2011). The Draft Concept of Operations (DoHA & NEHTA 2011), released as a discussion document, include the description of what is intended for the PCEHR. It also provides details of the policy direction for the development and implementation of Australia's national PCEHR. Extensive safeguards are provided for patient privacy. Patients can control the addition of information to the record, and selectively allow or deny access by healthcare providers and provider organizations. The Menzies Centre for Health Policy and The Nous Group (2008) conducted a survey of the attitudes of 1,200 Australians to the health system. The vast majority (90%) preferred the option of health providers having direct access to their health information, while 65% believed that confidential access to the record without specific consent was acceptable. A vast majority believed that the health record should be available to the treating doctor (99%), to other health professionals providing care (97%) and to the patient (95%). The policy as described appears to match these expectations, (Showell, 2011).

CANADA

The EHR initiative in Canada was referred as pan-Canadian Interoperable Electronic Health Information System. The implementation of the EHR was administered centrally by Canada Health Infoway.   Infoway was created in 2001 to lead the development and implementation of electronic health projects across Canada to support a safer, more efficient healthcare system. It is federally-funded, not-for-profit Corporation, whose members are federal, provincial and territorial Deputy Ministers of Health (Canada NewsWire, 2002; Canada NewsWire, 2007). The mandate of Infoway was to "…accelerate the development and adoption of modern systems of health information, and to define and promote standards governing the health infostructure to ensure interoperability" (Canada Health Infoway, 2015).

Canada had lack of standardized health information-specific legislation applicable nation-wide (D'Agostino and Woodward, 2010). By 2009 the Auditor General of Canada reports problems with the enforcement of standards in Electronic Health Records. The findings reveals that the enforcement of standards was not achieved and testing and processes to address policy breaches were not in place. (D'Agostino and Woodward, 2010). By 2011 an electronic health record was available for almost 50% of Canadians. In order to Canada obtain a nationwide interoperable EHR system by 2015, needs harmonization of privacy legislation nation-wide, clarification of ownership, control and access issues, and to adopt a governance model vigilant of the ownership and privacy questions concerning health record in Canada in order to gain the interoperability of EHR systems.   (D'Agostino and Woodward, 2010).

JAPAN

The Ministry of Health, Labour and Welfare in December 2001, in coordination with the e-Japan strategy of the Japanese Government issued the Grand Design toward Computerization in the Medical Field, which specified healthcare information technology programs planned up to 2006. Thus, the spread of EHRs became a national policy, after one year before, that the Ministry of Health and Welfare in 2000 issued a directive that permitted the storage of medical data in electronic media as long as three criteria, authenticity, visual readability, and storage property, (Hiroshi, 2007). An electronic health record (EHR) system was launched at Kyoto University Hospital in January 2005. The EHR system was introduced with the primary aim of collecting clinical information, constructing databases, and enabling extraction of data for hospital management, analysis of hospital affairs and clinical studies. A possible secondary use of EHRs is the storage of data for clinical and outcomes studies, which might yield financial savings an improvement in data quality relative to use of paper-based records, (Yamamoto, Matsumoto, Tada, Yanagihara, Teramukai, Takemura and Fukushima, 2008). The 2001 supplementary budget provided for a project of Medical Networking Promotion with Advanced Information Technology by the Ministry of Economy, Trade and Industry. Following the Grand Design, the Ministry of Health, Labour and Welfare implemented a project for the improvement of medical facilities equipped with EHRs (budgetary help for 249 medical facilities) in 2002 and 2003, (Yamamoto, Matsumoto, Tada, Yanagihara, Teramukai, Takemura and Fukushima, 2008). By 2006, the estimated adoption of EHR systems was 25 – 27%. The Grand Design achieved only about 50% of its goal.

KUWAIT

In Kuwait the expenditures and funding source for the development and implementation of EHRs as part of the National eGovernement policy and the National eHealth policy, had been from the governmental bodies. In 1999-2003, under the Ministry's computerization program, one of the objectives of the Ministry of Health in Kuwait was to establish an EMR system in all primary healthcare centers. The Ministry aims to improve the quality of healthcare by establishing a modern information technology system in all related processes and extending the system to various levels of healthcare (Ministry of Health 2004). This program, consistent with the Kuwait government's overall plan to have an "electronic government", will improve health professionals' performance, and hence the qualities of patient care. At present, EMR has been implemented in all primary healthcare centers, (Saadoun, Naser and Rafiq, 2009). During the late 1980s and early 1990s, the Gulf Cooperation Council (GCC) revolutionized the entire healthcare delivery system and Kuwait was ahead among the GCC Countries, integrated by Kuwait, Saudi Arabia, Bahrain, Qatar, UAE and Oman, (Mogli, 2009).   In Kuwait the factors needed to accelerate the use of EHRs and interoperability of EHRs include legislation on: personal and health related data, for sharing health-related data between health care staff through EMR/EHR, and for internet pharmacies; and Quality assurance approaches to health-related Internet content among others.

UNITED STATES

The United States Congress approved the Health Insurance and Portability and Accountability Act of 1996 (HIPAA Privacy Rules). HIPAA gives federal protections for information of a patient's health record and states it must be protected from unauthorized access. It also provides patients different rights with respect to the information that a health care provider may obtain to provide them with specific services (US Department of Health & Human Services, 1996).   The privacy rules stated on this act are not defined only to a paper-based record but it cover all information that is exchanged to different entities as the case of billing the health insurance for a services given to a patient. In April 2004, an Executive Order was signed 13335 by the United States' President to create the Office of the National Coordinator (ONC) for Health Information Technology (National Alliance for Health Information Technology, 2008). The objective of this executive order is to further provide the electronic health record to most Americans by 2014 (White House Portal, 2012). From 2004 and beyond, the United States government and different agencies in the healthcare industry had been pursuing the goal and many efforts had been done.   Recently, incentives had been allocated by the United States President Barack Obama by signing the American Recovery and Reinvestment Act of 2009 (ARRA). On 2009, Fetter concluded there is a concern for what can health providers do with data available in such systems.   Not all risks presented are caused by information exchange to external entities. Kin Than (2005) documented in a study that a possible risk presented by a breach of confidentiality may be the result of an authorized users who abuse of their privileges. In this respect, ethical responsibilities of the users of the information stored on EHR systems must also be taken into account (Kin Than, 2005).

The Health Information Technology for Economic and Clinical Health Act of 2009 (also known as HITECH Act), establishes that agencies shall utilize health information technology systems which meets standards certifying the system. The important aspect that United States providers must follow is the need of information exchange. This term, information exchange, has been defined as an electronic movement of health-related information among organizations according to nationally recognized standards (NAHIT, 2008). There is no cohesive medical data privacy policy in the United States and laws that protect the privacy and confidentiality of the information on a patient's record may vary from state to state and within specialties (D'Agostino and Woodward, 2010).

CHINA

In January 2009 China's government announced a $124 billion stimulus package to reform the nation's health care sector over three years (2009-2011), Beijing's $124 billion stimulus package will fundamentally upgrade healthcare services including a Electronic Health Record (EHR) and Regional Health information Networks (RHIN), (Zita,2009). The stimulus plan seeks to address five policy objectives: Increase the number and quality of healthcare facilities; Establish universal healthcare insurance; Reform pharmaceutical and drugs distribution; Improve public healthcare and Hospital reform. They plan to adopt Regional Healthcare Information Networks (RHIN) which will provide data centers and telecommunications networks to share data and clinical services among geographically dispersed communities. The EHR/RHIN vision purpose is to enable the next generation of "tele-medicine" services: powerful telecom networks, shared applications and data centers that allow patients in poor areas to obtain clinical services "virtually", using advanced information and communications technologies. Tele-radiology, video diagnosis, drugs databases, public health disease surveillance, and proved management of medical emergencies are part of the few applications that plan to be provided electronically to remote regions. The lack of standardization complicates the implementation and adoption of unified e-healthcare solutions. It promotes the adoption of multiple unique or customized technical systems, with limited interoperability and portability, encouraging decentralized hospital capital spending, and fragmented competition in the HIT market. From a technical perspective, the challenge is defining the data vocabulary and structure that can capture the different approaches to data reporting already in use by hospitals and health administrators. The challenge of the EHR/RHIN, is the adoption of a national standards and the creation of a new standard for EMR, (Zita, 2009).

NEW ZEALAND

In 1992 the New Zealand government initiated three key strategies that set the stage for the development of its EHR infrastructure. The strategies included the creation of a national health identifier database, the development of health information privacy code, and an agreement with private sector organizations to develop and deliver information services to the sector. Six years later, the New Zealand government provided general practitioner (GP) offices with a onetime grant of approximately $NZ 5000 to purchase computers, and mandated that electronic billing be compulsory. The New Zealand's monetary incentive motivates healthcare providers to participate in the initiative, (Protti, 2008; D'Agostino and Woodward, 2010). HealhLink, a privately owned company, is the sole provider of all healthcare related electronic services in New Zealand. Any additional services provided by HealthLink are paid for by the healthcare providers that utilize them such as laboratories, hospitals and general practitioners. Its sole provider model facilitates the coordination and uniform policies necessaries to ensure consistent data standards versus competing company services that needs more policy oriented decision making, (Protti, 2008; D'Agostino and Woodward, 2010). In New Zealand, HealhLink was an example of health System Integrator (HSI) that facilitates the uptake of national data communications standards, to ensure interoperability with other HSIs and to defer to a national governance framework. These standards are essential to the efficient and effective operation of the health system in New Zealand, (Protti, 2008; D'Agostino and Woodward, 2010).

METHODOLOGY

To conduct this exploratory study, a systematic review was performed to provide a comprehensive summary of literature to combine results from different published articles related to EHR implementation on different countries. For this study, countries selected for the study were United States, European Union, Canada, Australia, Japan and Kuwait. Two additional countries were included for the interoperability comparison discussed later on this article. Articles were collected from professional databases, like ProQuest and EBSCOhost. For the purpose of conducting the study, the analysis performed on the articles founded after the search on the databases was divided in two sections. The first section was about identifying similarities and differences in the factors that influence adoption and implementation of EHR system. To accomplish this, articles selected were from previous studies performed on implementation of an electronic health record in different countries and what benefits and barriers were described in those studies. This includes facilitators, benefits, barriers, limitations and risks. For the selection of articles on this part, we established a date range from 2000 to 2012 as the publication date of the article. Any other article beyond that date range was excluded from the review. The second section focused on legislation and government perspective on health care industry and interoperability of the systems where the main goal was to determine if countries are pursuing the goal of an international health system, able to interact between different countries or just within their own country. Because literature on regulations and legislation about healthcare may be started before 2000's, there was no date range on this regard. Articles used for the second part of the data collection process had no specific requirement in regards to methodology of the study.

FINAL SAMPLE AND REVIEW METHOD

There was a final list of 150 potential articles which can represent the national perspective of the implementation of EHR systems. From those potential articles, only 21 articles were used for the first purpose of the analysis. Articles selected performed a qualitative or quantitative study to identify risks, benefits, barriers and limitations before and after the implementation of electronic health record systems. The studies were conducted on any healthcare specialties, within single offices or within hospital institutions from different physicians. The critical factor for selecting the article for the study was that, at least, they must clearly state the methodology, sample and setting of their study. The results and discussion section of each article was completely analyzed and each factor was looked at the article, in order to see which one identified which factors. An iterative analytical method for saturation was performed, searching for any possible factor mentioned in the article until no more was found on each of them. After all the articles were completely analyzed and no more different article was found from a different country, then all factors were grouped by country. Those groups were used for the analysis and for the comparison between countries.

RESULTS AND DISCUSSION

After the data collection process was completed for the 21 articles selected for the first part of the study, all data was transferred to SPSS Statistics software (version 17). Descriptive statistics and frequency of the factors was retrieved for the first part of the study, which corresponds to the comparison of similarities and differences between countries. There was no correlation analysis performed with the data. The software was used just for frequencies of each factor and frequencies were identified as a whole and also divided by countries. For the purpose of the second part of the study, which is about the government regulations and the interoperability vision among the countries, data will be used based on the literature review on this article. From the 21 articles used as sample for this study, 42.9% of the articles were from the United States (9 of 21) having the highest quantity of articles published and accessible from the databases used for the study. A 28.6% represented European Union (6 out of 21), 14.3% from Canada (3 of 21). Other countries were represented with a 4.8% each one, having only one article in the sample for this study, which are Australia, Japan and Kuwait.

From the articles reviewed in this study, some barriers were identified by the majority (more than 50%) of the articles. First, the training and learning required for using the system represents a clearly majority of the studies with 81.0%. If we compared the results from the individual countries, we also see it was identified in all 6 countries having a high percent of articles in each country. Computer skills needed to use the system was also a significant barrier with 71.4%, which corresponds to 5 of 6 countries identifying it as a barrier where only Kuwait did not mentioned it on their results. The privacy, security, and confidentiality concerns for the records and the time constraints representing longer period of time were both identified with 52.4%. In respect to the individual countries, privacy and security concerns was of high concern on the European Union, Japan and the United States (3 of 6), and time constraints was mentioned on Australia, European Union and Japan (3 of 6).

Other significant barriers identified were the immaturity of the architecture or the system implemented. Loss of productivity and/or efficiency was mentioned in 38.1% of the articles as a barrier, corresponding to Canada, European Union and the United States (3 of 6). Computer and technical errors or problems presented when using an electronic health record was identified in 38.1%, corresponding to the European Union and the United States (2 of 6). Resistance to change or to use the system as also identified in 2 of 6 countries with 38.1% corresponding to Australia and the United States.. Among less common barriers mentioned between the countries are the practice size and quantity of physicians, identified only in the United States, user's age was only mentioned in Kuwait and the ownership of the record was only mentioned in Canada. Each of these three barriers ended with 4.8% of the overall articles. Table 1 summarizes the distribution of the barriers identified in general by all countries represented on the study, which shows results by country and the last column of the table shows the percent represented as a whole.

As opposed to barriers, each country presented different benefits and facilitators. Only two of the benefits were common in 4 of 6 countries compared. Table 2 summarizes benefits/ facilitators identified in the articles. Most of the articles, representing an 81.0%, agreed that the access and availability of the patient's information is a benefit of the electronic health record. The second similar benefit among countries was reduction and identification of errors, which was identified in 4 of 6 countries representing 42.9%. Validation of data input in technology is an important benefit as many simple typing errors are not permitted at the time the health professional is giving the information to the system. Besides those two similar benefits, the benefits identified in each country vary significantly from those identified in other countries. Additional benefits highlighted in the articles are the access to reports, statistics and study reports from the system with a 47.6%, identified in Japan and the United States. Increased safety standards which results in a better quality treatment for the patient represents 47.6% of the overall articles, identified in Japan and the European Union. Those are highly related because physicians, nurses and other professional may access the patient's record and reports summarizing the treatment progress and giving recommendations to their treatments, so they may give the patients what they need in order to continue improving their health. Quality treatment will be the result of such information availability. Overall patient satisfaction was identified in 42.9% as increasing after the use of an EHR. The patients rely more on the accuracy on the electronic record than to a paper-based record.

TABLE 1: BARRIERS IDENTIFIED BY COUNTRY

BARRIERS	AUSTRALIA (%)	CANADA (%)	EU (%)	JAPAN (%)	KUWAIT (%)	US (%)	ALL (%)
1-LOSS OF PRODUCTIVITY/ EFFICIENCY	-	33.3	33.3	-	-	55.6	38.1%
2-PRACTICE SIZE/ QUANTITY OF PHYSICIANS	-	-	-	-	-	11.1	4.8%
3-USER'S AGE (PHYSICIANS, SECRETARY)	-	-	-	-	100	-	4.8%
4-PRIVACY/ SECURITY/ CONFIDENTIALITY	-	33.3	66.7	100	-	55.6	52.4%
5-IMPLEMENTATION/ MAINTAINING COSTS	-	33.3	16.7	100	-	22.2	23.8%
6-COMPUTER SKILLS NEEDED	100	66.7	66.7	100	-	77.8	71.4%
7-LACK OF STANDARDS (WITHIN INDUSTRY)	-	-	16.7	-	-	22.2	14.3%
8-TRAINING/ LEARNING REQUIRED	100	66.7	83.3	100	100	77.8	81.0%
9-COMPUTER/ TECHNICAL OR PROBLEMS	-	-	50	-	-	44.4	38.1%
10-TRIANGULACION	-	33.3	33.3	100	-	11.1	23.8%
11-LOW CUSTOMIZATION	100	-	33.3	-	-	11.1	19.0%
12-IMMATURITY OF ARCHITECTURE OR SYSTEM	100	-	33.3	100	-	55.6	42.9%
13-LACK OF ACCESABILITY	100	33.3	16.7	-	-	22.2	23.8%
14-TIME CONSTRAINTS	100	33.3	66.7	100	-	44.4	52.4%
15-SCEPTICISM/ RESISTANCE TO CHANGE	100	-	33.3	-	-	55.6	38.1%
16-INDIVIDUAL/ ORGANIZATIONAL CULTURE	-	33.3	-	-	-	44.4	23.8%
17-OWNERSHIP/ CUSTODIAN OF THE RECORD	-	33.3	-	-	-	-	4.8%

TABLE 2: BENEFITS AND FACILITATORS IDENTIFIED BY COUNTRY

BENEFITS	AUSTRALIA (%)	CANADA (%)	EU (%)	JAPAN (%)	KUWAIT (%)	US (%)	ALL (%)
1-ACCESS/ AVAILABILITY OF INFORMATION	-	100	100	100	-	77.8	81.0%
2-FLEXIBILITY OF THE SYSTEM (CUSTOMIZE)	-	-	-	-	100	-	4.8%
3-EASY TO USE (USER FRIENDLY)	-	66.7	16.7	-	100	33.3	33.3%
4-TYPING ABILITIES FROM THE USERS	-	33.3	-	-	100	22.2	19.0%
5-TECHNICAL PERFORMANCE FROM THE USERS	-	33.3	33.3	-	-	33.3	28.6%
6-FAVORABLE ORGANIZATIONAL CULTURE	-	-	16.7	-	-	22.2	14.3%
7-EXPERT HUMAN RESOURCE	-	-	33.3	-	-	33.3	23.8%
8-MULTIDISCIPLINARY TEAMS	-	-	16.7	-	-	11.1	9.5%
9-REGULAR ASSESSMENT	-	-	16.7	-	-	22.2	14.3%
10-STANDARIZATION OF DOCUMENTATION	-	33.3	-	-	-	22.2	14.3%
11-ENHANCE COMMUNICATION	100	33.3	33.3	-	-	77.8	52.4%
12-COMPLETENESS OF RECORD	-	66.7	33.3	-	-	77.8	52.4%
13-OPTIMIZE PATIENT SCHEDULE	-	-	16.7	100	100	11.1	14.3%
14-ACCESS TO REPORTS/ STATISTICS/ RESULTS	-	33.3	33.3	100	-	66.7	47.6%
15-SEARCHABLE CAPABILITIES OF THE SYSTEM	-	-	50	-	-	33.3	28.6%
16-SAVES TIME (BILLING, SEARCH RECORD)	100	33.3	16.7	100	-	44.4	38.1%
17-INCREASED SAFETY STANDARDS (QUALITY)	-	33.3	66.7	100	-	44.4	47.6%
18-REDUCTION/ IDENTIFICATION OF ERRORS	-	66.7	50	100	100	22.2	42.9%
19-COST SAVINGS (LONG RUN BENEFIT)	-	-	-	-	-	11.1	4.8%
20-INCREASE PATIENT SATISFACTION	-	33.3	83.3	-	100	22.2	42.9%
21-FLAGS/ WARNINGS PROVIDED	-	-	16.7	-	-	22.2	14.3%
22-INCENTIVES/ GRANTS/ FUNDS	-	-	-	-	-	22.2	9.5%

Table 3 presents the results of interoperability status in different countries measured by five variables. An electronic health record is required in 100% of the countries used for this study, meaning that all of these countries have been pursuing the successful implementation of electronic health records. All countries in this analysis have also assigned some funds and/or monetary incentives to physicians in order to implement such systems. From the eight countries included in this analysis, 75.0% have adopted legislation (6 of 8) and 25.0% have not (2 of 8). In respect to standards, none of the countries (0.0%) was found that have adopted successfully national standards, 12.5% has partially adopted national standards (as the case of the European Union where 12 of 27 countries had partially implemented EHR) and the majority of the countries has not adopted successfully national standards on their implementation of EHR systems for a 87.5% (7 of 8). In the implementation, 50.0% administer the implementation of EHR systems centrally (4 of 8) and 50.0% have decentralized administration of the systems (4 of 8).

TABLE 3: INTEROPERABILITY STATUS AMONG THE COUNTRIES

Country	Required (Y/N)	Assigned Funds and/or Monetary Incentives (Y/N)	Adopted Legislation (Y/N)	Adoption of National Standards (Y/P/N)	Implementation Administered Centrally (Y/N)	Punctuation (Max 5.0)
E.U.	Y	Y	Y	P*	Y	4.5
Australia	Y	Y	Y	N	Y	4.0
Canada	Y	Y	Y	N	Y	4.0
Japan	Y	Y	Y	N	N	3.0
Kuwait	Y	Y	N	N	N	2.0
U.S.	Y	Y	Y	N	N	3.0
China	Y	Y	N	N	N	2.0
New Zealand	Y	Y	Y	N	Y	4.0

*Partially implemented (Implemented in 12 European Countries).

CONCLUSIONS

Our study provides a specific contribution to the emerging electronic information exchange in the healthcare industry and also in the international business area. The top management and administrative personnel in the government and private organizations need to know the current trends in different countries so they can compare and know the future on this nationally-adopted health technology.   More works needs to be done in respect to the implementation of electronic health record systems to document recent facts on the adoption of this technology. This review highlights specific similar and different trends in the adoption of a nationally-accepted electronic health system. It may provide a useful foundation for further comparisons between countries and somehow guide future works about interoperability of health systems among countries.

After finding similarities and differences on implementation of electronic health records among countries, we may conclude that there are more common barriers within the countries on the process of transition from a paper-based record to an electronic record.   The more common barriers were training and learning required using the system and computer skills needed by the users. Privacy, security and confidentiality were also identified in 3 of 6 countries used for the study. At the same time, some benefits were common among countries like reduction and identification of errors and access and availability of the information. Those benefits were identified in 4 of 6 countries. However, additional benefits and facilitators were quite different on each country which was common only in 2 of 6 countries. Among this benefits are that electronic health records enhance communication between providers and patients, it also increases overall patient satisfaction, saves time and are perceived as easy to use, among others. Besides the two main benefits, others were not similar within countries.

Future work may include additional countries for a more complete comparison on the implementation and interoperability of electronic health records around the world. This study was limited to only six countries in the comparison on the implementation of EHRs and eight countries in the comparison of the status of interoperability, and may be of quite interest if more countries are added on both analyses. In addition to finding similarities and differences on the implementation of EHR, more factors and variables for the analysis of interoperability of electronic health records in a national perspective may be useful for a more comprehensive comparison. More countries and variables may extend and enhance our analysis on this regard.

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