

# **The Status Quo of Health Information Technology and Health Information Management Efficiency in Saudi Arabia: A Narrative Review**

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## **Abstract**

The goal of this narrative literature review is to explore the current status of the reality of Health Information Technology (HIT) infrastructure in Saudi Arabia. The results of this study have indicated that poor HIT infrastructure in Saudi Arabia has exacerbated problems and retarded the adoption of electronic healthcare practices, which have suffered a reduction in technical project resources, primarily due to high costs, which occurs not only in Saudi Arabia, but also regionally and globally. Further, HIT practices in Saudi public hospitals have suffered a reduction of HIT specialists, training and awareness programs, as well as poor management. This study also revealed that the Electronic Health Record System (EHRs) implementation strategies were unsuccessful, and the National Informational Technology Plan appears too long-term and rigid. However, these unsuccessful ventures are secondary, and consequential to, a core triangle of interdependent, negative factors that persistently impede the development of the Saudi Arabian healthcare technology infrastructure, represented by: (1) an inadequate, partially dysfunctional HIT infrastructure further weakened by each implementation failure; (2) a dire shortage of suitably-qualified Health Information Management (HIM) professionals, incapable or reluctant to train application users, let alone additional staff members in their own department; (3) the failure to have implemented Health Data Standards, in accordance with International Organization for Standardization specifications.

**Keywords:** Health Information, Health Data Standards, HIT, HI, HIM, Saudi Arabia, EHRs

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## **1 Saudi Arabia's Healthcare Framework**

Health services in Saudi Arabia are free to citizens and expatriates, who are working in the government institutions, excluding those in hospitals owned by the private sector. However, health cover is provided for expatriate workers in Saudi Arabia by their sponsors in the private sector [1, 2]. In Saudi Arabia, there are three sources of health services: the Ministry of Health (MOH), other government health providers and private health sector providers [3]. Most health services belong to the public healthcare provider, the MOH, while the remainder is divided among the private sector and other governmental institutions such as the National Guard, Higher Education, Ministry of Defence, and Aramco [2, 4]. Historically, the health services in Saudi Arabia began in 1926 with the establishment of the Department of Health, mandated to provide healthcare for citizens in Saudi Arabia [5]. In 1954, the Saudi government was established the Ministry of Health [6]. Saudi Arabia is considered the biggest oil exporter in the world, and 90% of all Saudi exports are oil products. Since the discovery of oil in Saudi Arabia in 1970, it has been the mainstay of Saudi economy [7]. The oil wealth has provided the Saudi government the opportunity to improve the healthcare services [8].

## **2 The Status Quo of Saudi Arabian Health Information Technology**

Several Saudi Arabian studies, conducted on the national status of HIT indicate a complex web of circumstances leading to a low adoption rate. In general, a slow rate of HIT uptake permeates Saudi Arabia, despite extensive steps by hospitals in all healthcare sectors to upgrade their infrastructures, including HIT. A failure to define challenges and design solutions has had an accumulative effect. A number of researchers have analysed the factors obstructing HIT infrastructure improvements, particularly in the public hospitals. While the debate on strategies to improve the Saudi healthcare continues, much research over the past decade has pointed to the minimal use of HIT, and acknowledged that inadequate HIT infrastructure represents a challenge to all healthcare improvements [9, 10]. Sadly, there is unanimity that the absence of a strong HIT infrastructure on which to implement an electronic invention to transfer or share medical data, will present difficulties from the start.

There is a literary consensus that the underdeveloped HIT infrastructure in Saudi healthcare organizations, has not only had a significant negative impact on the improvements of healthcare, but has given rise to further challenges facing healthcare organizations. Alsadan, Elmetwally [11] noted that although information technology displays continuous improvements in developed countries in all fields including the economy, social welfare and the healthcare sector, there remains a significant lack of development of HIT in developing countries,

especially in the Arab world. The evidence of this study shows that the HIT has made a very late appearance in Arab countries, compared with developed countries. Otero, Almerares [12] emphasized that in most developing countries, there is a lack of HIT development, such that regulations, policies, implementation and standardization are scarce. Recent literature proves that the implementation of electronic health stalls in the preliminary stages in Saudi Arabia, as well as confirming the lack of HIM specialists, HIT infrastructure, software-hardware compatibility and dedicated funding, which hinders the adoption HIT development [13, 14].

The absence of health data standards and lack of awareness of the need interoperability has escalated HIT problems, according to the most recent studies, which all agree that Saudi Arabia must deal with longstanding challenges, before successfully upgrading the HIT infrastructure. Electronic health practices in Saudi Arabia commenced in 2000, when the government established a committee to overview electronic healthcare implementation [15]. This committee reported that inferior health data posed an initial challenge for health providers in the conversion to electronic health. In 2005, the government established the Saudi Association for Health Informatics, tasked with increasing awareness among healthcare professionals, of the benefits of using electronic health, by promoting scientific conferences in this field [15]. However, a lack of awareness of HIT solutions is increasingly recognised as a worldwide challenge. Union [16] noted that “[In the European Union] there is a lack of awareness of, and confidence in, eHealth solutions among patients, citizens and healthcare professionals.”

Saudi health services have displayed even less awareness of the need to improve HIT systems. Altuwaijri [17] noted that health services in Saudi Arabia had recently made great progress, with some health organizations receiving international recognition; notwithstanding, there remains a significant lack of understanding of health informatics practises, and an absence of related training programs. Recently, King Saud bin Abdulaziz and other universities, established educational programs in health informatics, following the recommendations of the International Medical Informatics Association. However, Alsulame, Khalifa [18] pointed not only to the current status of electronic health and its low implementation rate, but emphasized the minimal research assessing this unfortunate status quo. Studies conducted in MOH hospitals also noted a lack of HIT infrastructure, as well as integrated and compatible electronic connection programmes to exchange health information. There has been insufficient application of standardised electronic health networks among MOH hospitals [17, 19]. These insights present serious concerns to improve the side of health information in the country.

Poor HIT infrastructure development has been a consequence of Saudi healthcare providers’ failure to produce a unified strategy to purchase crucial software. This implies that basic mutual policy is ignored. The results of random purchasing of health technology software are evident, with individual hospitals from all providers in Saudi Arabia showing different strategies towards purchasing health

software. This has downgraded the efficiency of performance of HIT software. Alomeer [20] noted that the majority of hospitals across the country, representing all health providers, have all used different vendors. Thus, the hope of achieving interoperability and health data standardization to conduct Health Information Exchange (HIE) successfully and securely has not formed a part of policy and planning.

Some researchers explored the current status of electronic health in non-MOH Saudi hospitals. Al-Harbi [21] revealed that a survey conducted at King Abdul-Aziz Medical City (KAMC) had evaluated the implementation of health informatics, in terms of obstacles, benefits and motivations. The results indicated that the majority of healthcare employees at KAMC knew how to use health information applications and perceived these as valuable and useful. Obstacles included a shortage of computers and technical failures. The study found that hospital staff lacked training, as well as technical and management support. In terms of this study, KAMC does not reflect the MOH status quo which covers about %60 of healthcare services in the country.

Some researchers compared MOH and other governmental hospitals, regarding HIT development. Almalki, Fitzgerald [22] noted that although electronic health systems were being used in some hospitals in other sectors, such as King Faisal Specialist Hospital and Research Centre, utilization of these in the MOH hospitals was minimal.

In researching solutions to improve the HIT infrastructure in all health providers, Alsulame, Khalifa [23] conducted a case study into the perceptions of nine health informatics department heads of Saudi hospitals. The outcome suggests that there is a need for a national supervisory organisation to monitor electronic health and develop a national plan to implement e-health initiatives. Similarly, Alkrajji, Jackson [24] emphasized that the absence of a national reference organisation represents a challenge to improving e-health in developing countries. They noted that in Saudi Arabia, the lack of health data standards and plan for Medical Information Management, affected electronic health in general.

A number of longitudinal studies on electronic health have attempted to explain the challenges facing Saudi Arabia. Almalki [25] asserted that the situation was more severe for hospitals with minimal HIT. This included MOH public hospitals, whose regimes seemed ineffectual in managing the problems. The researcher proposed that the best option for improving the healthcare system in Saudi Arabia would be the privatization of public hospitals and development of a healthcare HIT infrastructure.

As the need for HIT development has been a continuous thread in the studies reviewed and its current inadequacy will provide a considerable stumbling block for the implementation of any electronic invention serves health information, it is important to grasp the HIT status quo in Saudi health organizations. Altuwaijri [26] argued that the adoption of electronic health is important in Saudi Arabia for the following reasons: (1) the majority of health centres and hospitals still use paper documentation of patient information; (2) there has been a major increase in the

volume of health-related information; however, incompatible systems, with minimal or no interoperability, are accumulating disconnected pools of information in different health sectors and hospitals; (3) the majority of information systems in current existence are of an administrative nature, rather than being patient focused. Saudi healthcare systems are organisation-based, rather than patient-oriented.

Over the past few years, a number of researchers have also sought to determine the challenges of adding specific HIT components of the Hospital Information Systems (HIS) infrastructure, in Saudi Arabia. Khalifa [27] revealed that despite some HIS usage in the Middle East, there were several challenges to using this technology successfully in the healthcare system in Saudi Arabia. The study identified the challenges facing Saudi hospitals in the use of HIS, of which eighteen related to technical and seventeen to human aspects. The results confirmed a high resistance by physicians to using HIS, attributed mainly to their lack of knowledge regarding the usage of information systems. The study suggested increasing HIS awareness, training for healthcare professionals in HIS, and improving the underlying HIT infrastructure in Saudi hospitals.

Several studies revealed that Saudi hospitals failed to consider the latest technical, training and awareness measures, in order to avoid confrontation with recalcitrant healthcare professionals, whose attitude according to researchers is founded on a lack of knowledge and training. Alkrajji, Jackson [28], Khalifa [29], Alkrajji, Jackson [30] and Khudair [31] all emphasized the resistance to innovation among healthcare professionals, in a profession in which keeping abreast of current developments in all departments, is considered crucial. Aziz [32] noted that in Arab countries, including Saudi Arabia, there is always resistance to healthcare system innovations by healthcare professionals.

Hayajneh and Zaghoul [33] used a survey to identify challenges facing health providers in selected Arab countries, including Saudi Arabia, in implementing HIT in their hospitals. The descriptive cross-sectional survey results indicated that financial resources, cost, poor management, bureaucracy, staff Information Technology (IT) competency, lack of qualified IT staff and lack of awareness of HIT values constitute the barriers. The researchers stated that, "lack of qualified Information Technology staff was perceived to be a barrier, mostly in Saudi Arabia" (P.3).

Discussing IT strategic planning in Saudi Arabia more than a decade ago, McConnell [34] noted that it should entail an initial five years of a total IT general strategy covering twenty years. The researcher noted that the Computing Society of Saudi Arabia, as well as the King Faisal Specialist Hospital, had been working together with the MOH, in formulating and establishing a systematic and well-developed infrastructure for health information, as part of the National Informational Technology Plan (NITP). However, a rigid and integrated twenty-year plan seemed unrealistic, as NITP was only in the planning stages. The plan entailed eHealth, eLearning, as well as Telemedicine. This strategy intends to reduce the negative reception accorded HIT developments among healthcare

professionals.

Regarding Saudi healthcare strategies, Uluc and Ferman [15] noted recently: “[Saudi’s MOH], has launched the e-health programme and the related strategy in 2011 which has been planned to be implemented in two phases, where each phase is referred as a five year programme.” However, all studies reviewed, emphasized longstanding shortcomings preventing the advancement of electronic health Saudi Arabia. Ultimately, the Ministry of Health in Saudi Arabia must be made aware of the minimum level of HIT infrastructure required by health organizations, in order to keep abreast of the global development in this field. Fundamental areas of focus are electronic health records, health data standards, health information exchange, clinical coding and HIM.

Alkrajji, Jackson [30] mentioned the lack of health data standards adoption by hospitals in their study designed to explore factors influencing the implementation of Decision of Health Data Standards in Saudi tertiary hospitals. Their findings indicated that poor IT infrastructure, including technological factors such as switching costs and lack of compatibility of health data standards, represents the greatest challenge to adoption of these standards. In a more recent study with the same focus, Alkrajji, Jackson [28] noted that major barriers included a lack of a data exchange plan and the absence of an effective national regulator. Another obstacle was lack of reasonable HIT policy relating to the national healthcare system and information management. Further, transformation costs and technical barriers to data standards were noted. There is increasing concern that a failure to inculcate health data standards throughout Saudi healthcare organisations will impact adversely on the healthcare system development.

The use of HIE through the HIT infrastructure in Saudi Arabia reveals a lack of reliable evidence in healthcare literature. Attallah, Gashgari [35] reviewed the literature for the period and found that, although the MOH has prioritised the adoption of HIE practices at all levels of healthcare, effective implementation is jeopardized by uneven HIT infrastructure and variations in data formatting and semantic ontology standards. The researchers did contend that the likelihood of implementation of HIE is strong, because the MOH considers this system more advanced than implementing EHRs in its healthcare institutions. Once Saudi Arabia succeeds in implementing HIE, this will allow healthcare professionals to share patient medical information securely electronically. This contention seems optimistic and contrasts with the position of so many recent studies, which agree that Saudi Arabia faces several unresolved challenges to improving the HIT infrastructure, especially in MOH hospitals, which have not yet upgraded to EHRs which are a vital component of HIE practice.

### **3 Electronic Health Records in Saudi Arabia**

EHRs are no longer optional in global healthcare, forming the basis of the clinical

documentation, reimbursement through health insurance and the HIE, at all levels. That Saudi public hospitals are still in the preliminary stages of implementing EHRs, is confirmed in several studies. In assessing the early implementation of EHRs in Saudi hospitals, all researchers show concern regarding the limited extent of successful implementation in hospitals [36, 37].

Although EHRs are being used in a few hospitals in Saudi Arabia, challenges still face these hospitals in completion of the implementation process, mainly related to dedicated budgets, as well as technical and administrative barriers [38, 39]. While technical issues pose a challenge to overall Saudi healthcare, they present a specific threat to implementing EHRs. Generally, healthcare researchers voice concern about the level of existing HIT infrastructure which stifles healthcare advancement. Hasanain and Cooper [39] revealed that HIT infrastructure and social challenges are considered the biggest barriers to the implementation of EHRs in Saudi Arabia. This study recommended that to overcome these barriers, there was a need for further investigation and planning, particularly in improving knowledge among healthcare professionals who deal with patient records, on the value of EHRs.

A World Health Organization (WHO) report dealing specifically with EHR implementation in developing countries, listed high cost, lack of clinical terminology standards, and resistance from healthcare professionals based on a lack of technology literacy [40]. An EHR-focused Saudi study indicated that, due to the widespread manual patient record systems still employed in Saudi public hospitals, intensive work would be required for the implementation of EHRs [41]. Hence, the lack development of EHRs in public hospitals is actually the outcome of a lack of thorough planning strategies and a neglect of necessary minimum technical standards. This study also indicated that hospitals in the governmental and private sectors faced several challenges to the successful implementation of EHRs, listing resistance from healthcare professionals to new technologies and managerial attitudes and lack of dedicated budgets as the primary obstacles. Khudair [31] noted that to overcome the resistance to EHRs, demands convincing and training physicians at the outset.

Alternatively, noteworthy progress in EHRs in certain governmental hospitals, which fall outside of the scope of the public provider, has been reported. The National Guard Health Affairs hospital, King Abdulaziz Medical City, as early as 2001, became one of the first hospitals to have implemented EHRs in the Eastern Mediterranean Region of the Middle East [42]. Despite that isolated success, a decade later, Al-Harbi [21] found that most Saudi health organizations were totally dependent on traditional manual paper methods of patient recording keeping, or used non-integrated software tools, such as patient admissions software. The same year, Bah, Alharthi [43] revealed that of nineteen public hospitals in the Eastern Province of Saudi Arabia, participating in their comparative study, only three representing 15.8% of the study locations, were using EHRs. These three hospitals had successfully implemented standardised EHRs. They identified the major challenge faced by these hospitals in

implementing EHRs, as a lack of interaction between physicians and nurses.

More recently, Saudi healthcare researchers have focussed on the challenges facing EHR implementation process in public hospitals. Mahalli [44] discussed the barriers facing nurses using EHRs in three public hospitals in the Eastern Province, where the system had already been implemented. The study found that loss of access, in the case of computer or power failure, was considered the most common barrier. Additional barriers listed included lack of continuous training and support for IT staff in hospitals. This indicates a lack of awareness, in management and administrative sectors, of core nursing staff needs. The study recommended the establishment of an EHR committee to highlight problems facing staff in using EHRs.

The inferior HIT infrastructure in Saudi public hospitals, in comparison with the other governmental hospitals, has compromised EHR adoption. Alsaifi [45] observed that while some other governmental hospitals had successfully implemented the integrated EHRs, there was a significant delay in overcoming barriers facing the implementation process in MOH hospitals. The study suggested that the MOH needed to overcome specific individual challenges in order to improve healthcare services. These included shortage of workforce, lack of an integrated system and a general negative attitude from doctors towards the implementation of EHR. To eliminate these stumbling blocks, a national strategy was introduced by the MOH in 2009, under the governance of the Saudi Health Council. A further strategy implemented by MOH to improve the quality of health care services is the eHealth Strategy.

Khudair [31] had already surveyed physicians' perceptions on introducing EHRs in Saudi hospitals. The study findings also listed resistance to the implementation process from hospital directors and health decision-makers, as well as technical and training issues. However, both earlier and later studies show that the implementation of EHRs is still in the very preliminary stages in Saudi Arabia. Mohamed and El-Naif [46] and Hasanain, Vallmuur [47] contended that lack of knowledge formed the basis of healthcare professionals and physician's resistance to EHRs.

## **4 Current Health Information Management Practice in Saudi Arabia**

That Saudi hospitals are still in the preliminary stages of understanding the role of HIM in the modern healthcare system is confirmed by the minimal national research in that area of healthcare. Foremost, a lack of HIM professionals has persisted for many years. However, the Saudi Health Information Management Association (SHIMA) was established under the supervision of CBAHI, and a step forward took place, with employment category of HIM professional having being included in Saudi hospital staffing structure, since 2012 [48]. SHIMA prepares

short, medium, and long-term HIM action plans, formulates programs and procedures for implementing HIM developments, as well as conducting, monitoring, and evaluating, policy and implementation processes. SHIMA also submits periodic reports to the relevant hospitals departments to assist in fast-tracking HIM innovations at national, provincial, district and city levels.

It has been observed that SHIMA achieved considerable success in the initial stages following its establishment, through facilitating an open discussion forum for members, in order to improve national HIM practices. During the last few years, however, the list of fundamental HIM challenges has not been heeded and dealt with. More qualified HIM professionals, raising awareness of the benefits of EHR have been presented as the key to addressing the resistance to implementing clinical coding in Saudi hospitals which recently adopted. Khalifa [29] noted that the lack of a qualified HIM professionals, together with a lack awareness of the advantages of EHRs, and other electronic health applications, persists.

Identifying factors influencing the implementation of HIM practices such as clinical coding or EHRs is crucial, especially at the commencement, in order to develop solutions favourable for all Saudi hospitals involved in the process. Thus, there was a need to build a body of knowledge on those applications, for Saudi hospitals, to disseminate an awareness of its accepted benefits. MOH leadership must ensure that technological imbalances among hospitals are addressed prior to making policy resolutions regarding the implementation. It is absolutely fundamental to ensure that the HIT infrastructure in public hospitals offers compatibility and interoperability with a new system. The required complement of professional HIM and HIT staff, including trainers, must be assessed, as well as the impact that initial training and the transition to a functional new system will have on ongoing workloads.

## **5 Conclusion**

It may be concluded that an adequate HIT infrastructure is fundamental to enhancements in healthcare organizations. Improvements to daily healthcare functions are subservient to improvements in health technical infrastructure. Examining the vast difference in the aims and prescribed guidelines of Saudi hospitals, and their actual technical practices, highlights a very limited understanding of HIT. The weak HIT infrastructure, has actually cast doubt on the value of implementing advanced technical practices. While general commentary on the technological and staff preparedness for recent initiatives to improve HIM such clinical coding implementation, arising from the Saudi healthcare literature review, will provide the conclusion to this paper, the issue of leadership recalcitrance demands commentary here. Resistance from non-professional human resource sectors can be overcome by inspired, dedicated leadership, and encouragement with offers of training which can lead to career advancement. However, when health decision-makers, hospital directors and

medical practitioners, display resistance to innovation, due to an inflexible approach that leaves them trapped in the routines that were practiced at the start of their professional careers, but are now outmoded, there exists a leadership vacuum. While not clearly proven, this lack of committed leadership, may well be partially to blame for ‘vicious circle’ that sees all meaningful progress stall.

## References

- [1] Aldossary A, While A, Barriball L, Health care and nursing in Saudi Arabia. *International nursing review*, 55(1), (2008), 125-128.
- [2] Walston, S., Y. Al-Harbi, and B. Al-Omar, The changing face of healthcare in Saudi Arabia. *Annals of Saudi medicine*, 28(4), (2008), 243-250.
- [3] Almasabi, M., An Overview of Health System in Saudi Arabia. *Research Journal of Medical Sciences*, 7(3), (2013), 70-74.
- [4] Ministry of Health. *Health Statistical Year Book*, Saudi Arabia, 2014.
- [5] Mufti, M. H, *Healthcare development strategies in the Kingdom of Saudi Arabia*. Springer Science & Business Media, 2000.
- [6] Niblock, T., *Saudi Arabia: Power, legitimacy and survival*. Routledge, 2004.
- [7] Jannadi, B., et al., Current structure and future challenges for the healthcare system in Saudi Arabia, *Asia Pacific Journal of Health Management*, 3(1), (2008), 43-50.
- [8] Saati, A., Principles of hospital management: applications in Saudi Arabia. *Riyadh: King Fahad National Library*, (2000).
- [9] Almuayqil, S., A. Atkins, and B. Sharp, Knowledge management framework for e-healthcare in Saudi Arabia, *The Seventh International Conference on eHealth, Telemedicine, and Social Medicine*, (2015), 112-117.
- [10] Alkrajji, A., *Issues of the adoption of HIT related standards at the decision-making stage of six tertiary healthcare organisations in Saudi Arabia* (Doctoral dissertation, © Abdullah Ibrahim Alkrajji), 2012.
- [11] Alsadan, M., et al., Health Information Technology (HIT) in Arab Countries: A Systematic Review Study on HIT Progress. *Journal of Health Informatics in Developing Countries*, 9(2), (2015), 32-49 .
- [12] Otero, C., et al., Health Informatics in Developing Countries: A Review of Unintended Consequences of IT Implementations, as They Affect Patient Safety and Recommendations on How to Address Them. *IMIA Yearbook*, (1), (2016), 70-72.
- [13] Alharbi, F., A. Atkins, and C. Stanier, Strategic Framework for Cloud Computing Decision-Making in Healthcare Sector in Saudi Arabia, *The*

- Seventh International Conference on eHealth, Telemedicine, and Social Medicine*, (2015), 138-144.
- [14] Alharbi, F., A. Atkins, and C. Stanier, Understanding the determinants of Cloud Computing adoption in Saudi healthcare organisations, *Complex & Intelligent Systems*, 2(3), (2016), 155-171.
- [15] Uluc, C.I. and M. Ferman, A, comparative analysis of user insights for e-health development challenges in Turkey, Kingdom of Saudi Arabia, Egypt and United Arab Emirates, *Journal of Management Marketing and Logistics*, 3(2), (2016), 176-189.
- [16] Union, E., Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels, *eHealth Action Plan 2012-2020-Innovative healthcare for the 21st century*, (2014). P.5.
- [17] Altuwaijri, M., Supporting the Saudi e-health initiative: the Master of Health Informatics programme at KSAU-HS. EMHJ, *Eastern Mediterranean Health Journal*, 16(1), (2010).
- [18] Alsulame, K., M. Khalifa, and M. Househ, E-Health status in Saudi Arabia: A review of current literature, *Health Policy and Technology*, 5(2), (2016), 204-210.
- [19] Altuwaijri, M., Electronic-health in Saudi Arabia. Just around the corner?, *Saudi medical journal*, 29(2), (2008),171-178.
- [20] Alomeer, S. H., *Integration of clinical information systems in Saudi Arabian health care contexts: A grounded theory exploration* (Doctoral dissertation, Queensland University of Technology), 2016.
- [21] Al-Harbi, A., Healthcare Providers' Perceptions towards Health Information Applications at King Abdul-Aziz Medical City, Saudi Arabia, *International Journal of Advanced Computer Science and Applications*, 2(10), (2011), 14-22.
- [22] Almalki, G. Fitzgerald, and M. Clark, Health care system in Saudi Arabia: an overview, *Eastern Mediterranean health journal*, 17(10), (2011),784-793.
- [23] Alsulame, K., M. Khalifa, and M. Househ, eHealth in Saudi Arabia: Current Trends, Challenges and Recommendations, *Studies in health technology and informatics*, 213, (2015), 233-236.
- [24] Alkrajji, A. I., Jackson, T. W., & Murray, I. R., Steps towards the Development of National Health Data Standards in Developing Countries: An Exploratory Qualitative Study in Saudi Arabia, *World Academy of Science, Engineering and Technology, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 8(6), (2014), 1625-1631.
- [25] Almalki, M. J., *Quality of work life and turnover intention in primary healthcare organisations: A cross-sectional study of registered nurses in Saudi Arabia* (Doctoral dissertation, Queensland University of Technology). 2012.

- [26] Altuwaijri, M., Health Information Technology Strategic Planning Alignment in Saudi Hospitals: A Historical Perspective, *Journal of Health Informatics in Developing Countries*, 5(2), (2012), 338-355.
- [27] Khalifa, M., Technical and human challenges of implementing hospital information systems in Saudi Arabia, *Journal of Health Informatics in Developing Countries*, 8(1), (2014), 12-25.
- [28] Alkrajji, T. Jackson, and I. Murray, *Barriers to the widespread adoption of health data standards: an exploratory qualitative study in tertiary healthcare organizations in Saudi Arabia*. *Journal of medical systems*, 2013. **37**(2): p. 1-13.
- [29] Khalifa, M., Barriers to health information systems and electronic medical records implementation. A field study of Saudi Arabian hospitals, *Procedia Computer Science*, 21, (2013), 335-342.
- [30] Alkrajji, A.I., Jackson, T. and Murray, I., Factors Impacting the Adoption Decision of Health Data Standards in Tertiary Healthcare Organisations in Saudi Arabia, *Journal of Enterprise Information Management*, 29(5), (2016).
- [31] Khudair, A., Electronic health records: Saudi physicians' perspective. in *Appropriate Healthcare Technologies for Developing Countries*, *5th IET International Seminar on Appropriate Healthcare Technologies for Developing Countries*, (2008).
- [32] Aziz, H.A., A review of the role of public health informatics in healthcare, *Journal of Taibah University Medical Sciences*, 12(1), (2017), 78-81.
- [33] Hayajneh, S. and A.A. Zaghloul, Barriers to the Adoption of Health Information Technology in Arab Countries' Hospitals: Practitioners' Perspective, *24th International Conference of the European Federation for Medical Informatics Quality of Life through Quality of Information–MIE2012*, (2012).
- [34] McConnell, H., International efforts in implementing national health information infrastructure and electronic health records. *World hospitals and health services: the official journal of the International Hospital Federation*, 40(1), (2004), 33-7.
- [35] Attallah, N., Gashgari, H., Al Muallem, Y., Al Dogether, M., Al Moamary, E., Almeshari, M. and Househ, M.S., A Literature Review on Health Information Exchange (HIE), *International Conference on Informatics, Management and Technology in Healthcare*, 226, (2016), 173-176.
- [36] Alqahtani, A., R. Crowder, and G. Wills, Barriers to the Adoption of EHR Systems in the Kingdom of Saudi Arabia: An Exploratory Study Using a Systematic Literature Review, *Journal of Health Informatics in Developing Countries*, 11(2), (2017), 1-23.
- [37] El Mahalli, A.A., Electronic health records: Use and barriers among physicians in eastern province of Saudi Arabia, *Saudi Journal for Health Sciences*, 4(1), (2015). 32-41.

- [38] Baus, A., Literature review: barriers to the successful implementation of healthcare information systems. *Office of Health Services Research, West Virginia University Department of Community Medicine, Morgantown, WV*, 2004.
- [39] Hasanain , R.A. and H. Cooper, Solutions to Overcome Technical and Social Barriers to Electronic Health Records Implementation in Saudi Public and Private Hospitals, *Journal of Health Informatics in Developing Countries*, 8(1), (2014), 46-63.
- [40] World Health Organization., *Electronic health records: manual for developing countries*. 2006.
- [41] Alanazy, S., Factors Associated With Implementation Of Electronic Health Records In Saudi Arabias [Thesis]. *University of Medicine and Dentistry of New Jersey, ProQuest*, 2006.
- [42] Altuwaijri, M.M., Sughayr, A.M., Hassan, M.A. and Alazwari, F.M., The effect of integrating short messaging servicesreminders with electronic medical records on non-attendance rates, *Saudi medical journal*, 33(2), (2012), 193-196.
- [43] Bah, S., Alharthi, H., El Mahalli, A.A., Jabali, A., Al-Qahtani, M. and Al-kahtani, N., Annual survey on the level and extent of usage of electronic health records in government-related hospitals in Eastern Province, Saudi Arabia, *Perspectives in health information management/AHIMA, American Health Information Management Association*, 8(Fall), (2011).
- [44] Mahalli, A.E., Adoption and Barriers to Adoption of Electronic Health Records by Nurses in Three Governmental Hospitals in Eastern Province, Saudi Arabia, *Perspectives in Health Information Management*, 12(Fall), (2015).
- [45] Alsahafi, Y.A., Studies of EHR implementation and operation in different countries with particular reference to Saudi Arabia, (Master dissertation, Massey University), 2012.
- [46] Mohamed, B.A. and M. El-Naif, PHYSICIANS', NURSES'AND PATIENTS'PERCEPTION WITH HOSPITAL MEDICAL RECORDS AT A MILITARY HOSPITAL IN RIYADH, SAUDI ARABIA, *Journal of family & community medicine*, 12(1), (2005).
- [47] Hasanain, R.A., K. Vallmuur, and M. Clark, Electronic Medical Record Systems in Saudi Arabia: Knowledge and Preferences of Healthcare Professionals, *Journal of Health Informatics in Developing Countries*, 9(1), (2015), 23-31.
- [48] Saudi Health Information Management Association. 2017 [cited 26/08/2017; Available from: <http://shima.org.sa/index.php/en/>].