

# The Utilization of E-Health in the Kingdom of Saudi Arabia

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**Abstract** - Scattered publications exist detailing the evolution of E-Health services in the Kingdom of Saudi Arabia. However, the initiation of the Saudi Vision 2030 has brought increased interest in more comprehensive understanding and implementations of E-Health services within the greater health system of the Kingdom. As the Kingdom of Saudi Arabia seeks to diversify its economy, it is also focusing on the development and improvement of all public services through technology and on helping the health sector meet the standards of the western world. The purpose of this research thus was to gather and present not only a kingdom-wide understanding of E-Health service implementations, but also a breakdown of their distribution, practices, and innovations at hospitals in the Kingdom that are moving from traditional health practices to E-Health systems. Data was gathered about 508 hospitals, including bed capacities, accreditation status with the Central Board for Accreditation of Healthcare Institutions (CBAHI), and utilization of 45 identified E-Health services across regions, social sectors, and political affiliations. Overall statistical information across the kingdom is presented as well as graphical depictions of the cross-sectioned data to showcase the number of hospitals which make use of E-Health Systems in the Kingdom. While the Kingdom is growing in its implementation and utilization of E-Health services, there is still great room for expansion in many aspects of Saudi society, particularly in the area of purely electronic E-Health services.

**Key Words:** Health, Hospitals, E-services, E-health, KSA, Vision 2030

## 1. INTRODUCTION

The Kingdom of Saudi Arabia's (KSA) Vision 2030, an initiative set up to reduce Saudi Arabia's dependence on oil by diversifying its economy, also seeks to improve and develop all public services through technology and to enable sectors such as health to meet the standards of the western world. The economic and development affairs sections of the vision express a long-term goal and expectation that Vision 2030 will build upon the country's unique strengths and capabilities. The vision intends to guide the country's aspirations towards a new phase of development with the aim of creating a vibrant society in which all citizens can fulfill their dreams, hopes, and ambitions to succeed in a thriving economy [1]. The Saudi Ministry of Health (MOH) has thus been launching several health initiatives related to the National Transformation Program (NTP) 2020 and the Saudi Vision 2030, with the realization that a new health

system is necessary to fully address both current and future needs. These initiatives also acknowledge that the new system must be based on non-traditional methods of financing, management, evaluation and development [2]. Accordingly, MOH has outlined an E-Health strategy to comprehensively overhaul and expand the healthcare services of the Kingdom [2]. However, one piece of this intricate puzzle is the question of how technology can be maximized for the development and expansion of the health sector in order to meet the world-class standard that Vision 2030 intends to achieve.

E-Health, which is the use of information and communication technologies (ICTs) to enhance and improve upon a wide range of health and care services through tools such as telecare, electronic medical records and health day analytics [3], has been of great interest to MOH ever since its introduction to the world. MOH Initiative 2030, in correspondence with NTP 2020 and Saudi Vision 2030, seeks to establish systems that will be compatible with current data while prospecting for future data, as a means of coming up with a health system that meets all needs for years to come as well as maintaining currently achieved health and safety standards [2]. E-Health has made the work of health services very easy and effective through its dependence on technology. With E-Health, doctors are able to administer treatment for patients, improve decision-making to respond to the ever-growing number of diseases, conduct research and monitor public health. Research [4] has revealed that despite the multiplicity of health service providers in KSA there have been no coordination or clear communication channels among them, which results in a waste of resources and duplication of effort. Although there has been an observance of computerized systems in hospitals and clinics for documentation, billing, patient bed management, and lab reports, systems have lagged behind in the integration of medical health records. In response to criticisms about the use of obsolete methods for in-patient treatment plans, manual nursing notes and manually accessed clinical information, studies highlight the fact that in KSA more than 95% of physicians use personal data assistants (PDAs). However, as a whole region, barely 1% of health service providers are using this technology; thus, the criticism holds valid that in the majority of health contexts, the core need for technology systems is still not satisfied [5]. There has been an uptick in E-Health systems moving slowly into MOH institutions, and a number of information systems have been in operation in the regional directorates and other central hospitals. Yet none of these systems are connected to

each other or to other private or specialized health organizations [6].

The paper (i) describes the importance of implementing E-Health technology to meet both international standards and the Kingdom of Saudi Arabia's own vision for healthcare; (ii) evaluates the current state of E-health utilization at 508 Saudi hospitals, and (iii) makes recommendations for improving E-health technology utilization throughout the Kingdom of Saudi Arabia.

### 1.1 Vision 2030 and Technology

One of the goals of Vision 2030 is to significantly increase the proportion of patients who receive complete medical treatment within certain amount of time, from emergency room entrance to exit from hospital, without sacrificing quality of care. Being able to increase this proportion from 36% to 54% [7] will, without doubt, need a good health plan, one that makes use of state-of-the-art technology in the health sector. Achieving the goals set in Vision 2030 for health care will entail serious implementation of Information technology (IT), but IT will be a fundamental aspect of meeting all the aims of Vision 2030, not only those of the health sector. IT has always been a major contributing factor in the creation of good businesses and the striving of the world's great economies. As an example of this, results from research on economic growth in developing countries of the Middle East and Northern Africa (MENA) and in Sub-Saharan Africa (SSA) over a period of 10 years (2007-2016) showed that communications and information technologies such as internet usage, mobile phones, and broadband adoption were the main drivers of economic growth [8]. Using information and communication technology (ICT) contributes significantly to growth and development because it raises productivity and work efficiency by enabling creativity, stimulating innovation and, most importantly, assisting penetration and persistence in global markets. ICT enables the participation of all stakeholders in programs and projects regardless of their location and physical distance if they have access to an available ICT network infrastructure [9]. The adoption and use of ICT by individuals and enterprises in the public and private sectors have been rising rapidly in recent years, and International Data Corporation (IDC) has outlined a number of strategies that Saudi Arabia could employ in order to facilitate its Vision 2030 goals and thereby develop a digital economy and society [10]. Saudi Arabia is, after all, the Middle East's largest spender on ICT, with technology spending estimated at \$35 billion for 2015 and expected to surpass \$39 billion by 2019 [10].

Hence a focus on the use of technology in the betterment of healthcare in the country is reasonable as well as essential. In fact, for sustainable development in any country, there should be universal health coverage that includes financial risk protection, access to quality essential health-care services and the availability of safe, effective, affordable essential medicines and vaccines [11], all of which can be achieved with the effective use of technology. Despite the achievements of the current structure of the Saudi healthcare system with MOH as primary provider and financier (covering

approximately 75% of the health care services), there are a rising number of issues concerning the quality of healthcare in KSA [12]. Some of these issues surround safety in the dispensing of medication, a rise in medical errors, the provision of treatment in a timely manner, long waiting lists, and the compilation of discharge instructions for continuing care. These issues degenerate the quality of healthcare in the Kingdom [12], but all can be addressed through better application of E-health technologies. In high-income countries, healthcare efforts can be maximized through the use of IT, and numerous studies focus on the use of e-health or health IT for prevention, treatment, health maintenance and wellness in various countries [13]. Technology is clearly on the rise these days, with everyone having some kind of technological gadget in hand, and Saudi Arabia (at 68% of the population) marks the highest number of people with internet access among Middle Eastern countries [13]. Yet there is a gap in the conjoining of technology to health care.

Vision 2030 will involve modern infrastructures, state of the art social facilities, and a First World standard of public services among many other achievements, and without any doubt all will be built using ICT. One of the main motives of the vision is to make KSA an open place for foreign investors and businesses, a goal which demands a technology-equipped environment. Moreover, to attract the number of investors needed for Vision 2030's massive projects, authorities have also placed significant investment in online campaigns and marketing strategies [14]. The resulting strategies have included the use of websites, TV and radio advertisements, emails, YouTube, and other social media platforms to share the vision more closely with the world, attracting the attention required to achieve its objectives [14]. This clearly shows how technology is an inseparable part of Vision 2030 and hence, for a great achievement in health care by 2030, there should be high patronage and utilization of e-health in KSA.

### 1.2 Health Services in KSA

Both as keepers of the Islamic holy sites and in agreement with Islam's historical commitment to the preservation and development of knowledge in scientific and medical fields, the Kingdom of Saudi Arabia has always had a keen eye on improving health services. In fact, KSA is ranked by the World Health Organization as 26th in the world in terms of health systems [15]. This ranking has been reached in part because of the MOH's consistent commitment to achieving excellent health results, as demonstrated through a decentralization policy that gives hospitals autonomy in planning, recruitment of professional staff, formulation of agreements with health services providers, and limited financial discretion [16]. The MOH also has cooperated actively with other governments such as those of Germany, the Netherlands, Thailand, and India, in exploring how to improve public hospitals [17]. Delivery of health services to the citizens and expatriates living in KSA has not been overlooked. The MOH provides about 60% of health services free of charge through 13 health directorates. Another 20% of health services are delivered free through other government agencies, and the remaining 20% of services are

provided by the non-government sector, which is growing rapidly [16]. However, in providing these extensive medical services, there has only been a small push for the greater use of technology to raise the standard of health services in KSA. Worldwide, health information technology (HIT) has become a fundamental basis for healthcare improvement and is a key benchmark for enriching the quality of health care, enhancing patient management, and extending excellent results in the delivery [5]. In Saudi Arabia too, consumers have begun to consider digital health technology as an integral part of effective health management. About 84% of consumers note the importance of technology in managing their health. They use websites (44%), applications (40%), social media (41%), and wearable technology (14%) to address their own health needs. Some consumers also use remote consultation (24%) and remote monitoring (12%) for health management. Further, health applications related to fitness (46%) and diet/nutrition (54%) are the very popular among users. About 81% of consumers acknowledged better care when their doctors accessed and used Electronic Health Records (EHR) [18]. Moreover, Saudi consumers are eager to track their health using digital tools and to share the data with their healthcare providers (HCPs) [18]. However, most health sectors still use old machinery and outdated technology and software in the delivery of health services rather than embracing new technology. Additionally, the health system of KSA has had a great dependence on expatriates for staffing, including doctors and physicians, and this is expected to continue for a long time despite an estimated 15,226 Saudi doctors joining the Saudi health force by the year 2020 [16]. With such a huge workforce of expatriates in KSA health fields, health services clearly need greater standardization in order to meet the Vision 2030 aim of improved health care. A KSA health system that is equipped with the right technology and utilizes e-health will ensure the trustworthiness of services not only for nationals but also for the large expatriate community that depends on both public and private hospitals for quality health care. Hospitals that are highly equipped with state of the art technology will attract a more experienced staff of doctors, nurses, and administrators to the health sector, thereby boosting the economy of the country as well. Current MOH statistics indicate a widely uneven distribution of health care services and health professionals across the country's geographical areas [19], and this could be the effect of not having the right technology in linking and creating communication between hospitals across regions within the country. Until now, even though health services are of a generally good quality, they have yet to reach all residents within the kingdom.

### 1.3 E-Health in KSA

E-Health services have brought about a tremendous change in the administration of health systems worldwide. Health systems have benefited from automating many tasks that were once done manually, moving from paper to paperless services and digitizing so that records are now interconnected for a more efficient and uniform system. In KSA, five major health authorities serve the majority of the

population in health, with the MOH managing 60% of hospitals, four other authorities managing an additional 20%, and the public sector managing the remaining 20% [20]. MOH having the majority of facilities in the health sector has been working on connecting hospitals to each other through a national plan for an E-Health service, since some hospitals have computerized systems while others do not. Even among those hospitals that do have computerized health information systems, the systems come from different vendors and are not integrated, creating a complex set of difficulties for the implementation of a nationwide E-Health system [17]. Improvement of healthcare is indeed a major component of Vision 2030 which calls for enhancing access to care, improving the value of the care provided, and strengthening preventive measures for the health status of residents [21]. Saudi Arabia currently has a national health care system in which governmental agencies provide 78.9% of total health services. A budget of SR 4 billion (US \$1.1 billion) has been allocated for this strategy to overcome the heretofore slow transition to IT and to improve the quality of healthcare services. Although 40% of MOH hospitals currently have electronic health records, primary healthcare centres still rely on paper-based records and are in a transition to adopt information technology [21]. Adoption of an E-Health System has thus been moving slowly in the MOH institutions, with a number of different information systems operating in the regional directorates and in central hospitals, without being connected to each other [22]. E-Health has, however, been picking up in recent years in KSA, with Makkah City hospitals [23] indicating a strong increase in E-Health usage. King Abdulaziz Medical City (KAMC) also makes use of an E-Health system and electronic concept as an adopted approach, with 98% of its departments utilizing E-Health programs [23]. Furthermore, King Faisal Hospital (KFH) has also adopted an E-Health system in around 96% of its departments, while Al Noor General Hospital E-Health system is at 76.9% adoption as it implements new applications of E-Health [23]. Since this is not enough, in preparation for wider implementation of E-Health in all hospitals before the completion of Vision 2030, MOH through the NTP is developing alternative funding sources for technology by increasing shares of ownership available to the private sector and by utilizing private sector management to improve the efficiency and effectiveness of HIT and digital transformation [24]. MOH has also moved to improve governance in the health-care system through a digital accountability mechanism [25]. Furthermore, the MOH through its 4 billion Saudi Riyals (1.1 billion USD) committed between 2008 and 2011 for the holistic development of E-Health programs and to improve the maturity standing of the country's health information infrastructure [26] is clearly providing a boost in the economy due to the utilization of technology in the health sector.

## 2. METHODOLOGY

In order to determine how distant hospitals are embracing and utilizing E-Health for their day-to-day administration of health services and to determine how technology is being advanced in KSA's health sector as a means of meeting Vision 2030's proposed high standard of health care, data was gathered from 508 hospitals identified by the MOH, located throughout the kingdom. Public information sources such as governmental resources, official websites, and information published (officially or tangentially) on the public internet, as well as direct email and voice communications with officials and administrators of hospitals, were used to come up with a comprehensive dataset. The hospitals selected were considered relative to 45 identified E-Health services. For each hospital, the number of beds, the CBAHI accreditation status, geographical region, societal sector, and political sector affiliation was also compared. Any characteristics that could not be determined during the gathering of the data were assigned a value of zero for the purposes of this research. For each hospital that provided any of the 45 E-Health services, an index was determined by multiplying the number of provided E-Health services by the number of beds and then dividing by the total number of beds for all hospitals in the division that provided any of the 45 E-Health services. This measurement is intended to provide an understanding of the relative impact of the E-Health services provided in each hospital based on the service capacities of the hospital for the division in question. Data from the 508 hospitals about accreditation status, geographical region, societal sector, and political affiliation was gathered so as to derive an understanding of which geographic regions in KSA had more hospitals that made use of E-health services, how E-health services are improving lives within different segments of the kingdom, and how much MOH and the government as a whole have achieved so far with the utilization of E-Health services in KSA. The data gathered here show how E-Health is currently being utilized and what impact that will have as Vision 2030 is implemented.

### 2.1 CBAHI Hospitals with E-Health

In this study, it was important to compare CBAHI accredited hospitals with non-accredited hospitals in the gathering of data, since CBAHI hospitals conform to basic rules and codes given by the government of KSA and because accreditation for healthcare institutions involves an accrediting body surveying and verifying compliance with recognized criteria/standards. It has been considered a useful tool to establish national standards and reduce variations in medical practice, and it has been shown to mitigate inappropriate medical care and improve the cost-effectiveness especially in strict and recessive economies [27]. KSA is one of the first countries in the eastern Mediterranean region to implement health care accreditation standards. The Central Board of Accreditation for Healthcare Institutions was established in October 2005

by MOH, and it now has approximately 45 health institutes across the country [28]. The Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) is the official agency authorized to grant accreditation certificates to all governmental and private healthcare facilities operating today in Saudi Arabia [27].

From an overall perspective across the kingdom, the 508 hospitals studied collectively had a capacity of 49,282 beds for patients, but out of these hospitals, only 116 were found to be CBAHI accredited, with a collective capacity of 17,587 beds. Of the 508 researched hospitals, only 172 hospitals, with a collective capacity of 27,356 beds, were found to provide any of the 45 E-Health services identified for this study. Of these, 67 were CBAHI accredited, with a collective capacity of 11,273 beds. On average, each E-Health service was provided by about 27 of the 172 hospitals, with each of the 172 hospitals providing an average of 7 E-Health services. By a wide margin, the eight most popular E-Health services provided, in order, were: providing feedback by patients, interacting with hospitals admin on social media, delivering patient education, making appointments, supplying maps, listing information about patients' rights and responsibilities, helping to find a doctor, and outlining hours of operation. The dominant popularity of these services seems to indicate that utilization of healthcare facilities in the kingdom is primarily oriented towards physical interaction with hospitals and physicians rather than utilization of purely online resources. Data gathered from the 172 hospitals saw patients being asked to come back for results one day after treatment and requests and staff needing to write down all prescribed drugs for the patient.

Charts 1 through 9 (shown below) provide a graphical understanding of the data based on three primary pieces of information: number of hospitals, capacity in beds, and the average number of E-Health services provided. The three primary pieces of information are cross sectioned in three ways: by region, social sector, and political affiliation. Charts 1 through 3 illustrate the numbers of hospitals. Charts 4 through 6 relay hospitals' bed capacities. Charts 7 through 9 show average numbers of E-Health services provided. Table 1 presents the 45 identified E-Health services along with the percentages of hospitals that implemented them, among those that implemented any of the E-Health services.

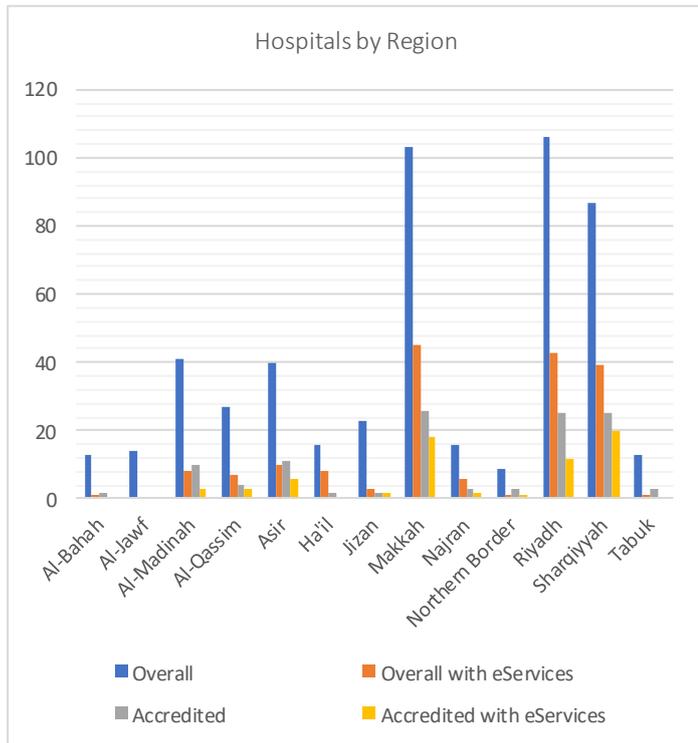


Chart -1: Hospitals by Region

Chart 1 showcases information gathered about hospitals by regions in KSA with E-services as well as accredited hospitals with E-services. Major cities like Riyadh and Makkah registered high numbers of hospitals providing E-services.

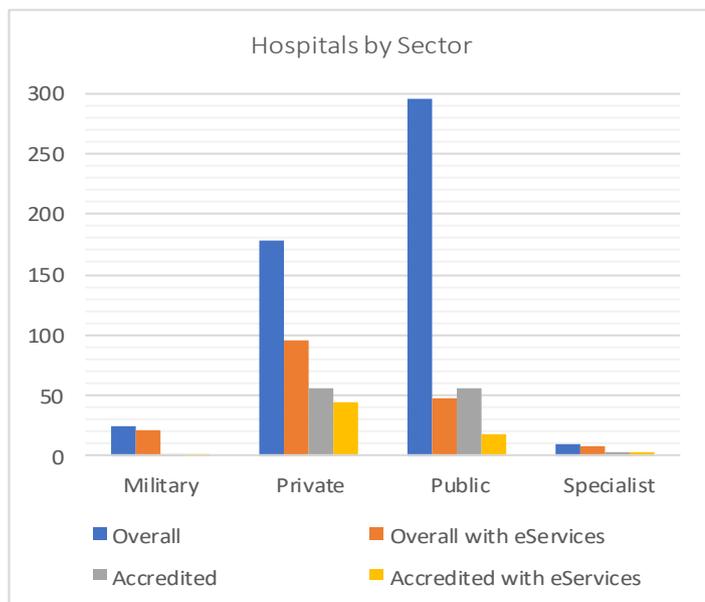


Chart -2: Hospitals by Sector

Chart 2 provides data showing the number of both accredited and unaccredited hospitals who have E-services

established. Although many hospitals were in the public sector, the private sector clearly had more hospitals with E-services.

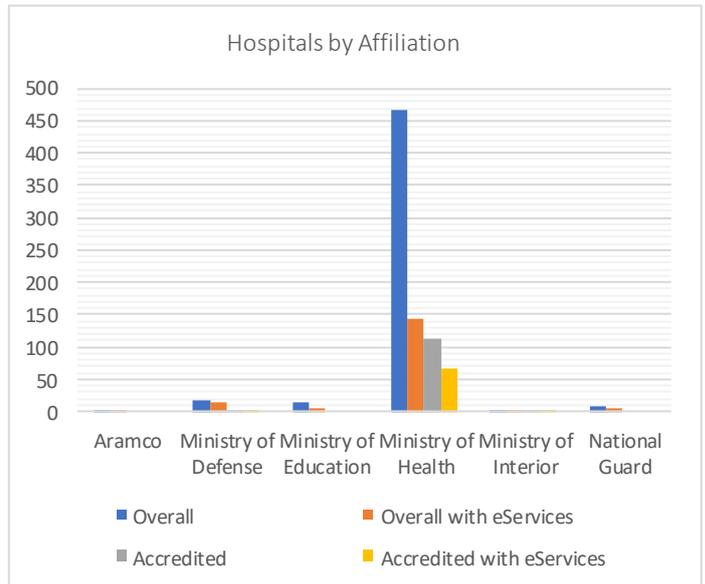


Chart -3: Hospitals by Affiliation

Chart 3's data shows hospitals by affiliation. A look at the collected data shows that among a high number of hospitals of any affiliation, few hospitals are making use of E-services.

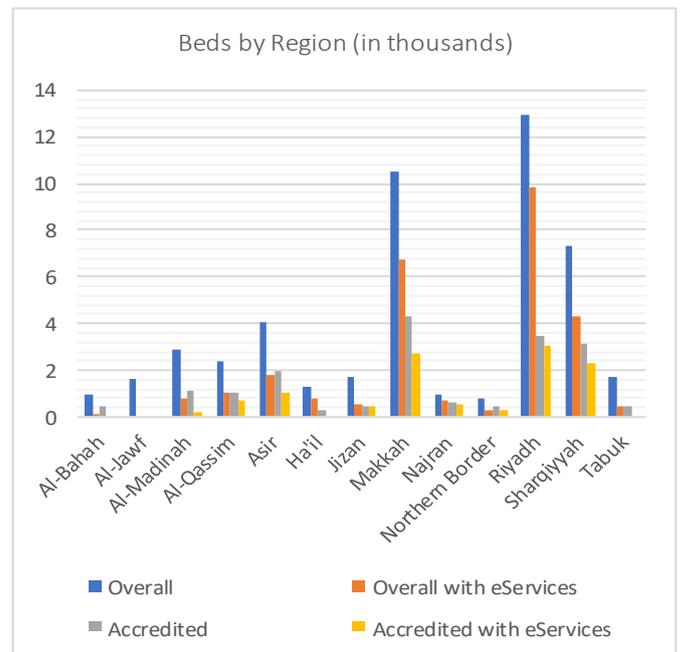


Chart -4: Beds by Region

Beds by Region are illustrated in Chart 4, where data was gathered on the number of beds in hospitals in the regions. Riyadh, Makkah, and Sharqiyyah showcased high numbers of both beds and E-health services.

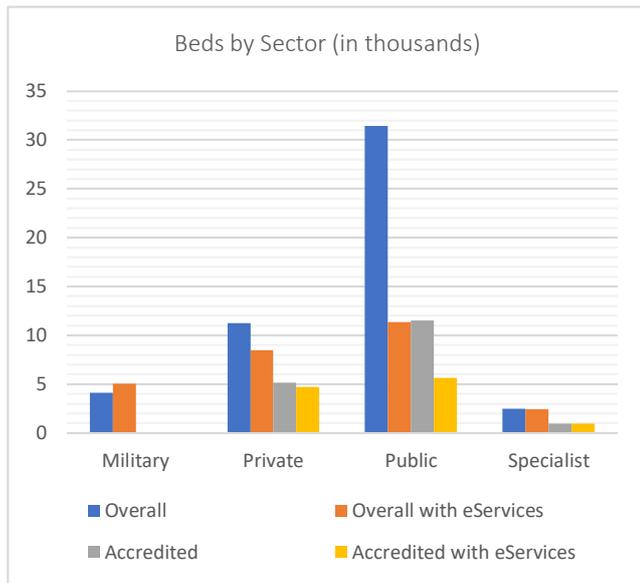


Chart -5: Beds by Sector

Also, in **Chart 5** one can easily see that the number of beds by sector shows the public sectors making more use of E-health services than the private sector.

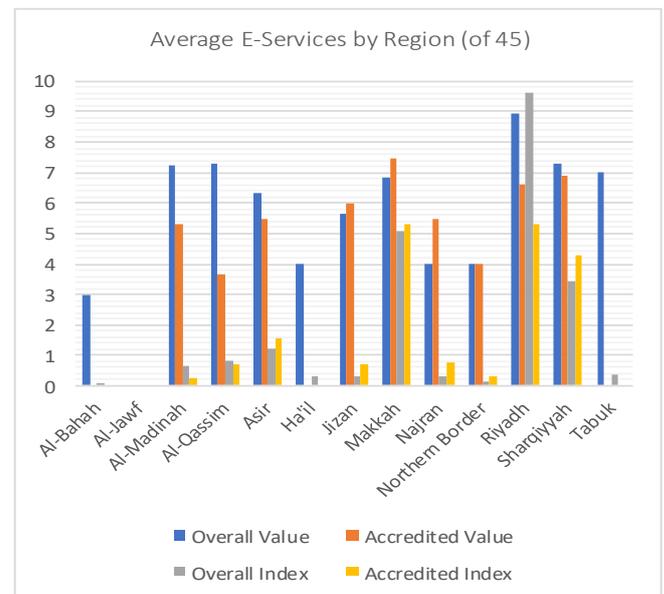


Chart -7: Average E-Services by Region (of 45)

Data gathered in **Chart 7** shows an average of the 45 E-Services as provided by region. Clearly, most of KSA's major cities reached higher accreditation standards.

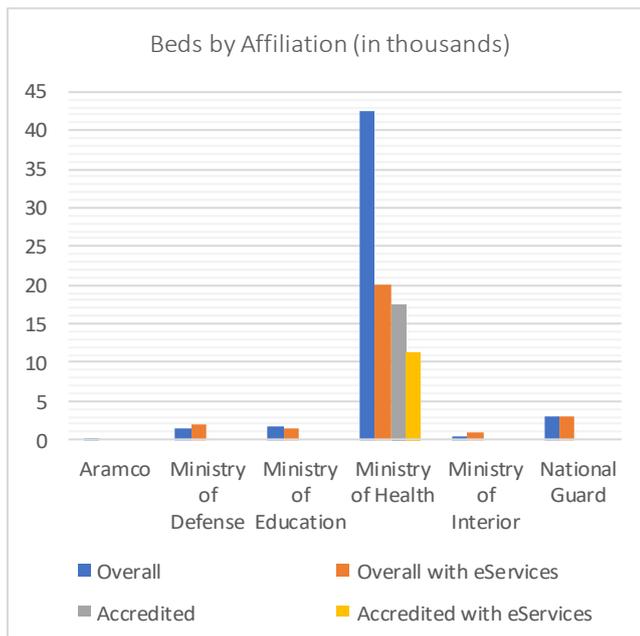


Chart -6: Beds by Affiliation

**Chart 6** also shows hospital beds by affiliation and highlights that larger hospitals associated with the Ministry of Health utilized a larger number of E-Health services.

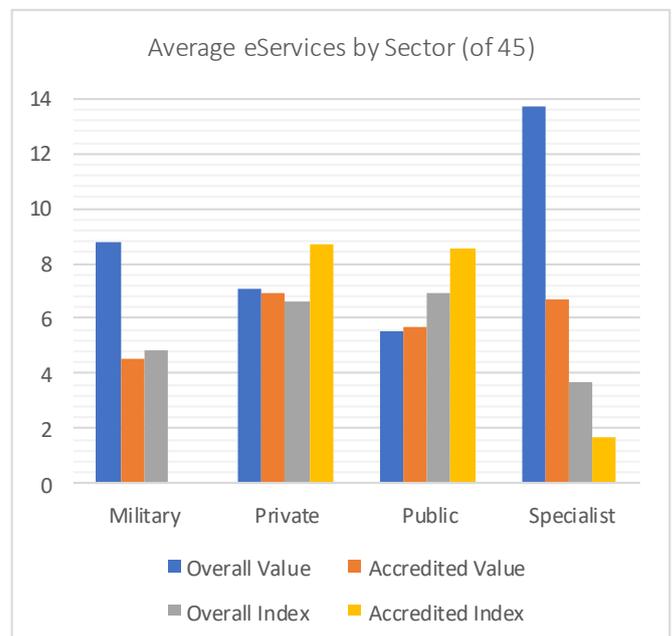


Chart -8: Average E-Services by Sector

**Chart 8** showcases the average availability and use of E-Services by sector with private hospitals having a higher accreditation value and index than the other sectors.

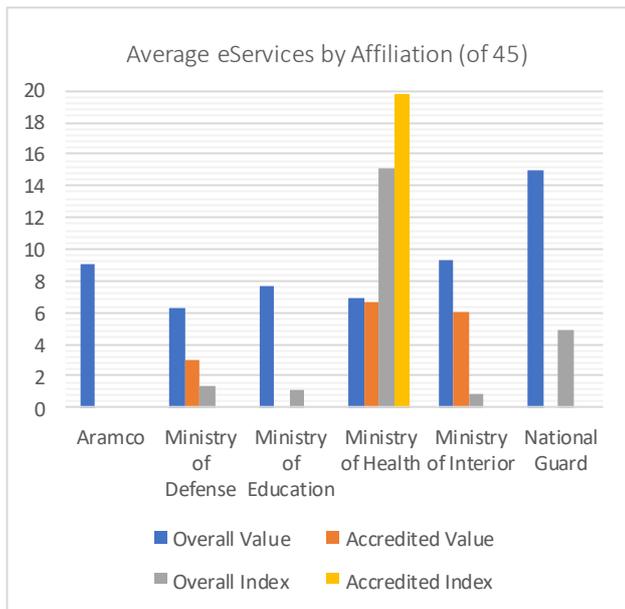


Chart -9: Average E-Services by Affiliation

Chart 9 also showcases the average number of E-services provided based on various affiliations across the country. The Ministry of Health had an excellent percentage of hospitals meeting accreditation standards when compared with the other sectors.

Table -1: Percentages of hospitals that implemented the 45 identified E-Health services.

<b>Feedback</b>	<b>Social Media</b>
74.42%	70.35%
<b>Appointments</b>	<b>Maps</b>
53.49%	50.00%
<b>Find a Doctor</b>	<b>Operational Hours</b>
44.19%	43.60%
<b>App</b>	<b>Ask a Doctor</b>
19.77%	18.60%
<b>Hospital Events</b>	<b>Lab Reports</b>
17.44%	15.70%
<b>Medication Refills</b>	<b>Vaccinations</b>

13.37%	11.63%
<b>Medication History</b>	<b>Radiology Reports</b>
10.47%	10.47%
<b>Update Info</b>	<b>Medical Eligibility</b>
8.72%	7.56%
<b>Medical Record Number Inquiries</b>	<b>Blood Bank</b>
6.40%	5.81%
<b>Medical Referrals</b>	<b>Registration</b>
5.81%	5.81%
<b>Registration</b>	<b>Vital Signs</b>
5.81%	4.07%
<b>Medication Reminder</b>	<b>Transfer to Oncology Center</b>
3.49%	3.49%
<b>Medical Report Archives</b>	<b>Find a Medicine</b>
2.91%	1.74%
<b>Pathology Reports</b>	<b>Supplies</b>
1.16%	1.16%
<b>Stem Cell Transplant</b>	<b>Cardiac Reports</b>
1.16%	0.58%
<b>Discharge Summary</b>	<b>Online Chat</b>
0.58%	0.58%
<b>Symptom Checker</b>	<b>View-Dependent</b>
0.58%	0.58%

**Table 1** shows, among other things, low percentages of hospitals using E-services to update information, handle medical record number enquiries, and archive medical reports. This indicates that the hospitals studied depended more on human encoding and non-digitized filing systems for these tasks.

### 3. RESULTS AND DISCUSSIONS

From the 508 hospitals reviewed in this research, Riyadh and Makkah showcased a higher number of hospitals than the other cities and regions. This could be because these cities are major business districts in the Kingdom and are the regions with the highest population concentrations. Despite the number of major hospitals in these two cities, however, only half were accredited by the MOH, with little or no E-Health services in place to serve patients. In fact, according to research by Alsakkak et al [29] in an analytical study to evaluate the first phase of Saudi Central Board Accreditation of Health Institutions (CBAHI) in a Primary Health Care (PHC) accreditation cycle through survey visits in 20 regions from October 2016 to January 2017, 28 out of 93 PHC centers (30%) were targeted for PHC accreditation in Phase 1. Of those 28 institutions, 8 PHCs were accredited (29%), while 11 PHCs received conditional accreditation letters (39%) and 9 PHCs were denied accreditation (32%) [29]. It appears that hospitals tend to implement the MOH's basic accreditation requirements such as patient beds, adequate and competent staff, and lab services, with little to no regard for E-Health services. In most regions of the kingdom, there is a large number of public hospitals, as MOH is determined to bring health care to all; however, private hospitals tend to more frequently implement and make use of E-Health services than public hospitals. The military hospitals follow closely behind private hospitals with a significant number of E-Health services provided within their system. Hospitals affiliated with governmental bodies and other institutions are on the rise in KSA with the Ministry of Health having a high number of affiliated hospitals. Yet the number of MOH hospitals do not match up with the expected numbers for the usage or implementation of E-Health services. By far, hospitals in the cities of Riyadh and Makkah had the highest capacity of beds for patients, and about 11,273 beds in MOH-accredited hospitals are in the system ready to admit patients from all over the kingdom. Yet only a handful of hospitals had an existing E-Health service in place or had recently implemented one, even in the kingdom's largest metropolitan areas. This necessarily affects the quality and delivery of health services within the kingdom, and an ineffective health information system (HIS) has been identified as a major administration-related challenge in "Hospital Bed Utilization" research by Kanwar, Gupta, Goel & Gupta [30]. Furthermore, the index created by this current study to identify the 45 E-Health services each hospital implemented or practiced found that two major cities, Riyadh and Makkah, showed a good overall number in the index of E-Health services utilized

but that few hospitals in these cities had achieved both E-Health and accreditation.

For the handful of hospitals which have not yet been accredited by MOH, the results of this study could also show that these hospitals are not only below standard but also lack any E-Health services to offer patients and the general public as a whole. However, social media and websites appear to be a basic means that hospitals that least practiced to boost their E-Health service ratings, as shown in (Table 1) on the percentage of feedback and social media. Clearly, E-Health programs that provided a way for customers to give feedback about services as well to interact through social media was a popular practice among most hospitals in KSA. Hospitals from Table 1 also displayed a high rate of E-health usage for Patient Education (59.3%) and Appointments (53.49%), clearly showing that most hospitals focus on E-Health services that manage interactions with patients only. In fact, when used wisely and prudently, social media sites and platforms offer the potential to promote individual and public health, as well as professional development and advancement [31]. Nevertheless, these should not be the only form of E-Health services that hospitals in KSA can offer. This is more so the reason why there is a need for clarity of terms such as E-Health because the absence of clarity may lead to fewer opportunities for shared discourse and to fewer resources for full E-Health implementation [32]. MOH implementations of E-Health services in hospitals should not fixate on software apps, wearables, social media, the Internet, and Web-based portals and programs. Instead, they should also focus on practical applications of eHealth technologies for remote service provision, health monitoring, care planning and coordination, communication, information storage and exchange, precision and predictive health care, professional support and development, and consumer empowerment [32].

Although this research showed the use of different E-Health services in the various hospitals, most hospitals focused on social media interactions more than on electronic health records such as communication of patient data between different healthcare professionals or electronic transmission of prescriptions from doctors to patients or pharmacists (ePrescribing). This could be seen in the low usage percentages reported for E-health services related to Medical Eligibility (7.56%), Update Info (8.72%), Pathology Reports (1.16 %) and Medical Report Archives (2.91%). This may indicate a failure to keep abreast with technology in the hospitals or perhaps a reluctance to embrace E-Health over traditional healthcare delivery methods. Cost of implementation may also be cited as another reason why most hospitals have still yet to fully embrace and utilize E-Health in KSA, as most E-Health setups will involve high-end machinery and computers as well as the education of staff on how to use them. Misdistribution of health services also exists as the number one factor hindering a real implementation of E-Health in the hospitals of KSA. In fact, MOH statistics indicated beyond doubt that there is an uneven distribution of healthcare services and healthcare professionals across geographical areas of the country [33].

Most of the hospitals that were studied often depended on traditional methods for delivering health services such as the handwriting of patient admission information, and the keeping of paper files instead of any electronic databases. The hospitals were heavily dependent on human resources with little to no effort being made to use any technology that would ease and speed up services for better health care. Literature has shown that information technology systems have begun to be implemented in some hospitals across Saudi Arabia, but even in those hospitals, these technologies are under-utilized [34]. This wholly does not help the Kingdom in achieving its aim of a standardized healthcare system for nationals and expatriates as outlined in Vision 2030. This is all the more reason why MOH and other health sectors need to focus on driving a much deeper root in utilizing not just any technology but one that emphasizes the true implementations of E-Health.

#### 4. CONCLUSIONS

E-Health services installed in the health system of hospitals in KSA would eventually lead to a better-structured and more organized health system. There are existing E-Health systems in the kingdom but there are yet to be interconnections and communications between hospitals using these services. Although applying e-health solutions has brought some positive impact, its full potential has not yet been realized, especially in regions where expertise is scarce [35]. E-Health services differ from hospital to hospital with no uniformity of E-service systems and hence no guidelines to follow. There also seems to be a reluctance to fully operate an E-health service. Even most hospitals accredited by CBAHI have yet to live up to international standards for information technology implementation. The private sector hospitals seem to be innovating more with E-Health services than the public hospitals. In fact, the data showed that more than 95 hospitals in the private sector were operating some sort of E-Health services, compared to just 45 hospitals in the public sector, and 44 hospitals in the private sector were accredited with E-Services as compared to 18 hospitals in the public sector (see Figure 2). It was also noted that most hospitals relied on traditional patient care methods such as keeping handwritten files for patients or handwritten prescriptions from doctors. These kinds of services can easily be done more accurately and efficiently with the use of E-Health services such as E-Prescribing if these systems are present and available to the hospitals.

Research by Khalid and Ahmad [36] revealed that the government of Gulf countries exerted efforts in coming up with the most innovative and technological solution for medical and clinical problems of patients as well as to revolutionize the whole health care sector so that most of the tasks will be achieved in accordance with international standards. This is more so true now than ever as KSA seeks to draw more investors in to aid the country in diversifying the economy and moving its economic dependency away from the production of oil. Vision 2030 should be seen as not

only putting Saudi Arabia on the map as a great investment. It should also focus on raising the standard of living in KSA, health-wise, as this will prompt more expatriates to migrate to the country and hence directly raise the number of investments. MOH needs to realize that now is the most significant time to boost the standards and policies that will utilize technology efficiently, most especially in E-Health as Vision 2030 draws near.

There are, however, various factors still affecting the implementation of E-Health in KSA. Some factors identified in research by Alsulame et al are cultural, bureaucratic, and human resources issues [22]. This paper, furthermore, also identifies one adamant factor, that the dominant popularity of services administered by most hospitals seems to indicate that healthcare facilities in the kingdom are primarily oriented towards patients interacting physically with hospitals and physicians rather than being open to the utilization of essential E-Health technologies. Hospitals operating now in KSA highly depend on physical interactions such as seeking test results in person from the laboratory rather than using E-services where one could easily access lab results anytime and anywhere. It is therefore easily established that E-Health in KSA has been up and running but without any promise of integration or transformation. To achieve Vision 2030, KSA needs to embrace the use of technology within health facilities and the practices of E-Health systems such as the cloud computing-based model proposed by R. Kurdi et al for centralizing all KSA hospitals' databases on the cloud, thereby creating easy access and sharing of basic patient information between hospitals and caregivers [37]. MOH can also make use of the proposed framework of Almalki, Househ, and Alhefzi [38] to upraise technology in the health sector. The Saudi Health Informatics Competency Framework (SHICF) can be utilized to define the field of health informatics within the country as well as define the boundaries of the field of health informatics and distinguish it from areas such as Bioinformatics based on the competencies outlined in the framework [38]. Overall, creating, administering, and integrating as well as transforming KSA's health sector from traditional healthcare delivery methods to a more modernized and technological state with broad acceptance and utilization of E-Health would see much more than the conceptual achievement of Vision 2030. It would also achieve greater financial wealth and investment in the health sector.

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#### REFERENCES

- [1] Kingdom of Saudi Arabia. (n.d). Vision 2030. Retrieved July 10, 2019 from <https://vision2030.gov.sa/en>

- [2] Ministry of Health. (n.d). National E-health Strategy MOH Initiatives 2030. Retrieved July 10, 2019 from <https://www.moh.gov.sa/en/Ministry/nehs/Pages/vision2030.aspx>.
- [3] Barbabella, F., Melchiorre, M.G., Quattrini, S., Papa, R. & Lamura, G. (2017). How can ehealth improve care for people with multimorbidity in Europe? Retrieved from [http://www.icare4eu.org/pdf/PB\\_25.pdf](http://www.icare4eu.org/pdf/PB_25.pdf)
- [4] Alhusaini H.A. (2006). Obstacles to the efficiency and performance of Saudi nurses at the Ministry of Health, Riyadh Region: analytical field study. Retrieved from <https://www.moh.gov.sa/Ministry/MediaCenter/Publications/saudi/001.pdf>.
- [5] Househ Mowaf, Alsadan Meshal, Metwally El Ashraf, Ali Anna, Khalifa Mohamed & Jamal Amr. (2015). Health information technology (HIT) in Arab countries: A systematic review study on HIT progress. *Journal of health informatics in developing countries*. 9(2) 32-49.
- [6] Almalki M, Fitzgerald G & Clark M. (2011). Health care system in Saudi Arabia: An overview. *Eastern Mediterranean health journal La Revue de sante de la Mediterranee orientale*. 10(7).
- [7] Vision 2030 Kingdom of Saudi Arabia. (n.d). National Transformation program. Retrieved August 30, 2019 from <https://vision2030.gov.sa/en/programs/NTP>
- [8] Raéf Bahrini & Alaa A. Qaffas. (2019). Impact of information and communication technology on economic growth: Evidence from developing countries. *Economies*, MDPI, Open Access Journal, vol. 7(1), pages 1-13, March.
- [9] Berisha-Shaqiri, Aferdita & Berisha-Namani, Mihane. (2015). Information technology and the digital economy. *Mediterranean journal of social sciences*. 10.5901/mjss. 2015.v6n6p78.
- [10] Rajan Abdulaziz Al-Helayyil Ranjit & Schaller Massimiliano Claps Olivier. (2016). Saudi Arabia Vision 2030: Envisioning a technology-led transformation – IDC’s initial view. Retrieved from [https://images.idc-cema.com/mail-image/1156030/cema41301016\\_saudi\\_arabia\\_vision\\_2030\\_idc\\_insight.pdf](https://images.idc-cema.com/mail-image/1156030/cema41301016_saudi_arabia_vision_2030_idc_insight.pdf)
- [11] World Health Organization. (n.d). SDG 3: Ensure healthy lives and promote wellbeing for all at all ages. <https://www.who.int/sdg/targets/en/> Accessed on June 21, 2019.
- [12] Almutairi KM, Moussa M. (2014). Systematic review of quality of care in Saudi Arabia. A forecast of a high quality health care. *Saudi medical journal*. 2014;35(8):802-9.
- [13] Nasriah Zakaria, Ohoud Alfakhry, Abeer Matbuli, Asma Alzahrani, Noha Samir Sadiq Arab, Alaa Madani, Noura Alshehri, Ahmed I Albarrak. (2018). Development of Saudi e-health literacy scale for chronic diseases in Saudi Arabia: using integrated health literacy dimensions. *International journal for quality in health care*. 30(4), 321-328.
- [14] Alshuaibi Abdulaziz. (2017). Technology as an important role in the implementation of Saudi Arabia’s Vision 2030. *International Journal of Business, Humanities and Technology*. 7(2) 52-62.
- [15] The World Health Report. (2000). Health systems: Improving performance. Geneva, World Health Organization.
- [16] Sebai, Z. A., Milaat, W. A., & Al-Zulaibani, A. A. (2001). Health care services in Saudi Arabia: Past, present and future. *Journal of family & community medicine*, 8(3), 19-23.
- [17] Alsulame, Khaled & Khalifa, Mohamed & Househ, Mowafa. (2016). E-Health Status in Saudi Arabia: A Review of Literature. *Health policy and technology*. 5. 10.1016/j.hlpt.2016.02.005.
- [18] Al Kuwaiti, A., Al Muhanna, F. A., & Al Amri, S. (2018). Implementation of digital health technology at academic medical centers in Saudi Arabia. *Oman medical journal*, 33(5), 367-373. doi:10.5001/omj.2018.69
- [19] Almalki M., Fitzgerald, G. & Clark, M. (2011). Health care system in Saudi Arabia: An overview. *Eastern Mediterranean health journal La Revue de sante de la Mediterranee orientale*. 10(7).
- [20] Al-Hanawi, M. K., Alsharqi, O., Almazrou, S., & Vaidya, K. (2018). Healthcare finance in the Kingdom of Saudi Arabia: A qualitative study of householders’ attitudes. *Applied health economics and health policy*, 16(1), 55-64. doi:10.1007/s40258-017-0353-7
- [21] Al-Shorbaji, N., Househ, M., Taweel, A., Alanizi, A., Bennani, O.M., Abaza, H., Bawadi, H., Rasuly, H., Alyafei, K., Fernandez-Luque, L., Shouman, M., El-Hassan, O., Hussein, R., Alshammari, R., Mandil, S., Shoman, S., Taheri, S., Emara, T., Dalhem, W. & Serhier, Z. (2018). Middle East and North African Health Informatics Association (MENAHA): Building sustainable collaboration. *Yearbook of medical informatics*. 10.1055/s-0038-1641207.
- [22] Alsulame, K., Khalifa, M. & Househ, M. (2016). E-health status in Saudi Arabia: A review of literature. *Health policy and technology*. 5. 10.1016/j.hlpt.2016.02.005
- [23] Zaman, U.T., Raheem, T. M. A., Alharbi, M. G., Shodri, M. F., Kutbi, H. A., Alotaibi, M. S. & Aldaadi, K. S. (2018). E-health and its transformation of healthcare delivery system in Makkah, Saudi Arabia. *International journal of medical research & health science*, 7(5) 76-82.
- [24] Al-Hanawi, M.K., Khan, S.A., & Al-Borie, H.M. (2019). Healthcare human resource development in Saudi

- Arabia: emerging challenges and opportunities—a critical review. *Public health reviews*.
- [25] F Alharbi, Mohammad. (2018). An analysis of the Saudi health-care system's readiness to change in the context of the Saudi National Health-care Plan in Vision 2030. *International journal of health sciences*. 12. 83-87.
- [26] Alkrajji, A.I. (2012). Issues of the adoption of HIT related standards at the decision-making stage of six tertiary healthcare organizations in Saudi Arabia.
- [27] Siddiqui, A. (2016). Essential safety requirements - ESR standards for Saudi CBAHI accreditation in hospitals and PHCS. GDHARR Riyadh Saudi Arabia.
- [28] Qureshi, Ahmad Z., Sami Ullah, and Rubina Ullah. "The trend of hospital accreditation in the Kingdom of Saudi Arabia." *Saudi medical journal* 33.12 (2012): 1350-1351.
- [29] Alsakkak, M. A., Alwahabi, S. A., Alsalhi, H. M., & Shugdar, M. A. (2017). Outcome of the first Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) primary health care accreditation cycle in Saudi Arabia. *Saudi medical journal*, 38(11), 1132–1136. doi:10.15537/smj.2017.11.20760
- [30] Kanwar, V., Gupta, A. K., Goel, S. & Gupta, P. (2015). Hospital bed utilization: Perceptions of healthcare practitioners from Northern India. *International journal of hospital research*. 4(3), 113-118.
- [31] Ventola C. L. (2014). Social media and health care professionals: benefits, risks, and best practices. *P & T: A peer-reviewed journal for formulary management*, 39(7), 491–520.
- [32] Shaw, T., McGregor, D., Brunner, M., Keep, M., Janssen, A. & Barnet, S. (2017). What is eHealth (6)? Development of a conceptual model for eHealth: Qualitative study with key informants. *Journal of medical internet research* (10):e324
- [33] Ministry of Health. (2014). *Statistical book for the Saudi Ministry of Health*. Ministry of Health. Riyadh.
- [34] Alyami, Awad Ali (2018). Smart e-Health system for real-time tracking and monitoring of patients, staff and assets for healthcare decision support in Saudi Arabia. Doctoral thesis, Staffordshire University.
- [35] Shah, J., Miah, J. H. & Gammack, J.G. (2017). On-cloud healthcare clinic: An e-health consultancy approach for remote communities in a developing country, *Telematics and informatics*. 34(1), 311-322
- [36] Khalid, A. & Ahmad, H. (2011). The promise of the services sector: A United Arab Emirates perspective case study. *American Journal of Social and Management Sciences*, pp. 34-40.
- [37] Kurdi, R., Aljehani, M., Subasi, A., & Qaisar, S.M. (2017). Cloud computing based healthcare information systems: A proposal for the Kingdom of Saudi Arabia,

International Conference on Electrical and Computing Technologies and Applications (ICECTA), 21-23 Nov. 2017, Ras Al Khaimah, UAE.

- [38] Almalki, M., Househ, M., & Alhefzi, M. (2019). Developing a Saudi health informatics competency framework: A comparative assessment. International Medical Informatics Association (IMIA) doi:10.3233/SHTI190396.

## BIOGRAPHIES



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