

An Overview of the Studies of Health Information Systems in Turkey

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Abstract— This paper presented a literature review about health information systems. Health information technology gives information about health section data and data generation, compilation, analyses and gives reliable information for policy and system development. Health information technology is based on efficiency, quality and cost of healthcare. There are positive influences of health information technologies on healthcare, but also some difficulties and failures that need more detail investigations in the future. The aim of this paper is given literature information for overview of health information systems in Turkey and other countries' systems. The results would provide a useful approach for evaluating the positive and negative factors and give ideas for the health information system users and researcher in Turkey.

Keywords: Health Information systems, Hospital information systems, healthcare, Turkey, Health information technology, Information Technology.

I. INTRODUCTION

The Health is a national priority and responsibility of government for this is constant and continual. In recent years studies about health information technology have shown growing interest in health as a governance tool. Health information technology gives reliable information for policy and system development. It uses statistical indexes for estimation of health outcomes and appreciates health care system [1].

Health information technology can be defined as using of information processing including computer hardware and software for custody, retrieval, dividing and using of health care information, records and experience for connection and arrival at a solution [2]. Health information technology involves Electronic health record, Personal health record, Clinical Decision-support tools, Telemedicine [3-5]. Also health information technology includes using of the Internet, inclusive the Web, for interchange of data and knowledge [6]. Nowadays, providing healthcare services on the mobile platform is considered as a promising technological development. In addition, use of mobile platform in health service technologies, within the context of Health Information Systems, gained importance [7-10].

The importance of health information systems becomes significant subject with development computer and information technologies [11]. Particularly doctors, patients, governments, politic makers' interest with health information systems for budget [12]. Data mining in healthcare can help managers to make strategic decisions by sorting and estimating future trends [13]. Chaudhry and others find health information technology as a source for progressing efficiency and quality of healthcare [14]. For solution makers and users a strong estimating of this technology is recommended [15].

In our era of information technology, health institutions invest huge amounts of money in hospital information systems. The aim of these investments is to make healthcare more effective [16]. Hospital information system influences the decrease in medical errors, growing the efficiency, cost effectiveness, timely decision making, and improving the quality of health care services [17-19]. In addition, the main aim is to eliminate manual processes for increasing organizational performance in terms of providing fast and efficient health services [20]. Also geographic information system technology is used for epidemiological aspects of public health practice, planning and research efforts [21-22].

Our objective was to overview health information systems in Turkey while comparing with other countries. In the first section of this paper a brief introduction of the topic is described about health information systems with a general approach. The second section of the paper, we discuss some reasons for the limited of health information systems in Turkey.

II. INTRODUCTION TO THE SURVEY

This paper is based on the analysis of articles from Web of science, PubMed, Google scholar and Science Direct which covers the years 1995-2015. The terms used in these researches including health information systems, health information system in Turkey, hospital information systems in Turkey, health information technologies in Turkey, healthcare information technologies in Turkey. The steps of research were given in **Fig. 1**.



Fig. 1. The diagram of search plan

In first step, we identified key words and search database. The key words were chosen as health information systems, health information system in Turkey, hospital information systems in Turkey, health information technologies in Turkey, healthcare information technologies in Turkey. There were over thousand articles were found in first research. The keywords and titles were examined from first search. After refinement articles, 496 articles' abstract were reviewed to eliminated for study criteria. Finally, the 77 articles used to review for this study.

III. DISCUSSION

In this study we demonstrated significant qualities-, efficiency- and cost related benefits of health information technology in literature. Electronic health record scan improve the quality and effects of healthcare, and support the health of people, involve:

- More accurate and better designed documentation and data;
- Automatic classification and generalization of data so that pertinent information is presented to the physician when needed for decision making;
- Direct access and immediate renews records and distant access to patients' records at anytime;
- Fewer hazardous medical errors (due to poor handwriting or order-entry mistakes) and better clinical decisions by using structured data, predictive modelling, and decision support tools, and disease control;
- Easier quality guaranty,
- Potential of structured medical records to help for research precedence's, investigating the etiology and epidemiology of disease, estimating the effectiveness of preventive interventions and medical care, paying providers based on their performance, control the safety of drugs and implements, preventing swindle, abuse, including monitoring prescriptions,
- Permanent improving of clinical decision making, by decision-support technology, and following changes in patient outcomes [6,3,4].

Studies examined two main types of information technology effects on efficiency: using of care and provider time [14]. There has demonstrated the effect of health information technology in reducing employment and medication mistakes. Considering rising cost of care, health information system can reduce the expenses of services. Health information technology integrated with the Internet is

supposed to promote patient-focused care, to contribute transparency in prices and performance, and to permit consumers to control changing of the healthcare system [6]. The ways that Electronic Health Records may reduce the price of care involve:

- Decreased spending connected with record keeping;
- Improved work processing, practice management [3-4];
- Automated sharing of information among producers and patients (for example, duplicative tests);
- Decreased visits (to get results) and hospital admissions (occasioned by lacking information)
- Reduced risk of malpractice actions.

On the other hand the findings from a considerable amount of studies reveal the negative effects of information technology implementation on health care [23]. It is estimated that nearly 70% of information technology implementation projects fail [24], resulting in the loss of huge amounts of money and, more importantly, loss of confidence in these implementations. Despont-Gros summarized the major reasons for failure as technical issues, project mal administration, organizational questions, and excessive growth of information systems [25]. According to Heeks R. health information system failure is a significant problem. There should be more attention to developing the essence, instruments, roles and expertise, not to variations on traditional methodology [26].

The importance of securing information systems that are used to transmit, process, and store information increases progressively as more organizations depend on them [27-28]. As organizations focus mostly on external attacks, the use of new and sophisticated security technologies, varying from simple antivirus software to cutting edge biometric tools, does not minimize the number of security incidents [29]. To reduce the risks of such security incidents, organizations try to promote and increase security awareness; however, results show that overall information systems security awareness is limited [30-32]. This problem is expected to persist in the future, even though the computer literacy of employees continues to increase [33].

In literature review we found materials about acceptance of technology manageable services in healthcare [34]. Some literature researched various aspects connected with adoption of information technologies in healthcare. Kuziemy et al. reviewed the critical further research [35]. Peterson et al. investigated the understanding of users in the case of adopting Electronic Health Record [36]. Demiris et al. reviewed literature about teledermatology [37]. Chen et al. researched the acceptance of a web based learning system for nurses through are view study [38]. Especially adoption of telehealth services have been searched at arising rate. A group of researchers investigated the acceptance by getting data from the physicians. Vuononvirta et al. searched the positions of teams in seven health centers and two universities in the case of teleconsultation [39]. They

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discovered that telehealth was more admitted in education and in diabetes teleconsultations. King et al. searched the appearance in the event of rural Scotland [40]. Also they recognized some barriers to the adoption of telemedicine, including trusting that video conferencing can reduce the quality of communication in education and clinic and that telemedicine is not fit easily with the organizational structures of the working. Spaulding et al. investigated telemedicine among physicians in Kansas [41]. They concluded that adopters and non-adopters of telemedicine understand its value very differently. Some scientist searched the characteristics effecting the adoption of wireless technology in the health care [42-43]. They studied the physicians and found that technology clinical administrative and communication factors played a crucial role in determining the aim of using wireless technology. According to Leape, compared to other knowledge rich industries such as the financial and telecommunication industries, using of information technology in the healthcare sector is very slow [44]. In addition, the healthcare sector has been reported to be far behind in adopting the information system [45-46].

In Turkey, healthcare industry is in a changing phase. The healthcare is mainly controlled by governments [47]. In last 50 years, there has been a great increase in private hospitals. Lack of coordination among different types of hospitals (university, private and public hospitals) has been a very big problem technologically and structurally. Improvement of healthcare in Turkey is inhibited by the transfer of patients between hospitals. Using the integrated Information Systems (IS) in all hospitals may prove to be a good solution [48]. The first step for conversion healthcare was Health Information System Action Plan. It included such projects as Family Medicine Information System, National Health Data Dictionary, Teletraining and Telemedicine Applications and Patient Rights Information System. The Ministry of Health has been realized the health transformation programme (HTP) for improving the management, efficiency and quality of the Turkish healthcare, and the continued successful effect situation of this reform programme is relied on tracking its influence on health results, exits and structures. A previous and ongoing practice under HTP framework is increasing the importance of communication between patients and healthcare persons [49].

Turkish National Health Information System (e-Health Project), completed the infrastructure works for the determination of a health information system covering all health services and all persons of the healthcare. The main components of this program are reaching e-health, with the next purposes:

- Providing standardization of data used in health system
- Making the Electronic Health Record for citizens
- Decision Support System– data analysis support for managers
- Accelerating the flow of information among agents

•Keeping supplies and rising efficiency in the healthcare [50].

In concordance with the Minimum Health Data Sets included in the National Health Data Dictionary, the project aiming at collection electronic health records from all hospitals is realized and in the near future health data is assembled via this system. Electronic Health Records develop communications between healthcare producers, such as medical insurance and dental insurance [51]. There are evolution of National Health Data Dictionary (NHDD) and Minimum Health Data Sets (MHDS), Family Medicine Information System (FMIS) [55]. Saglik-NET portal was set into maintenance of the citizens, information service, and health workers. Additional planned projects in this area involve e-identity (smart card), e-prescription, e-banking, e-transformation, e-government, Central Hospital Appointment System, and the Central Call Center projects [56-59].

A Technology Acceptance-based Model (TAM) for E-government was developed in study of Sebetci O. for Sgb.Net system. This model can be used to measure acceptance mandatory technology use in e-government system for health workers in Turkey and other countries. The model can also be further extended to address to the needs of e- government systems in different institutions and countries [60].

In an effort to enhance health services and increase satisfaction in Turkey, e-prescribing system was initiated in Turkey in 2013 as a hospital information system to enhance electronic services and to increase service quality. E-prescribing application enables pharmacies, physicians and hospitals to access patient information over system that is open to joint use without using paper [61].To get strategic advantage in medicine, e-prescription is added to Medula system. Medula system is a Pharmaceutical Service System that has been in use by pharmacists in Turkey for more than ten years. Medula has three main functions: registration of patients (recording patient information), services (selecting pharmaceutical services) and invoices (receiving prescription and invoicing transactions). The other appointments of the Medula system are: attaining right possession and contract checking, obtaining revision and referral follow-up, payment request, invoice registration, payment status control and medical report supply (Social Security Institution, 2013). E-prescription brings beneficial results like saving time and preventing frauds [48].

There is summarizes information about information technology in health care using in some countries (Table 1).

Nevertheless, there are some distinctions of opinion among stake holders regarding the current realization practices yet. For instance, it is registries that some family physicians report some troubles in entering medical data to the FMIS and information entered is not always total (like incomplete disease symptoms). There are efforts for completeness and improving medical data but still more

work is necessary in this area. Especially, family physicians and hospital administrators need support in technical areas to estimate various health information technology trader offerings, in end-user training and support. The deficiency of qualified staff and outsourcing of information system investment activities are said to interfere efficient information systems implementation in both public and university hospital settings. The significance of ensuring patients' and information confidentially is accented by some stake holders. Some agents signify concerns about the slowness of the compensation process, partly due to the technical issues with the social security institution's (SSI) Medula system as well as the limited personnel capacity of the SSI. Also some users showed some problems with e-prescription systems like interruptions, slow connectivity, and lack of some modules. Improvement of infrastructure and speed of connectivity can improve the adoption of e-prescription. The combination of the information systems and data sharing conventions between the ministry of health and the SSI are recognized as clue areas that need enhancement by a number of key stakeholders. In addition, the need to effectively use the existing information systems to support evidence-based decision and policy making in healthcare is emphasized by several key stake holders. A few agents debate that the ministry of health's information system intending to patient specific follow-up is very expensive and difficult to support financially during long term. These realities need studies challenging aspects of implementing health information technology more specifically. A potential work is to explore specific security information sources for trust estimating [51].

Herand D. et all offered service-oriented architecture (SOA) for healthcare management. According to authors healthcare system of Turkey based on SOA can be more flexible and beneficial [52]. Sahin et all suggested MedWise– a public health information system infrastructure for decreasing workload of physicians and increasing effectiveness of physical examinations of patients [53].

New information and connection technology has strongly affected our public, including healthcare. Hence, medical informatics should be efficient develop and strategic manage. New possibilities for the systematic processing of data, information and knowledge in medicine and healthcare may not ably promote not only to the progress of medicine and the health sciences but also to the progress of informatics in general [54].

Table 1. Healthcare technology initiatives around the world.

Countries	Technology initiatives
Europe United Kingdom Denmark Sweden Germany	Electronic patient booking systems, prescription messaging, Picture Archiving and Communication System (PACS), e-Referral systems, clinical repositories, test results storage and send capability [61]. Hospital EHR, GP computing, development of integrated communication capacity with home based care and making treatment information available through a portal, national registries and databases, standards development for data interchange purposes [63] HER, Smart-card technology [64]
North America United States Canada	EHR, telehealth, health information network, Personal Health Record (PHR) [65] Diagnostic imaging, medication management, registries, laboratory and public health surveillance, telehealth [66]
Asia Singapore Malaysia Taiwan Japan	A good level of IS/IT penetration in clinical, administrative and logistics activity in seven main hospitals, Ophth Web, Teleophthalmology [67] HIS which covers all aspects of the hospital's operation such as clinical, administrative and financial systems HIS which covers all aspects of the hospital's operation such as clinical, administrative and financial systems [17] Telemedicine, National Health Insurance Smart Card to update patient's record [68]. HIS, telemedicine,telehealth, Decision Support System (DSS) [69]
AustraliaAustralia NewZeland	EHRs, E-Health initiatives [70] E-Health, secure online transfer of health information and national register [71]
Turkey	HER, E-Health, Decision Support System,National Health Data Dictionary (NHDD), Minimum Health Data Sets (MHDS), Family Medicine Information System (FMIS),Telemedicine,e-identity (smart

card), e-prescription, e-banking, e-government, Central Hospital Appointment System, Central Call Center [72, 50, 48, 55]

IV. CONCLUSIONS

We have shown the effectiveness of health information technologies in improving quality, efficiency and cost of healthcare system of some countries, including Turkey. Health information systems of Turkey are in developing stage and we have shown many positive aspects of using information technologies on healthcare. In the same time there are some difficulties and failures of information technologies that need more detail investigations in the future. For example, the study, which was conducted at the university and state hospitals in Turkey, found positive contribution on performance by the information devices owned by hospitals. Followings may be recommended as guidance for the future studies: ensuring creation of policies to increase the support of the Ministry of Health especially for data collection; and a research on the reasons behind the ineffective use of resources by hospitals and evaluation of effectiveness analysis to develop methods for more effective use of these resources. Future studies may address to the waste of investments in information processing systems in hospitals and to the ways to prevent this waste and save those resources for the economy of the country. There is no doubt that this study will contribute to the future studies as it is observed that the impact of the information systems on the effectiveness of hospitals started to increase in recent years [74].

In the context of Turkey, three basic issues can be addressed to generally remove the limitations of Hospital Information Systems (HIS) and global researches on these issues can be studied to provide country based adaptations. The first issue is the addition or development of the resource planning aspect of HIS. The reason is that the hospital administrations are searching to find HIS software to provide their patients with faster and more quality service in the present competitive conditions and to ensure more effective use of hospital resources [75]. HIS are sectoral solution built on the core modules of the Corporate Resource Planning (CRP) systems in order to meet the requirements of the health sector and the organizations serving to the health sector [76]. Therefore, HIS need to be the special adaptation of CRP systems to the health sector and it should be expected that HIS would bring several medium and long term financial contributions to the health organizations while providing the required infrastructure for a health organization to offer trouble-free, quality and fast services [77]. Secondly, HIS used by public or private health organizations, small or big, should connect to each other within certain controls. This integration is very important with respect to speed, cost control, patient information accuracy and safety for the

public of private health insurance organizations covering health insurance with HIS. Final issue is the requirement that the organization and control on HIS be done by the Ministry of Health.

In conclusion, the findings of this study indicate that the effectiveness level of HIS is not low and yet the system cannot be used effectively as a whole. At this stage, the planners, hospital administrators and academicians determining the health policy of the country need to conduct a more detailed study of the reasons behind the failure of effective use of the system and to take the measures necessary for a more rational distribution of solution.

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