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TELE OPHTHALMOLOGY, A BEST PRACTICES CASE IN NETHERLANDS•

Taşkın KILIÇ**

Abstract

In developed countries, absolute hospital-oriented health service provision is not sufficient anymore subject to increasing demand of aging population toward health services, difficulties experienced in accessing health services due to geographical and economic reasons, long patient wait lists, increasing health service costs, follow-up of chronic, handicapped and aged patients, information need of health service providers and patients, mobilized life style of today's society and increasing person-oriented health service. Within this scope, some countries, in pursuit of transforming and developing their health services, transited into **"eHealth system"** through the information and communication technologies. In this regard, various applications such as "Tele-medicine, Mobile Health, Digital Hospitals, Robotic Health, and Electronic Health Records" have been put in practice.

The purpose of the present study is to investigate theoretical and practical dimensions of the eHealth system introduced in recent years and "Tele-Ophthalmology Diseases" system applied in Netherlands, having one of the best health systems of the world, as the best clinical practice.

Theoretical section of the study was prepared based on the reports published by the World Health Organization (WHO) about the eHealth, Reports published by the Netherlands Ministry of Health and on available literature on the relevant subject. The field research of the study was conducted through interviews regarding **e-Eye** Health in Netherlands, one of the prominent countries of the world in terms of eHealth area, in the period of June 5-12, 2016.

83% of patients with eye disease examined through the eHealth system were held at the first tier so that significant cost advantages could be obtained. Whereas wait lines were reduced, access to the service was facilitated in the Ophthalmology Clinics.

Keywords: eHealth, Tele-Medicine, Tele Ophthalmology.

INTRODUCTION

Radical changes in the information and communication technologies along the last three decades have significant impact on all sectors. As technology usage has penetrated in all areas of life, service provision reached beyond space and time limitations. Similar evaluations have been experienced in the health system constituting focal point of the present study. When health systems in developed countries are considered, it is possible to observe that technological applications such as "eHealth, Tele-medicine, mobile health, digital hospitals, and Robotic surgery" are utilized in all levels of the health industry. Similar to other industries, utilization of technological tools in the health domain has evolved structure of the given services, its way of provision and its orientation. On the other hand, such practices have allowed tailor-made health service; and introduced side benefits such as reduction of costs and patient wait time. For instance, 50% of the mental patients in Netherlands which constitute sampling group of the present study and having the best Health and eHealth systems of the world are diagnosed and treated through the "Tele-medicine method (video conference)" without necessitating them to paying visit to hospital; and patient wait lines, hospitalization periods and health related costs have significantly reduced.

Again, current health investments of countries are considered, countries transited into the eHealth system make investment into Health technologies rather than opening larger hospitals. These investments have made contribution in expanding health service range from face-to-face service in hospital environment to larger service receiver groups located in long distance (by means of Tele-medicine and mobile practices). Thus, health services have been free from limitations of time and space in reaching individuals. Based on this feature, contemporary Health services approach differs from the conventional approach (hospital-oriented health service provision) remarkably. Owing to eHealth practices harnessed by the most advanced health systems of the world, dependency to hospitals has reduced; instead, demand towards mobile applications and health technologies capable of providing 7/24 service and which could be accessed by everyone has significantly increased. For example, as of 2016, 20 EU-member countries employ eHealth system actively.

1. CONCEPTUAL FRAMEWORK

1.1.eHealth (eHealth): The European Union Health Commission describes the eHealth concept as "utilization of information and communication technologies (network connections, mobile software, Robotic

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** Assoc.Prof. Dr., Gümüşhane University, Healthcare Management Department, taskinkilic79@hotmail.com

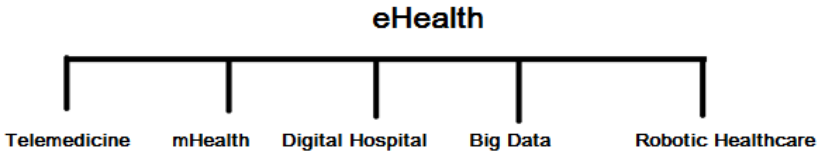
practices, smart phones, data bases, video conference etc.) in health services to prevent diseases, diagnosis and treatment, monitoring and management of health" (www.*ec.europa.eu*). The "e" reference used in the beginning of the eHealth concept implies "Electronic, digital, internet-based, effective, fast, information-oriented and technology" nature of health services**.**

Long distance video-conference information exchange in health services until 2000s has been referred as Tele-medicine (Mea, 2001). However afterwards, **"eHealth"** concept has started to be used as more comprehensive concept and as main title upon introduction of usage of different information and communication technologies such as "mobile health (m-health), digital hospitals, Electronic Patient Records, Robotic Applications" in health services extensively, the WHO, the European Union and scientists regarded the "Tele-medicine" reference as a components.

Therefore, eHealth concept was used as the main concept in the present study.

Applications such as Tele-Medicine and Mobile Health were considered under a sub-title. This application was presented in the relative scheme below (Kılıç, 2016):

Figure 1. e-Health and components



1.2. Tele-medicine (Telemedicine): Transfer of medical information through information technologies in order to evaluate and develop health conditions of individuals medical (American Telemedicine Association, 2015).

Although it was harnessed for diagnosis and treatment operations conducted through information and communication tools in long-distance health services from the time when the Tele-medicine application was first introduced in 1960s until 2000s, it is used as a component of eHealth concept.

Tele-medicine practices could be classified into two different ways (Wootton et al, 2007**).**

1. Tele-medicine used by health workers for information share among themselves (consultancy, training, etc.).

2. Tele-medicine used between health employees and patients (examination through video-conference etc.).

1.3. Electronic Patient Records-EHK (Electronic Health Records):

This includes process of keeping patients' individual, medical and treatment history and all relevant information. The EHK covers previous diagnoses in the history, applied treatment plan, transfer operations, vaccination status, allergic reaction information, chronic diseases, x-ray images, lab results, insurance status and demographical characteristics. Thus, authorized divisions and persons (pharmacologists, physicians, insurance agent, manager, statisticians etc.) could access all information momentarily independent from location (www. healthit.gov).

Figure 2. Traditional and Digital Archive

Traditional Archive

Digital Archive

1.4. Robotic Practices in Health Services (Robotic Healthcare):

Owing to advanced robotic technology and applications, some processes of health services could be implemented by robots. Especially elders and handicapped individuals who need home care services, it is possible to receive service from robots in lithotripter, hair transplantation, consultancy and nursing services today. For instance, robots with artificial intelligence, which provide home care service in Germany, are capable of establishing communication with patients; and of giving them bath and assisting them in bathroom needs. Even these robots could entertain elders and lonely individuals by dancing. On the other hand, robot nurses developed in Japan are capable of receiving blood samples from patients and giving them education. Robotic practices are available to meet doctors and other health professionals with technology to enhance their performances; put factors such as efficiency, productivity, speed and cost control into prominence so that more robust, dynamic, flexible and human-oriented health services could be provided.

1.5. mHealth (Mobile Health):

mHealth *(mHealth),* a component of eHealth concept, is abbreviation of *"Mobile Health"* word. According to the definition suggested by the WHO, mHealth is support to the medical and public health services by utilizing from smart phone, patient monitoring devices, digital devices (tablet etc.), other wireless tools (radio etc.) and mobile devices (www.who.int).

According to another definition, mHealth is the whole process including receiving, analyzing, processing and transferring of health information from medical devices through sensors and smart phones (Adibi, 2015). mHealth could be briefly defined as provision of health service, transmission of health-related information and establishing communication by harnessing smart phones, web pages, messaging services, tablets and wireless mobile devices**.**

1.6. Digital (Paperless) Hospitals:

Digital Hospital is to integrate long distance health professionals and departments with each other so as to provide high quality health service through combining clinical and administrative work flows with information and communication technologies, carrying hospital services beyond physical hospital walls (homes, emergency stations etc.). **Digital hospital** is the concept contributing into increasing personnel productivity, accelerate hospital operations, enhance process quality and ensuring patient safety by integrating advanced technologies and applications such as medical devices, smart information, facility control and automatic material handling systems, location-based services, sensors and digital communication tools with processes (Netherlands, 2009).

Paper-based practices are almost at the minimum level in a digital hospital. Patients' blood analysis results, x-ray, MR and tomography images are totally kept and maintained in a digital environment. Physicians at such hospitals could conveniently access health information of patients regardless of distance through cell phones, tablet and PCs. For example, a physician on duty at a digital hospital with the highest **"Stage 7"** level could regulate **serum flow rate** of an inpatient in any clinic by means of an application in his/her cell phone. According to specialists, digital hospital concept could bring **35% productivity** to the hospitals (http://saglikbilisimzirvesi.org).

2. RESEARCH METHOD

Data Collection Process and Method of the Study: Study data was collected and compiled through an interview method. In this scope, as a result of the interview conducted with Optometrists, who works in the **eEyes** health also **Major Company** founder and operator of the Dutch Tele-medicine System in the period of June 5-12, 2016 by paying visit to Netherlands, one of the pioneer counties of the world in terms of **eHealth**; additionally, presentations in the eHealthWeek Summit organized in June 8-10, 2016 were considered.

2.1. Tele Ophthalmology Diseases System (Tele Ophthalmology):

Tele Ophthalmology Diseases is the application actively used within the body of Dutch **eHealth** system. This system was designed to connect "patient, family physician, optometrist, oculist and other relevant divisions" with each other and to allow them to operate in coordination.

Unlike other countries, in diagnosis and treatment of eye diseases in Netherlands, **"Optometrists"** also play role. Although optometrists do not have authorization for surgical intervention to eye, they could determine problems of patients suffering from visual impairment and prescribe glasses or contact lenses; they are allowed to open optician store for sales of eye glasses and lenses independent from oculist (www.iskur.org).

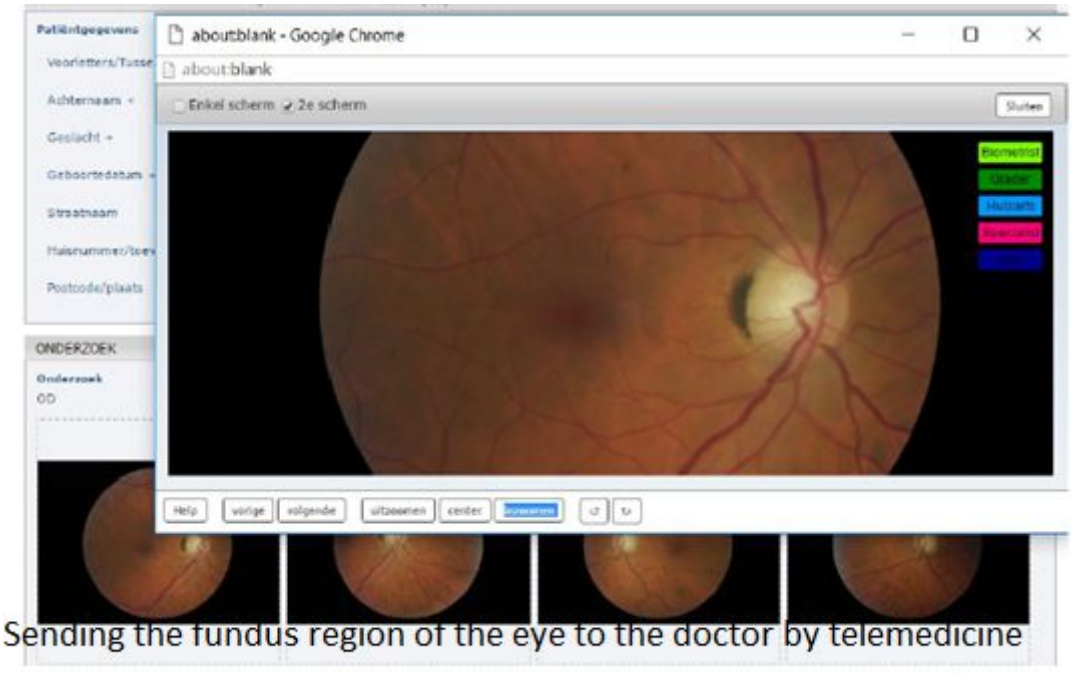
As of 2016, the population of diabetic patient in Netherlands reached 1 million. 90% of these patients are classified in "Type-2" diabetic. All these diabetic patients need regular retina/eye examination to assess the potential harm of fluctuations in insulin level. Each patient diagnosed with diabetic need to attend ophthalmologic examination once a year even though they do not experience symptom or complaint (www.turkdiab.org).

When number of population requiring ophthalmologic examination is taken into consideration, work load and wait lists of oculist would reach such high levels. In order to handle this issue, the Dutch Ministry of Health introduced **eHealth** system in diagnosis and treatment of eye diseases.

In Netherlands, 90% of patients were appealing to second level hospital for their check-ups until 2010. Afterwards, majority of patients were able to visit first level hospitals through the Tele-medicine system. For example, whereas 23,634 patients from Rotterdam were appealed for check-up to the optometrists providing the first level health service in 2015, 78% were found normal, 5% were directed to family physicians. Only 17% of the one directed to the family physicians were referred to the second level hospitals. When these rates are considered, it was accomplished that 83% of ophthalmologic patients were resolved at the first tire. This system change has also reflected on financial statements; while insurance companies saved 8.54 Euro/Patient, patients saved 10.92 Euro individually. On the other hand, oculists gained opportunity to concentrate on more specific areas.

2.2. Operation of Tele Ophthalmologic Diseases System: The patient who wants eye examination through the Tele-medicine system appeals to the closest optometrist (either in private physician's office or sales store) for the examination. While an optometrist examines applicant patient, retina and other relevant images similar to the ones below are recorded into the **Tele-medicine** system. In this process, especially they try to make a diagnosis first; if this is not possible, try to connect oculists working at other hospitals across the country through the **Tele-medicine** system and request consulting or diagnosis. In the meantime, family physicians are notified about the decisions made about the patient through the Electronic Patient Record System.

Figure 3. Sending the eye photo by telemedicine



Eye diseases diagnosed, checked-up and treated through the "Tele-Ophthalmology diseases system (Tele-medicine)" in Netherlands were summarized below:

Glaucoma: As a result of increasing internal pressure of the eye (clear substance), visual nerves are impaired, which results in visual impairments and even in blindness (www.dogaltedavi.net). In Netherlands, optometrists conducted 681 Glaucoma check-up in 2015, and 24% of them were considered to be checked-up by ophthalmology specialist; accordingly, it was concluded the others could be able to be diagnosed and treated at the first level.

Examination of fundus oculi: This operation includes examination of choroid coat which composed of retina, optical disc, macula and choroid veins, which could be viewed from through pupil through the funduscopy device (www.nedirnedemek.com).

Macular Degeneration: This is also known as age- related macular degeneration (www.dunyagoz.com).

Cataract: Loss of gloss of natural eye lens which allow visual sense (15).

Examination of Other Diseases: Redeye, Cornea Problems, etc.

Eye diseases mentioned above were the ones which could be examined actively through "**e-Eye / Tele-Ophthalmology System**" in Netherlands.

Owing to **eHealth** applications, especially dependency of diabetic patients to hospitals has reduced; even they could get their eyes examined when they are out for shopping just by stop by the closest optometrist.

According to the PhD. Witkamp, CEO of the **KYSOS** Company, if the same progress continues with the **eHealth** program in Netherlands, eye disease-related hospital visits will be reduced by **50%** in the future.

Status of e-Eye Diseases in Turkey: It was observed that there is no any clinical practice in Turkey similar to the ones in Netherlands. However, there are various services similar to the one shared below, offered by some hospitals in Turkey such as "online eye test, question/answer and e-appointment".

CONCLUSION

As a Result of the Tele-Ophthalmology Diseases System Practiced in Netherlands;

- ✓ 83% of overall patients were checked-up, diagnosed and treated at the first level.
- ✓ Eye services offered at the first level were considered economically more advantaged in comparison with the second level. Due to Tele-Ophthalmology diseases system, insurance companies saved 8.54 Euro/patients; and patients saved 10.92 Euro.
- ✓ Long wait lines in Ophthalmology clinics were eliminated.
- ✓ Owing to the health services received from optometrists located in proximity of residences, these services could be accessed more conveniently.
- ✓ Owing to this system, symptoms and diagnosis could be finalized immediately.
- ✓ Through the Tele-medicine system, Family Physicians and Optometrist who remain in contact with Specialist Physicians have gained experience and expertise along the process.

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