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## **INFORMATION AND COMMUNICATIONS TECHNOLOGY AND ITS APPLICATION IN THE MATERIALIZATION OF AN ADVANCED ELECTRONIC HEALTH RECORD**

The application of new technologies in health units suggests the materialization of an advanced Electronic Health Record as a central axis in medical information management. The aim of present study is to point out the position Information and Communications Technology has in the health field and how it can play a major role in the materialization of an advanced Electronic Health Record, offering major filing capacity in small volume, while strong huge medical data, based on international standards which are directly accessible and processable.

### **1. INTRODUCTION**

The application of the Electronic Health Record (EHR) in health units comprises the central axis in medical information management as well as the mutual indication point for its usage by medical staff teams, with the aim of upgrading the doctor and nursing staff services. The information health systems, in combination with the electronic filing for patients, in which all the patient's data is stored (demographic data, patient data, prior examinations, medical treatment and prescribed medicine) comprise the daily procedures of a health unit [9].

The use of Information and Communications Technology (ITC) is rapidly expanding in Health sectors as well. According to the Information Technology of America (ITAA), Information and Communications Technology, ICT is a study, a development, an application, a materialization, the support and management of the computer, based on the information systems [4]. Therefore, with the help of ICT, every organization is provided with the possibility of tasks being indicated in such a way that the staff are in the position of easily upgrading them or changing them completely when needed. More specifically, we will analyze the way in which ICT contributes to the materialization of former Electronic Health Record based on international standards in operational website environment.

### **2. THE ADVANTAGES OF ICT APPLICATION**

Nowadays, ICT application takes place in place in many organizations and private jurisdictions since it increases their readership and upgrades the services which are offered to the citizens. More specifically, it offers: Fuller comprehension and increased efficiency to the managerial force through the upgrading of all decisions which are made/complete and efficient customer service, through better observation of demands/improved reading, due to the development of information sources/the possibility of timely development and improvement in the quality of results, based on professional geography and the other forms of activities/continuous adjustment and improvement in the organizational structure, resulting in an increase in company course communication, consequence and continuation of managerial staff and the creation of trust in their relations with occasional suppliers and colleagues [1].

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The aim of the theme mentioned, is to lay out a course for the maximization of the social and economic force of ICT, mainly of the website, which is a vital means of economic and social activities, aiming to improve the daily life of the citizens and companies.

### 3. PURPOSE, APPLICATION AND USE OF ICT IN THE HEALTH SECTOR

The purpose of ICT is to grant access to the citizens in primary, secondary and higher services, in the framework of a decentralized system, where medical specialization and experience are available to all, regardless of their social, economic level or disability. The existing possibilities of the new technologies concerning digitization, systematic organization, processing and transfer of medical data at a low cost, form the basis for important improvement in the health services which are offered.[1]

#### 3.1. THE IMPRESSION, CATEGORIZATION AND APPLICATION OF THE SERVICES ICT OFFERS IN THE HEALTH SECTOR ARE SHOWN BELOW:

Electronic Health Record/Protection of personal data/Electronic Health Card/Cross Border Health Networks/E-Booking/Electronic payment of health services/Electronic prescription writing/Medical treatment information/Informative hospital system/Hospital wide area network/Electronic supplies/Telemedicine/Collaboration of the public and private sector.

Facing the total types of ICT applications which are used in the field of health and welfare, the basic information systems used in health are extensively introduced. Specifically:

The health information systems allow the automatization/electronication of internal procedures of a health unit. In combination with the electronic patient health record, in which all the patient's data is stored, the health information systems accelerate and ameliorate the forwarding of daily tasks in a health unit. The security of medical confidentiality and the protection of personal data is crucial through systems and technical hierarchy access of data according to each users "role".[9]

The electronic health card will replace the patient's health booklet and its use enables electronic medical record distribution (for example, certificate of discharge, reference, examination results, etc.).

The electronic health gates provide uninterrupted access to awareness and scientific information with the application of certain standards, which will secure maximum contact and operation among the developing systems, for the adaption of practical advanced electronic health.

The procedure of electronic appointment booking is greatly improved and supports quick appointment booking, rescheduling an appointment to another day/time or doctor's surgery, waiting list, complete demographic information and appointment history for each patient.

The electronic payment for health services which is adopted in collaboration with the Electronic Health Record (EHR) and the smart cards, contributes to better and more direct health services for the citizen anywhere he may be in the world.

The term electronic prescription writing means the production, distribution and control of medical prescriptions and references for medical applications, with the use of telecommunication, in all places (surgeries, health centres, hospitals, etc.).

A typical Hospital Information System comprises the process, dispatch and information reception among its different sections with the aim of supporting all the necessary actions for patient rehabilitation, data security, resource management and the support of all the necessary management-economic services as well.

A hospital network gate must be available at any time, from any position, from any computer, even from remote wireless devices, so that it provides managerial support and patient management with total confidentiality.

The electrical supply applications allow hospital transactions, pharmaceutical and doctor supplies, technology equipment with the use of electronic means, which contributes to the reduction of operational costs.

The basic services which are offered and consist of the tele-medical field, have to do with tele-diagnosis which is mentioned in the supply of diagnosis and distance, the tele-advising which assists health professionals in their collaboration with specialized scientists, for the quality supply of primary

health care in distant areas and tele-education which contributes to the continuous training of health professionals.

Public and Private Sector collaboration is a method for the creation of public substructure and public service supply, with continuous expanding application with the collaboration of public and private sectors through work contracts, old hospitals will be able to be restored, while the Public Sector will be able to develop again [9].

### 3.2. THE USE OF ICT IN THE HEALTH SECTOR SHOULD SAFEGUARD:

**Authentication** (authenticity identity control of data exchange sections), **Authorization** (the user's access must be authorized), **Confidentiality** (the observation of data confidentiality), **Integrity** (the data must remain integral, without any alterations), **Non-repudiation** (the user should not be able to refuse his co-operation in data exchange), **Revision/Audit** (each modification or data process must be checked, from whom or when it was done), **Accountability** (it should be obvious who is responsible for the introduction, access or modification of earth data), **Transparency** (there must be proof of the process procedures in order for them to be checked), **Availability** (the data must be available when required) [9].

## 4. RESEARCH METHODOLOGY

Facts have been compiled mainly from the Ministry of Health and Social Services, the General Secretary of Social Insurance, the Information Society A.C. and the 7 Healthcare Districts of Greece. In addition, information has been compiled from doctorate (Phd) theses, publications in medical journals and electronic record applications in health units around the country.

## 5. THE CONTRIBUTION OF ITC IN THE EHR MATERIALIZATION BASED ON INTERNATIONAL STANDARD TRANSMISSION, DIGITILIZATION AND OPERATIONAL WEBSITE ENVIRONMENT

Up until recently, the ICT application efforts in the health sector were fragmentary, a fact which resulted in a basic structure being developed, still incomplete. The structure creation of an informational system, which covers a wider area regarding the needs in the health sector as much as possible, requires technological harmonic coexistence and collaboration, which already exists with the new technologies. Following this, there will be a reference on the practical digitalization's as well as the international transmission standards contributing to the materialization of former HER [1].

## 6. INTERNATIONAL DIGILIZATION STANDARDS

In Europe, the Technical Committee 251 (TC 251) of the European Standardization Organization (CEN) is responsible for the standardization of information messages in Health. The ISO organization has founded the Technical Committee 251 (TC 251) with the aim of standardizing the medical computer science sector [10]. The European Standardization Committee (CEN) has published a Pre-standard for the EHR, named ENV 13606, which was published in 2000, defining general information structures and common characteristics in each EHR without defining the exact medical information it holds will be materialized. In the USA, the Health Level 7 (HL 7), which standardizes messages according to the admission, transfer and patient charge, the communication between hospital and insurance companies and the general management of pharmaceutical orders? The DICOM standard today, comprises a data standard in the form of images which medical equipment create. Picture Archiving and Communication System (PACS) is a standard, whose goal is to file, manage, distribute and store medical images and data.

## 7. TRANSMISSION AND DIGITALIZATION

Transmission is a research subject and is constantly developing in the field of digitalization and in the obtainment of information in website services as well as data exchange. The total transmission which will be chosen in a work framework is specifically important, as the characteristics which will be recorded for the description of prototypes depends on this. The choice of suitable transmission is crucial for every digitalization task, as through this, the description of digital records accelerates and as a consequence, the regaining of specific object or object with common characteristics through a wide compilation. The functioning of transmissions maximizes when established standards are followed. There are many powerful standards transmissions. In many digitalization tasks, the Dublin Core standard is mainly used. However, there should exist a common transmission core which will facilitate the quest in many digital complications in the same or other countries [1].

## 8. OPERATIONAL WEBSITE ENVIRONMENT

Nowadays, the development of high speed networks has the same revolutionary result as the development of electric energy networks and transfer a century ago. The huge force of ICT may be mobilized through a full harmonious circle of activities [1]. Attractive content and services must be provided through an operational website environment. Saying operational, we mean the connection of different information systems which each have a different purpose. The electronic health priority for pioneering purchases will promote the standardization and the operation of medical files so that they are accessible or exchangeable electronically among the member countries. Another application of services provided through the internet is the development of detailed knowledge sources in the form of rules, ontologies and data bases for different illnesses, from medical canthers or other instructions, which will from an important support factor of medical diagnosis and decisions, especially in complex situations. In order to achieve these ambitious goals, it is necessary to develop two parallel targets: complete wide zone coverage with fast website speeds and the spread of new generation network access (NGA) in a wide area of the European Union [5].

To sum up, it comes to the conclusion that ICT plays a determining role in the materialization of EHR [1] which will be based on international digitalization and codification standards, in order for there to be an increase in the quality of services offered to each citizen with a simultaneous reduction in the cost. It is obvious that the creation of an operational framework among information systems is required, based on international standards and experience, so that the EHR is user friendly and easily accessible, regarded of geographical position and timing.

## 9. INDICATIVE MATIRIALISM OF EHR. POSITIVE AND NEGATIVE. USEFULNESS OF ITC

The application of ICT in the health sector as mentioned, has the aim of storing clinical data and its exchange among the health units. The basic information system of structured information that may consist of every type of medical information, is the EHR, which comprises a good base for data analysis for decision making, ameliorates study conduct and research, analyzes the data and produces statistic results, continuously observes the patient's health course and assesses the dangers, reduces the use of patient file and the repetition of medical examinations [5].

The private sector in our country shows a large reception degree of ICT, in connection with the public sector, with the development and application of a Complete Hospital Information System [8]. Specific examples consist of Diagnostic and Therapy Centre "Health" which, in collaboration with Harvard Medical International, has developed a hospital information system based on international standards, which is connected with the section "at home nursing", providing high standard nursing care in the Attica region. The "Onassis Cardiac Center" adapts Hospital Information systems with subsystems which are conventional with the protocol HL 7 and on-line connection with electronic medical libraries. In Crete, has developed the "Hygeia net", a complete peripheral network of telematic applications and

services [2], which connects all the health centers in the region in Crete. This proves the fact that the state supports the materialization of EHR.

One would expect that the introduction of information systems in organization with such complex information management, such as hospitals, would drastically reduce the operational cost [2], which is difficult to determine, mainly because of continuous upgrading. Another important parameter is the lack of system reception from the hospital staff. The basic problem is the difficulty in exchanging data and application connection among the existing information systems [1]. A look of standardization in the communication structures which are used is also observed, in addition to a lack of operational framework based on international standards and indirect access and application.

Taking all these into account, we come to the conclusion that the application of ICT is necessary in the health field. More specifically, with the application of ICT, as we will prove analytically below, we will have an introduction of advanced software which will support the HER technologically, so that it is user friendly, for there to exist immediate access and collaboration with other applications continuously and from any geographical region to comprise automatic computer image processing and finally, for there to be a valid diagnosis.

## 10. PROPOSED SYSTEM OF ADVANCED EHR WITH THE USAGE OF ICT

Taking into account the application of the EHR nowadays and the way in which it is applied in a number of healthcare units, as well as what was mentioned above, the need for the creation of an advanced EHR is strongly required, based on international standards. More specifically, ICT will support in its materialization, an improved EHR, specializing in specific medical problems, which will be based on digital medical supply and will support the doctor in his diagnosis, treatment and prognosis of medical problems. For example, a doctor receiving a patient with thyroid cancer at the outpatient department of the hospital will select a programme from the hospital central information system for this purpose, which will have been exclusively materialized for endocrinological patients and he will be able to add information about the specific patient. In this way, the following will be achieved [2]:

1. Doctor assistance for the creation of an electronic patient record, based on predetermined protocol, which will contribute to direct and not superfluous history access,
2. Easier search for personal data (individual or family), even in the case where the patient has been hospitalized in a certain clinic of the same or different hospital,
3. Improved data concerning the patient, which includes images, biological signs, clinic plans, photos,
4. Digital management and medical information processing,
5. The existence of technical solutions for digital information management, as well as work flow support, long-term management and strategic development of health organizations,
6. Greater possibility in international standard digitalization use and standardization procedures, which lead to the creation of a digital medical analysis supply of patient data,
7. Determination and harmonization of medical transfer which will be compiled and stored based on international standards, with the aim of harmonizing digital medical supplies with the international standards, in order to achieve maximum operation with the international data,
8. Assistance for prompt patient diagnosis and therapy, through access in knowledge-based systems.
9. Easier data input from laboratory examinations through automatic protocol incorporation of these examinations,
10. Easier recording of comments because of the existence of codification systems (ICD 10, GEHR, ICPC),
11. The possibility for better therapy result assessment through data access to other doctors dealing with similar cases,
12. The possibility to observe the patient's course of illness from a distance, since the programme will support laboratory examinations and will enable the doctor to write out electronic prescriptions as well as to offer advice on television [10],

13. Improve the user's daily tasks since it is no longer necessary to complete forms and the applications are constructed in such a way that they will facilitate and help the user (for example, default field rates, codified lists, assistance messages e.t.).

As it has been proved from the present study, several efforts have been made for better organization of medical data. Unfortunately, the desired results are not feasible in all situations. The main reasons why certain applications have failed are because they do not respond to the demands of professional health and in general, the demands of each user, since they are not easy to use. Moreover, another observation is a lack of immediate access to the application at any time as well as difficulty upgrading it. Therefore, collaboration with other applications or incorporation into another system is extremely difficult. Taking into account what has been mentioned above, there is a need to materialize an advanced information system where the information will be the best possible organized and accessible.

In other words, the proposal is the materialization of an ideal EHR which will offer as much as possible to the health field. More specifically, its main characteristic will be its "power". The data impute for illnesses will be conducted by the super user, while the user will choose the illness with which he wants to deal with and will impute or process the patient's facts. In addition, any user can enter the system with his code and the object he is interested in. Also, through a specific choice, he will be able to search for information he desires, in different medical data bases and on the internet. Another possibility the suggested EHR offers is the ability to diagnose the illness according to the facts which have been recorded. An important contribution to the validity of the diagnosis is offered by the Technical Neuronic Networks which are responsible, based on their data, for diagnosis deduction with minimal rate of error. Direct system access with use of network technology is also necessary so that the user has access at any time. In that way, there will be a special system edition which will be suitable for smart portable devices (smart phones, tablets) [3].

## 11. FUTURE PURSUITS-RESULT EXPECTATIONS

Summing up the study into different applications of Information Systems in the health field, we come to the conclusion that the immediate materialization of advanced EHR is an imperative pursuit for the future of health, which, with the support of ICT will develop algorithm decision support and data base related technology with the following expected results [6]:

- The possibility to control and coordinate in distant places and simultaneous information availability with the use of the internet,
- Huge computer dynamics which allow the conduct of complex calculations in minimal time with the slightest possibility of error,
- Great recording dynamics in small capacity and the possibility to research and to receive information quickly.

This means that:

- ✓ The insured patient is able to have the same Health System and Social Insurance, regardless of his type of health insurance or the Health Unit with which he transacts,
- ✓ Medical procedures and prescription writing can be checked and processed easily and precisely,
- ✓ Huge amounts of medical data are available and processable quickly,
- ✓ Financial transactions can be conducted immediately and examined centrally.

## 12. CONCLUSION

ICT aims to ameliorate the personnel working conditions in health units. The absence of advanced EHR proves that the existing Hospital Information System suffers because there is a lack of operation and application of international digitalization standards, it is difficult for professional healthcare personnel to use, it is not based on quick network technologies and it does not contribute to the diagnosis of an illness. For this reason, the materialization of an advanced EHR is imperative with the use of ICT, however, organizational and institutional changes are necessary so that the existing system can be upgraded and for hospital units to be managed with technically equipped personnel.

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