Cancer Biology

Necessity of E-Health as a New Tool for Cancer Care Improvement

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Abstract: Cancer has economic, social and psychological burden for countries. Modern Ehealth technologies can improve cancer and reduce cancer incidence. The use of Ehealth tools such as telemedicine, mobile and handheld technology, and artificial intelligence can remove distance barriers, empower patients, and provide suitable palliative care. Delivering high quality continuous patient care, health behavior changes strategies and use of artificial intelligence and agent technology advantage are other benefits of Ehealth systems. The success of Ehealth tools in cancer care depends on the design, development and implementation of appropriate infrastructure in technical, information, confidentiality, and privacy domains and organizational culture. This article presents capabilities of Ehealth tools in improving the delivery of cancer care service in preventing, early detection, control, treatment and palliative care domains and discusses about the key infrastructures for successful implementation.

Key words: E-Health, New Tool, Cancer Care Improvement

Introduction:

Cancer is one of the most preventable and common chronic diseases (1) that has economical, social and psychological burden for patients, families and the society. According to WHO reports, more than two thirds of all cancer deaths occur in low- and middle-income countries (2). In 2008, approximately 72% of cancer deaths occurred in these countries. In spite of lower incidence of cancer in low- and middle-income countries , the survival rates are low (3) because of delays in diagnosis and identification of disease in advanced stages. The incidence of cancers in Iran has gone even further than expected according to the World Health Organization (4). In Iran cancers are the third cause of death and the second prevalent chronic diseases (5).

Nowadays health systems confront with increased complexity of cancer control. Some of the most important ones are: rapid unplanned urbanization and changing in lifestyles toward unhealthy habits (6), limited national funds and resource for cancer care expenditure (7), lack of expert human resources to provide health care (8),poor communication and coordination between cancer care providers and inaccessibility to patient information in real time (9). The problems of cancer in the world are so huge that makes it difficult to find the right solution to improve them.

One of the most practical preventable methods is cancer screening. Electronic health (E-health) supports optimal cancer screening program operation, monitoring, and evaluation in all dimensions (10). In fact, E-health is the practical application of information and communications technologies (ICT) in the delivery of cancer care and cost-effective for different entities of care. For instance, tele consultation as one of the main areas of E-health applications in cancer is useful and provides equitable services to remote areas and allows experts communicate with each other from a remote place (11). Also, other ICT tools can reduce medical errors with providing timely access to specialist's opinion about interpretation of cancer

investigations and related health information (12). The aim of this review article is to survey impacts of new information and communication technologies on the delivery of cancer care services in preventing, early detection, control, treatment and palliative care domains for cancer care improvement.

Necessity of the Use of E-health To Meet Cancer Care Challenges:

E-health as an application of internet and other related technologies in the healthcare industry can improve the access, efficiency, effectiveness and quality of health care process. Using the power of IT through the internet and telecommunications, one can provide home care and mobile health to improve public health services, social support and the delivery of health information for health professionals and health consumer's. E-health systems include lots of different types of tools. Some of the significant applications directly support or relate with patient treatment and some of them support research and health reporting, and care management (13).With the development of medical knowledge and advances in technology, cancer care systems for better outcomes and increased productivity need to take advantage of the latest E-health technologies. Some of these technologies include: Telemedicine, Mobile health and Handheld Technology, and Artificial Intelligence.

Telemedicine:

Telemedicine acts as a potential source to extend authorized users access to related information, early detection, and cancer control. It also helps to optimize the resources for providing suitable quality palliative care, and support home care (14). There are various telemedicine applications in cancer field in different countries, such as Patient Centered Oncological Electronic Medical Record (PEMR), WCHM's pilot project, and Oncology patient centered medical home (OPCMH).

PEMR: Tele consultation based on electronic medical records specifically in cancer is designed for the clinicians as a collaboration tool in care management. The aim of this project is to design, develop and evaluate a computer-based framework to support the clinicians in the management of cancer treatment in different centers and provide an efficient tool for professionals to improve delivery cancer care service (15).

WCHM's Pilot Project: This project as a first national telemedicine network in the world is established in Malaysia. This system connects 41 hospitals and public health care centers through a remote integrated network. The primary focus is on Cardiovascular, Cancer Antenatal, Perinatal, Trauma and Emergency Medical tele consultation (16).

OPCMH: In fact, this system has become an oncology practical model that changes management processes and accountability to deliver high quality cancer care. OPMCH improves continuous patient care and satisfaction by reducing the overall cost of cancer care. In the future of health care domain, the Oncology Patient-Centered Medical Home can be a profit system (17).

Mobile Health and Handheld Technology:

Advent of mobile devices and handheld technology with capabilities of handy and easy caring is one of the modern effects of IT whose application is growing especially in the industrial sectors such as cell phones, smart phones (mobile phones processing capabilities, storage, and intelligence communications) and personal digital assistant (PDA) (18).

Easy to carry and quick access to information on mobile devices make them perfect tools for healthcare providers. Mobile devices play an important role in consulting, diagnosis, treatment (19), medical education, research (20), service reimbursement, quick access to information during shift change sectors, chronic disease management (21), patient empowerment, and rapid establishment of communication regardless of distance restraints (22). M-Health applications include:

NIR Scanner TM: The near-infrared (NIR) is a safe, affordable, non-invasive, handheld device which can detect breast cancer in women early by using an optical scanner. This tool is used as a means of personal care and public health for breast cancer pre-screening and as a first step, affordable and easy to use mass screening device. This system is available to the general population and over the counter without a prescription but cannot replace other diagnosis methods such as x-ray mammography (23).

Mobi health BAN System: This project aims to improve patients' quality of life and freedom in their daily activities and complete mobility (24).This system is used for cancer care at home, tele monitoring, tele treatment, cardiology, obstetrics, trauma care, rheumatology, psychiatry, pulmonary medicine, gerontology, and neurology (25). Users because of wireless extra communication in this system can have complete mobility (26).

Personal Health Monitor System (PHM):

This system is used for chronic disease management, cardiology, general well being, rehabilitation, and monitoring. The system can provide

outcome of the monitoring depending on the clinical tools and patient preference. For example elderly people who live alone can use reminders and alarms in sound format (27).The system runs on the mobile phone and uses cable or wireless communication (28).

Game-based Technologies: In recent years, development of 3G network and handheld device has lead to innovations in mobile technology and the move to health games (29). Technology-based video game playing is one of the fascinating and fun ways to deal with emerging needs for personal health care management (30).The aim of designing these games in the field of health is combining established principles of learning and health behavior change strategies.

Serious games seek to support user training in their real life. The first wave of games, try to understand how to use the games in many fields such as health. Some games are useful to decrease stress in children under chemotherapy and improve the situation of young burn victims in terms of recovery of hand, wrist, and elbow motion. Games running on mobile devices with the help of bio-sensors and Internet access can have a wide influence on personal health-related behaviors (31).

Artificial Intelligence (Agent Technology):
Agent technology has emerged in the past years as a new paradigm in artificial intelligence (AI) and has become an interesting area in health care. One of the characteristics of agent is mobility, which is suitable for telemedicine and E-health systems (32).

Multi agent approaches apply in different fields in health care such as tele care, education, medical image processing and bioinformatics (33,34).Some agent based health care systems include:

Integrated Mobile Information System (IMIS): This system is used for chronic, diabetic homecare and elderly care. Some of the system capabilities include integrating and coordinating various healthcare activities under the same fundamental activity system, self-treatment, preparation before face-to-face diagnosis, accessing and sharing the same and right information on right time (35)**.** Cancer care system can use these capabilities to increase quality of care management, early detection, prevention and suitable treatment.

SAPHIRE: The aim is to provide clinical decision support system based on semantic infrastructure for tele monitoring in home care or hospitalized patient. With the help of this system, the workload of medical personnel and health care costs are significantly reduced. (36)Annicchiarico et al., 2008).

Key Infrastructure of E-health In Cancer Care Improvement:
Evolution of E-Health in cancer care requires coordination capability between the resources and the coordination itself needs infrastructures. Some of the most important infrastructures include:

a- Technological Infrastructure:
Technical infrastructure is the basis for all information systems in health care organization. Nowadays, due to the widespread use of clinical e-tools, health care industry in order to maintain its survival in the current competitive environment needs information technology. Development of this technology vitally depends on the network infrastructure. As a first step to create the appropriate infrastructure, one must understand the needs of end-users, occupational needs of users and types of applying technology and identify the environment. Next step is to define applications of broadband network and service quality requirements.

In designing the network one should consider the following:

1- It should be able to identify the latest needs of end users dynamically.

2-It should be flexible in terms of engineering and be able to support the future developments.

3- The support should focus on the most essential and important things. Periodical investments or support of cases less relevant to objectives leads to serious crisis.

4- Current management requirements should be minimized (37)

b- Information Infrastructure:
Information infrastructure is a tool that makes it possible to develop e-health concepts and systems. To provide appropriate information infrastructure and accelerate development of electronic health system especially in cancer care, it is necessary to address the following items and apply them: Coordination of information models, preparation and development of comprehensive standard, legislation of appropriate laws, providing medical services according to specific needs, and information infrastructure for patient record.

c- Confidentiality and Privacy:
Privacy and confidentiality are often considered synonymous words and are sometimes used interchangeably. Privacy and confidentiality is a concept that an individual can have the right to decide what information about him/her should be disclosed.

One of the most positive features of electronic records is easy access to patient data. But this ease of

access increases the risk of confidentially violations (27) Of course health care systems must use technical, political, and physical tactics in order to secure protection of data privacy and confidentially.

Different levels of security in the information technology in health care providing organizations include physical, network, system and data security. Primary tactics for maintaining the confidentiality of secure data is as follows: Access control, Monitoring, Auditing, Encoding and decoding of data, and Authentication (All actions about organizing and accessing the information should be based on the level of allowed people) (37)

d- Organizational Culture:

Organizational culture has an effect on the success or failure of information systems in organizations. Each group of health care professionals have their own culture, philosophical background, personal beliefs about the role and status of the profession in the health care team in information technologies implementation. Application of information technology tools in the health system, especially in cancer care needs to change organizational culture to valuing innovation, positive attitudes towards information and communication technologies tools (27,37)

Conclusion:

Cancer is one of the chronic diseases and an important public health problem. Screening, as one of the most practical preventable methods, helps early detection and prevention of cancer. E-health improves cancer screening, treatment and delivery of cancer care services. Recent advances in E-health tools specifically in telemedicine, mobile health and handheld technology, and artificial intelligence lead to health care organization and taking advantage of these modern technologies for efficiency and effectiveness of their outcomes. Telemedicine can decrease unnecessary admission, remove distance barriers, and facilitate on time access to health information and follow up disease. Mobile health in addition to the benefits of telemedicine advantages have more positive points like easy to carry and quick access to information, support user training, and patient empowerment. This technology because of extensive adoption by people may offer cheaper solutions to telemedicine.

Electronic health care system, in order to develop and increase its capabilities, needs to use the artificial intelligence tools and intelligence systems like agents. Agent technology because of mobility is very suitable for telemedicine and mobile health systems. Intelligent behavior and agent characteristics lead to better performance. The success of E-health

tools in cancer care depends on design, development and implementation of appropriate infrastructures in technical, information, confidentiality, privacy and organizational culture. It should be noted that using E-health systems only with a technical view cannot lead to the removal of obstacles. In delivering health care to patients, considering social and human aspects and having a systematic view for implementation of E-health systems are essential.

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