

Original Article

Health Technologies and Reflections in Nursing Practices

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Abstract

Modern healthcare system uses many advantages of information and communication systems, in order to increase the quantity and quality of medical healthcare services. In medical healthcare institutions, the largest labor force with clinic knowledge comprises of nurses. In line with this purpose, increasing the knowledge in nursing practices, using new technologies becomes important. The purpose of this article is to examine the innovations in the healthcare technologies and its effects on both Turkey and worldwide.

Key words: Nursing Practices, Health Technologies, Telehealth, Telenursing

Introduction

Rapid and suprisingly astonishing innovations in science and technology have brought a fierce and confidential competition among countries and this competitions made the countries to improve their existing technologies inevitable. Additionally, citizen's expectations to live in a more prosperous environment increased the improvements in technology. Consequently, use of techonology has become an obligation rather than a priviladge. Medical healthcare sector has become the pioneer of this technology improvement sector, plus brought up the concept of health technology, which has importance in making the life meritable. Health technology is defined as the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of lives (WHO, 2013).

In contemporary society, information and communication technologies advance inevitably, so that it affects the shape of healthcare services. Like all other professions, correct and efficient use of technology affects nursing as a profession. Nursing institutions accepts technology as an important variable that affects the healthcare practice and efficient use of technology,

acquiring the knowledge, skills and attitute has become a requirement in nursing (Hegarty, Walsh, Condon, & Sweeney, 2009; Isik & Kaya, 2011).

Hence, use of information technologies is one of the major components of basic competency areas of nursing and medicine. Nurses, when determining the technology that they use, renew policies and procedures which are applicable, usable and reliable , also concern the level of effectiveness, cost, social, legal and ethical aspects (Barton, 2010). Technology systems such as healthcare mobile applications, robotic surgery, nanotechnology, smart wearable technology, web based care and education applications, health informatics, tele-medicine applications, wound care technologies, programmed barcode infusion systems, simulation, social network applications; are used for a variety of applications such as, acceptance of physician requests, prevention of errors and side effects, barcode retrieval for drug applications, decision support systems, nursing education, establishment of standard nursing care plans, clinical guidelines, procedures etc. (Canadian Nurses Association, 2006; Hegarty et al. 2009; Valiga, 2012; Doyle, Garrett, & Currie, 2015).

Efficient use of healthcare technology systems have important roles

- In organization and management of nursing services
- In recording, storing and sharing the patient information
- In facilitating clinical decision making
- In speeding up the communication network
- In standardization of nursing care planning
- Averting medical complications
- Commuting clerical work
- In alerting changes of patient condition
- In escalation of maintenance time
- In decreasing the patient care costs
- In identifying possible future diseases
- In statistical evaluation and development of research database
- In distribution of health benefits (Potter & Perry,1997; Menke, Broner, Campbell, McKissick, &Edwards-Beckett, 2001; Hovenga, Gadre, & Heard, 2005; Langowski, 2005; Ay, 2007; Barton, 2010; Lammintakanen, Saranto, & Kivinen,. 2010).

Table 1. Intelligent Wearable Patient Tracking System Sensors

Sensor Types	Signals	Signal Source
Skin Electrodes	Electromyogram (EMG)	Muscle electrical activity
Electrodes placed in the head skin	Electroencephalography (EEG)	Electrical activity of brain potentials
Skin Electrodes	Electrocardiogram (ECG)	The waves of P, Q, R, S, T, U
Accelerometer	Activity, Mobility, Declination	Posture and Limb movements
Piezoelectric / Piezoresistive sensor	Respiratory rate	Unit breathing
Phonograph	Heart sounds	Record with heartbeat microphone help
Glucosemeter	Blood sugar	Evaluation of the amount of glucose in the blood
Pulseoximeter	Oxygen satiety	Oxygen hemoglobin in blood
Temperature probe and skin tape	Body or skin temperature	Body or skin
Woven metal electrode	Galvanic skin response	Skin electrical conductivity
Stepper	Number Of Step	Walking
PPG sensor	Volumetric blood value	Finger and ear lobe

Tele Health-Tele Nursing

Tele health is "the sharing of health data, education and healthcare information between health personel and patients, students and other health personel, education, telecommunication, using telephone, computer, interactive television or a combination of them (Koch, 2006).

This includes systems and procedures including a simple phone call , medical videoconferences, the ability of doctor/nurse to monitor the patient data online, video system usage for online doctor/patient/nurse visits, teleconsulting, conducting remote surgical operations via robotics.This system, provides a bidirectional communication between healthcare personnel and patients.

The system includes devices (blood pressure, oxygen saturation, electrocardiogram), video camera, computer, monitor, and internet connection that provide the measurement of life signs in the patient section. With this system, the measuring apparatuses are attached to the body of the patient, the patient data is transferred to the computer by a cable, transmitted to the health professionals, or interviewed by the health professionals through the video-conference method (Jenkins & White, 2001; Frantz, 2004; Koch, 2006). The telehealth system provides for early identification and intervention of changes in the patient's condition, reducing the number of home visits, urgent visits to the hospital and hospital admission, hospitalization, effective communication, reducing the cost of care, and increasing the patient's self-care (Ratliff & Forch, 2005; Koch, 2006; Hain, Ng, Aronow, Swanson, & Bolton, 2009). Tele-health services are helping to improve care management and quality of life, especially for patients with chronic illnesses. The International Nurses Association (ICN) defines tele-nursing as "the use of communication technologies in nursing to improve patient care," while the American Nurses Association (ANA) defines "nursing practices such as information about patients' health status, Activity ", approved in 1999 as a component of nursing practice.

Within the scope of tele nursing, telephone nursing, tele-triage and tele-home care nursing are applied to the patient. At the same time, patient education, high-risk group of patients, counseling and communication are maintained (Valanis, Tanner, Moscato, & David, 2003). In tele triage practice, the nurse ensures that the patient identifies their health problem and directs it to the necessary resources. In tele maintenance practices, nurses collect and evaluate the information of patients and direct them to appropriate health resources at the appointed time. It also follows systems that include alarms, sensors and other equipment that help people with social and health care needs live longer without external care. As part of the tele-home service, the station is equipped with a videoconferencing unit connected to a regular telephone line. Patients provide the necessary home monitoring equipment (such as a glucometer, blood pressure monitor, pulse oximeter). The necessary measurements are followed and necessary interventions are performed (Lorentz, 2008).

With tele nursing, changes in the patient's condition can be detected and intervened early, responsiveness to patients' treatment and care can be improved, satisfaction can be improved, and they can help return to their role in daily life (Downe-Wamboldt et al., 2007; Reinhardt, 2010).

In Turkey, services for tele nursing have been given in the fields of application in some health centers and scientific studies and although the importance has been put forward, the definition of job has not been done yet. In order for telehealth services to be widespread, it is necessary to determine the task and definition of tele nursing, to be seen as a field of expertise, to be disseminated at national politics level, to be included in clinical applications, administrative support and financial resources should be determined.

Electronic Health Records (EHR)

Electronic Health Records are resources that patient datas are recorded digitally and transmitted securely and only can be accessed by users who have proper authority. Computer and computer controlled systems, bring extraordinary extents to diagnosis and treatment in modern medicine, provide convenience and accelerates the medical processes. It provides many complex yet similar cases to be interpreted easier, safer and correct and enables medical data to be accessible without any distance. Thus, examination, evaluation, diagnosis, treatment, access to information about health, education and professional help can be provided easily. EHR provides not only readable and interdisciplinary data sharing but also facilitates evaluation of data (Ay, 2009; Yanamadala, Morrison, Curtin, McDonald, & Boussard, 2016).

Nurses are the biggest medical personnel who are direct caregiver to patients and determines the patient needs (Hovenga et al., 2005) Hence, nurses are the primary users of the computerized system. Both many quantitative and qualitative data are recorded by nurses (Cho & Park 2003; Park, Cho, & Byeun, 2007). These data supports nursing practices not only for the improvement of nursing information systems but also for hospital information system improvement.

Effective use of computers has significant influence on maintaining patient care and improving quality. Indeed, contemporary information systems mitigate repetitive

bureaucratic procedures, reduce the need for paperwork, and increase the time spent directly on patient care. This increases the quality of the care provided (Kleinbeck & Dopp 2005; Ay, 2007) as it allows time and labor to be used more efficiently and patiently.

In addition, the EHR also provides standardized care plans that can guide patient care nurses in detail, record patient care and care results, improve patient care quality, and help with managerial decisions such as charging, performance assessment, and determining the number of nurses needed.

Nursing is a system that provides nursing support for nursing knowledge, management of data for care, nursing practice, tools, phases development. (Erdemir, Hanoglu, & Akman, 2005). Nurses use the information system for many different purposes, such as registering care and treatment and monitoring their results, registering development and change in patient status using clinical or other methods, communicating between departments and shifts, and statistically evaluating outcomes of healthcare (Elkin, Perry, & Potter, 1996). This system facilitates clinical decision making, increases time allocated to the patient, standardizes nursing care plans, improves written communication between nurses, ensures that patient records are kept in order and creates a database. In addition, these records establish a legal document for the protection of the nurse and increase the responsibility of the nurse. At the same time, the number of observations that result in forced reminders increases. Additionally Blocks medical errors and improves the quality of care. Moreover, it generates data for statistical evaluations and surveys as the data about the patient provides for the recording and storage of plans. (Potter & Perry 1997; Menke et al., 2001; Hovenga et al., 2005; Ay, 2007)

In Turkey, electronic medical records and web-based maintenance programs are generally used for outsourced computer programs. These programs do not conform to the Turkish Health System, language structure, legal regulations and cultural structure in Turkey. Prepared packaged programs written in Turkey do not respond adequately because they are written by individuals who do not have sufficient knowledge of software and hardware, or who have little knowledge of computers or have no knowledge about occupational functions. They

do not reflect professional performance in patient records (Erdogan, 2003). Easy to use information retention system that allows information flow and usage among the units in Turkey, enables inquiry on the records kept on the computer, is flexible enough to reflect patient changes in the diagnosis, treatment and care of all health professions, And must be reliable in auditing.

Robotic Surgery

Robotic surgery is defined as surgery performed by a physician via a robot. This is a new technology that has recently opened new horizons for medical science and physicians use this technology for an increasing number of different surgical procedures. There are many reasons why robotic surgery is so widely used and accepted in the medical world. These include; that the area of surgical incision is small, patients have little pain, bleeding and infection rates, have a short period of discharge and shortness of discharge and do not disturb the patient in terms of cosmetics and chemotherapy (Palep 2009).

Nurses play important roles during robotic surgery practices ; especially in pre-surgery period; proper positioning of the patient, preperation of the system and its control, securing the surgery team. During surgery; supporting the surgeon to conclude the surgery correctly, maintaining the asepsis, reading the data on the videoscopic screen correctly and quickly, taking necessary precautions in case of a possible power insufficiency. Nurses also have many important roles in post-surgery period; such as controlling the airway clearance, preventing medical complications (Tabor, 2007; Ucuzal & Kanan, 2008; Celik, 2011).

In Turkey, many fields of urology, general, chest, cardiovascular surgery, orthopedic surgery, plastic surgery, otorhinolaryngology and gynecological surgery are conducted with the help of robotic surgery. Nurses also adapt themselves to this continuously improving technology as an important member of the surgery team and integrate these improvements to their practices in compliance with their duties and responsibilities.

Gamma Knife Radiosurgery

Gamma Knife radiosurgery, is a treatment which allows to perform a surgery without any cuts, the location of diseased brain tissue is determined by

coordinates and destroyed or the growth of diseased tissue is stopped by gamma rays. It is a technique which can be conducted without any general anesthesia, which has %25-%30 lower costs, which do not cause any pain or uneasiness on patient or hair loss, which causes no infection or blood loss risk due to no need for surgical wounds, which enables patients to return their daily lives the day after the surgery (Kayhan, 2005).

In gamma knife radiosurgery preoperation patient preparation process, the nurse takes place; in the training of patient on the treatment plan, supply of necessary equipment and preparations, the preparation of Gamma Knife unit and conducting a healthy communication among team members. During the operation nurses take place; in preparation of sterile material preparation during stereotactical frame insertion, assisting the doctor during operation procedures, conducting final controls before Gamma Knife operation and maintaining the sterile environment during frame extraction. In post-surgery period nurses take place in, monitoring the life signs, pain and bleeding check, preventing medical complications and providing discharge training (Tekin, 2010; Celik, 2010)

This technique applied in specific and limited centers both in Turkey and worldwide; has become one of the standard treatment methods of neurosurgery with its wide application area, sharpness, low complication and high success rate. For this reason, it is very important for nurses working in the field of surgery to have continuous training on Gamma knife radiosurgery technology in terms of safety and quality.

Nanotechnology

Nanotechnology provides great contributions to the field of health through the development of medicine, drug development, diagnosis, treatment, prevention of disease and traumatic injuries, control of pain, protection and development of human health, water decontamination, information and communication technologies and production of durable and light materials (Singh et al., 2009). Additionally, gene treatment through nanorobots, discovery of the secrets of DNA and treatment of genetic diseases will be enabled (Botstein & Risch 2003). Today, clinic systems such as orthopedic prosthesis, cardiovascular implants,

neural implants, plastic and reconstructive implants, dental implants, ophthalmic systems, catheters, insulin pumps, syringe, adhesives and blood substitute systems are used in our clinics. Nanotechnology is expected to have a very important place in the future as materials, devices and systems with more functional, faster, less space-consuming, less energy-consuming new features are produced.

While nanotechnology has been talking about benefits to human health and medical practice, it has recently been stressed that can cause toxic, mutagenic systemic effects in individuals. It is stated that nanotechnological products entering medical applications may cause possible toxic effects on nerves, respiration, digestion, blood and skin due to their molecular properties (Berk&Akkurt, 2012).

For this reason, nurses working in clinics need to be aware of the molecular structures and sizes of nanoparticles and develop protective applications to prevent them from being inhaled and removed from the skin.

In Turkey nanotechnological products, especially the one used in early diagnosis of cancer, effects in cancer patients, new possible symptoms, individual treatment interpretations of patients, records of nurse observations will be able to provide the distinguishing data from the traditional treatment. Additionally, it is suggested that; researches on the long term effects of nanotechnology in certain fields such as pain control, wound recovery and diabetes management should be conducted and nurses should provide consulting services to patients on this field.

Wound Care Technology

Wound care has been an important topic throughout history and many methods of wound care have been developed. Today, wound care, one of the special branch nursing fields, requires special knowledge and skills. Another aspect of nursing care is comprised of making use of new technologies and efficient use of these technologies. Both acute and chronic illnesses can be successfully healed with new injuries, new treatments and care initiatives which become a major problem for patients. There are a number of wound care products such as films, foams, hydrocolloids, alginates, hydrogels, etc., which can be used according to the clinical scene. When choosing a large number of

dressings materials developed, nurses should be careful not to make the dressing material simple, expensive, highly absorbent, and not stick to the wound.

Numerous biological and synthetic dressing materials have been developed in the world and in Turkey, especially for the treatment of chronic wounds, to reduce pain, accelerate epithelization, reduce the frequency of dressing change, and shorten the duration of treatment (Baskan, 2005; Eski, Nisançı, Yapıcı, Devci, & Sengezer, 2007). In this direction, nurses use new technological products to improve the quality of care and the duration of wound healing.

Intelligent Wearable Patient Tracking Systems

Intelligent wearable patient tracking systems is designed for monitoring an individual for 24 hours a day and warn in case of necessary conditions. Recipients include wearable items such as jewelery, eyeglass, watch, clothes (PWC Health Research Institute, 2014). This may include monitoring the individual's health activity, measurement of the individual's glucose level and warning against possible dangers (Akbulut&Akan, 2015).

Intelligent Wearable Patient Tracking Systems are a new trend envisioned by individuals to be able to monitor their health status in real time by measuring data related to their own health and thus help them to protect their health. Medical parameters such as blood glucose level, body weight, blood pressure, heart function, and the level of oxygen in the body can be recorded in the individual measurement applications as well as the healthy life items such as the number of daily steps, sleeping period, meal level, stress level (Ananthanarayan & Siek, 2012).

As a component of tele nursing; the data that intelligent wearable patient tracking systems provide are transmitted to health professionals and enables early diagnosis and intervention opportunities. At the same time, it is enabled that patients take more responsibility in their treatment and healthcare and reinforces health services provided at home. In Turkey, studies on intelligent wearable patient tracking system technologies has a priority in research funds and researchers are encouraged.

Conclusion and Suggestions

As a result, nurses are healthcare personnel who has a key position in maintaining health and improvement. Studying newer trends which affect nursing profession, and researching on the effective use of these newer trends play an important role in reconstruction of nursing practices. For this reason, continuous training of all healthcare professionals are quite important in terms of quality and safety of healthcare practices. Use of information and communication technologies will increase the quality of nursing practices and the quality of healthcare; while contributing to the nurses and nursing managers on the road to professionalism.

References

- Akbulut F.P. & Akan A. (2015). Smart Wearable Patient Tracking Systems. National congress of medical technology. Mugla, Turkey.
- Ananthanarayan S. & Siek K.A. (2012). Persuasive Wearable Technology Design for Health and Wellness. 6th International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth) and Workshops, USA.
- Ay F.A. (2007). Process of Nursing. In: Ay FA (ed). Basic Nursing: Concepts, Principles, Practices. Istanbul Medical Publishing, 60-74.
- Barton A.J. (2010). Patient-centeredness and technology-enhanced care. *Clin Nurs Spec*, 24:121-122.
- Baskan S. (2005). Contribution of surgical developments to the treatment of infectious diseases. *Journal of ANKEM*, 19:14-18
- Berk S. & Akkurt I. (2012). Nanoparticle: The Scared Dream of Your Future. *Tuberk Toraks* 60(2):180-4.
- Botstein D. & Risch N. (2003). Discovering Genotypes underlying human phenotypes: past successes for mendelian disease; future approaches for complex disease. *Nature Genetic*, 33, 228-237.
- Canadian Nurses Association (2006). Toward 2020: Visions for nursing, <http://www.cdha.nshealth.ca/towards-2020-visions>.
- Cho I. & Park H.A. (2003). Development and evaluation of a terminology-based electronic nursing record system. *J Biomed Inform*, 36: 304-312.
- Celik S. (2011). Information Update in Surgical Care. *Journal of Acibadem University Health Sciences*, 2(2): 61-65.

- Downe-Wamboldt B.L., Butler L.J., Melanson P.M., Coulter L.A., Singleton J.F. & Keefe J.M. et al. (2007). The effects and expense of augmenting usual cancer clinic care with telephone problem solving counseling. *Cancer Nurs*, 30: 441-453.
- Doyle G.J., Garrett B. & Currie L.M. (2015). Integrating mobile devices into nursing curricula: Opportunities for implementation using Rogers' Diffusion of innovation model. *Nurse Education Today*, 34(5): 775-782.
- Elkin M.K., Perry A.G. & Potter P.A. (1996). *Nursing Interventions and Clinical Skills*. St Louis: Mosby-Year Book, 1-13.
- Erdemir F., Hanoglu Z. & Akman A. (2005). Opinions of nurses about computer and internet use and the value of computer use in nursing. 2nd National Medical Informatics Congress, Antalya, Congress Summary Book, 78-84.
- Erdogan S. (2003). Using standard and common language is the opportunity for the future of nursing?. *Journal of Nursing*, 50: 1-13.
- Eski M., Nisançi M., Yapıcı A.K., Deveci M. & Sengezer M. (2007). Use of silver-containing hydrophilic dressing material in the treatment of partial thickness burn wounds. *TPRECD*, 15, 100-104.
- Frantz A. (2004). Matching telehealth applications to the patient, clinician, and agency's needs. *Home Healthc Nurse*, 22: 672-675.
- Hain P.B., Ng C.S., Aronow H.U., Swanson J.W. & Bolton L.B. (2009). Improving communication with bedside video rounding. *AJN*, 109:18-20.
- Hegarty J., Walsh E., Condon C. & Sweeney J. (2009). The undergraduate education of nurses: Looking to the future. *International Journal of Nursing Education Scholarship*, 6,1-11.
- Hovenga E., Gadre S. & Heard S. (2005). Nursing constraint models for electronic health records: A vision for domain knowledge governance. *Int J Med Inform*, 74: 886-898.
- Isik, B. & Kaya H. (2011). The role of nurse educators in the integration of information and communication technologies into the teaching-learning process. *Journal of Istanbul University School of Nursing*, 19(3): 203-209.
- Jenkins R.L. & White P. (2001). Telehealth advancing nursing practice. *Nurs Outlook*, 49: 100-105.
- Kayhan Z. (2005). Innovations and predictions in anesthesia and analgesia. *Journal of Medical OMU*, 22: 19-25.
- Kleinbeck S.V.M. & Dopp A. (2005). The perioperative nursing data set—A new language for documenting care. *AORN J*, 82: 50-57.
- Koch S. (2006). Home telehealth-current state and future trends. *Int J Med Inform*, 75: 565-576.
- Lammintakanen J., Saranto K. & Kivinen T. (2010). Use of electronic information systems in nursing management. *Int J Med Inf*, 79:324-31.
- Langowski C. (2005). The times they are a changing: effects of online nursing documentation systems. *Q Manage Health Care*, 14:121-25.
- Lorentz M.M. (2008). Telenursing and home healthcare the many facet of technology. *Home Healthc Nurse*, 26: 237-243.
- Menke J.A., Broner C.W., Campbell D.Y., McKissick M.Y. & Edwards-Beckett J.A. (2001). Computerized clinical documentation system in the pediatric intensive care unit. *BMC Med Inform Decis Mak*, 1: 3.
- Palep J.H. (2009). Robotic assisted minimally invasive surgery. *Journal of Minimal Access Surgery*, 5:1-7.
- Park H.A., Cho I. & Byeun N. (2007). Modeling a terminology-based electronic nursing record system: an object-oriented approach. *Int J Med Inform*, 76: 735-746.
- PWC, Health Research Institute (2014) Health Variables: Early Days. http://www.pwc.com/en_US/us/health-industries/top-health-industry-issues/assets/pwchri-wearable-devices.pdf.
- Ratliff C.R. & Forch W. (2005). Telehealth for wound management in long-term care. *Ostomy Wound Management*, 51:40-45
- Reinhardt A.C. (2010). The impact of work environment on telephone advice nursing. *Clin Nurs Res*, 19: 289-310.
- Potter P.A. & Perry A.G. (1997). *Fundamentals of Nursing*. 4th ed. St Louis: Mosby-Year Book, 179-205.
- Singh N., Manshian B., Jenkins G.J.B., Griffiths S.M., Williams P.M., Maffeins T.G.G et al. (2009). Nanogenotoxicology: The DNA damaging potential of engineered nanomaterials. *Biomaterials*, 30(23-24):3891-914.
- Tabor W. (2007). On the cutting edge of robotic surgery. *Nursing*, 37: 48-50.
- Tekin S., Yılmaz K., İnanır İ. & Peker S. (2010). The Role of Nurse in Gamma Knife Radiosurgical Patients. 6th Congress of Neurosurgical Nursing. Turkey.
- Ucuza M. & Kanan N. (2008). Robotic assisted laparoscopic radical prostatectomy and nursing care. *Journal of Istanbul University School of Nursing*, 16:57-64.
- Valanis B. Tanner C., Moscato S.R., Shapiro S., Izumi S. & David M. et al. (2003). A model for examining predictors of outcomes of telephone nursing advice. *J Nurs Admin*, 33: 91-95.
- Valiga T.M. (2012). Nursing education trends, future implications and predictions. *New Directions in Nursing Education*, 47(4): 423-434.
- Waldo B. (2003). Telehealth and the electronic medical record. *Nurs Econ*, 5: 245-246.
- WHO. (2013). Health technology assessment of medical devices WHO Medical device technical series.
- Yanamadala S., Morrison D., Curtin, C., McDonald

K. & Hernandez-Boussard T. (2016). Boussard, T.H. Electronic Health Records and Quality of Care. An Observational Study Modeling Impact

on Mortality, Readmissions, and Complications Medicine (Baltimore), 95(19): e3332.