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The use of new technologies as a tool for the promotion of health education

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Abstract

New technologies in today's knowledge society and information technologies (ICT) have become a sign of progress, improvement and quality that determine our lives and have an essential role in health education as it relates to the prevention, diagnosis and treatment of the symptoms of disease.

This article will explore some of the technological advances in the field of health. They have greatly contributed to some very significant changes in the configuration of standard health services.

We analyze some of the major benefits and savings achieved through the use of technologies in the area of health, like increased efficiency and quality of patient care, reduced administrative and operational costs, improved primary health care and optimized access to health care. In addition, we present some of the drawbacks to the use of new technologies in the field of health as found in the literature, such as the risk of misdiagnosis due to possible software errors, and therefore the issue of ethical responsibility.

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1. Introduction

Technologies are an essential element of the knowledge and information society. The information society is bringing us major new technological developments and advances in different occupational realms, and in health promotion it is having an impact by improving people's quality of life.

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Globalization, the cyber revolution and computer science, economic competition and the broad spread of knowledge as an indisputable factor of progress are multiplying the phenomenon. Information and communication technologies, or ICT, are advancing with gigantic strides. They are affecting our lives, providing drive for change and fresh perspectives in every aspect of human endeavor. The Jakarta Declaration (1997) asserts, “Some [changes] have great potential for health, such as the development of communications technology.”

According to Fumero and Roca (2007, 47), ICT has spread “to all realms of society and forms part of the basic culture of new generations as a consubstantial part of the Social Network.” The Web 2.0, or the second Internet generation, also known as “the Social Network,” provides a way of developing human health promotion and prevention programs. This is due largely to the impressive development of medical technology, which constitutes one of the biggest factors influencing changes in health systems today (Colomer and Álvarez-Dardet, 2001). Because of the speed of technological progress, people are now even talking about the Web 3.0 or the semantic web, whose main challenge is to connect to knowledge, and the Web 4.0 or the ubiquitous web, which will seek to harness the united intelligence of individuals for decision making.

In fact, information and communication technologies enable information to be processed and transformed and are fast becoming a strategic innovative element for health promotion and education in most developed countries.

The rise of new health education technologies is providing significant support and highly important educational content. Health education is not unaffected by these changes. It has gradually incorporated both the Internet and ICT into health education and services that benefit not only health practitioners but also people and society in general.

The possibilities of technology are many. They include health portals and electronic health records, telemedicine services, tele-ICU services and health information networks, which help improve and promote health by assisting us to detect, diagnose, prevent, monitor and treat diseases, manage our lifestyle and improve our wellness and quality of life.

Studies on these topics have proliferated (inter alia, Stroetmann, Artmann, Stroetmann, & Whitehousee, 2011; Philips, 2011; Ekeland and Flottorp, 2012; Mistry, 2012; Kidholm, Ekeland, Jensen, Rasmussen, et al., 2012; Gabarrón & Fernández, 2012; Heart & Kalderon, 2013). In addition, a new set of terms not unrelated to health industry practitioners and users has become part of our vocabulary, such as “electronic health,” “e-health,” “mHealth” (Resources, Technology and Health), “Health 2.0,” “e-patient,” “e-medicine” and “eHealth.” eHealth is associated with the availability of tech-related health services, notably telehealth, electronic medical records and mHealth or health via mobile devices.

In this article we endeavor to highlight how new technologies are having a fundamental impact on health education and opening fresh perspectives in the field. Next, we present a rough history of technologies for health education and technologies as a resource for health promotion today. We then address the advantages and drawbacks of technologies as a means of improving wellness and quality of life for people and society.

2. History of health education technologies

The changes health education has undergone since the early years of the 20th century have been caused by the swift development of applied sciences like chemistry, physics, physiology, microbiology and engineering, in their progress toward the development of techniques for disease treatment and diagnosis.

In the 20th century a whole series of new technologies arose for use in disease diagnosis, prevention and treatment, constituting an indisputable factor of progress for people and society. The new technologies, which included computerized axial tomography (CAT), positron emission tomography (PET), nuclear magnetic resonance imaging (NMRI), functional magnetic resonance imaging (fMRI), catheterization and massive sample analysis systems, gradually became incorporated into the health area, increasing both diagnostic and therapeutic efficacy. Table (1) below presents a short history of health technology.

Table 1. Short history of health technology

William Crookes (1869-1875)	British scientist who, in the 19th century, observed electrical discharges into certain gases to study the properties of cathode rays, leading to what was termed the “Crookes tube.”
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Wilhelm Conrad Roentgen(1895)	German physicist who discovered X-rays, which he produced working with Hittorf-Crookes tubes and the Ruhmkorff coil to investigate the violet fluorescence that cathode rays produced by means of an electromagnetic radiation in wavelengths.
Willem Einthoven(1903)	Dutch physiologist who developed the first electrocardiograph to measure the electrical activity of the heart. This launched a new stage in cardiovascular medicine. In 1953 the first cardiopulmonary bypass was introduced.
1940s	Tools like the electrocardiogram. Cardiac catheterization, angiography and arteriography (X-ray examination of arteries, pulmonary and cardiac blood vessels and their valves by means of contrast agents introduced by means of a small, flexible, sterile tube called a catheter).
	Nuclear medicine emerges.
1950s	Ultrasound is applied in gynecology and obstetrics (1958).
1960s	One of the first great applications of computer science in radiology, the scanner, is developed. It is used as a procedure for real-time contrast studies, such as computerized axial tomography, ultrasound and magnetic resonance imaging, which are recorded, interpreted and stored using radiological images.
	Ultrasound
1970s	Rise of telemedicine. The Mayo Clinic linked its Rochester headquarters to the Royal Hospital of Jordan by satellite.
1990s	Given the backing of the World Health Organization, e-health strategies are beginning to be incorporated into health policy to strengthen health systems and improve health care quality, safety and access.
	The World Health Organization alludes to the importance of using information and communication technologies to foster health both in situ and remotely (cyberhealth).
21st Century	

In short, technologies have continued to evolve, right up to the development of the first computer-based medical instrument, computerized tomography. New diagnostic imaging technologies have since appeared, such as magnetic resonance imaging, positron emission tomography (PET) and digital subtraction angiography, mammography, the scanner, the digital electroencephalogram, monitoring systems, nuclear medicine, ultrasound, defibrillators and cardiovascular equipment.

3. Technologies as a health promotion resource

For over 50 years exploration has been ongoing into how to leverage computer science and telecommunications in the field of health. Any health promotion activity that enables a disease to be prevented, diagnosed or treated constitutes a technological step forward for health in today's information and knowledge society.

In the early days of the incorporation of new technologies into health practitioners' work, new technologies were fundamentally used for administrative tasks involving data storage and statistics. Later, however, technologies gradually began to be used to save personal records and clinical summaries, giving health practitioners access to data on individuals and diagnostic, preventive and health maintenance information that they could even share with colleagues. Computerized health cards have been a reality in many communities since 2003; and they in their turn set the stage for the use of electronic prescriptions, which for the first time will incorporate data about the patient's medical history. The use of electronic medical records is becoming increasingly consolidated as well. In fact, the databases are connected over the National Health System's Intranet, and this is proving to be a key tool in health planning.

The technological revolution is creating an environment conducive to a phenomenon known as Health 2.0, which enables networks of social and medical professionals to coalesce and contributes to the formation of communities where information can be shared. There are communities for health practitioners only (www.sermo.com), communities for health practitioners and patients (www.salupedia.orf, www.vivelasalud.com), electronic publications on CD-ROM, newsgroups and services like Medline ([www. Medine.com](http://www.Medine.com)), CyberMed (www.cybermed.com.mx), the Mediweb social network (www.mediweb.com) and mobile health (mhealth), which is becoming more routine every day. In addition, in recent years the Internet has seen a proliferation of programs promoting healthy habits, disease prevention programs and general information on health topics, such as the healthcrates wiki created for medical resources (<http://www.healthcrates.com/>), the healthMap digital world map of epidemic alerts (<http://www.healthmap.org/es/>),

the Isla de la Salud virtual platform, which provides health information, and patientslikeme, the community where health practitioners and patients can share information and talk about their experience with disease (<http://www.patientslikeme.com/>).

The number of both for-profit and not-for-profit health institutions that are starting to use the web to provide information about specific syndromes and diseases has gradually increased. Spain is home to Grupo Neat, e-Diagnostic, Fundación para la eSalud-FeSalud and Artica Telemedicina; and abroad we find the American Telemedicine Association, the Institute for Community Medicine and the Norwegian Centre for Integrated Care and Telemedicine.

More and more often, spaces are being created where users can share their medical experiences with one another. Even in Europe, where most health services are publicly funded and the majority of medical facilities are state-owned, scores of “Web doctors” and specialized centers that use telemedicine abound.

In Spain the Health Technology Evaluation Agency was founded in 1994 as a branch of the Carlos III Institute, with the technical and scientific support of the Spanish Ministry of Health and the Spanish National Health Institute. The agency’s mandate is to evaluate the different health technologies and promote good use of existing technologies.

As mentioned before, technological progress and the application of technology to the field of health are made possible thanks to the combination of scientific and technical disciplines (such as engineering and robotics) with communications. Research agreements along these lines have been made between Spanish schools, like the agreement between the Complutensian University of Madrid School of Medicine and Madrid Polytechnic University (e-health research) creating the Innovative Medicine Cluster, which is working on developing new imaging-based diagnostic techniques so that new advanced social services and e-health services such as telemedicine can be rolled out.

To sum up, telemedicine devices are becoming a viable alternative for patients. Every day talk of telecare, telemedicine and telemonitoring is becoming more frequent. Table (2) below lists some of the telecommunication instruments that are playing the biggest roles in the development of telemedicine.

Table 2. The telecommunication instruments that play the biggest roles in the development of telemedicine.

Telemedicine	Telemedicine spans a wide range of telecommunications and information technologies and many clinical applications, although the most common medium is interactive video. The first telemedicine programs were established nearly 40 years ago, but technology has surged ahead in the last decade. Despite the spread of telemedicine, the volume of patients who receive services using telemedicine technology remains relatively low (around 21,000 in 1996). Research into the efficacy of telemedicine is rather limited, although the work that has been done to date supports the hypothesis that in general the technology is medically effective. The cost/effectiveness of specific telemedicine applications has not yet been rigorously proved. Telemedicine services focus on health applications such as tele-ultrasound, tele-cardiology, tele-pathology, tele-radiology, tele-cytology and tele-education (Wootton and Bonnardot, 2010).
Telecare	Telecare includes technologies, equipment and technological services providing personal health care from a distance (Valero, Sánchez & Bermejo, 2007). Telecare runs the gamut from remote monitoring of a patient’s vital signs to evaluation of clinical analyses, systems that sound an alarm should the patient’s health fail, diagnosis via videoconference and a multitude of health care applications. “Home tele-assistance” has been and still is one of the most important, widespread contributions technology has made to enabling disabled persons to live autonomously and independently in their own home. The Spanish Red Cross has a praiseworthy pilot mobile telecare project based on the use of communication technologies, cell phones and remote locating systems (GSM and GPS) aimed at working with the potential of new ICT to expand the advantages of home tele-assistance.
Telemonitoring	Telemonitoring is a specialty that got its start in the USA twenty years ago as a part of telemedicine. It enables real-time or recorded data to be communicated or transmitted between the patient and health practitioners, so certain biological parameters can be tracked right from the patient’s home.

4. Effects of technology on health promotion and our quality of life

Technological progress offers great potential in the acquisition of health information, care and services. It forges technologies into increasingly powerful tools with expanding possibilities for the development of health education and prevention programs.

According to Córdón (2007), the Internet has become an integral part of the modern concept of health. It provides support for not only health institutions and practitioners, but also for the population at large. In addition, technologies foster efficiency and open up possibilities for new treatments and wellness.

The contributions new technologies have made have changed some of the paradigms we use in public health promotion (inter alia, the biomedical and the biopsychosocial). They have also changed the mission of education in

this area by helping to improve quality of life and facilitate shared information and communication among health practitioners and between health practitioners and their patients.

ICT use provides greater flexibility and the capacity for stronger and finer control, evaluation and management of health and personal wellness. In addition, ICT enables a greater quantity of information to be gathered and processed. It facilitates use of the necessary resources in disease treatment to minimize possible side effects, thus making disease treatment safer.

Nevertheless, although many technological advances contribute to health and make daily life easier, unbridled use of technology in the daily environment can lead to negative effects on the human body. In addition, the way that technologies can change the practitioner/patient relationship and the caregiver/practitioner relationship are topics in which there should be further research. The same may be said of organizational aspects, such as the degree of patient and practitioner engagement in the process, with process use, acceptance and continuity.

4.1. Technologies' contributions to health promotion

According to work done in the OECD Health Policy Studies (2010, 11) "Findings illustrate the potential benefits that can result from ICT implementation." The areas indicated in the report include improved health quality, reduced clinical and administrative costs, and reduced time between diagnosis and therapy and new modes of care.

The benefits are clear. Hospital stays are shortened, and so people's quality of life is improved, waiting lists are reduced and practitioner productivity is augmented.

Another of the contributions of technologies to health promotion, according to Vance, Howe & Dellavalle (2009), is the swift dissemination of information, although sometimes this may not be as positive in some cases as one might think.

In addition, technologies facilitate a better knowledge of one's disease, good use of health services, greater adherence to treatment and participation in health decisions, improvement in perceived support and social backing, sharing, support and reciprocity.

Another of the benefits of using technologies to promote health is that the storytelling community of patients and relatives can share their experience with disease (such as bodily changes and the aftereffects of illness).

4.2. Limitations and drawbacks of technology use in health promotion

Although nobody doubts that health education finds in technologies and social networks an ally and a good tool for accessing health content, people have to be made aware of the need to view content critically and to learn to be discriminating about information quality. Sometimes the information people find can have negative consequences. There is the example of the teen obsession with physical appearance, which can be associated with unhealthy behavior. Research shows that young people reject technologies as a means of conveying messages about health promotion or disease prevention and accept technologies only as a source of information about how to look good (Cuesta & Menéndez, 2009).

According to Valverde (2005), one of the consequences of health technologies' development is that health practitioners are not reflecting on the ethical implications of modern procedures. To give one example of the ethical issues, information that is digitalized and stored is more likely to be released publicly, paving the way to confidentiality problems.

Add to this the fact that information sources are short on scientific detail, in the opinion of authors like Vance, Howe & Dellavalle (2009), which makes it harder for regular users of educational tools to compare content and check its veracity.

Another of the limitations on the use of technologies to promote health stems from the fact that the real impact of health technologies is analyzed in partial studies only. Health practitioners are aware of this. Further research is therefore needed, as is the creation of an evaluation system relying more on broader, less-restrictive studies.

Of the dangers, we would like to highlight the fact that people are relying on the prolific information health technologies provide to educate themselves about their diseases. The diagnoses and treatments that result may be mistaken or, worse, may ultimately lead to serious, even fatal consequences. A study carried out in the United States

shows that 50 % of people talk to their doctor about information they have found on the Internet (Wright & Moore, 2008).

5. Closing Reflection

The technologies we use to improve our health are constantly growing. In fact, technologies have caused some highly significant changes in the configuration of health services. Technologies are an extraordinarily effective tool that will improve our quality of life and usher in a trend of development via fair resource use.

In addition, as an element of our daily life and work, technologies ensure progress and stimulate creativity and innovation for the benefit of individuals and society. New digital technologies are giving individuals fairer access to certain services, even from hard-to-reach places, and are providing great support for maintaining and fostering health from an increasingly humanized standpoint.

Nonetheless, while it is true that it is hard for us to do without the advantages of tech use in health, it is no less true that we need to use technologies rationally. Overusing technology can have bad connotations if we do not first analyze and evaluate the negative effects technologies can have on physical and mental health (e.g., muscular aches, lack of concentration, addiction, stress, insomnia) and the possible consequences (e.g., the consequences of electromagnetic fields due to indiscriminate technology use). That is why health educators should create a role for themselves as authorities who can help people learn to discern which health information is reliable and to interpret that information. Ekeland and Flottorp (2012) stress the importance of evaluating training abilities in educational technology and even maintain that efficacy depends on the health practitioner's age and tech savvy.

Other authors, Gabarrón & Fernández-Luque (2012), affirm, "Politicians and health managers have got to understand that we are facing a new generation of users and patients who have access to information, and that leading and managing this situation properly ought to be seen as an opportunity to convert our health system to a new model that is more collaborative, accessible, transparent and sustainable." And education, of course, must not be left behind. Quite the contrary: Making health a reality for everyone through technology must be fostered and encouraged.

Let us not end without underlining the importance of training health educators properly in the use of new health promotion technologies and, of course, in greater quality of life, so the health advantages of technologies can be leveraged.

In short, educating people to use technologies in today's society and apply technologies to health, always bearing in mind the recommendations of professional ethics for tools of this type, will undeniably help promote healthy lifestyles, prevent and palliate disease, aid with rehabilitation and facilitate care for possible aftereffects.

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