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SCIENTIFIC RESEARCH, NEW TECHNOLOGY AND SOME ETHICAL ISSUES

Abstract: Breakthrough scientific discoveries and implementation of new technologies have already raised life expectancies quickly and dramatically, even in poor countries without much health infrastructure. From molecular genetics research to groundbreaking drugs and the implementation of health information systems, biomedicine can no longer be appreciated without reference to some of the most recent advances from many different scientific fields.

The aim of this research is to promote the understanding of innovative methods in health care technology and medicine and affirm an approach to technology-related decisions beyond commercial concerns, but also to acknowledge social, ethical and environmental issues, and discuss some dilemmas. It also aims to expand a critical understanding of the implications of scientific research and implementation of new technology for progress and reform of health systems, especially in developing countries. Special focus of this research is on the complex interrelation of Information Technology in Health Care and Bioethics. Information Technologies (IT) have the enormous potential to improve the quality and efficiency of patient care but also raise some important social and ethical issues. As primarily an instrument IT can have both intended and unintended consequences. In this research authors present the case study for telemedicine project „THYRONET SERBIA” and investigate some ethical issues concerning patients risks and benefits, patient-doctor relationship and influence on medical decision process.

Key words: health care technology, telemedicine, *electronic consultation system, organizational change, thyroid disease.*

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INTRODUCTION

TECHNOLOGY IN HEALTH CARE AND MEDICINE

Human Development Report 2001 (Oxford University Press, 2001) commissioned by the United Nations Development Program (UNDP) argues that information and communications technology and biotechnology can actually make major contributions to reducing world poverty. „Ignoring technological breakthroughs in medicine, agriculture and information will mean missing opportunities to transform the lives of poor people”. Advanced medical technologies provide an important solution to providing high quality health care and controlling costs. They can save money, improve quality, increase economic productivity, and save lives. Medical technology is enabling diseases to be diagnosed faster and more accurately, health care providers to be more efficient, patients to recover faster and with improved quality of life, and nations to create greater productive wealth.

It is apparent that a just society and a strong economy need a healthy population, not just efficient health care services. Conversely, a feasible, sustainable future for the health care services depends on scrutiny of the rising demands. According to the Report from Centers for Medicare and Medicaid Services, health care spending in US will reach \$3.1 trillion by 2012. Projected growth of 7.3 percent annually would result in health care spending accounting for almost 18 percent of gross domestic product (GDP) compared to 14 percent in 2001. In 2006, U.S. health care spending increased 6.7 percent to \$2.1 trillion, or \$7,026 per person. The health care portion of gross domestic product (GDP) was 16.0 percent, slightly higher than in 2005. Prescription drug spending growth accelerated in 2006 to 8.5 percent (1). Some of the factors that are expected to increase spending in coming years include:

- a) Consumer demand for less restrictive insurance plans,
- b) Increasing insurance premiums and
- c) New technology.

The list of new and potentially expensive ways to diagnose and treat disease is growing at an enormous pace. Few examples from that list include: chelation therapy to lower cholesterol levels, pharmacotherapy for alcoholism, gamma knife brain surgery, ambulatory blood pressure monitoring, Viagra, etc. The goal of health care institutions is to spend money wisely, so it is neither wasted on less-than-optimal treatment nor withheld from procedures that would be truly beneficial. Part of the difficulty is the quickened pace of medical invention and the unprecedented high costs of some of the new methods. The line between experimental and accepted treatments is clearest with drugs, where Food and Drug Administration approval is needed to market to the general population. New offerings in the drug sector push premiums sky-high, if all are widely adopted, as soon as the government gives the

approval. Pharmaceutical industry alone generated more than \$255 billion in 2002. The life science Tools & Techs market size in 2002 was about \$1.6 billion and is projected to more than double to about \$3.5 billion by 2007, growing at a CAGR of 17.7%. The global pharmaceutical market grew to US\$712 billion in 2007 at a compound annual growth rate (CAGR) of 10.0% between 1999 and 2007. Year-on-year the global pharmaceutical market increased to 10.7% in 2007, largely as a result of strong sales for new innovative products and high market growth in emerging pharmaceutical markets such as China. The global pharmaceutical market is forecast to grow to \$929 billion in 2012, an equivalent compound annual growth rate (CAGR) of 5.5% over the next five years (Pharmaceutical Market Trends, 2008 – 2012) .

The array of new technology presents everyone who manages health care with the dilemma of deciding what to pay for and what to reject or put aside until more evidence is in. But, legal liability must be emphasized as well. Jurors order Aetna, U.S. Healthcare to pay a widow \$120.5 million, for refusing to cover the experimental stomach cancer treatment her husband's doctor had requested. It is a vivid reminder that the wrong decision on new technology can have dire consequences for plan as well as patient.

Health care costs surpassed budget expectations for almost half of all employers surveyed in a Watson Wyatt/WBGH surveys (2, 3). With costs projected to rise another 15 percent per year, it is to expect fewer employers to absorb the increases. Over the last several years employers have been absorbing the bulk of higher costs.

„Is Technological Change In Medicine Worth It ?”

„Technological change is bad only if the cost increases are greater than the benefits,” according to a study published in *Health Affairs* (4) . In contrast, technology that increases spending but improves outcomes is even more valuable (5). This may seem obvious, but the point is that there will not be a valid answer unless there is reliable evidence. Another study reported in *Health Affairs* found that use of newer drugs, although generally more costly, lowers all kinds of non-drug medical spending, particularly for hospital stays (6). Just one example: laproscopic surgery may be cheaper in the long run if it gets a patient back to work considerably sooner than traditional open surgery, despite the higher price usually associated with it. On the other hand, innovation sometimes raises overall costs, not because it is s more expensive but because a less invasive, safer procedure is likely to be performed on a larger group of patients.

The Technology Evaluation Center supported by the Blue Cross and Blue Shield Association (BCBSA) uses five criteria to determine whether a technology is valuable and worthy of coverage. These criteria are:

- The technology must have final approval from an appropriate government regulatory body
- The scientific evidence must permit conclusions concerning the effect of the technology on health outcomes
- The technology must improve the net health outcome
- The technology must be at least as beneficial as any established alternatives
- The improvement must be obtainable outside the investigational setting

Some policy issues for discussion : more than 6 in 10 Americans worry a „great deal” about the availability and affordability of healthcare, according to the 2005 Gallup survey. Those figures make healthcare the No. 1 issue tested in the poll. Other issues that concern the public a great deal include crime and violence (46% of Americans say the issue worries them a great deal), drug use (46%), the possibility of future terrorist attacks in the United States (42%), and the economy (41%). In 2001, the two most worrisome issues were crime and violence (62% of Americans said they were worried a great deal about the issue) and healthcare availability and affordability (60%). Drug use also ranked high (58%). But in the past years, public worries about drug use and about crime and violence have declined, while worry about healthcare has remained high.

SOCIAL IMPLICATIONS OF TECHNOLOGY IN HEALTH CARE AND MEDICINE

Hippocrates understood how science brings progress while opinions (not based on science) make life interesting as it reflects our human feelings that science often cannot describe nor measure. Contemporary research and application of new technologies are a product of social, economic and political forces as they are of technical logic.

Health Informatics in modern society

Information and Communication Technology can be of great assistance to healthcare professionals in the process of diagnosis, treatment, monitoring, medication prescription, referral, information retrieval and communication, documentation and transactions. Innovations from the information technology industry, applied to health care, can be grouped into the following categories:

Public information on health: health care services and providers, health care policies, legislation, news/information about health and medicine.

Health information exchange for administrative purposes between organizations, patients, patient-health insurance, hospitals, clinics; health authorities.

Telehealth/Telemedicine: investigation, monitoring, management of patients using remote access to patient data and information [provider to provider or provider to patient].

Over the years the terminology in health related information technology has changed and continues to change. The World Health Organization (WHO) has addressed this issue with an alternative idiom, Health Telematics, which is a composite term defined as:

„... health-related activities, services and systems, carried out over a distance by means of information and communications technologies, for the purposes of global health promotion, disease control and health care, as well as education, management, and research for health.” The WHO Report on Health Telematics (7) recommends that WHO and Member States:

Integrate the appropriate use of health telematics in the overall policy and strategy for the attainment of health for all in the 21st century, thus fulfilling the vision of a world in which the benefits of science, technology and public health development are made equitably available to all people every where;

Explore and promote the best use of health telematics in public health: e.g. in disease surveillance, prevention and control, health education, health promotion, health systems and service development;

Use health telematics as a means to address their information needs and health care requirements, and to specifically include health telematics in their overall planning for health development, education, research programs, and telecommunications;

Ensure that the development of health telematics is driven by the health needs of people in accordance with the functional and operational capabilities of WHO's divisions, regions

Most countries in Eastern Europe and Asia are going through rapid changes aiming at restructuring and developing system components that are compatible with Western Europe and North America. Important characteristics of these modern societies are the integrated information systems applied in the domains of education and health care (8). Clinical applications of health informatics can be done in all areas of patient care (9) provided by real-time and/or store-and-forward technologies (10) ranging from telephone and fax machines, e-mail, chat rooms, discussion boards, audio- and video-conferencing. Administrative applications include recording (11) and sharing of billing summaries, electronic connections to pharmacies, etc. Remote medical instruments include various types of imaging technologies (12), pressure sensors, haptic feedback devices and robotics. Telehealth/Telemedicine is also assuming an important function in these systems. It is based on electronic communications and digital technology, so their development has led to the rapid development of telemedicine as well. Educational applications focus on continuing medical education for professionals and patients (13) including tele-mentoring. Further, there exists substantial evidence that a byproduct of telemedicine implementation is substantial continuing education for all participants.

The greatest advantages of telemedicine are increased access to health care, reduced costs and quality improvement. Numerous programs demonstrated feasibility

of tele-health systems. Nevertheless, despite success, most of the projects have been discontinued. One of the principal reasons for such adverse outcome is inadequate management and unsuccessful organizational change within health care system. All new technical implementations impact the social system of which they become a part. The technological innovation and the desire to diffuse it into the medical profession of the project region, must strategically engage stakeholders within its project scope, and be sensitive to cultural beliefs and the local values system. Of fundamental importance is a clearly articulated and hierarchically supported purpose that facilitates the change process (14). Continuous feedback loops maximizes stakeholder input, enhances the recognition for the need to change and indicate level of commitment to the process. Effective change requires that people not only believe that change is necessary but understand how change will come about and what the consequences will be. This is particularly true of Health Informatics systems (15,16).

„THYRONET SERBIA” – An Electronic Thyroid Consultation Network to Optimize Patient Care in Serbia

Previously, we have reported development of cost-effective, highly efficient electronic consultation and referral system for Thyroid disease from primary care to secondary and tertiary institutions in Serbia – „THYRONET SERBIA” (17).

Our main goal was to develop electronic system that will optimize the time a specialist spends with a appropriately referred patient, since this needy patient will not be competing for specialist time with inappropriately referred patients. Electronic storage of patient information allows for rapid retrieval and secure archival of critical information. Additionally, modern database information supports detailed data analysis to observe clinical patterns and treatment effectiveness.

Nevertheless, ITC – telemedicine projects like „Thyro-Net Serbia” not only hold the potential for increasing patient access, and enhancing the quality and timeliness of patient care, but they also hold the potential of altering the flow of clinical information and the potential to alter the loci of clinical decision-making. It is in the latter two areas that we find the roots of social resistance to the utilization of Health Informatics systems. The degree of this resistance varies from case to case, but is always present and more often than not results in low utilization rates of Health Informatics solutions after the initial “honey moon period” of new implementations. To overcome this serious problem, the design of the Health Informatics system needs to include both a priori Organizational Change effort to overcome latent resistance within the social system and an early-on and continuing evaluation component to assure accurate feedback of utilization rates on a continuing basis. We have defined organizational change interventions during the initial implementation phase and a continuous monitoring of system utilization for „ThyroNet Serbia” (18). Additional

Organizational Change interventions will be designed as dictated by downward trends in utilization rates of this project.

Ethical issues at the intersection of medicine and information and communication technology are numerous and have so far generated interesting and important questions:

- What are appropriate uses of health information systems?
- Who should use these systems?
- What benefits and risks do these technologies have for patients?
- How does information technology change the physician-patient relationship?
- How does (and will) medical decision making change?

More work is needed to clarify issues and approaches and to provide practical tools for medical practitioners (19, 20).

There are many large scale economic, political, social, and environmental questions relevant to medical technologies and we have presented just a brief outline focusing primarily on the impact of health technologies on Health systems and Public policy and tried to raise some important issues of their contemporary advances We have tried to contribute to the conception of the inter-relationship between technology in health care and medicine, and society and environment, as versatile and complex.

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