

THE PAST AND FUTURE IMPACTS OF HEALTH/MEDICAL INFORMATICS ON HEALTHCARE DELIVERY

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Keywords: Health Informatics, electronic health records, telemedicine, primary care computing, health information technology

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Summary

This chapter presents the case for the use of information technology in health care and identifies a number of the challenges and issues that are being faced around the world. The benefits and both the positive (improved patient safety) and negative impacts (unintended consequences) of electronic health records, computer-based decision support and physician order entry are presented. The highly successful introduction of information technology in the American Veteran's Health Administration is discussed as is the international evidence on how information technology can assist clinicians with chronic disease management. The chapter concludes with a description of the increase role of telemedicine or the use of communications technology to support care at remote sites and across broad distances.

1. Introduction

There is much about organizing and managing healthcare that is unique and difficult. According to Claude Forget, the former Minister of Health for the province of Quebec in Canada,

“We have a system that is unique in our economy. It is a mixture of a quasi-medieval guild system and a socialist command and control approach..... As a result, health managers have almost no say over the crucial factors which most managers anywhere else in the world and in other industries need to have in order to be effective.”

In addition, a person's state of health is the result of the complex interaction between their unique genetics, brain, environment, and habits. For example, while some individuals may be able to carry on fairly normal activities despite severe loss of 80 percent of their pulmonary capacity, others may be disabled by minor arthritis. Careful reproduction of a healthcare process that results in a good outcome for the first will not help the second. Managing to a good outcome requires adaptation and matching of the process to the individual, and it may not be possible to find a gold standard for a process that guarantees good outcomes for individuals.

Humans are biological creatures and biological systems are inherently variable. Every individual has its own copy of genetic material—material that mutates and evolves randomly. Because of the variability, the number of formulas and data points required to document each instantiation of a biological system increases several fold. As a result, the number of conditions that need to be handled by uniform data standards is much greater than that required by standards for simpler physical, production or materials handling systems, however large or geographically widespread they may be.

Healthcare services are not only unique in their variety and range of services and products, they are typically not chosen by the “customer” but by someone acting on their behalf – usually a doctor who is increasingly influenced by the payer and/or government. In most industries the market is driven by the customer- but not always is that the case in healthcare.

Health industry requirements are also exceptionally demanding in a number of areas. Most notable are the implications of violations of personal privacy whilst involving all those who need to know, dual responsibility for personal and public health, the complexity and expansion of the knowledge base and terminology, the high risk to the providers livelihood combined with pressures to make critical decisions continuously and rapidly, and poorly defined outcomes; all of this in the context, as Forget put it, of a “guild system” of responsibility, accountability and power. The health care industry also has to support personal and moral values which in itself are very complex. The judgments taken about personal attitudes to risk and potential benefit on interventions are all driven by our unique physical and mental make-up and local context. And our values change over time.

Physicians practice in a state of incomplete information much of the time, according to Dr. Marc Overhage, an American physician, and many others. In their opinion, they often do not apply best evidence to their decision making at the point of care. It is little wonder since medical information doubles almost every five years and new knowledge often makes established treatments obsolete. There are over 22,000 new journal articles per year, at least 30 new drugs per year, and more than 6,000 combinations of drug compatibilities to consider. The number of drugs has grown 500% in just the last decade to over 17,000 trade and generic names for pharmaceuticals marketed in North America alone. The information flood, long working hours and a busy schedule make it increasingly difficult for clinicians to keep up with, and incorporate, current knowledge.

Healthcare services are perhaps the most complex large scale business of any country's economy. More variability and uncertainty at the point of service, as to causality,

processes and to the outcome of that investment, exists in healthcare than in any other sector. With such “variability and uncertainty” in the healthcare business, it is not surprising that identifying and measuring, let alone valuing, a financial return on investment (ROI) from computers in healthcare presents special challenges.

The difficulties in ‘measuring’ the computer’s value contributions are that:

- many infrastructure investments cannot be cost justified on a return-on-investment (ROI) basis
- new systems are often implemented to change difficult to measure actions
- strategic systems usually elude measurement
- many of the investments do not take account of prior costs
- efficiency (doing things right) is easier to measure than effectiveness (doing the right things)
- since effectiveness (doing the right things) and innovation (doing new things) can not be readily quantified in terms of traditional outputs, improvements are not usually reflected in economic efficiency statistics

Computers are purchased for use in healthcare primarily to capture and manipulate data for improved decision making – both clinically and administratively. As Bend and others have pointed out, part of the value of computer technology investments derives from improvements in the effectiveness of the clinical decision-making process. That is, an electronic record system should enable physicians and nurses to make better, quicker decisions through mechanisms such as on-line access to evidence-based results for designated disease conditions, assistance in placing orders (detecting a drug-drug interaction before the order for a medication is actually placed), and receiving an alert electronically after a significantly abnormal test result. Increasing the effectiveness of the clinical decision-making process should also lead to higher efficiency of that process — fewer errors should be made and fewer resources should be consumed.

The impact of information technology (IT) on patient care can be quite substantial. Some of the potential benefits include:

- Improved communication between providers, and between providers and patients. In many countries, the flow of information has grown exponentially.
- In a number of countries, the implementation of IT among various professions has created momentum for working in teams. The electronic health record (EHR) has been a catalyst for accelerating this key element of health care innovation widely supported at the policy level throughout the world.
- Patient empowerment. Increasingly, people have access to their EHR. They can review information such as laboratory results and prescriptions to improve self-care – particularly important for chronic disease management. They can see which providers have viewed their records, which allows them to monitor privacy.
- Improved adherence to preventive measures. The literature suggests that electronically generated reminders for screening and follow-up increases adherence by 10% to 15%.

- Improved delivery of recommended care for various conditions. The Vanguard group in Boston delivered recommended care about 60% of the time in a baseline study. It improved to over 90% by combining team-based practice with the EHR.
- Nation-wide implementation of the EHR in the USA, including e-prescribing with decision support tools built in, could reduce adverse drug events by 2 million annually, preventing 190,000 hospitalizations.
- According to the literature, introducing IT into the ICU reduces ICU mortality by 46% to 68%; complications by 44% to 50%; and overall hospital mortality by 30% to 33%.
- A major touted benefit of the EHR is chronic disease management (CDM). Some believe the benefits have already been demonstrated and there is consensus that the EHR is a necessary, but perhaps not sufficient, tool to improve CDM.

The number of case studies of the overall impact of IT is growing, not only from a clinical perspective but also from a managerial point of view. Space does not permit a full discussion of the impact that data warehousing and business intelligence, emerging technologies such as RFID, management information systems and expert systems are having. Hence a few examples have been chosen to describe the impact that health informatics and medical informatics is having on health care delivery.

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Biographical Sketch

Denis Protti was the founding Director of the University of Victoria's School of Health Information Science in 1981, a position he relinquished in 1994. His research and areas of expertise include: National Health Information Management & Technology Strategies, Electronic Health Records, Primary Care Computing, and Evaluating Clinical Information Systems. Professor Protti has written hundreds of publications in books and journals and has given even more presentations to a wide range of audiences around the world. He is on the advisory board of a number of overseas academic programs in Health Informatics. He regularly advises and sits on expert panels for health care organizations and government agencies in both Canada and abroad. In 1998, Professor Protti was commissioned by the Her Majesty's Treasury to review the proposed National Health Service (NHS) Information Strategy for England prior to its release. He later developed the evaluation methodology that was used to monitor the local implementation of their national strategy – a process referred to as the Protti scores. Since then he has been invited annually by the Government and a variety of English organizations to conduct on-site reviews, give seminars, and comment on their progress with the Electronic Health Records journey. In 2006, he was appointed chair of the Informing Healthcare's International Advisory Group for NHS Wales, and visiting professor and chair of Health Informatics at City University London.