

C. Lovis

University Hospitals of Geneva
Service of Medical Informatics
Geneva, Switzerland

Synopsis

Health and Clinical Management

Building a safer and more efficient care system has become the most shared goals of all actors involved in health care. From a historical perspective, there has been an impressive shift towards awareness of the impact of errors in medicine in the last 20 years. In the early nineties, research and report papers about patient safety, incident reports and first order-entry systems were published, mostly originating from academic settings. At about the same time, the first reports of the US Institute of Medicine (IOM) on computerized patient records stressed the need for information communication and availability to improve care [1]. Ten years later, by the end of the nineties, a famous report of the IOM called attention to errors in healthcare [2]. This latter report has been a strong promoter of clinical information systems, which have since also received a lot of attention from the industry: The Leapfrog Group, a consortium of companies that belong to the Business Roundtable, has endorsed computerized physician order entry (CPOE) in hospitals as one of the 3 changes that would most improve patient safety in America. Recently, in June 2004, the US president's Information Technology Advisory Committee (ITAC) released a remarkable report with recommendations to accelerate

the application of information technology in healthcare [3]. The four core elements of this framework are: i) Electronic health records for all Americans; ii) Computer-assisted clinical decision; iii) Computerized provider order entry; iv) Secure, private and interoperable electronic health information exchange.

This movement of the interest about importance of information technologies in healthcare, from academic to industry to the highest political level is very strong and is by far not limited to the United States. The impact in the healthcare system, the environment and all stakeholders including patients will be considerable. This progression goes along with the growing interest towards letting systems spread out of hospitals towards connecting people and facilities within local or community based, regional, national and international healthcare networks.

For this evolution to be economically sustainable, technically possible, culturally acceptable and ethically responsible, the self awareness, empowerment and education of all stakeholders, including patients and care providers must be improved.

Improving safety, efficiency and cost relies on three pillars: the availability of affordable systems bringing information technology

benefits at a reasonable cost; the extension of clinical decision-support systems to management, such as optimizing resource usage and cost; and finally the ability to detect, prevent and help correcting undesirable events, such as resource over usage, drug side-effects or interactions, clinical pathways deviation, amongst many others and learn from these events.

The four papers selected for this "*Health and Clinical Management*" section of the 2005's edition of the Yearbook illustrate important aspects of these three pillars.

From research to routine use

The use of information technology in healthcare must move from a world of case reports and success stories to a world where it belongs to routine use and standards in care providing. Helping providers to make the best possible decision at the right place and the right moment according to patient needs, resource availability and state-of-the art medicine is still an unmet goal for clinical information systems. In this long standing quest, clear evaluation of overall costs and benefits of information technologies at all levels is needed. This includes the individual's point of view, such as providers and

patients; up to a nationwide health care system management. The return on investment for large clinical information systems is difficult to calculate because baseline costs of key processes are hard to determine; several benefits are not easily amenable to measurement. Many aspects of costs, such as user's education, impact of processes reengineering or maintenance are almost not measurable with precision. The same difficulties arise when evaluating the potential benefits. If some of them are easily measurable, such as prevention of drugs interactions, others are very difficult to evaluate, such as long-term patient outcome. Few controlled studies are available that provide such an evaluation, mostly because they are difficult to design and to run in an unbiased way. Such studies might even be unethical in some cases. In addition, fulfilling expectations of all stakeholders is rather difficult, especially when these expectations include the resolution of organizational and structural issues. However, the shift from experimental developments to large scale implementation is now on the go. Experience gained in the last two decades in the development and description of numerous computer-based decision support systems in routine clinical practice to facilitate health and clinical management is well documented in the literature. The convergence of academic and industrial developments has already been fruitful, and several mature products are now available on the market. This evolution is a decisive step to increase the use of these technologies at a lower cost. A lot has however still to be done in order to develop systems that are flexible enough to be adapted to the heterogeneity of the health market though keeping an affordable price. This might only be achievable with a serious technological evolution of most commercial systems towards

the development of component-based and service-providers architectures. Such architectures will offer the freedom to build complex systems with small and inexpensive business-oriented components from different providers adapted to the need and financial capacities of users. Moreover, the intelligence and the knowledge embedded in such systems will finally become shareable, which is of highest importance as this is by far the most expensive, difficult to maintain and value-added benefit of IT in healthcare. However, this evolution will only be possible if the semantic lying in-between business core-logic of systems and their interactions is built on formal and open description frameworks. In this perspective, the importance of ontologies, terminologies, and standards can only grow. Even if that road might look long, it is a fascinating one, open for creativity and, in any case, promised to success. The future age where not having computer-aided decision-support while prescribing drugs will belong to malpractice might not be that far and good evidence-based outcome research on that subject should be supported. In this near future, information technology such as decision-support and CPOE will become part of the quality criterion for standard of care.

In that perspective, the two first papers of this synopsis present a highlighting view about CPOE, providing a deep review of concerns and effects of such systems. They support a strong argumentation to encourage their large dissemination. The first paper by Kuperman et al., "*Computer physician order entry: benefits, costs, and issues*", presents a clear, comprehensive and complete review of existing CPOE, discussing current concerns about their deployment and use. Most systems and features currently available are presented and discussed, with their

expected impacts on clinical practice. Despite the fact that the costs of CPOE are substantial both in terms of technology and organizational process, and often underestimated, this paper supports that this technology can yield many significant benefits and is an important platform for future changes to the health care system. Kuperman et al. advocate for CPOE as a critical tool in improving health care quality and efficiency.

The paper by Park et al., "*Does the physician order-entry system increase the revenue of a general hospital?*" demonstrates the effect of CPOE on significantly increasing revenues from both outpatients and inpatients on a large scale study involving most general hospitals of South Korea. Based on the analysis of 4 years of data from inpatient and outpatient revenue of all general hospitals (212) in South Korea, their study demonstrates that CPOE decreases outpatient waiting time and inpatient length of stay by speeding up the information flow. One of the consequences observed is that, in turn, it increases the number of patients, which results in revenue increase.

Real-time care production management at the bedside

When speaking about decision-support, CPOE or about direct clinical data acquisition, the needs for means allowing care providers to have access to decision-support at the point and the time of decision is now clearly recognized. This is linked to the fact that, at various levels and points of view, management has become a new part of care providing. Management is now present at the patient level, when a clinician has to adopt the best diagnosis instrument or care pathway, according to constraints such as patient state, resource availability, and competences accessibility. It is also present at the

nursing level, for example when planning the daily care or the appointments of a patient; team management is an important aspect of the work of the nurse managers that have to optimize shifts at the ward level. And there is no need to mention the importance of management at the institutional or higher levels. These are only a very few among many examples. From the singular relationship between the care provider and the patient up to the top executives of the hospital and the ministry of health, management has become part of the daily life. However, the new and remarkable evolution is the importance taken by local and real-time management at the direct care production place. This leads to two comments: a) the work of care providers on a ward is to be assimilated to micro-management. However, although they are responsible for the operation of business units, physician and nurse managers are often less prepared, if at all, to manage the business activities than the clinical activities. b) There are very few tools helping direct care providers in their managing activities. Most tools available are only indirect, such as reminders or instant display of the cost of a drug prescription.

It is the originality of Ruland et al. in the third paper of this section entitled “*Usefulness and effects on costs and staff management of a nursing resource management information system*” to demonstrate that “ward-level” management can lead to impressive improvements in care resource use. This article presents evaluation results of an information system designed to provide decision support for nurses in charge of managing ward staff. The tool presented helps the financial management, resource allocation, and activity planning of a ward. Using this tool, Ruland et al. could account a 41% reduction in expenditures for overtime and extra hours during the evaluation period. In

addition, nurse managers reported a substantial improvement in management information and stated that they had gained control over costs.

Dealing with the unexpected

Dealing with unexpected or unforeseeable events is one of the important challenges that have to be addressed by healthcare. They are important in two very different ways. The first one is the unexpected event in the usual meaning of unwanted events, such as drug side effects. The second however, concerns the ability to capture new events in the meaning of “unknown”. This latter type of event is one of the cornerstones of the ability of science to learn and produce new knowledge. This is an important aspect to point out, especially with the growing use of normalized terminologies and structured patient records, which traditionally dissuade the representation of anything not previously known. Unexpected or unattended events occur at all levels of healthcare. For example, this might be a new emerging disease, as experienced with the SARS at the international level. Unexpected events can have to deal with the sudden arrival of new patients on a ward or the atypical presentation of a patient or course of a disease, the unattended reaction to a drug, the false positive/negative values of investigations, artefacts in the reconstruction of magnetic resonance images or the noisy alarms of patient monitoring in intensive care. At any time in their work, care providers or health managers have to work within an unpredictable and quickly changing environment. Many studies have focused on adverse drug reaction detection or clinical alerts and reminders, some on the large scale implementation of clinical pathways and the management of unfitting cases. The field of epidemiologic surveillance has received much attention in the last

few years; however, many domains that are deeply influenced by unexpected events still require investigation. One of these domains concerns medical devices. In the impressive paper by Samore et al. “*Surveillance of medical device-related hazards and adverse events in hospitalized patients*”, a 9 month long study conducted in a 520 bed tertiary teaching institution, the authors evaluated electronic rules to estimate the incidence of problems associated with devices and compared these results with post-discharge ICD9 codes, the existing hospital incident event-reporting system, a prospective checklist system for telemetry-related problems, a post-discharge patient satisfaction survey and a review of the clinical engineering logs. Less than 10% of the computer-triggered alerts resulted in true device-related incidents. They report estimated 9-month incidence rates (per 1000 admissions) for adverse medical device events of 1.6 (0.9-2.5) for incident reports, 27.7 (24.9-30.7) for computer flags, and 64.6 (60.4-69.1) for ICD-9 discharge codes.

All together, all methods are deceiving in their ability to provide a true image of device-related incidents. According to these results, it appears that all what is known in routine on that subject, mostly such as by the use of self-report incident systems, largely underestimate the reality and are of limited value. This a domain where it does not seem, at a first glance, that information technology is really able to improve results, as no real working model is available. And, as concluded by the authors, the high rate of device-related events suggests they are an important patient safety issue, but additional research is necessary to identify optimal detection strategies.

The four papers presented in this section present state-of-the-art aspects of information technologies in the field

of health and management. They also open the door of what is to be expected to be done in the near future: Improving the affordability and availability of computerized order entry; developing decentralized tools to help management at all levels of the care process; and improving strategies to optimally identify and learn from unexpected events. Reaching these goals is not, by far, just a technological or intellectual challenge. It is also a cultural shift that must be accompanied with education, support, and convinced leaders. Finally, these goals might be expensive to

reach, but this is the price to pay for a better future and the evolution of the health sector.

References

1. Institute of Medicine (US). The computer-based patient record: An essential technology for health care. Washington DC: National Academy Press; 1991. Revised edition in 1997.
2. Institute of Medicine (US). To err is Human: Building a safer health System. Washington DC: National Academy Press; 1999.
3. President's Information Technology advisory Committee. Report to the

President, Revolutionizing Health Care through Information technology. Arlington: National Coordination Office for Information Technology Research and Development; June 2004.

Address of the author:

Christian Lovis
University Hospitals of Geneva
Service of Medical Informatics
24, Micheli-du-Crest
CH-1211 Geneva 14, Switzerland
Tel: +41 22 372 6201
Fax: +41 22 372 8680
E-mail: christian.lovis@hcuge.ch