Health and Clinical Management — Maximising Health Care Efficiency for Better Outcomes
Supporting Health Care Professionals in the Ever-increasing Complexity of Patient Care

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Summary

Objectives: To present some of last year's best papers in the field of health and clinical management.

Method: Synopsis of the best articles selected for the IMIA Yearbook 2010.

Results: All five selected articles present promising results, each in a different subtopic of health care management. From automated clinical syndrome detection to global population surveillance, through improving alerting systems' impact, the selected articles should give an idea of how IT, not only can, but how it does help in health care management.

Conclusions: While some people fear that computers might, one day, replace humans in health care, this is very far from being the case. What literature shows is that IT merely provides health care professionals with valuable tools that let them spend more time with their patients, prevent them from missing critical information, support them in their decision making and thus help improve their efficiency.

Keywords

Medical informatics; International Medical Informatics Association; yearbook; decision support systems, management; patient care management; public health informatics.

Introduction

The potential of IT to improve health care management is enormous: IT helps in gathering, processing, organizing, distributing, storing and retrieving data faster than any other mean, in a much larger scale and with much higher reliability.

With the help of specific devices, valuable clinical parameters can be collected by patients themselves and transmitted to expert systems that can, for example, detect early acute exacerbations of chronic conditions and orient patients to seek medical advice when necessary [1]. Specific software can help gather data that can then be analysed to find triggers of clinical conditions [2] without health professionals needing to spend time in interviews with patients.

Whereas humans can process only a limited amount of information, are prone to omissions or to make mistakes because of interruptions or work overload, computers and electronic devices can process far more information in much less time, recover well from interruptions and usually don't forget. Thus, IT can, for instance, offer solutions to remind health care providers of pending tasks like to communicate test results to patients [3], to further investigate abnormal test results [4] or simply to renew a patient's drug prescription [5].

Another consequence of the quantity of information contained in modern medical records, whether paper or electronic, is that it becomes rapidly time-consuming for health providers to parse through a patient's record to find all the valuable information in a given context. To reduce the time needed to find relevant information, research shows that automated and dynamic solutions for the selection and organization of context relevant information can be built [6].

Both cause and consequence of this growing volume of medical data in patient records, health professionals tend to be more specialized in specific areas. Added to this, the increasing number of poly-morbid patients in the population and the increasing mobility of patients all around the world, patients' medical data collected all along their entire lives spreads across numerous medical records. These changes create new needs for solutions for localizing all repositories storing a patient's medical data and enabling systems to communicate one with another to allow for continuity of care [7].

While interconnecting health information systems is of obvious usefulness, research shows that even credit card and supermarket transactions can be helpful information: in the context of bio-surveillance, these data have successfully been used for identifying the cause of an infectious disease outbreak [8], thus extending the range of clinically valuable data.

Because of the vast amount of information contained in medical records, their long-time archiving should be considered [9]. Unfortunately, the stor-

age of paper-based medical records requires large volumes of space and information contained within them is hard to locate. On the contrary, IT can store the same information in lesser space and permits for rapid localisation and retrieval of information of interest. In this sense, IT enables all this information to be a real source of data for research so that new knowledge can be built on top of it.

The few examples above of IT's valuable help in health care only demonstrate how broad is the topic of health and clinical management. Thus, with such a large topic, the few articles selected for the present yearbook cannot be considered as a summary of all accomplished work. They are merely examples of excellent research in the field.

Best Paper Selection

The five articles selected this year deal with some of the topics mentioned above. Mabotuwana's paper about medication adherence [12] shows that medication possession by patients could be improved would physicians renew prescriptions on time. This suggests that electronic patient records could implement a checking on medication prescription and prompt for prescription renewal. This paper also illustrates how linking data from various systems can increase the precision of information: linking pharmacy dispensing systems to electronic medical records can improve the precision of our knowledge about single patient's adherence to medication.

A second article [11] illustrates how computers can perform much better than humans in detecting clinical situations. With their ability to not oversee information and never forget to apply all the checking rules, they can perform much better than humans.

In CPOEs, this capacity has been used for a while to support physicians in drug prescribing; knowledge about drugs being too vast to expect physi-

cians know every valuable piece of information, CPOEs implement drug checking and alerting functions to inform physicians when some adaptation should be done. Interestingly, it has been shown that physicians are generally very resistant to these alerts. The study made by Paterno et al [13] deserves to be noticed as their approach to improve the impact of alerts on clinicians obtained positive results.

The value of computers in extracting and organizing information is demonstrated in Were's article [14]: automated clinical summaries can help improve patient care as physicians can spend more time with patients instead of parsing records to find information of interest.

The last selected article [10] is an excellent work in the area of public health surveillance. Based on data collected from general practitioners' electronic records, authors were able to determine incidence and prevalence rates for all ICPC codes and identify a few striking trends over time.

Conclusions and Outlook

There is no more need to prove that IT has a potential in helping improve health care, but there still is a lot to be done

before all the potential of IT can be fully used. We can therefore expect next year's literature to provide us with some more exciting reading.

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Table 1 Best paper selection of articles for the IMIA Yearbook of Medical Informatics 2010 in the section 'Health and Clinical Management'. The articles are listed in alphabetical order of the first author's surname.

Section
Health and Clinical Management
■ Biermans MCJ, Spreeuwenberg P, Verheij RA, de Baker DH, de Vries Robbé PF, Zielhuis GA. Striking trends in the incidence of health problems in the Netherlands (2002-05). Findings from a new strategy for surveillance in general practice. Eur J Public Health 2009;19(3):290-6.
■ Herasevich V, Yilmaz M, Khan H, Hubmayr RD, Gajic O. Validation of an electronic surveillance system for acute lung injury, Intensive Care Med 2009;35:1018-23.
■ Mabotuwana T, Warren J, Harrison J, Kenealy T. What can primary care prescribing data tell us about individual adherence to long-term medication?-comparison to pharmacy dispensing data. Pharmacoepidemiol Drug Saf 2009;18: 956-64
■ Paterno MD, Maviglia SM, Gorman PN, Seger DL, Yoshida E, Seger AC, Bates DW, Gandhi TK. Tiering drug-drug interaction alerts by severity increases compliance rates. J Am Med Inform Assoc 2009;16:40-6.
■ Were MC, Shen C, Bwana M, Emenyonu N, Musinguzi N, Nkuyahaga F, Kembabazi A, Tierney WM. Creation and evaluation of EMR-based paper clinical summaries to support HIV-care in Uganda, Africa. Int J Med Inform 2010 Feb;79(2):90-6.

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10. Biermans MCJ, Spreeuwenberg P, Verheij RA, de Baker DH, de Vries Robbé PF, et al. Striking trends in the incidence of health problems in the Netherlands (2002-05). Findings from a new strategy for surveillance in general practice. Eur J Public Health 2009;19(3):290-6.

11. Herasevich V, Yilmaz M, Khan H, Hubmayr RD, Gajic O. Validation of an electronic surveillance system for acute lung injury. Intensive Care Med 2009;351018-23.

12. Mabotuwana T, Warren J, Harrison J, Kenealy T. What can primary care prescribing data tell us about individual adherence to long-term medication?-comparison to pharmacy dispensing data. Pharmacoepidemiol Drug Saf 2009;18:956-64.

13. Paterno MD, Maviglia SM, Gorman PN, Seger DL, Yoshida E, Seger AC, et al. Tiering drug-drug interaction alerts by severity increases compliance rates. J Am Med Inform 2009;16:40-6.

14. Were MC, Shen C, Bwana M, Emenyonu N, Musinguzi N, Nkuyahaga Fet al.. Creation and evaluation of EMR-based paper clinical summaries to support HIV-care in Uganda, Africa. Int J Med Inform 2009; *ePub ahead of print*.

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Appendix: Content Summaries of Selected Best Papers for the IMIA Yearbook 2010, Section on Health and Clinical Management*

Biermans MCJ, Spreeuwenberg P, Verheij RA, de Baker DH, de Vries Robbé PF, Zielhuis GA

Striking trends in the incidence of health problems in the Netherlands (2002-05). Findings from a new strategy for surveillance in general practice

Eur J Public Health 2009;19(3):290-6

Biermans et al. present in this paper their work on the development of a new strategy for public health monitoring. They used data from general practitioners' EMRs to determine morbidity rates of all codes of the ICPC and searched for striking trends over time. The denominators for incidence and prevalence rates were easily estimated: the Netherlands have a gate-keeping system (patients visit a general practitioner (GP) before eventually consulting a specialist) together with a list system (every patient is registered with a GP). For the estimation of the numerators, two situations were distinguished: diagnosis codes were either directly attached to episodes (in episode-oriented EMRs) either, from contact-oriented EMRs, diagnosis had first to be grouped into episodes – grouping that was done through an automated system (EPI-CON). Once the rates for all ICPC codes were determined, authors reviewed those that showed a striking trend over time and searched for possible causes for these trends.

Herasevich V, Yilmaz M, Khan H, Hubmayr RD, Gajic O

Validation of an electronic surveillance system for acute lung injury

Intensive Care Med 2009;35:1018-23

In this paper, the authors present their work on the development and evaluation of a computerized near real-time surveillance system for the detection of acute lung injury (ALI) in ICU patients. The automated system was based on arterial blood gas analysis data as well as on the analysis of free-text chest X-ray reports. The medical records of ICU patients were manually reviewed by two physicians (considered as the gold standard) to determine for the presence of ALI. The comparison of the automated system's results with the manual review of medical records showed a sensitivity of 96% for the automated system and a specificity of 89%. Compared to routine clinical assessment which detects ALI in approximately one for every four cases, the automated system performed much better, thus demonstrating the value of IT.

Mabotuwana T, Warren J, Harrison J, Kenealy T

What can primary care prescribing data tell us about individual adherence to long-term medication? - comparison to pharmacy dispensing data

Pharmacoepidemiol Drug Saf 2009;18: 956-64

Patients' adherence to prescribed medication is known to be a significant challenge in health care management. In the present study, authors analysed prescribing data from general practice electronic medical records and calculated prescription possession ratios (PPR). These ratios were then compared to the medication possession ratios (MPR) calculated on the base of data collected from electronic pharmacy dispensing systems. The analysis of these data showed that the MPR is a good predictor of the PPR. Thus, there is good potential for general practitioners to identify medication adher-

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* The complete papers can be accessed in the Yearbook's full electronic version, provided that permission has been granted by the copyright holder(s).

ence problems with the sole data contained in their medical records, although the availability of further data (from dispensing systems) can improve this detection.

Paterno MD, Maviglia SM, Gorman PN, Seger DL, Yoshida E, Seger AC, Bates DW, Gandhi TK
Tiering drug-drug interaction alerts by severity increases compliance rates
J Am Med Inform Assoc 2009;16:40-6

In the field of computerized medication prescription, Paterno et al. have, in this study, analysed how to improve physicians' acceptance of system alerts related to drug-drug interactions. They tiered alerts in three groups and presented the alerts of each group in different manners. Level 1 alerts, those indicating a real threat for the patient were made blocking and users had no choice but take an action (change the prescribe medication). Level 3 alerts, related to minor conditions, where pre-

sented as simple information and did not require any action at all. Level 2 alerts, requiring attention from prescribers, were presented as none blocking alerts but required at least to be acknowledged. Pre-post intervention response rates to alerts increased to 100% for level 1 alerts (which let no other possibility to the user than to conform to the system's suggestion) and increased significantly for level 2 alerts (from 10 to 29%). These results clearly demonstrate that users acceptance of alerts can be greatly improved.

Were MC, Shen C, Bwana M, Emenyonu N, Musinguzi N, Nkuyahaga F, Kembabazi A, Tierney WM
Creation and evaluation of EMR-based paper clinical summaries to support HIV-care in Uganda, Africa
Int J Med Inform 2010 Feb;79(2):90-6

In this article, authors evaluate the impact of automated EMR-based clinical summaries on the time spent by

health providers in direct care of patients in an HIV/AIDS clinic in Uganda. An automated clinical summary was implemented in the existing EMR. After each patient visit, new data was entered in the EMR and an updated clinical summary was generated, printed and placed in the patient's paper record (as physicians don't use the EMR during patient encounters). At the next visit, the printed clinical summary made the most relevant information be readily available to the care provider, without needing to search in the entire paper record. The impact of the intervention was evaluated by comparing the amount of time spent by health care providers and patients in their activities. The overall results showed, although to a limited extent, improvement in clinical efficiency and shorter patient stays in the clinic. This demonstrates that IT can bring valuable help even in countries with very limited resources.