G. Pangalos

Synopsis

Informatics Laboratory,
Faculty of Technology,
University of Thessaloniki,
Greece

Health and Clinical Management

Introduction

Physicians, nurses, and other practitioners related to health and clinical management know very well that information technology has yet to transform totally the way they care for their patients. Contemporary medicine depends on computers similar to the way 19th century farming depended on horses [1]. Information technology is, therefore, of particular significance in hospitals, where the communications flow is truly information-intensive. Automated systems affect the daily routines and activities of all hospital staff, including physicians, nurses, paramedical staff, and financial and administrative staff. The development of information systems is thus one of the most challenging tasks facing hospitals today. The challenge is to provide health-care practitioners access to information when and where they need it, and to do so in a manner that minimizes costs and training time while avoiding incremental time commitments.

For the physicians of the 1990s and beyond, workstations will be their windows to the world. Much of the necessary technology already exists. In contemporary health care, computer networks link health professionals in their workplaces and deliver health services to patients in their homes. The characterization of the use of such health services delivered via computer networks remains, however, problematic. In her article Patricia Flatley Brennan proposes a four-perspective

framework which provides a mechanism for combining various measures of use into a coherent whole [2].

The development and use of clinical guidelines for improving patient care is another major problem related to health and clinical management which can be facilitated by the use of modern information technology. The papers by Tiernet et al. [3] and Pearson et al. [4] address this important issue. The paper by Tiernet et al. [3] describes their attempt to implement one such set of guidelines for treating heart failure, using a network of workstations in an urban teaching hospital. It discusses their successes and failures and makes recommendations for future guideline development. Pearson et al. [4] evaluate the reproducibility of a consensus guideline development process across three different physician panels at a health-maintenance organization.

Recent developments in technology coupled with expanding needs for health services have also led to new uses of computer networks as, for example, telepathology, a way to make expert knowledge available everywhere in real time. The paper by Ito et al. [5] examines the validity and accuracy of telepathology services in the histological diagnosis of biopsy specimens from human transplanted kidney and liver. It reports their early experience and discusses the validity, diagnostic accuracy and limitations of a telepathology system used in support of organ transplantations.

Finally, length of stay (LOS) has

recently become a major issue in hospital efforts to control costs in the US. Shea et al. [6] test the hypothesis that a computer-generated information message directed to physicians would shorten LOS.

Characterizing the Use of Health Services

Patricia Flatley Brennan [2] examines the problem of characterization of the use of health services delivered via computer networks, and focuses on the need for explicit characterization of the use of such services. Recent developments in technology coupled with expanding needs for health services have led to a use of computer networks not envisioned two decades ago such as, for example, telemedicine, counseling, social support, health education, etc. The problem of characterizing the use of health services delivered by computer networks concerns the selection from a range of operational definitions and appropriate metrics.

A model, which is based on human-computer interaction theory, the 4-S framework, is proposed for this purpose. Relative to computer network use there are four perspectives or units of analysis in it: system level, service level, session level, and subject level. The proposed 4-S framework incorporates perspectives based on user (subject) behavior: access to and use of the total system, use of specific services, behavior within single ses-

sions, and enduring behavioral characteristics.

The utility of the 4-S network is illustrated using data delivered from a completed, randomized field experiment in which 47 categories of persons who had Alzheimer's disease had access to a special computer network, providing information, communication and decision support to homebound caregivers of persons who have this disease. Through the application of the proposed 4-S framework, an understanding of both quantitative use and qualitative use emerged. The proposed framework also provides a mechanism for combining various measures of use into a coherent whole.

Use of Guidelines for Improving Patient Care

The increasing amount of available medical knowledge, the existing practice variation, and the ever-increasing patient demands for high-quality care have created a fertile environment for developing and using clinical practice guidelines. On the other hand, electronic patient records and other similar advances in medical informatics have provided an opportunity to invoke and use guidelines during the everyday practice of clinical medicine to improve health-care quality and control costs. This has stimulated a significant number of professional organizations, federal agencies etc. to develop clinical practice guidelines [3,4]. These guidelines are often defined as systematically developed rules to assist practitioners' decisions about the appropriate health care in specific clinical circumstances. They usually target clinicians, but could also be used by hospitals, managers, researchers, etc., to improve decision making and optimize patient outcomes.

Tiernet et al. [3] describe an attempt to implement a set of guidelines developed by the Agency for Health Care Policy and Research (AHCPR) for treating heart failure, using a network of workstations in an urban teaching hospital. They describe in detail the methodology followed and the difficulties encountered in automating the AHCPR guidelines. They discuss successes and failures and make useful recommendations for future guideline development.

The AHCPR guidelines provide - according to the authors - a very good, evidence-based review of the current state-of-the-art for treating heart failure due to systolic malfunction. As pointed out, however, in their present form it is difficult for third parties to use the guidelines in assessing and improving clinical performance. Based on their experience, the authors propose specific improvements which include their present form, their algorithmic logic, the need for their local translation, the rules about errors, etc. As pointed out by the authors, the AHCPR heart-failure guidelines have taken the practitioner's viewpoint and, as such, they are a good start for a first-rate evidence-based clinical review. However, for guidelines to move beyond a purely educational role, definitions will have to be more explicit and standardized.

Flourishing guideline development programs can be found today within medical societies, insurance companies and government departments. To date, physician consensus groups have served as the foundation of most guideline development efforts. Formal physician consensus methods have become increasingly visible tools for designing guidelines to address problems in healthcare. A question that arises is [4], however, whether this growing edifice of guideline development rests securely upon its methodological base of consensus groups. One of the bulwarks of confidence in any method of guideline development should be a demonstration of its reproducibility [4]. However, it remains unknown when making these guidelines operational, whether or not different groups of physicians, located in different places, using the same consensus method, will create similar guidelines. This uncertainty possesses a serious threat to the validity of the guideline development process.

One of the goals of the paper by Pearson et al. [4] is to address this uncertainty by evaluating the reproducibility of a consensus guideline development process across different physician panels at a health-maintenance organization. The physician groups were composed for this purpose of internists, who were provided with identical selections from the medical literature and first-draft "seed" algorithms on the management of two common clinical problems: acute sinusitis and dyspepsia.

Their study compared the guidelines produced by three separate consensus groups. The setting was a mixed staff and group-model health-maintenance organization in New England. The methods used and the results obtained are described in the paper. This information is of significant importance since, as pointed out by the authors, despite the fact that formal consensus guideline-development programs exist today in more than 60 organizations, there has been little information available on how to evaluate or to improve the various consensus processes that lie at the root of the guideline development programs.

Telepathology for Transplantation Pathology

Transplantation pathology has become one of the highly sub-specialized fields [5]. Recent developments in clinical organ transplantation have increased the necessity for, and the number of cases in which only the expert pathologist in the field can provide the best available treatment for

the organ-transplant patient. Currently used methods, such as mailing of slides and specimen blocks to the expert for pathology consultation, reduce the value of the biopsy, especially in cases of organ transplantation. For transplant teams lacking an expert pathologist in the hospital, opportunities should, therefore, be provided to consult expert pathologists for cases under consideration.

Given this background, Ito et al. [5] have focused their attention on telepathology, as a way to make expert knowledge available everywhere in real time. More specifically, their paper examines the validity and accuracy of telepathology services for the histological diagnosis of biopsy specimens from human transplanted kidney and liver. The paper reports their early experience and discusses the validity, diagnostic accuracy and limitations of a telepathology system used in support of organ transplantations.

The results from the authors' early experience indicate that their system is apparently useful for the surgeon or the pathologist who has a deficiency of expertise in transplantation pathology. More experience with this system as well as upgraded instruments, such as a remotely-controllable robotic microscope are, however, necessary to further improve diagnostic results and the accuracy to a standard equal to direct-light microscopy [5].

Effect of Messages on Length of Hospital Stay

The length of stay (LOS) of patients in hospitals has always been a major factor in formulating the real cost per patient admission [1,6]. Because of recent changes in charging schemes, length-of-stay per admission has become a major issue in hospital cost management in the USA. Therefore, hospitals now have major financial incentives to complete the diagnostic

and therapeutic care of patients as quickly as possible within, of course, the limits of medical appropriateness. Many factors contribute to excessive LOS, and some of these factors cannot be influenced by physicians within the limits of good medical care. However, studies in several medical institutions have shown [6] that computer-generated informational interventions directed at physicians can affect physician behavior. For example, outpatient test ordering and costs were reduced when physicians were shown prior test results, test prices, computer-generated predictions, etc. [6].

Shea et al. have developed and evaluated a computer-generated informational message directed to physicians as an intervention to reduce LOS at their institution. They also evaluated the effectiveness of their intervention using a randomized controlled design.

The findings reported in this article [6] add to the growing body of literature showing that computer-generated messages directed to physicians at the "point of service" - at the time when and at the place where clinical decisions are made - can improve the quality and efficiency of health care. These messages can be effective, even in the absence of educational efforts or other organizational changes, if the information they contain is credible and relevant to the care of specific patients.

Conclusions

Health and clinical management-information systems are intended to support a wide range of pertinent health issues today, for example: assurance of the quality of care, supporting of the management of health-care institutions, monitoring and containing the cost of care, implementing technology into health-care without violating social values, ensuring the equity and

availability of care, preserving humanity despite the proliferation of technology, etc. In this context, the problems discussed by the five papers of this section are particularly important, both for health professionals and computer scientists.

References

1. Ball MJ, Douglas JV, O'Desky RI et al, eds. *Healthcare Information Management Systems*. New York: Springer-Verlag Inc, 1994.
2. Brennan PF. Characterizing the use of health care services delivered via computer networks. J Am Med Inform Assoc 1995;2:160-8.
3. Tierney WM, Overhage M, Takesue BY, Harris LE, Murray MD, Vargo DL, McDonald CJ. Computerizing guidelines to improve patient care and patient outcomes. The example of heart failure. J Am Inform Assoc 1995;2:316-22.
4. Pearson SD, Margolis CZ, Davis S, Schreier LK, Sokol N, Gottlieb LK. Is consensus reproducible? A study of an algorithmic guidelines development process. Med Care 1995;33:643-60.
5. Ito H, Adachi H, Taniyama K, Fukuda Y, Dohi K. Telepathology is available for transplantation-pathology; experience in Japan using an integrated, low-cost, and high-quality system. Modern Pathol 1995;7:801-5.
6. Shea S, Sideli RV, MuMouchel W, Pulver G, Arons RR, Clayton PD. Computer-generated informational messages directed to physicians: effect on the length of hospital stay. J Am Med Inform Assoc 1995;2:58-64.

Address of the author:
Prof. G. Pangalos,
Informatics Laboratory,
Computer Division,
Faculty of Technology,
University of Thessaloniki,
Thessaloniki 540 06, Greece.
E-mail: gip@eng.auth.gr