

Ling Zhu

Beijing Lianshi Technology Co. Ltd.  
Beijing, PR China

## Synopsis

### *Health and Clinical Management*

The Healthcare industry is certainly one of the most information intensive industries. Medical information and clinical data are growing at close to explosive rates each day. Processing medical information and clinic data has become increasingly difficult in medical and clinic management. Computer-assisted information management systems have been used to provide an effective mechanism to present the relevant information/knowledge that is essential in the decision-making processes in Healthcare.

The papers selected for this section address the issues of information applications in health care, especially in clinical management.

The paper by Chakravarty et al. presents a pattern specification language (CAPSUL) to support both acquiring knowledge about patterns from domain experts and searching for these patterns in clinical data sets.

Patterns, as standard solutions to repeating problems, have become increasingly important in formulating the problem-solving processes in many areas of information technology. Some major research focuses with regard to patterns is how to capture patterns as well as how to describe them.

In many medical domains, care providers and clinical researchers need to specify and detect recurring trends, not only at the level of time-stamped data, but also at higher levels of data abstraction. As a result, the detection of repeating patterns in time-oriented clinical data often becomes an important component of the analysis of a large set of clinical data. The pattern specification language (CAPSUL) presented in the selected paper is used as a critical component in a data analysis system. CAPSUL defines a set of expressive constraints upon temporal entities that already exist in the knowledge case. Using a graphical knowledge acquisition tool, expert physicians can specify pattern queries using a variety of temporal and value constraints. CAPSUL provides an expressive language in which one-time only and repeating patterns of intervals can be described. The CAPSUL language is designed both for the task of knowledge acquisition as well as data interpretation, which is very significant to build knowledge-based intelligent medical and clinical information systems.

The paper describes CAPSUL in details as a language to capture the repeating patterns. Many examples are discussed to display the expressive

power of the language, its flexibility as well as its limitations. The article also discussed CAPSUL as a knowledge acquisition tool to obtain the domain expertise from experienced expert physicians.

The intensive care unit (ICU) is an environment with abundant data. Each second, a patient data set is produced by online monitoring systems. Clinical data is collected manually at various time intervals. A computer-based patient data management system (PDMS) stores data that has been collected online or entered manually within a specified time frame. Even if these electronic patient records are complete and correct, they are difficult to analyze because they contain so much data. The paper by Horn et al. describes a graphic tool, VIE-VISU, a graphic visualization system, as an aid to comprehending and analyzing a large amount of data.

Graphic representation offers a wide variety of methods to support data integration. Which method is chosen depends mainly on what information is to be displayed for clear comprehension. The article discusses the domain of neonatal intensive care in which recognizing changes of neonatal status over time is critical. As an example,

the article describes the 24 hours display of VIE-VISU by using metaphor graphical objects that represent circulatory data, respiratory data and fluid balance.

The nurse change of shift report occurs on most hospital wards everyday. Little study and research, however, has been done upon examining how changing the style and information content of the shift report may affect an individual's ability to process information on her/his duty. The paper by Dowding presents a study that suggests that how individuals structure their knowledge, is an important consideration when examining how they process information.

The nurse change of shift report provides information about patients in the ward or unit to those nurses who are beginning their shift. Often information is provided verbally. The aim of this experimental study was to explore the possible ways that information is processed during the change of shift report on an acute medical and surgical ward in order to provide evidence with which to explore the relevance of the change of shift report to nursing practice. Various assumptions are made about the importance of the information communicated during the shift report. The information which nurses receive during the report is perceived to subsequently enable them to plan and to give care effectively and efficiently to patients. Specific research studies that have examined the nature of the nursing shift report have concentrated too much on the information content of the communication. Those studies have concluded that the verbal communication at the change of shift can be characterized by being retrospective and task orientated, focusing on actions that the nurse has carried out and the medical treatment the patients have received. Despite those assumptions, no research currently

appears to exist to support the claims which have been made. There have been attempts to replace the verbal shift report with written communication, however, these studies have not examined the effect this has had on patient care. There is also no apparent information regarding its usefulness depending on the skill or expertise of the nurses involved in the communication.

It appears from the previously discussed literature that the purpose of the verbal change of shift report is assumed to be to communicate information from one nurse to another nurse(s), and that through this communication, the nurse receiving the report will be able to plan care effectively for his/her patients. Therefore, it could be suggested that the nurse receiving the report has to "process" the information he/she receives in some way. As the theory of information processing suggested, human beings have limited capacities for processing information. And there are only a small number of studies that have examined how nurses process information to form plans of care and make decisions regarding patient care.

The paper discusses the result of an experimental study where report style (retrospective vs. prospective) and schema information (schema consistent vs. schema inconsistent) were compared in a factorial design. A sample of 48 registered nurses from acute medical and acute surgical wards were randomly allocated to one of the four experimental conditions. Outcome measures included the amount of information that subjects accurately recorded and recalled from the shift report, together with their ability to plan patient care. The results of the study indicated that the type of report has a significant effect on an individual's ability to plan patient care, and the type of information content has an

effect on their ability to accurately record and recall the information they heard.

The paper discusses the insufficiency of the current theories of knowledge organization which fail to address how knowledge categories may be linked together, or how new information is accumulated into existing knowledge structures. As an alternative explanation for how knowledge may be organized in the long-term memory, the article describes a schema theory which is regarded as more complicated networks of represented information, using common themes or situations as a way of organizing knowledge. A number of examples of different types of schema have been given in the article.

This study, however, was based on a fabricated shift report situation and therefore the results need to be treated with some caution. The results of this study did indicate that verbal communication at the change of shift may not be the most effective way of communicating information about patients to enable patient care to be planned effectively. Further research needs to be carried out into the exact role that the change of shift report plays within the context of patient care. Further research also needs to be carried out examining how nursing knowledge affects how information is processed in patient care situations.

Chemotherapy has been regarded as an important component of childhood cancer treatment. Because of the intensity of the therapy, an error in calculating the dosage of the cytostatic drug would have severe consequences. The paper by Knaup et al. presents a computer-aided therapy planning system in pediatric oncology (CATIPO) that aims at reducing errors and saving time during the development of a therapy plan.

CATIPO is actually a knowledge-based expert planning system that aims at determining the adequate therapy for individual patients by determining a complete chemotherapy cycle in advance. It consists of three system components 1) CATIPO-kam, a knowledge acquisition module that formulates the therapy protocol guidelines; 2) CAPITO-dss, a decision-making module that is able to process the formulated protocol guidelines and produce a patient-specific therapy plan; and 3) a knowledge base.

One of the major tasks in CATIPO is to identify, model and formulate the general knowledge of the protocols. Such knowledge is formally represented which allows for use of the implicit knowledge for various patients and for various trials. Part of this process of identifying, modeling and formulating knowledge is the analysis of the explicit knowledge that is acquired by the knowledge acquisition tool, CATIPO-kam. Such knowledge consists of 1) drugs, which are to be used in the chemotherapy cycle; 2) solutions containing an active agent; 3) infusion, which is composed of drugs and solutions; 4) sequential order of drug applications; and 5) inclusion criteria, which takes patients' variables or conditions into account for planning the chemotherapy cycle. All of the formulated knowledge will be used by CAPITO-dss, a decision making tool, to generate a patient-specific therapy plan that adheres to the definition of a therapy protocol.

The paper also discusses some other systems supporting the protocol-guided therapy in oncology and compares them with CAPITO.

In medicine, business, and other domains, people tend to assume that

more information cannot hurt. Underlying this assumption is the belief that people have clear and stable preferences that can only be refined by becoming informed. Research in psychology, on the other hand, suggests that individuals' preferences are often unclear and tend to be constructed during the process of making a decision. Psychological research has discovered systematic inconsistencies that stem from individuals' imperfect ability to distinguish relevant from redundant information. One weakness is the tendency to pursue no instrumental information that may be relevant but ought not to alter the decision. In this vein, people sometimes pursue more information than necessary and, once they receive it, tend to see it as crucial for the decision.

The paper by Redelmeier et al. presents a study that investigated whether clinicians also show a tendency to pursue and potentially misapply non-instrumental medical information.

The study tested whether clinicians make different decisions if they pursue information than if they receive the same information from the start. The study was carried out on three participating groups of clinicians: dialysis nurses, practicing urologists and academic physicians with medical scenarios formulated in 1 of 2 versions. And the result of the study indicates that the pursuit of information can increase its salience and cause clinicians to assign more importance to the information than establish that such an awareness of this cognitive bias may lead to improved decision making in difficult medical situations.

The survey that the study was based upon adapted methods developed by

psychologists for evaluating how decisions are prone to systematic errors. One scenario with the two different versions was given in the survey, and each version was formulated with different descriptions of information on the scenario. The survey aimed at providing evidence of whether or not clinicians are prone to make different decisions when they pursue information than when they are given the information all at once.

The study suggests that one factor influencing clinicians' decisions is their own behavior. Using scenarios, the article shows how the pursuit of information can lead nurses and doctors to weigh information more heavily than if the information were available at once. As a result, the paper suggested physicians to consider the relevance of missing information before it is pursued. In situations where a piece of information is non-instrumental but is hard to forgo, physicians might be well served by constraining themselves to a pre-specified course of action. For situations in which missing information has been sought without a clear pre-specified plan, the physician may want to consult with a colleague who can review the data easily without biases related to an involved search.

Address of the author:

Dr. Ling Zhu  
Beijing Lianshi Technology Co. Ltd.  
4/F, Building 7, No.28 Yuhua Road  
Area B, Beijing Airport Industrial Zone  
101300 Beijing, PR China

or:

Dr. Ling Zhu  
China Medical Informatics Association  
No.17, Zhengjue Jiadao, Xijiekou  
Xicheng District,  
100035 Beijing, PR China  
E-mail: lzhu\_md@yahoo.com