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Development of an information system prototype for the optimization of the use of diagnostic services in intensive care units.

A self-control based approach.

Keywords: Prototyping; Information requirement determination; Interface design; Executive support system; Medical IS.

In the health care system, we usually find two types of information system: the Medical Management Information System (MMIS) and the Administration System (AS). The MMIS main objective is to record the patient's medical history whereas the AS provides administrators with financial information and other records to allow resource management decision-making.

The objective of our study is to define the main characteristics of a new type of information system centered on the physician rather than the patient or the administrator. We have chosen to concentrate our efforts on the use of diagnostic services in the intensive care units, because, since 1988, an

estimate of more than 10 billion dollars of unnecessary tests are carried out in US university teaching hospitals[1]. It is difficult to estimate the contribution of intensive care units to these unnecessary costs but it is known that the costs of intensive care units represent 0.2% of the GNP in Canada and 0.8% in the United States[2].

In our study we will consider the organizational, psychological and sociocultural dimensions as well as different theories of executive information systems in order to create a tool which will enable the unit medical director to develop optimization strategies in the use of diagnostic services.

As this tool needs to take advantage of the very large MMIS databases, it will most certainly suggest new ways of conceptualizing and exploiting these databases.

Research Questions

In this research , we wish to answer two fundamental questions for the elaboration of a new type of medical information system:

- What information does the intensive care unit medical director need in order to optimize the use of diagnostic tests?

We have determined that neither the MMIS nor the AS give physicians information about their practice and as a result they do not have a platform on which they can base strategies for the optimization of their practice. To improve this situation, we propose to define their information needs and to provide evaluation criteria in order to measure the improvements and the savings achieved as the use of diagnostic services is optimized.

- What should be the characteristics of an executive support system designed to meet these needs?

We assume that physician's information needs depend on various criteria (field of expertise, work environment, etc.,) and that a definition of generic characteristics of an information system for physicians should facilitate its implementation whatever the circumstances.

Theoretical Background

The use of information technology to reduce health care costs, and above all, those linked to laboratory tests has given interesting results in the past: for example, the research undertaken by Dr. Roberts of the Winnipeg Health Sciences Center[3] or that of Dr. Tierniey at Wishard Memorial Hospital[4]. However, in both cases, the objective of the systems used was not to give the physician a tool designed to help him optimize his practice.

Our approach is doctor oriented. The research of Chantale Roy[16] allows us to consider doctors as decision-makers who are concerned with the financial impact of their decisions and who need information that will improve their efficiency

in decision-making. We think that, thanks to the self-control mechanism, and as long as they are given the necessary information, doctors can significantly reduce the cost of their practice without compromizing the quality of their practice.

The information needed to optimize the use of diagnostic tests is not limited to health care as doctors are also influenced by non-medical factors at the time of ordering tests. In our study we take into account different factors within two dimensions: the organizational dimension and the psycho-sociocultural dimension.

The organizational dimension[5,9] will be studied by interviewing key personnel from the intensive care unit. The objective of these interviews is to make a description of the environment in which the research will be undertaken. The organizational dimension takes into account the following factors: the mission of the unit, its structure, its technological capacity, its operational characteristics, its communication processes and the optimization strategies already used.

The psycho-sociocultural dimension[6-8] will be assessed by a questionnaire. Twenty-five (25) factors are being assessed, among them, the clinical experience of physicians, supervision of senior physicians, attitudes towards risk of legal action and patients' requests.

Our objective is to give the personnel responsible for managing the intensive care unit a tool which will enable them to assess the performance of their unit in regard to the use of diagnostic tests whether on a short-term (a day) or a long-term basis using an information rich environment. To do so, we have chosen the Executive Information System (EIS) model as development approach. The EIS is

" a computer-based information system that serves the information needs of top executives. It provides rapid access to timely information and direct access to management reports. It is very user-friendly, supported by graphics, and provides exceptions' reporting and "drill-down " capabilities. It is also easily connected with online information services and electronic mail. "[10].

In our study we view the unit medical director as the top executive of his unit and we believe that an EIS, given its characteristics [12], is the most appropriate computer-based tool for efficient decision-making in managing a medical unit.

Research Methodology

Our approach consists of 7 steps:

1. compile a literary review that deals with optimization and cost-containment strategies in health care, the psycho and sociocultural aspects of test ordering as well as with executive information systems;

2. draw up and construct a questionnaire that measures physician's perception of in the importance of personal characteristics in relation to situational characteristics at the moment of requesting a diagnostic test;

3. submit this questionnaire to all physicians in a university hospital;

4. organize and conduct a series of interviews with the intensive care unit's physician coordinator and chief nurse to describe its organizational context;

5. analyze and interpret the questionnaire's results;

6. analyze and conceive an information system that will give doctors the necessary information to optimize the use of diagnostic tests[10-14];

7. evaluate the impact of the use of the system in relation to the use of diagnostic tests.

State of project

The four initial project stages are completed and currently we are analysing the questionnaire replies concerning the influence of different factors on test requesting. The questionnaire was distributed to 550 physicians, residents and students of the university hospital centre at Sherbrooke. On the 21 June we had received 136 replies, giving a response rate of 24.7% The results should enable an analysis of the perception of the relative importance of the different factors that can influence a physician at the time of making the test request and hence to define key information factors which should be included in the prototype. In parallel to the questionnaire distribution we have started the analysis and conception of the prototype. Even though preliminary, the first results seem very promising.

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