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An Information System to Improve Financial Management, Resource Allocation and Activity Planning: Evaluation Results

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Abstract

An important strategy for improving resource management and cost containment in health care is to develop information systems that assist hospital managers in financial management, resource allocation, and activity planning. A crucial part of such development is a rigorous evaluation to assess whether the system accomplishes it's intended goals.

Purpose: To evaluate CLASSICA, a Decision Support System (DSS), that assists nurse managers in financial management, resource allocation, staffing, and activity planning.

Methods: Using a pre-post test design with control units, CLASSICA was evaluated in four test units. Baseline data and simultaneous parallel measures were collected prior to system implementation at test sites and control units. Using expense reports, staffing and financial statistics, surveys, interviews with nurse managers, and logs as data sources, CLASSICA was evaluated on: cost reduction, quality of management information; usefulness as decision support for improved financial management and decision-making; user satisfaction; and ease of use.

Results. Evaluation results showed a 41% reduction in expenditures for overtime and extra hours as compared to a 1.8% reduction in control units during the same time period. Users reported a significant improvement in management information; nurse managers stated that they had gained control over costs. The system helped them analyze the relationships between patient activit staffing, and cost of care. Users reported high satisfaction with the system, the information and decision support it provided, and its ease of use. These results suggest that CLASSICA is a DSS that successfully assists nurse managers in cost effective management of their units.

Keywords:

system evaluation, decision support systems, hospital management, nursing costs.

Introduction

Decision support systems (DSS) to assist in financial management, resource allocation, and activity planning are particularly important for nurse managers, as nursing is the largest and most labor-intensive component of hospital costs. Nurse managers are in a pivotal position to achieve cost savings and contribute to the financial stability of hospitals.[1,2] Therefore, one of the major opportunities for improving resource management and cost containment in health care is in developing information systems that provide nurse managers with better management information. CLASSICA was developed for this purpose. System evaluation had been defined as in integral part of the developmental process. The purpose of this study was to evaluate CLASSICA's effect on nursing costs, quality of management information; user satisfaction; and ease of use; and its usefulness as decision support for improved financial management and decision-making.

Brief System Overview

CLASSICA is a DSS for nurse managers that integrates essential information about patient flow and activity, quality, staffing, and cost of nursing care at the nursing unit level. The system assists nurse managers in activity planning, in estimating the number and qualifications of nursing staff needed, and in balancing their budget. Combining different types of data showing, for example, the relationship between patient activity, use of overtime, workload, sick leave, and expenditures enables the nurse manager to identify barriers to and the mechanisms by which unsatisfactory resource management occurs. CLASSICA also contains forecasting and simulation options that allow nurse managers to project the consequences of manipulating some of the factors that affect nursing costs and help them to make the appropriate corrections. For example, if expenditures show signs of exceeding the budget, the nurse manager may query the effect of reducing overtime pay by a given percentage for the rest of the year on the balance of the budget. The

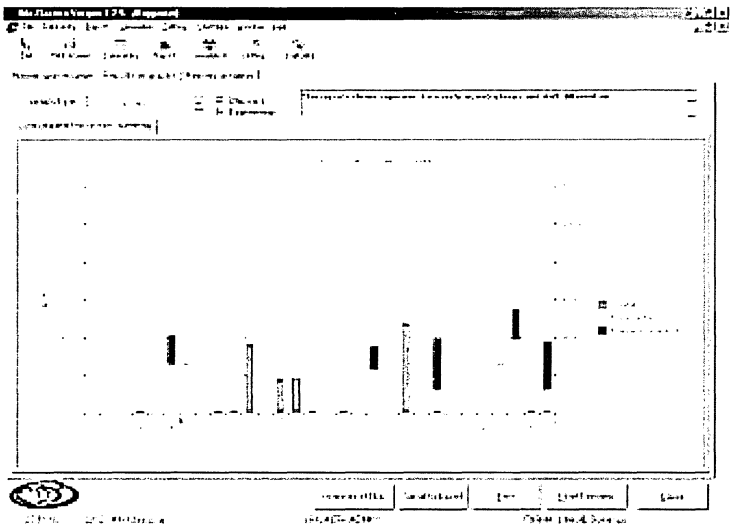

Figure 1- Example of a Report

integration and combination of a variety of economic, staff, and activity measures in a highly flexible manner is very different from other financial information systems.

CLASSICA runs on a PC with Windows 95 or NT and has a graphical user interface. The application uses a standardized SQL database (Access) and an ODBC interface that allows the integration of data with other applications in the hospital. The system consists of 4 main sections: data entry, reports, administration, and simulations that contain forecasting options and analyses of "what if...." situations.

Data Entry and Reports

To use CLASSICA, the nurse manager moves daily through three screens to input key variables on about the unit's activity, staffing and resource use. This takes about 3– 6 minutes per day. Based on this information and other predefined unit- specific parameters that are stored in the system (such as staff salary, number of RNs, the unit's budget etc), a series of different reports (32 total) are available. Numerical and graphical reports can be viewed on the screen, printed, converted into an Excel spreadsheet, or opened and sent as an HTML file through the Internet (e.g. if a head nurse wants to send a particular report electronically to the department head or CEO). User friendliness was highly emphasized and the program is very easy to use. and Reports and statistics are displayed in an easily comprehensible format to allow users to get an immediate grasp of the unit's situation. All reports are available on a daily, weekly and monthly basis. Users choose the reports they wish to see, either for every day in a chosen month or for a longer time period. Examples of reports are:

- Numbers and cost of extra hours and overtime
- Relationship between sickness leave and use of extra hours & overtime
- Total unit's cost for nursing care; cost per patient day; average cost per patient stay
- Total hours absence/illness/education (hours and costs)
- Budget balance this month and this year
- Expenses for this year compared to expenses for last year, in different expense categories
- Ratio of float/agency nurses to regular staff
- No. of student nurses and nursing staff in orientation
- No. of patients per RNs
- Relationship between expenses, patient activity, staffing level, and resource use and more.

Forecasting and simulation options include:

- Forecasting of expected deviations from budget at the end of year, based on expenditures so far this year
- Budget adjustments for remaining part of the year in order to achieve budget balance, based on deviations from budget so far this yea
- Cost-estimation of different staffing alternatives
- Simulation; eg. what happens if...
- and more.

Figure 1 displays an example of a graphical report of CLASSICA. In this report costs for overtime, extra hours

and shift changes for every day within one month are displayed.

Methods

Since achieving benefits is crucial to the success of system implementation, the design of CLASSICA involved active engineering of expected benefits into the system; and the development of a comprehensive evaluation scheme from the very onset of the system's planning and design phases.[3] Main evaluation criteria in this study were:

- Nursing costs
- Financial management
- Quality of management information
- CLASSICA's usefulness as decision support
- User satisfaction
- Ease of use
- Perceived usefulness

CLASSICA was evaluated over a period of 4 months after its implementation in the four test units who had participated in the development of the system. Simultaneous parallel measurements as well as post-implementation measures were used in control nursing units that had not been exposed to the system. Random assignments of test and control units were not possible in this study. To be selected as test sites, units had to have allocated budgets at nursing unit level (which was not the case throughout the hospital). To test CLASSICA in a diversity of settings, it was also considered important that selected test sites that represented the main clinical specialties of medical, surgical, pediatric and intensive care. Finally, since the development and evaluation of CLASSICA required commitment by nurse managers, a strong interest to participate in this project was a factor for being selected. Control units were chosen based on similarity to test sites. They represented the same departments, and had to be comparable in number and mix of staff, patients and workload.

Collecting baseline data enabled the measurement of changes produced by the implementation of CLASSICA. Without valid measurement both before and after the implementation, it would not have been possible to know what benefits would have been achieved and if the costs of the system, and the use of human resources, were justified. To evaluate a variety of effects we used a combination of qualitative and quantitative methods. This allowed us to focus on a series of technological, economic, organizational and behavioral aspects. Data sources for evaluation were:

- Semi-structured interviews with nurse managers, and questionnaires, measuring resource management, usefulness, ease of use, and user satisfaction, as well as users' attitudes towards implementation of CLASSICA
- Expense reports, staffing and financial statistics
- Logs and reports from focus group meetings

Results

Effects on Costs

During the evaluation period, test units showed a 41% reduction in expenditures for overtime and extra hours compared to average expenditures before the introduction of CLASSICA. In comparison, control units had a reduction in these expenditures of 1.8%.

Figure 2 below shows other financial results. It displays the deviation from the budget for one of the test units. Negative numbers are steadily increasing during the first eight months, accumulating considerable over- expenditure. CLASSICA was implemented September 1. After that, budget balance was steadily improving, and by the end of the year almost in balance.

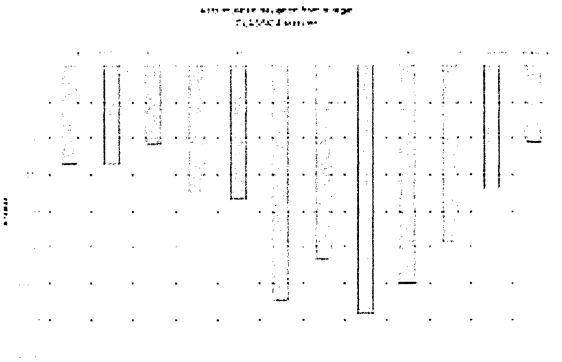

Figure 2 – Unit Deviation from budget 1999

User Satisfaction

The End-User Computing Satisfaction Scale (EUCS)[4] was used to measure user satisfaction. (N=7 nurse managers from participating test units). The EUCS is a twelve-item survey instrument with 5 sub-scales that measure user satisfaction with the content, accuracy, format, ease of use, and timeliness of a computer application. The EUCS is scored in a 5- point Likert-type format, ranging from "almost never" to "almost always". Higher scores indicate more positive responses. The table below displays Means, Standard Deviations and Possible Ranges. The positive results displayed here were supported in individual interviews, suggesting that users were very satisfied with CLASSICA.

Table 1- User Satisfaction

End-user Satisfaction (N=7)	Mean	SD	Possible Range
Content	18.3	2.1	4 - 20
Information Accuracy	8.3	1.2	2 - 10
Format	8.6	1.2	2 - 10
Ease of Use	9.9	0.4	2 - 10
Timeliness	9.1	0.9	2 - 10
Total Satisfaction	54.7	4.4	12 - 60

Other Results

Data on the effects of CLASSICA on information access, ease of use, and perceived usefulness were obtained using the "Ease of Use" and "Perceived Usefulness" Questionnaires,[5] the "Job Performance" subscale of the "System Implementation Attitudes Questionnaire[6], that measures an information system's effect on job performance and performance visibility, as well as in individual interviews with nurse managers from test units. High scorings were obtained on "Perceived Usefulness" and "Ease of Use" questionnaires as well as on job performance, indicating positive evaluations. Transcripts of individual interviews with nurse managers supported that CLASSICA improved documentation, decision making and management, as well as increased economical awareness. According to nurse managers the system provided up-to-date day-to day information about costs, activity and staffing at nursing unit level. There was a significant improvement in management information, and nurse managers reported that they now had continuous control over costs, and budget balance. The system helped them analyze the relationships between patient activity and acuity, staffing, and cost of care. In conclusion, CLASSICA resulted in better cost-containment and management with highly satisfied users. The developmental process of CLASSICA is described elsewhere.[7]

Discussion

Part of the system's success may be attributed to paying careful attention to those factors that are essential for successful system design:

- Project goals were clearly communicated
- User involvement was strongly emphasized
- Benefit planning was part of the system's design
- Institutional commitment and leadership support was obtained
- The system was integrated into it's organizational context
- It was invested in learning, close user- follow- up and support of change in financial management routines; and
- Ongoing discussion and evaluation of the system's functioning during the design process providing feedback that facilitated further refinement.

This allowed the project group to tailor the system to nurse managers' responsibilities, work process and needs for information and decision support.

However, CLASSICA is still a new system. Continuing evaluations are necessary to monitor the system's long-term effects and to evaluate generalizibility of results in a larger number of settings.

Acknowledgements

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