Decision Support Systems In The Healthcare Industry

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Executive Summary

Why are so many healthcare chief executive officers and users so dissatisfied with their computer-based management information systems? The answer lies partly in the fact that the systems were implemented and forced into use before the users understood the current healthcare environment. Without such knowledge of the environment, it is clear to see why there is great dissatisfaction and frustration.

The purpose of this article is to briefly examine the current healthcare environment and describe the main DSS applications available in the healthcare industry today. Also included are several practical steps to improve the functionality of current DSS in the hospital industry so that the users are better served.

A recent survey published in the October 1991 issue of Hospitals reports that 85% of hospital executives say they don’t receive the factual information they’re looking for to make decisions and 82% say they want their computers to produce such information. Only 45% of the chief executive officers (CEOs) feel that their information systems are worth the money they have invested in them.

Robert F. Raco, in a December 1989 Computers In Healthcare article, says the main products of most so-called decision support systems (DSS) are endless reports that contribute little to the decision making process. The information is being provided in formats that managers can’t understand.

Why is there so much dissatisfaction in the healthcare industry with computer-based management information systems? The answer partly lies in the fact that the systems were put up and forced into use before the users understood the current healthcare environment. Without such knowledge of the environment, it is clear to see why there is great dissatisfaction and frustration.

This article begins with a brief examination of the current healthcare environment. This is essential for understanding information requirements of decision makers in the hospital industry. Following that is a description of the main DSS applications available in the healthcare industry today. Finally, several practical steps are suggested to improve the functionality of current DSSs in the hospital industry so that the users are better served.

The Current Healthcare Environment

A new age in United States hospital management has begun, prefaced by a dramatic change in the way hospitals are paid for their services. Prior to 1983, Medicare—the single largest payer of acute care hospital services (covering approximately 45% of all such admissions)—paid the hospitals’ full cost of each Medicare admission. There was no motivation for inefficient hospitals, whose costs were excessive, to reduce their costs. This would just translate into reduced payment. Likewise, there was no motivation to perform extensive analyses on the impact of capital acquisitions (equipment and facilities) before their purchase. Hospitals were guaranteed the payback of their cost outlay.

In 1983, Medicare paid each hospital a flat amount per discharge, based on that hospital’s 1981 costs, updated for an inflation factor approved by the U.S. Congress. As long as a hospital’s costs had not increased dramatically from 1981 to 1983 and there was not a significant change in services provided and/or number of discharges, hospitals did not realize a negative impact from this payment change. However, beginning in 1984, the Medicare program began paying hospitals based on each patient’s diagnosis, referred to as a Diagnosis Related Group (DRG). Each of the 468 DRGs was given a rate and, after a four-year transition period, all acute care hospitals in the country are now paid the same amount for any patient with the same DRG.

Because in most cases, the DRG payment has proven to be significantly less than hospitals’ costs, hospitals have reacted in various ways. Many have increased their charges so that other payers of services would cover the loss from Medicare patients (referred to as cost shifting). Some have attempted to decrease their costs, entered into joint ventures with physician groups and/or diversified into different, more profitable services. The non-Medicare payers have, in turn, reacted to the cost shifting by requiring pre-admission and continued stay certification, establishing health maintenance organizations (HMOs) and preferred provider organizations (PPOs), and contracting directly with hospitals to reduce their costs.

Consequently, these changes have fundamentally altered the information needs of hospital managers. The information systems in place under cost-based reimbursement were largely driven by financial needs. To
provide an accurate picture of your business, you only needed to monitor the daily census and revenue to predict the financial situation. Now, monitoring the census, occupancy and revenue are useless exercises providing no relevant data to manage by. For most of their patients, hospitals are paid by the case rather than by the day, and payment is rarely the recorded revenue but rather some discounted amount.

Today, hospitals require sophisticated tools to determine what services are rendered to each group of patients and what those services cost at different volume levels. One of the reasons is that insurance companies and corporations are establishing sophisticated payment systems and are requiring hospitals to submit bids for their patients. Without knowledge of what the specific costs are and, bidding accordingly, hospitals risk incurring significant losses.

The Current Status of DSS Utilization In The Healthcare Industry

Since the early 1970s decision support systems have attracted the attention of academicians and practitioners in the field of computer-based information systems and in for-profit and not-for-profit organizations. A survey of the past two decades published in the June-July 1990 issue of Interfaces shows an increasing number of specific DSS applications in many different fields. In not-for-profit organizations, the two dominant fields of DSS application were the natural resources management area (water pollution control, wild-land use planning, etc.) and the hospital and healthcare industry. In this section, we examine various applications of specific DSSs in the hospital and healthcare industry. Financial Planning And Cost Accounting

DSS financial planning and cost accounting are major application areas of DSSs in the healthcare industry. A crucial role of DSSs is the management of cost accounting, which provides the ability to determine the cost of individual hospital service items (such as a chest X-ray) as well as the cost and profitability of all hospital services. Modern information technology can significantly improve a hospital's cost accounting system by maintaining data accuracy and allowing managers easy access and interactive query.

The computer-based DSS is an indispensable management tool that enhances management's ability to plan strategically on a more informed basis and department heads' ability to control their operations in a more cost effective way. In doing so, numerous data must be assimilated to develop product cost per procedure/service, which then could roll up into cost per patient in the cost accounting system. Such required data include patient billing (identifying the services and supplies used), patient acuity classification (identifying the comparative degree of resources consumed by each patient so that the nursing costs can be directly associated with each patient), the general ledger (identifying costs, fixed assets and inventory), and medical records (identifying the diagnoses).

Productivity DSS

Prior to 1983, incentives did not exist to stringently manage resources, since hospitals were paid their costs. Generating productivity information was not a top priority for operating managers in the healthcare industry. In today's environment, however, the ability to identify, manage and predict the cost of providing services is the top priority of most operating managers. Much of the information generated by the productivity DSS can be used to improve department efficiency and productivity.

Productivity and cost accounting DSSs, used together, increase the amount and accuracy of the information required for effective decision making. By setting productivity standards and monitoring actual performance against them, managers can measure their ability to organize the process(es) within their control to maximize output while minimizing input within a high range of quality.

Fundamentally, components of productivity and cost accounting are similar, although a productivity DSS requires certain additional information. This includes data from payroll and labor distribution, revenue statistics/workload recording, budget variance reporting and time and attendance.

Providing department managers with routine productivity reports is not enough to effect change. Without the skills necessary to analyze the information and to formulate appropriate plans to improve performance, in time the value and success of the system will be diminished. Therefore, it is critical to understand that all of the system users must be educated so that they will use the information routinely.

Product Line DSS

Prior to the advent of payment based on diagnoses, hospital management was structured by departments such as surgery, radiology, pharmacy, nursing, etc. With the change in payment methodology, management has realized a need to focus on the different product lines of services (such as oncology, neurology, reconstructive surgery, orthopedics) rather than the individual departments.

A product line DSS is basically a management tool designed to enable hospitals to understand their costs, revenues and profitability by product line. Without this DSS, it would be impossible for managers to make the transition from the traditional departmental way of viewing their services to this more holistic approach. Specifically, product line DSSs assist management in analyzing product costing, profits/losses made on a service, DRG, MDC, physician, physician specialty, patient, and/or procedure alone and/or in combination. They can track PPS payments as well as PPO and HMO contract performance. They enable managers to perform breakdowns of resource consumption by acuity, severity and disease stage within each product line, compare treatment patterns by clinicians and analyze utilization patterns over time.

With this type of DSS, managers can easily analyze the interrelationship of product line volumes, fixed and variable salary and nonsalary expenses, and revenues. This in turn facilitates budgeting simulation and strategic planning (particularly with respect to expanding or deleting services and programs) in the current turbulent environment.

Consultants typically categorize product line management information requirements as market and product definition; physician and market channel management; payers, prices and profitability; product design and treatment patterns; and clinical quality. The DSS must be flexible enough to allow the hospital's own definitions of the products themselves (such as one DRG or a group of DRGs) and appropriate hierarchies for internal reporting.
The system should also be able to track actual internal experience against the market. Data relating to the market is typically external to the hospital’s databases and pertains to the area’s demographics, defining populations and opportunities for product development and placement. In addition to the information required from other sources for cost and productivity DSSs, product line DSSs require patient and physician demographic data as well as payment information on each patient’s account(s) and market demographic data.

A product line DSS should be able to assist management in the following activities:

1. The management of physician and market channel including the tracking of volume and profitability by physician, physician group, clinical specialty and payer as well as physician profile information.

2. Accurate profitability assessment by product and tracking of patient/product demographic, utilization and cost information (both fixed and variable) by payer.

3. Tracking discrete services used in producing products.

4. Review of concurrent patient treatments.

5. Identification of treatment patterns by clinicians and review of retrospective patient treatments using large product line databases. This enhances quality review, evaluation and action based on sound data.

6. Projecting resource requirements using volume forecasts and tracking actual practice by physician, reporting any variances from standard practice.

**Jewish Hospital Healthcare Services Uses DSS**

Jewish Hospital Healthcare Services (JHHS) is a regional healthcare provider based in Louisville, KY. It owns and manages seven facilities for a total of 1,000 patient beds and 3,500 employees. The total information management and computer services costs represent approximately 3% of the organization’s operating budget. According to David Pecoraro, vice president and chief information officer, JHHS made the decision to move into decision support systems (DSS) toward the end of the completion of their first long-range information systems plan. They were finishing their basic installation work in late 1988 and determined that they wanted a higher level of system capability from a management information standpoint.

Currently, JHHS is utilizing various decision support system applications in the areas of productivity, cost accounting, case mix and nurse staff scheduling. These applications are developed based on two mainframe DSS generators, MAPS and SAS, and PC-based DSS generators such as Lotus.

Just a few months ago, an integrated DSS generator named MAPS became operational. The capabilities of this system include modeling, forecasting, planning, communications, database management systems and graphics. Based on MAPS, JHHS developed the productivity DSS. JHHS had been delving into productivity since 1983 and determined that it was time to move up the scale to higher level decision support systems. Managers can now quickly receive (or generate) reports containing essential information for their decision making. For example, they receive four graphs on a single piece of paper to see their productivity, their workload, their hours worked and the impact of their productivity on salary. Pecoraro’s staff has trained all levels of management, from supervisor on up, in the use of system so that they can see very clearly “a picture of what we produced in the past weeks, what it took to produce it and the cost to the organization.”

The JHSS staff is positive about MAPS because it is faster and easier to interpret than old system. Also, all of the data ties back to the key clinical and financial systems so there is a high level of trust and credibility in the integrity of the information provided. Implementation of the cost accounting DSS began in 1990. It became operational in 1991 and has now become quite valuable to the organization. It is being used for bidding contracts and services as well as in costing. The productivity standards are not part of the cost accounting system. However, although the cost accounting system is not linked to the productivity system, they do share a common data base. The cost accounting system is tied to the case mix system. These systems are used by the product line managers for assistance in formulating and monitoring their business plans.

The Statistical Analysis System (SAS) was added in the past year. This is a report generating tool with statistical analysis. It allows JHHS managers to take both the clinical and financial files from mainframe to perform statistical analysis on the data. JHHS also has a nursing acuity system on the mainframe where patients are classified by the “intensity” of their illnesses. These calculations are passed from the mainframe to the nurse staffing system so that, on a daily basis, the nurses receive their staffing requirements and a comparison of these to actual staffing levels.

Although JHHS has not yet implemented an executive information system, they are preparing for a move in that direction of tying the managed hospitals to the main computer system.

Knowledge of these different costs is essential for the preparation of accurate budgets and financial forecasts as well as for the accuracy of a hospital’s cost accounting, productivity and product line DSS. Today, DSSs have become an important tool for integrating the clinical information in the patient acuity system with the hospital’s cost, productivity and product line cost accounting DSSs helps to ensure that nursing information for each hospital in-patient is accurate. The patient acuity classification systems provide a reliable and detailed methodology for recording the different levels of actual nursing resources consumed for each day of each patient’s stay to minimize the faulty decisions.

In addition to assistance in determining and documenting patient acuity and related cost, nursing DSSs are also used to assist in nursing staff scheduling, sending and receiving orders to different hospital departments, making inquiries, care planning for their patients, documentation, nursing notes, and charting. Also, nursing managers, in
particular, can use DSSs to predict recruitment, training and utilization needs.

Managed Care Contracts DSS

With payment being made on a per-case, per-day, capitated or other "non-charge" related basis, hospitals are exposed to considerable risk for patients who require more than the "average" resources. This risk is unavoidable because hospitals cannot afford to refuse managed care payment arrangements. The competition among hospitals for patients is too strong.

DSSs help hospital managers measure the profitability of their managed care contracts by calculating their rate of return and determining whether the contract is helping the hospital maintain market share. With a DSS, managers have the tools to evaluate how various provisions within the contracts (such as "stop loss" provisions) affect their individual profitability as well as the hospital's overall performance. DSSs also assist in monitoring contract compliance as well as in suggesting how managed care contracts affect physician referral.

DSSs enhance contract negotiations because hospitals have the information needed regarding treatment trends in the area as well as the cost to provide services and the potential profit, based on volume of referrals. Without the use of DSSs, this information would not be available. Successful hospital negotiation of managed care contracts would be based on pure luck.

Equipment Purchasing DSS

DSSs can be used to determine the economics of certain existing pieces of equipment and for making decisions to acquire new pieces of equipment. Because payment for the services generated by the equipment is no longer guaranteed and the financial resources are limited, it is especially important to buy prudently.

Operational Assistance DSS

A DSS can provide major assistance to healthcare supervisors in performing their jobs in all stages of the decision making process. Examples of such assistance include structuring, producing and storing specially designed reports to monitor department/program performance; conducting descriptive statistical studies of data collected on operations using standard summary models; signaling exceptions and analyzing any data that warrants further investigation.

Emergency Medical Service Vehicle Deployment DSS

Another interesting application of DSSs is in the area of emergency medical service (EMS) systems. An EMS system helps to determine what services should be delivered, by whom, via what numbers and types of equipment, and to which location. An EMS system can reduce average response time, improve critical pre-hospital medical care and provide other important but hard-to-quantify benefits.

Blood Distribution DSS

Computer-based DSSs have been used to reduce the outdated and incidents of shortage in blood distribution systems. Human blood is a scarce and perishable resource with a usable life time of 21 days. The mathematical programming model-based DSS has been used successfully to optimize the allocation of the regional blood resources under various policy constraints.

Conclusion

We have examined the current healthcare environment that has made many DSSs designed before the Medicare payment change obsolete. Currently, although the hospital and healthcare industry is a major DSS user, many managers and CEOs are not happy with their computer-based information and decision systems. Here we are suggesting several fundamental and critical steps that must be taken to solve the problem facing DSS users today.

Developing clear objectives of what data is needed and how it will be used is the first step. These objectives must then be communicated effectively so that the current or planned systems can be designed to meet them. Senior management's data needs for both strategic planning and daily operations must be determined, met and presented concisely and in the proper form so that it can be used for effective decision making.

The data and information must also be passed, in a timely manner, to middle managers and physicians to enable them to improve both their and their staffs' effective and efficient performance. This flow of data and information is a crucial part of information management. Educating these users in how to use the data and information is also critical. Computer-based DSSs can be an essential tool to substantially reduce the cost of delivering care if front-line clinicians and physicians better understand the financial implications for what they do, and have access to better information to utilize their limited resources in an effective way.

Once the exact information requirements and sources have been determined and accurate, timely information is getting to all levels of management in an understandable, "user-friendly" format, much of the dissatisfaction currently experienced will be greatly reduced.

More consistent healthcare delivery can be achieved through tying expert system technology to one or more databases through a DSS. Expert systems have the potential to reduce malpractice costs by both helping to prevent complications, as well as by documenting the decision process. Physician deviations from the expert system's suggestions are simply documented in the patient's chart. Expert systems provide excellent audit trails, especially important in preventing medical-legal action.

Time, coupled with the ever present need to improve the quality of healthcare delivery at a reduced cost, will force the issue of using DSS, expert systems and, in many instances, executive information systems in the hospital setting. The benefits are just too great to be ignored. Also, additional functions such as electronic medical records — currently performed manually or with some computer assistance — will become highly automated. Such systems will be comprehensive, online systems collecting all patient data from throughout the hospital, outpatient clinics and medical centers as soon as care is delivered.

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