IS COMPUTERIZATION WORTH THE PRICE? AN EVALUATION OF 7 YEARS' USE OF TMR

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Abstract

Pickens Health Center, a university-based, multi-program ambulatory care center, conducted an evaluation of its computer services to determine whether the computerization of medical practice was worth the price. Pickens had implemented TMR, an interactive medical and management information system, in 1977. After seven years of computerization, increasing financial pressures forced Pickens to ask itself whether its programs might be better off financially and operationally if converted back to a manual system. An in-depth analysis of the use of TMR at Pickens Health Center led to the conclusion that computerization was cost-effective, encouraged high-quality medical care and was worth the price.

Introduction

Pickens Health Center of the Department of Community and Family Medicine at Duke University Medical Center is an ambulatory health care center shared by a variety of patient care programs. The Student Health Service offers a comprehensive health care program to Duke students, and the Employee Occupational Health Service provides work-related health services to Duke employees. Both programs are university funded. The Occupational Health Service provides contractual occupational and industrial medicine services to local, regional and national businesses, and the Family Practice offers primary care to patients in the Duke and Durham communities. In addition to providing care on a fee-for-service basis, the Family Practice participates in a prepaid health plan. A fifth program, the Dietary Rehabilitation Center, which offers medical, nutritional, and behavioral care for obesity, recently moved from Pickens Health Center to its own facility in Durham. Annual patient encounters from all programs total more than 54,000. All programs share a wide range of ancillary and support services based at Pickens Health Center.

Budgetary pressures during fiscal planning in early 1983 led to an analysis of all clinical ancillary and support services to evaluate the cost-effectiveness of each. These analyses were directed toward identification of any services which were draining financial resources and failing to compensate with equal or greater financial or quality of care benefits. Particular concern was expressed over the annual operating cost of the computer services department. Continued frustration with, and mixed acceptance of, computerization led some of the medical staff to question whether the Pickens Health Center programs would be better off financially and operationally if converted back to a manual system. Is computerization worth the price? Could the dollars being used to support the computer services division be saved or would there be equal or exceeding costs associated with a manual system?

A cost-benefit analysis is often difficult to perform when attempting to quantify variables relating to quality of care. There were, however, a number of measurable effects of computerization which were identified. This paper presents the methods used to evaluate the computer services, the information gained, and the conclusion reached.
Methodology

The evaluation of the computer services division primarily involved an indepth analysis of each module of TMR presently installed at Pickens Health Center. The advantages and disadvantages of each module were examined; any measurable effects on cost, quality, or efficiencies of operation were identified; and, the effects of converting to a manual system were considered. Those TMR modules and options not yet fully implemented were also reviewed to determine whether total installation of TMR might contribute toward cost reduction or enhanced quality of services.

Another step in the evaluation was a survey of all physicians, departmental executive and administrative staff, and supervisory personnel in each of the ancillary and support departments. The survey was used to assess computer problems and needs from the users' perspectives. Finally, a series of meetings was held with the surveyed personnel to discuss the findings of the analyses of the TMR modules and the survey results, and attempt to come to some consensus of over the future of computer services at Pickens Health Center.

It is important to emphasize that the evaluation of computer services was for the purpose of deciding whether to continue computerization at its present level, to commit to implementing TMR in its entirety or to convert back to a manual operating system. The alternative of switching from TMR to another information system was not discussed at this time. Those members of the medical and administrative staff with moderate interest in, and knowledge of, ambulatory medical information systems felt strongly that TMR was state-of-the-art and offered the comprehensiveness and flexibility required to meet the diverse medical and management information needs of the patient care programs at Pickens Health Center.

Discussion

The first step in the computer services evaluation was the analysis of each TMR module presently being used at Pickens Health Center. The following discussion summarizes the advantages and disadvantages of each module and points out any measurable effects of TMR on operations or quality of care.

Appointment Module

Pickens Health Center uses TMR's appointment module for professional staff, health screening and financial counselor schedules. The system offers variable time schedules to meet the needs of Pickens multiple providers and sites. Appointment making is decentralized and may take place at time of patient discharge, by telephone or upon patient arrival.

The advantages of this TMR module were found to be numerous. TMR has easily accommodated the scheduling complexities associated with multiple sites and providers. The ability to access any schedule from any terminal is viewed as a major convenience to patients and staff. Such schedule availability has led to increased patient compliance with followup care and health maintenance visits. TMR also has a holding file for storing future appointments when the schedule is unknown. This file may later be retrieved and used for contacting patients, an option which is especially useful for patients participating in health protocols or maintenance programs.

At the time an appointment is made, any future appointments the patient has are displayed thus decreasing the number of duplicated appointments. Also, the patient's primary provider is prompted which has promoted better continuity of care. As a result of interaction with the registration and accounting modules, the patient's financial status is also displayed at time of appointment, making it possible for the scheduling personnel to assist the patient with payment arrangements or to schedule an appointment with the financial counselor when appropriate. The patient's address and telephone number are also displayed and may be updated at this time. Both the financial and demographic displays have contributed significantly to better front end collections.

When scheduling an appointment, the system allows entry of a comment regarding the reason for the visit. This reason then appears on the hard copy of the schedule and on the patient encounter form which is generated at registration. Scheduling personnel use the appointment comment to determine the appropriate amount of time needed for the visit; therefore, maximizing utilization of provider time. The nursing and medical staff also find the appointment comment useful when preparing for the day's schedule.

Patients are pre-registered the evening prior to their appointments. This process generates chart request forms and encounter forms both of which are used by the medical records staff to prepare the charts and distribute them to the patient care teams. This significantly improves the patient flow process by decreasing patient waiting time, allows more efficient use of clerical manpower, and gives the nursing and medical staff time to review charts prior to patient arrival.

Management reports available through the appointment system include daily no show reports and periodic provider utilization reports. These are useful for evaluation of individual and group productivity, capacity and resource allocation.

There are several disadvantages to a computerized appointment system. Preparation of the schedules and data entry are time-consuming and sometimes complicated, although the manpower requirements are probably less than what would be necessary to prepare a manual schedule. Patient
waiting time is increased as looking up a schedule in the video terminal is not often as quick as flipping pages in a manual appointment book. Finally, during down time there is no efficient scheduling alternative. This inconveniences the patient by postponing appointment-making. Fortunately down time is not a problem at Pickens Health Center; therefore, this particular disadvantage is minimized.

In summary, the contributions of the TMR appointment system toward decreasing the cost of operations, enhancing the quality and continuity of care, and increasing patient satisfaction far outweigh any disadvantages. A manual system in a high volume practice with multiple providers and sites is much less desirable and offers very few of the advantages outlined in the above discussion.

Registration/Insurance Module

TMR's registration system is used to compile patient demographic and insurance information and to generate patient encounter forms at time of visit. The demographics/insurance data is accessible to all sites and is easily retrieved and updated. Display of this data at appointment scheduling and at patient check-in encourages better record keeping than is found with manual systems. In the family practice program, mail return due to bad addresses has decreased from 6.4% to 2%.

The availability of financial status and insurance information at registration has made it possible to implement and enforce more stringent credit and collection policies resulting in significantly improved front end collections for the family practice programs. The front end collection rate has increased from 13% to 50%. This has also improved the overall collection rate and contributed to a significant decrease in bad debt expense.

The registration process may also be used to print three forms at the time of a patient's visit; and encounter form, a health summary form, and a diagnostic studies flow sheet. The encounter form displays selected registration and financial data, the payment category (fee-for-service, prepaid, contractual, program funded), and appointment information. The form is used for recording all visit data including diagnoses, professional charges, studies and therapies ordered, and disposition of encounter. All visit data is entered from this form into the computer at time of patient discharge. The health summary and diagnostic studies report will be discussed further under the discussion of TMR's medical modules. All registered encounters must be checked out by the end of the work day. An encounter audit identifies those encounters which have not been completed so that visit data may be located and charges entered. As a result, a significant decrease in lost charges has been experienced. In a manual system ledgers are easily misplaced and efficient auditing system is not available.

The information stored in the registration system has provided valuable marketing information which has been useful in health service planning. Easily generated mailing lists and letters to all or selected target groups of patients facilitate communication to patients. This is especially useful when disseminating preventive or other health educational material, as well as keeping patients up-to-date on changes in the practice, new services, or other items of general interest.

Finally, TMR's registration system, coupled with the appointment system, has made patient processing much more efficient. The result has been a decrease in personnel needed in the registration area.

The advantages of better record keeping, improved collections, decreased lost charges, easily compiled marketing data and decreased manpower requirements easily overcome the disadvantages of computerization. This system is clearly superior to a manual system which would have difficulty providing any of these benefits.

Accounting Module

TMR's accounting and financial module has had a significant effect on operations at Pickens Health Center. The interaction of the accounting system with the registration, appointment and medical modules has resulted in a comprehensive, flexible and highly efficient business information system.

Each patient care program has multiple accounting categories with different associated charge mechanisms. The accounting category indicates whether the visit charges are fee-for-service, prepaid, contractual or program funded. TMR coordinates this information and produces a series of detailed and summary reports which are used by the business office staff to verify all daily accounting transactions and to validate accounts receivables by program.

The accounting system also produces a variety of reports which aid in collection efforts. Aged trial balance reports are available by multiple accounting categories or by third party payor. Such reports have improved follow-up of past due accounts and insurance claims. The report format allows efficient division of responsibilities among business office personnel. A special accounts report also aids in followup of problem accounts and payment plans.

The dunning and turnover functions are both initiated by the computer for specified accounting categories at user-designated account ages. Patient letters are generated at both stages and detailed reports for the collection agency are automatically generated at turnover. Computerization of these functions has reduced personnel time, improved collections and reduced the accounts receivable.

Turnaround time for insurance reimbursement is rapid as a result of daily claim generation. Patient billing is performed easily and in a timely
manner. Billing accuracy is improved as a result of the numerous checks in the accounting and registration systems. Cash flow is increased as a result of these features.

Management reports are available in a variety of formats. Most of the information which has been needed by the Pickens programs is easily generated by the computer instead of requiring special programming. Preparation of the necessary financial and statistical reports by the computer has saved a great deal of administrative time. Problem solving and decision making have been enhanced as a result of the ability to evaluate clinical activity and program financial status in a timely manner. Quick intervention is possible when problem areas are identified.

Numerous measurable results of computerization were identified during the evaluation of the TMR accounting module. Front end and overall collection rates have improved. Bad debt expense has decreased more than 50% and the number of months of revenue in accounts receivables has decreased from 5 to 1.5 months. Personnel costs have been reduced in both the business office and administrative areas as a result of increased efficiencies in operations, computerized billing and comprehensive reporting functions.

Several disadvantages were noted with the accounting system. The family practice program has been participating in a prepaid health plan with levels of co-payment which vary by employer group coverage. The accounting system has had some difficulty handling this variability and has not yet provided an entirely useful revenue or productivity report for management. Finally, the Dietary Rehabilitation Center's patients are "day patients" receiving multiple daily services in addition to initial and weekly packaged services. There has been no efficient way to handle data entry of charges for this program as the nature of the business places it somewhere between an inpatient and outpatient system. Efforts are presently underway, however, to modify the accounting module to manage the above situations more efficiently.

In summary, the computerized accounting system has been extremely cost-effective. A manual system, particularly in an operation the size of Pickens Health Center, would increase operating costs significantly and decrease overall business office efficiency.

Studies Module

TMR's studies module computerizes test ordering and entry of results for laboratory, radiology and other diagnostic studies and provides a comprehensive filing and auditing system.

Studies are ordered through the computer at time of visit. This process initiates a number of things. First, entry of the order automatically charges the cost of the study to the patient's account. The number of lost ancillary charges has decreased significantly. The order also prompts printing of a studies requisitions in the appropriate ancillary area. The patient is relieved of having to carry forms to the area, and registration personnel are relieved from the manual effort of completing multiple requisitions. Also, Pickens Health Center uses a number of laboratories in addition to its own. The performing lab for each type of lab study prints on the requisition. This has assisted the lab technicians with preparation of specimens and has greatly decreased processing errors and lost tests; therefore, saving the patient a return trip to have the testing repeated.

Studies results are entered into the computer by the ancillary personnel. Patient care is enhanced by having results which are easily retrievable and available at multiple sites. Flow sheets of studies results for each patient's visit are generated daily with a copy for the provider and a permanent copy for the chart. Each flow sheet holds up to four visits. The sheet includes normal ranges for each diagnostic component and automatically flags abnormal results for rapid identification. The flow sheet has improved the quality of care rendered by giving the provider timely and comprehensive information. Ease in reviewing studies from multiple encounters has also contributed to a reduction in unnecessary study duplication. Medical records operations are more efficient and less costly since the flow sheets decrease the number of papers to be filed and reduce chart space used. Copying expense is also reduced as studies summaries are easily printed for consultations or referrals.

A diagnostic studies report is also printed with the encounter form at time of patient registration or may be generated by use of TMR's computerized message system. The latter option is used when handling requests for studies results from patients or staff and has contributed to more efficient communication of results.

A daily pending list is produced which includes any studies five days old or greater which are awaiting result entry. This list serves as an audit for ancillary personnel assuring that results are located for each study and the patient's record is accurate and complete.

Management reports regarding number and types of studies performed are readily available by site, provider or patient care program. They have been extremely useful for budgeting, services planning, resource allocation, pricing and cost allocation among programs.

The only disadvantage experienced with the studies module has been an unexplained duplication of diagnostic flow sheets over a number of printings. Receipt of the same studies report more than once has created some confusion for the nursing and medical staff and created extra effort on the part of the medical records staff as they attempt to file the same chart copies a second and third time. This problem is presently under investigation.

Overall, the studies module has facilitated operations in the laboratory and radiology areas, increased efficiency of almost every clinical sup-
port area and improved the quality of care provided. Computerization of the studies functions has also contributed to a reduction in personnel in the laboratory, nursing, accounting, registration and medical records areas.

### Therapies Module

The TMR therapies module has been used in a very limited form. Therapies information is entered into the patient's computer medical record along with other encounter data. Prescriptions filled by the Pickens Health Center pharmacy are automatically charged to the patient's account upon entry of a prescription number. A medications summary with dosages, expiration date and refill limits is printed with the encounter form at time of registration or may be generated through the computerized message system.

Plans are underway to fully install the therapies module. This module is expected to facilitate the pharmacy operation and contribute to improved patient care. Implementation of the therapies functions will allow printing of prescription labels, a more comprehensive and effective medications listing, and the ability to develop patient profiles and identify drug interactions. Data entry responsibility will be moved to the pharmacy staff. A reduction in data entry errors is anticipated; no increase in pharmacy personnel is expected.

### Problem Module

Use of the TMR problem module has also been limited, however, even in limited form the module has provided numerous advantages to its users.

Providers are responsible for recording the appropriate diagnostic codes on the patient encounter form. These codes are entered into the computer along with other encounter data. The combination of this information with the patient's demographic, financial, studies and therapy data provides a modified computerized medical record which is easily retrieved and available at times when the hard copy record is not. Providers may use a video terminal to review the patient's record or may depend on the health summary sheet which is printed with the encounter form at registration. The health summary provides a twelve-visit profile with visit dates, diagnoses, providers seen and therapies.

The business office and medical records staffs have also benefited from the computerized record as it has eliminated the paper flow between those departments. Diagnoses are automatically printed on patient bills and insurance claims. Business office personnel may review visit data on their video terminals when responding to questions about claims or bills without having to pull a hard copy medical record.

Problem information has been very useful in identifying patients for health prevention, chronic disease programs and quality assurance review. Reports identifying diagnoses seen over specified time periods have been very helpful in planning health care services, and educational programs for patients and staff.

One problem with computerization of problem information relates to inaccurate and incomplete diagnostic coding. This is not the fault of TMR, however, but is the result of asking the providers to do the coding. Also, the permanent problem list produced by TMR has not been useful to the medical staff in its present configuration. A team of physicians are presently working on a set of recommendations aimed toward making this list more responsive to particular types of practice needs.

In summary, the TMR problem module has been very helpful to many of the clinical support departments. The providers, however, have continued to rely on hard copy medical records, using the computerized problem information or health summary sheet only when no other alternative is available.

### Subjective And Physical Examination Module

This module has never been installed at Pickens Health Center. Implementation of the subjective and physical examination module, in combination with the other TMR modules presently being used, would produce a wholly computerized medical record including progress and consultation notes.

Although the evaluation of the computer services division included a brief analysis of this module to determine its effects on cost and quality of care, that discussion will not be presented in this paper except to note that several areas of potential cost reduction were identified and some positive impact on quality of services rendered would be expected.

### Findings

The dollars saved from computerization were shown to exceed the annual operating costs of the computer services department. Despite steady patient volume and expanded clinical hours, increased efficiency from the use of TMR led to a reduction in personnel over the past year of 0.4 FTE's from the registration (2), medical records (3), nursing (.8), business office (1.2), administration (1), and laboratory (1) areas. The number of personnel in other support departments remained the same. The total cost represented by these positions exceeded the cost of computer services by more than 30%. As noted in the preceding discussion, revenues have increased as collections have improved, bad debt has decreased and fewer charges have been lost. Other expenses such as paper, supplies, and office space cost have also decreased over the years.

Quality of care benefits were not as easily measured in dollars and cents. Improved patient care seemed to be demonstrated, however, by more accurate and complete medical records, less duplication of diagnostic studies, less nursing and medical staff time spent on paperwork and more
time spent on patient care and health education, more effective program service planning, and finally, increased patient satisfaction.

The second step of the computer services analysis was a survey which was conducted to assess computer needs and problems from the users' perspectives. The survey results showed more acceptance of computerization in medical practice than had been perceived. The majority of the problems described were actually resulting from inadequate knowledge of how to use the system rather than problems with TMR. Numerous suggestions were made for further improvements in computerized practices of the Pickens Health Center patient care programs. Overall, the survey was a very useful management tool.

In summary, the computer services analysis and evaluation was a very valuable exercise. It served its purpose of guiding the Pickens Health Center staff to a decision regarding the continuation of computerization.

Conclusion

Pickens Health Center concluded that the use of TMR to support its university-based, ambulatory care practice was worth the price. The complex medical and management information needs of the multiple patient care programs based at Pickens were easily met by the comprehensive and cost-effective information system provided by TMR.