DEPTH VARIANCE IN MEDICAL RECORD AUTOMATION FOR AMBULATORY CARE

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Abstract

Clinically-oriented software for ambulatory care is characterized by a dramatic variance in the ability to capture, transform and report data. In this paper, a framework is presented which describes both user needs and application software potential along a continuum of increasing depth or complexity. User organizations which operate in a cost-effective manner will likely find a good fit between their level of need for clinical information-handling and the depth of the clinical software they use.

Introduction

The last fifteen years in health care have seen a proliferation in automated systems that is likely to continue accelerating in the years ahead. Computer-based information systems are now commonly seen in the ambulatory health care environment. Free-standing clinics and medical groups routinely automate information flow in areas such as billing, appointments, studies ordering, the pharmacy and accounts receivable. The automation of medical record-keeping, however, has faced unique obstacles. The complexity of the data, cost/benefit concerns and a lack of legal precedents have all acted to constrain the development of medical record (M/R) applications. There has been no consensus among users of these systems on what features constitute a desirable M/R application. System designers have responded by offering a variety of M/R applications which collectively meet a wide range of user needs and resources. As a result, currently available M/R applications run the gamut from comprehensive "paperless" systems to those distinguished chiefly by what they cannot do. Potential users must therefore be able to identify those M/R applications which have the level of complexity or depth most consistent with their needs.

A Depth Variance Framework

Cost-effectiveness is a predominant issue in the selection of any information system. In the turbulent and competitive health care environment of the 1980's, control over cost and quality may well prove to be THE survival issue for solo practitioners and medical groups alike. Exhibits I and II display user goals and the corresponding M/R software characteristics which will capture the level of depth most appropriate to those needs. It is likely that cost-effective automation of clinical information will be achieved in those instances where the closest fit occurs between system design and user needs.

EXHIBIT I

CONTINUUM OF USER NEEDS

Simple

Describe the overall characteristics of clinical encounters. This may include tabulating statistics on the patient population served, providing navigational data for organization management and documenting clinical productivity.

Intermediate

Improve the effectiveness/efficiency of clinical encounters. The focus is on
automation of at least the most labor-intensive or most critical element of the clinical evaluation process. Automation of medical history-taking or the results of a history & physical report is one intermediate level system in growing use.

**Complex**

Optimize the effectiveness/efficiency of clinical encounters. In order to satisfy this need, an online system is essential. Desirable features include the support of clinical decision-making, control of M/R department growth and the elimination of dictation/transcription of medical notes.

In Exhibit II, shown below, the range of complexity of currently available medical record applications is described. These exhibits attempt to pierce the mystique of the term "M/R Applications" and answer 4 questions: 1) What are the basic needs? 2) What are the functional elements of M/R Applications? 3) What dynamics act on these elements? 4) Given the answers to these questions, what do those answers imply for cost-effectiveness and organization survival in today's competitive environment? The exhibits respond to questions 1 & 2, while 3 and 4 require further comment. In response to question 3, several dynamics are involved, the first of which (software characteristics) is shown in Figure 1 (shown on last page). The second dynamic is ad hoc use. Simple M/R applications discourage ad hoc use by requiring manual data analysis. Intermediate applications support limited ad hoc use. Complex M/R applications, however, support extensive ad hoc interaction and reporting. The third dynamic

### EXHIBIT II

DEPTH VARIANCE OF M/R APPLICATIONS

<table>
<thead>
<tr>
<th>Major Variables</th>
<th>SIMPLE</th>
<th>INTERMEDIATE</th>
<th>COMPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data Elements</td>
<td>patient # demographics</td>
<td>encounter dates diagnoses operations/dates</td>
<td>medical history-taking &amp; physical results cancer registry data (which includes &quot;simple&quot; data elements listed in the second column plus staging of the cancer)</td>
</tr>
<tr>
<td>2. Input Options</td>
<td>clerical only</td>
<td>clerical/ancillary</td>
<td>all providers/clerical</td>
</tr>
</tbody>
</table>

(CONTINUED)
### EXHIBIT II

**DEPTH VARIANCE OF M/R APPLICATIONS**

(Continued)

<table>
<thead>
<tr>
<th>Major Variables</th>
<th>SIMPLE</th>
<th>INTERMEDIATE</th>
<th>COMPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.b. format</td>
<td>fixed</td>
<td>often fixed, although choice of sub-sets may be available (e.g., h&amp;p format for the internist, for the neurologist, etc).</td>
<td>user-defined, via either additional programming or through a data dictionary.</td>
</tr>
<tr>
<td>2.c. data descriptor options</td>
<td>limited list of codes.</td>
<td>data elements have either fixed codes or are &quot;free text&quot;-only.</td>
<td>user-defined coded choices, with optional free text supplements for many parameters.</td>
</tr>
<tr>
<td>3. Output Options</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. report generator</td>
<td>frequency counts only.</td>
<td>frequency counts and individual patient summaries defined by user criteria.</td>
<td>frequency counts, individual patient summaries and trend reports according to user-defined criteria.</td>
</tr>
<tr>
<td>b. reporting intervals</td>
<td>fixed</td>
<td>ad-hoc, although manual report analysis may be needed to track a subset of data through the report in which it resides.</td>
<td>ad-hoc, according to user-specified criteria.</td>
</tr>
<tr>
<td>c. decision support attributes</td>
<td>lists of treatments or findings.</td>
<td></td>
<td>reminders, flowcharts, protocols, graphic profiles, models, clinical algorithms.</td>
</tr>
<tr>
<td>d. time-oriented flow data</td>
<td>view each encounter date, or track the data thru fixed-interval summary reports on all patients</td>
<td>not applicable for medical history-taking systems; a prime component of cancer registry systems.</td>
<td>track all data elements of interest over an unlimited time span, with ad-hoc transformations such as protocol reminders.</td>
</tr>
</tbody>
</table>

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is the user environment: Does the organization offer focused care, comprehensive care, or both? How many physicians and physician extenders are there? What medical specialties are represented? How is the patient population described (i.e., total number, demographics, health status)? What are the practice management needs? We offer a word of caution here, however. We suggest that the organization's complexity rather than its sheer size is the best yardstick for calculating optimal M/R software support. The Industrial Age concept that economies of scale parallel increased organization size tends to obscure the real question of whether there is any relationship between economies of scale and organization complexity. It seems likely that the impact of economies of scale can be determined only after the organization's...
The last question raised by Exh. I-II, cost-effectiveness, is explored through an example of a specific system. "The Medical Record" (TMR), a complex ambulatory care software system, was developed at Duke University and was installed two years ago at California Primary Physicians (CPP), a large private medical group in Los Angeles. Its major components are registration, appointments, problems, therapies, studies, flow sheets, encounters, accounting and report generation; additional medical features include protocols, drug interaction summaries and MD-assist algorithms. A data dictionary makes it possible for users to define/update the system for each installation site without additional programming. The software represents the state of the art not only as a complete ambulatory care information system but also in user-friendly features: Users can define what data is captured and what system "prompts" to activate, as well as receiving support in answering ad hoc queries. TMR is also "user-smart" in allowing experienced staff to enter code numbers which bypass the alphabetic prompting routines. The TMR Pre-Encounter Report both summarizes the patient's health status and acts as a data capture tool for the current encounter. Its contents include:
- the patient's demographics, employment data, insurance data, missed appointments, appointment time/provider, and regular provider.
- active problem list, date of onset & optional free text modifiers.
- subjective/physical parameters and results of diagnostic studies for the last 9 visits, with space to record today's encounter.
- prior assessment/plan (from the last encounter).

By a review of the Pre-Encounter Report, the physician can rapidly assess the patient's health status, the frequency of encounters and problems associated with those visits, and the types of medications prescribed. Patient compliance with recommended regimens can also be readily assessed.

TMR has enabled the CPP Medical Group to improve the quality of health care and to support the marketing of services to the community in two ways. First, it helped to identify marketing opportunities both in our existing patient population and in the external community. Second, it optimized the efficiency of both practice management and clinical encounters, and it assured that increased revenue was reached at a minimal increase in overhead expense.

Conclusion
The heterogeneity of M/R applications for ambulatory care information processing challenges users who seek a software product which matches their needs. A perspective has been presented on the variation in depth of M/R software, along with a framework indicating the range of current options. The discussion of the TMR system illustrates the flexibility and user friendliness of a complete M/R system. The current popularity of all three categories of software - simple, intermediate, and complex - suggests that considerable diversity will continue to exist in this field for at least the remainder of this decade.

References