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Synopsis

Computer-Based Patient Records

Introduction

I often hear the question posed, "Why have computer based patient records (CPRs) not been more widely adopted?" From what I can tell, everyone *wants* a CPR in order to accomplish the Four "I"s:

- Improve efficiency;
- Increase flexibility;
- Inform the care process; and
- Implement changes in the care process.

To improve efficiency, they need to address problems of availability, content, format and integration of patient records. Business restructuring, growth of managed care, and increased provider and patient choice drive the need for increased flexibility. Informing the care process becomes more important as they write contracts and seek to identify the critical areas for improvement. Finally, to impact these critical areas, they need a method to change the care process in a cost effective, sustainable manner.

The ideal CPR captures patient data necessary to perform outcomes analysis, utilization review, profiling, cost, patient care and others. The possibility tantalizes hospital and managed care administrators. However, these promises may be difficult to keep. Delivering on those promises within reasonable cost targets requires considerable work.

A great deal of data needed for a CPR are already available in existing departmental or administrative systems. Registration systems contain patient demographic data. Most pharmacies record prescription transactions in a database. Nearly all radiologists and consultants create their reports with a word processing system. Laboratory computer systems support extensive databases of test results. Much of this data is ripe for the picking by a CPR.

If everyone wants a CPR and the sources of electronic patient data are so abundant, why are CPRs so scarce? Part of the problem is focus. For the last quarter century, the computer system was the goal and researchers and vendors invested energy in making the best possible computer system. The clinical data were the incidental grist for the system. The reality is the opposite. All of the work and all of the value are in the data; the computer system is merely a receptacle. Computer systems come and go; data stay forever. There are two problems with the data. First, the sources of electronic patient information that do exist reside on isolated islands have been very difficult to bridge. Second, we have not yet learned how to capture the data from clinicians in a structured and coded form.

Standards for exchanging patient data between systems exist. With these standards we can solve many of the problems and create a substantial CPR from the existing data. We have standards for exchanging structured medical record content such as patient registry records, orders, test results (ASTM/HL7), and have standard identifiers for coding many of the concepts we want to report in the fields of such structured records. Kohane and colleagues [1] describe an approach using Internet standards for network communication, visual presentation and screen management.

The data in many ancillary systems have been understood through many generations of development. We store laboratory test results, for example, in databases with specific fields dedicated to each atom of information. Most of these fields contain codes or numbers that can be "understood" and processed by the computer. In contrast, we do not understand much of the data that comes from physicians. Physicians usually just record their observations as free text, combined with idiosyncratic abbreviations, figures, and glyphs. Some notes are problem-oriented, some structured, and some are unstructured globules of text. Some providers record volumes of information and others very little.

Coding and Structuring Data

Coding data always requires some amount of menu selection to encode the observations and other information. *I believe that recording complex information by menu selection* *will always take longer than the equivalent free text entry*. Recall your reaction to the last questionnaire you completed. Even though it only had a few questions, it took several minutes to complete. You puzzled over which choice best represented your opinion. While the fully structured, problem-oriented medical record has more value than an unstructured one it also takes longer to record. It is no surprise that fully structured records are rare.

I do not think the problem of coding is completely soluble by technology. An intrinsic mismatch exists between the model for expressing a thought in the mind of the user (intrinsic model) and a different model for representing the concept in the CPR (extrinsic model). However, this option presents great challenges because entering structured data takes longer than entry of free text information. It takes longer because it requires users to map their concepts into the computer's version of the concept. It takes longer because (a) coding requires the user to find the "right" code or phrasing from among the available choices; (b) the computer often asks for more specific items of information or for a more granular representation than the user knows; and (c) users require a moment to orient themselves to each window or sub-form or question that pops up.

Better technology including natural language processing can reduce this problem, but not eliminate it. The solution is a proper balance between coded and free text entry. Do not force users to code everything they want to express, and provide enough secondary time, quality and efficiency benefits to compensate for the entry time costs. Two major questions then are: (1) what to code, and (2) to what degree. This means we will have to live with a mixture of coded and free text information. The challenge becomes to decide where to draw the line between coding and free text. What categories of information are valuable enough to justify coding and what can be left as free text? What level of granularity is required? Do we really want to code the presence of an S4 gallop? Does it predict anything of value if we are likely to have a cardiac echo and all of its fully coded hemodynamic measurements for patients with heart symptoms? These are questions that could be answered empirically, but getting these answers will require considerable work.

First there is the problem of translating free text notes into computer understandable codes and structure. In many settings, computer systems store physician's notes via dictation and transcription. We can assume that all physicians will eventually enter notes via computer voice understanding. The challenge is how to convert this text information into computer understandable meaning. Even at the current level of granularity (that is too coarse for most of the sophisticated CPR functions), manual coding is error-prone and expensive. Despite decades of investment, computers cannot accurately interpret unconstrained text, though some promising work continues. So we are left the option of physicians coding their own data as they enter it through selection menus and other techniques.

Van Ginneken et al. [2] provide a conceptual organization that recognizes the coding problem and defines a coded "mother record" that has minimal structure and is intended for use by primary care physicians. More structured "child records" designed for use by specialists record richer data. But even within these records "direct" and "indirect" capture are proposed. Direct capture is used when highly regularized, consistently collected data are to be entered. Indirect capture is to be used when less common, perhaps somewhat less structured data are to be captured. Pringle et al. [3] validates the "mother record" concept by comparing coded data entered by general practitioners in four practices in England with data recorded in the paper medical record and videotaped observation of patient interactions. They find that, in these selected practices providers can and do enter correct, complete coded data. The papers included in this volume by Poon [4] and Müller [5] highlight issues and approaches to capture data such as the "child records" by Van Ginneken et al.

Chosing Important Data

There are many unanswered questions such as what data are critically important and what data are simply desirable. Most statistical analyses boil down to 5 to 10 variables; even if you begin with 50 or a 100 variables. This means that, perhaps, you do not have to collect all the data with the same level of intensity. Which data are more important is another research question. There are many opportunities for physicians to interact with workstations. This is the only opportunity to capture that rich clinical data we ultimately need.

Kohane [1] discusses evolving a "common medical record" definition that represents what data should be present in a CPR. Another paper in this volume discusses practical experiences with such a "common medical record" using optical memory cards [6].

How do we define and collect the less understood data elements described in providers' notes? Do we define each variable as a formal survey question? If so, each different way of stating the question and each different sets of response answers define a distinct variable. Validated survey instruments exist for some subject matter (Hamilton for depression and SF36 for general health status for example) but we lack them for many subjects and for much of clinical care. We have the problem that checklist symptom questionnaires elicit many more (and less important) symptoms than open entry questions. The significance is not known. We find differences between patient-completed and provider-completed (and filtered) questionnaires as well.

Second, we have the problem that much of the data that regulatory agencies, managers and outcomes analysts seek is not currently in the medical record. Further, we do not really know exactly how much information is required for these purposes. For some disorders such as angiography and knee joint replacement surgery, data sets have been proposed, but we do not know the operating characteristics of the data elements within these sets, nor do we know what minimum set of these data elements would provide most of the information required for the above purposes. For most subject areas we have not even proposed, let alone tested and refined any data set.

Whatever the final result, progress is likely to be slow, because productivity demands limiting the amount of physician time that could be dedicated to coded data entry. We might expect a more complete set of patient social and functional status measures at the first visit, perhaps collected via a direct patient survey instrument; a handful of structured questions per major diagnoses; a larger but still modest set of questions for each procedure and hospitalization; and, my own favorite, is a coded impression on every imaging study report. If office practitioners can muster the effort to code their diagnostic impression, why shouldn't a diagnostic service do the same?

Conclusion

Any "complete" CPR to be produced in the near to intermediate term will have to be a hybrid: some material entered as structured and coded data and some as free text. I have left diagnostic images and tracings out of the discussion, but some of them will also be available for intermediate term CPR. Moreover, institutions have to move to a CPR, by melding data currently stored on computers into an integrated system and they will have to do this in stages. They should add the most difficult components, such as physician notes, as unstructured text, coding them only when industry demonstrates acceptable solutions to the capture problem. Considerable benefit can be derived from such partial or nearly completely CPRs.

References

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