ASOP: A New Method and Tools for Capturing a Clinical Encounter

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ASOP is a proposed method for future medical record notation. This permutation of the original POMR-SOAP method is necessary to provide the standardized workflow and medical nomenclature which will be essential for automated medical record systems and forms-based encounter recording. The development of an ASOP system is dependent on tools to map assessments to appropriate terminology within a universal medical dictionary and generate intelligent queries across the World-Wide-Web. In this study we intend to demonstrate the need for change in the POMR system and highlight some of the current tools in development to make the ASOP method the medical record notation system of choice.

INTRODUCTION

Weed first published the problem oriented medical record in 1968[1]. Weed's intention was to develop a paper based system as a model for the computerized implementation of that same system. "If we accept the limits of discipline and form as we keep data in the medical records the physician's task will be better defined, the role of paramedical personnel and the computer will be clarified, and the art of medicine will gain freedom at the level of interpretation and be released from the constraints that disorder and confusion impose."

Weed's statement still holds true today. Physicians and medical personnel need tools that will better record their data and plans while providing them the freedom to master the art of caring in a high quality, low cost setting. As a result of Weed's Problem Oriented Medical Record (POMR) came the development of the "SOAP" note (Subjective-Objective-Assessment-Plan)[2].

The POMR and SOAP have been revered, refuted, enhanced, desecrated, and reborn many times in the past 27 years[3-8]. The basic intent of the process has somehow changed over time. Initially, there was a single SOAP note associated with each problem. Now, we find the problems listed as individual items under the assessment of the patient's condition. We need to review the philosophy behind the development of this system.

To improve the value of the single note method, we propose to change the POMR-SOAP system into a POMR-ASOP system. The placement of the assessment at the beginning of an encounter or initiation of data entry would then allow for the generation of guideline specific elements of data collection, suggest possible treatment protocols and trigger the appropriate plans on a problem by problem basis.

An assessment is described as ANY symptom, finding, diagnosis, or pathophysiologic process. In this method, it is replacing the problem list as a separate entity and embedding it within the initial write-up and each follow up note. Each assessment is then responsible for determining a set of subjective and objective data to be recorded. Development of an ASOP-oriented patient record is the subject of this paper.

BACKGROUND

The everyday practice of efficient, compassionate and high quality medical care is often lost in the development of better and faster tools for the practice of medicine. Of equal concern, the external forces of managed care and capitation are requiring physicians to see more patients while maintaining a more thorough medical record. While our goal as informaticists is to develop these tools, we need to examine closely those areas where a new tool would best be used to aid in the everyday practice of medicine. The development of better tools is paramount for cost-effective, high quality medical care.

Perspective

The typical office visit in our clinics is a fifteen minute return visit. At our present efficiency, our physicians tend to run between 30 and 60 minutes late for a half day clinic of 16-20 patients. When residents are involved, the total patients seen by an attending may reach 35. If only 10 minutes are spent with the patient in history and physical examination, that leaves 5 minutes for case discussions, nursing instruction, and thorough documentation of all events.

Problems

In this setting, two problems arise. First, many people interacting with a single system will generate variations in style in diagnostic terminology, data collection and plan development. Second, there is no time to access the medical knowledgebases for the most up-to-date diagnostic algorithms, industry-generated practice guidelines, and insurance-approved treatment protocols.

The greatest problem that currently exists in these situations is the clinician's inability to use a standard vocabulary to represent his/her findings[9]. The diagnosis of diabetic cardiomyopathy and its associated complications may in fact be represented by any of the following assessments: congestive heart failure, CHF, pulmonary edema or pulmonary congestion.

Since Weed's first writings, we have successfully increased the size and complexity of our diagnostic and terminology databases yet have done little to improve the accuracy of recording our assessments. Policy statements can be generated at the clinic or institutional level in attempt to combat these differences, but there is always a greater scope in which a clinic or institution only represents one of many organizational members.

When we are unable to represent our patient assessments accurately, the second problem, which naturally follows, is increased in complexity: The translation of these assessments into a terminology which can then be used to generate intelligent search strategies to answer our intellectual queries.

Cimino[10] demonstrated a useful solution to this second problem with the "MEDLINE Button." He was able to generate intelligent MEDLINE queries based on the information in each note. No differences in vocabulary were accounted for. The MEDLINE database may be the definitive database for the published medical literature; but by no means is this now the most useful (or accessible) source of medical information.

THE ASOP MODEL AT WORK

Transition to a POMR-ASOP method of information recording could solve both problems described. With the exception of the new patient visit, most clinic patients have a fixed list of problems that change infrequently. These problems and diagnoses or "assessments" are then used to drive the subjective and objective information gathered with each visit.

Assessment

Medical assessments, when appropriately specific, can provide an excellent index of a patient encounter. Each assessment item can have defined fields which will need to be completed during the subjective and objective components of the workflow. The appropriate fields, tied to each assessment, could be user, division, department, or nationally specified. The more global the specification the more likely that all health care providers will be collecting consistent medical information. If the information is consistent, then analyses across a wide number of sites can be more easily completed.

A single assessment would generate a limited list of information to be collected. Each additional assessment would then generate a new list with reconciliation of overlap information. Very specific assessments will generate specific lists while vague assessment will generate highly complex lists.

Once the workflow list is defined, the information can be recorded. A method of encounter representation similar to the PEN-Ivory method[11] would allow for rapid, consistent, and thorough representation of the information to be recorded.

Subjective

Subjective data can be recorded by the patient and other appropriate medical personnel before the patient is ever brought back to the room to interact with the physician. New problems or concerns can be recorded by the nursing staff in the assessment section (e.g. shortness of breath, cough, fatigue) which would then generate the workflow of necessary clinical data to be captured. Generating predetermined forms assures a consistent medical vocabulary between patients. The majority of subjective information (history) will be predefined by the assessments. There is always the opportunity for addition information, as discovered in the interview, to be appended to the form. These additions can then be addressed as needed, and the appropriate vocabulary amended.

Objective

Objective data will be recorded by the nursing staff and physician. Again, the content of the forms will be defined by the assessments and amended subjective information. Findings from previous visits can be used to populate each of the content fields or be left blank if not previously evaluated. Since physical exam findings do not change frequently in a stable out-patient environment, this might result in little or no change in the content of the objective form. Changes which need to be made may only take a few seconds to record with the use of a gestural controller. The end result is that the physician does not have to spend much time reviewing the chart or taking notes. Her time can be directed at the patient completely.

Plan

At the completion of the encounter, the physician has the opportunity to add or refine assessments. Any additions at this point may change subjective and objective form elements, but the physician is still with the patient, the most appropriate place to make any further additions. The physician can continue to move through amendments to the A-S-O forms until they are complete. At this point, the three forms can be committed and a plan generated.

The plan form is a logical conclusion to the encounter. Data collected from the assessment, subjective, and objective forms can be compared against predefined guidelines to generate the plan. This would include laboratory tests to be performed, health maintenance procedures, and the suggestion of therapeutic interventions. The plan form will serve several purposes. It can represent a patient handout advising them of the next steps for their health care, instructions for nursing personnel, prescription generation to be forwarded to the pharmacy, and procedure scheduling. The plan page can also act as a checklist for nursing personnel to be sure that all of the planned procedures are completed prior to the next clinic visit.

ASOP and the WWW

The workflow represented by the ASOP model proposed here could be supported by a hypertext system such as that found in the World-Wide Web (WWW). Tools such as Trellis[12] could be incorporated into the common gateway interface of a WWW server, providing the necessary dynamic control over the process of workflow in the clinical environment. A significant advantage of using a system like WWW in the presentation of the ASOP model is that it further allows the clinician to gain access to other resources through a common user interface. WWW services in the medical domain have proliferated exponentially in the last year. Tools can be developed with the ability to intelligently "review" these new services on-line and report the results back to the clinician, all within a single WWW user interface. Although WWW's hypertext markup language (HTML) is currently insufficient to provide the necessary layout commands for display of clinical information, developments in HTML occur rapidly, and specialized support for new features specific to the needs of the medical record is a further possibility. These features may be provided through visual objects supported by interpreters such as Tk or JAVA that can be embedded in a WWW client[13-14]. Increasing sophistication of WWW servers can be expected to lead to adequate support for security and privacy as well.

While there is some suggestion that these interrogatives of remote resources would be going on in real time at the site of care, a more realistic interpretation would be for these results to be available to the clinician when he is in the relative solitude of her office after clinic hours are over. However, the ability to instruct the agent to do rapid superficial search for results to be reported in the clinic would be an excellent enhancement.

For the ASOP model to reach full effectiveness as a recording system, standardization of the medical vocabulary is essential. We propose a series of tools to maximize the effectiveness of this system.

ASOP SUPPORT TOOLS

The HTML used to drive the ASOP workflow would be served by the Ambulatory Services Architecture (ASA) server[15-16], which would easily allow access to tools such as the Distributed Medical Dictionary and Medibots:

Distributed Medical Dictionary

The problem of vocabulary standardization and term relationships makes it necessary to develop a single data dictionary for use by ALL medical domains, both clinical and basic science or a tool to browse those multiple dictionaries currently available[17].

The advantage of a distributed architecture for a medical vocabulary resource lies in the ability to extract general information from the central resource services and more specific information from local, specialized resources. The Distributed Medical Dictionary (DMD)[18] has an architecture that provides several advantages both to development and deployment, including simple recursive search structures, smaller local resources, uniform vocabulary, reduced demand for hardware, and involvement of more domain specialists in the expansion of electronic medical vocabularies.

Medibots
"Medibot" is our name for query engines designed to traverse the Internet applying semantic knowledge acquired from the UMLS and other knowledge resources, including, potentially, the DMD, to the task of information discovery in the medical domain. Our first Medibot categorizes medical literature on the WWW[19]. Medibots are an application of Amanuensis[20], which supports naming and typing of data in local and remote information sources and computations, thus facilitating both human and automatic search and retrieval in hypertext, and integrating diverse electronic resources into the same user interface. Amanuensis "query engines" are servers that provide interfaces to diverse information resources, such as MEDLINE, the UMLS Metathesaurus, and the SNOMED nomenclature. An interface to Amanuensis was developed to support WWW browsers as a user interface.

By constructing dynamic queries against medical information resources such as the ones supported by Amanuensis, Medibots can become agents that will function as the next generation of Cimino's MEDLINE button. These Medibots will be able to interpret problems, map terms to dictionaries beyond the institution, and generate an intelligent search to provide clinicians with either rapid and shallow or slow and thorough responses to their questions.

SCENARIO

Let us take the case of a patient returning to the office for follow-up of his diabetic care. The patient is seen by a different doctor. The patient indicates that he has a new problem, shortness of breath. This new problem will now generate a new series of content items to be included on the subjective and objective forms. The content of these forms will be generated from the assessment "shortness of breath" based on appropriate predetermined guidelines.

When the encounter is complete, the physician will then update the assessment form prior to leaving the patient room. These new assessments, Pulmonary Edema, S3 Gallop, and Dyspnea, will be confirmed for vocabulary consistency against the DMD when the form is committed. The new assessments may then trigger new subjective and objective content items. Once the form is committed, a Medibot can be invoked to combine semantic and procedural knowledge in the DMD with patient data from the ASOP chart to map any new assessments back to a least common ancestor in the patient chart. The Medibot will first search any assessments that are already identified in this patient. If a single ancestor can not be found then it will try to map the assessments individually. Again, comparison will first involve previously defined assessments for this patient. The Medibot should map these assessments back to the single assessment: Congestive Heart Failure.

A distributed medical vocabulary like the DMD is the critical component for success of the ASOP model. The system efficiency is predicated on the use of common medical nomenclature to drive the workflow system necessary to generate each successive form. When the mapping is complete, a plan can be generated from guidelines and treatment protocols taken from the appropriate elements of the DMD hierarchy. Suggested interventions can be made and treatment plans edited.

A second role of the Medibot is to perform search strategies identified on the fly during clinic visits. Using knowledge derived from the DMD and the refined assessments, intelligent and complete queries may be generated. Superficial queries can yield results delivered directly to the clinic in real time, while more in-depth strategies can be employed with results returned later in the day for a more detailed review after conclusion of the visit. These Medibots should be self generating similar to the MEDLINE Button[11] yet have a much wider search domain.

CONCLUSIONS

We propose the change from a traditional Problem Oriented Medical Record with multiple Subjective-Objective-Assessment-Plan components to a single encounter note in the form of Assessment-Subjective-Objective-Plan. The change will abbreviate the amount of original information required to be recorded at each encounter by generating workflow documents from previously recorded assessments. This will yield more efficient and cost effective patient care.

New assessments can be generated at any time prior to or during an encounter to assure that the appropriate supporting data is collected prior to the patient leaving the clinic. The success of such a change is predicated on a consistent medical vocabulary which uses the concept of a distributed medical dictionary to map all terminology back to the appropriate databases (local, UMLS, SNOMED, etc.).

The discussion of the computer-physician interactions of the patient encounter in the SCENARIO should not give the impression that any of these problems, the development of workflow support for ASOP, the construction of distributed medical knowledgebases, or the design and development of intelligent medical agents, is trivial to solve. The application of intelligence to workflow technology is only now becoming feasible; the drive to consensus on the form and content of medical vocabulary is gaining impetus, but consensus and development are far from what is necessary to support real applications; and the use of agents in distributed information discovery and retrieval is in its infancy.

Adherence to a unified medical language is paramount for the success of future medical record keeping. As longitudinal patient records and centralized medical record databases become more commonplace, adherence to a unified language will be required to ensure successful data retrieval for outcomes, quality, and utilization research.

The ability to adhere to unified nomenclature will also significantly aid in the ability to do real-time and exhaustive searches of the World-Wide-Web for medical reference materials. It is inevitable that increasing amounts of the most timely medical information will be posted on the WWW (or its logical successor in electronic publication, whatever that may be). As more data comes on-line, more efficient and intelligent searching tools must be available to aid the clinician in her everyday work.

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