Non-Categorical Problem Lists in a Primary-Care Information System

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An ambulatory-care patient-tracking system has been implemented that records non-categorical problem descriptions in the outpatient problem list. The system does not restrict physicians to the use of predefined diagnostic categories. Instead, the system stores patient problems in a database as free-text records. Subsequent diagnostic categorization and coding is accomplished through prompted free-text input and appropriate reference databases. This system design allows an outpatient problem-list summary to reflect non-categorical health-status information in addition to coded medical diagnoses.

Computer systems have been used for many years to maintain patient records in an ambulatory-care setting. One of the challenges associated with computer-stored outpatient records is that of maintaining a problem list that fully describes a patient's problems, yet remains useful for categorization and tabulation of problems in the clinic population. The difficulty lies in devising a problem-recording strategy that fulfils both requirements.

This difficulty is neither new nor unique to computer-stored medical records. For example, in traditional paper-based outpatient charts, the problem list is usually visualized as a summary of medical diagnoses [1]. However, in a primary-care setting, physicians require more than a set of predefined diagnostic categories in order to describe problems related to a patient's ongoing health status.

One approach to this issue is to force physicians to record problems in terms of coded diagnostic categories [2,3]. One drawback to this strategy is that no single diagnostic coding scheme fully describes what physicians and patients perceive as being health-related problems. A second difficulty is that unified coding schemes do not fully apply to all primary-care settings or all medical specialties. Although several different coding schemes have been proposed [4,5], in practice most diagnostic coding strategies are driven by the need to supply data for clinic management or to third-party payors for reimbursement.

On the other hand, in a problem-oriented medical record, a problem list is a descriptive formulation that organizes medical information about a patient [6]. Problems that appear in such problem lists do not always fall into predefined diagnostic categories. The use of descriptive, non-categorical problems should not be construed as simply giving physicians the freedom to record data with imprecision or inaccuracy [7]. Physicians may choose to describe problems in ways that clarify their thinking about a patient even if the problem descriptions are not easily categorized using a diagnostic-coding scheme.

The system described here reconciles these two requirements of the outpatient problem list by separating the problem-recording function from the coding function. In so doing, it compromises between freely recording problems as described by physicians and strictly encoding all recorded problems.

System Design

The patient-tracking system used in the UCLA pediatric outpatient clinics has been described elsewhere [10,11]. The system is implemented as a local-area network of microcomputers. Physicians and data-entry personnel access patient data at microcomputer workstations on the network. Patient data flows into databases both from charts transcribed at the keyboard and from a link to a hospital-based patient-registration system implemented on an IBM 3090-series computer. Data-communications interfaces rely on public and proprietary standards, including NetBIOS [12], Dynamic Data Exchange [13], and the proposed ASTM 1238 (HL-7) standard for the communication of clinical data [14].

Physicians record patient problem lists directly on an encounter form (see Figure 1 on next page). In addition to patient problems, the form lets a physician record a list of current medications, a structured history and physical examination, assessment of problems, and plans for diagnostic workup, therapy, and followup.

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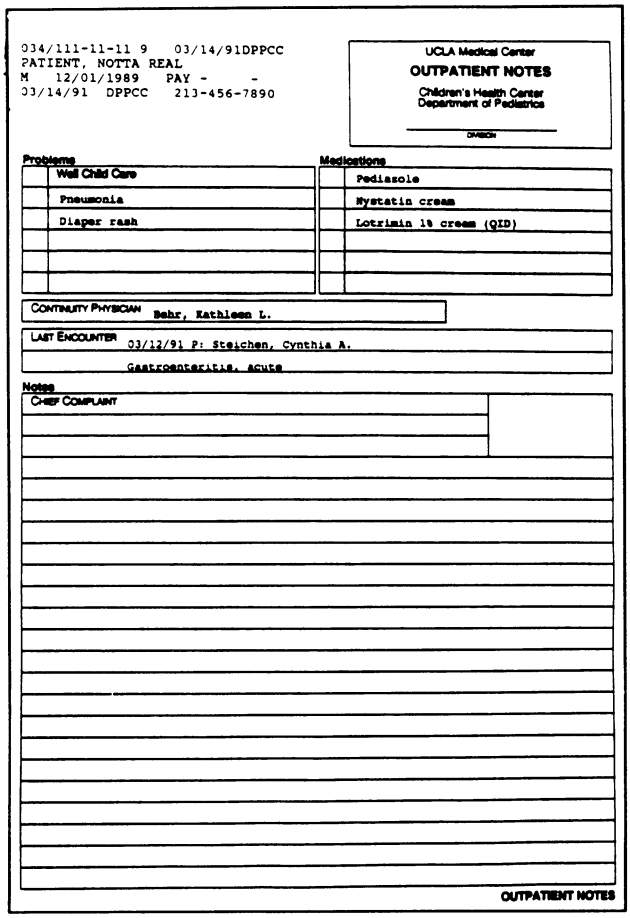

Figure 1. *Encounter form used in UCLA pediatric clinics. Information in the shaded areas is transcribed by support personnel into the computer system.*

New information is transcribed from each encounter form into the computer system within 24 hours of an encounter. The transcription is done by people who are familiar with medical terminology but who are not physicians or nurses. The transcribers copy information from the shaded areas of the encounter forms into the computer system.

The information stored in the computer system is used to update the encounter form when the patient returns to the clinic. On a patient's initial visit to the outpatient clinic, the problem-list and medication-list areas of the encounter form are blank. On subsequent visits, the problem list and medications recorded at the most recent previous visit are printed on the form by the computer system. The physician is then responsible for verifying and changing the information in these lists.

Problem recording

Each problem in a patient problem list is recorded in three parts: a problem, a modifier, and a comment. In this scheme, a problem is a free-text entry that represents the main description of the problem. The optional modifier serves as a temporal or conditional qualifier to the problem description (see Figure 2). The comment, which is also optional, is a free-text entry that explains or clarifies the main problem, or adds additional information. For some problems, the comment identifies a body location. For other problems, the comment amends the main problem by qualifying it or relating it to another problem in the problem list.

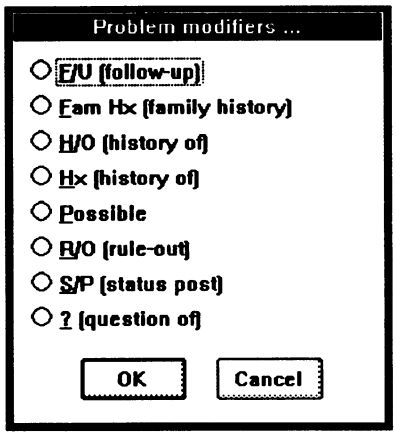

Figure 2. *Problem modifiers displayed on the screen at the time the problem list is updated.*

Problems are entered into the computer system as prompted free text. When a problem is typed into the system, the user is prompted with a scrollable list containing 328 common problems, synonyms, and abbreviations (see Figure 3).

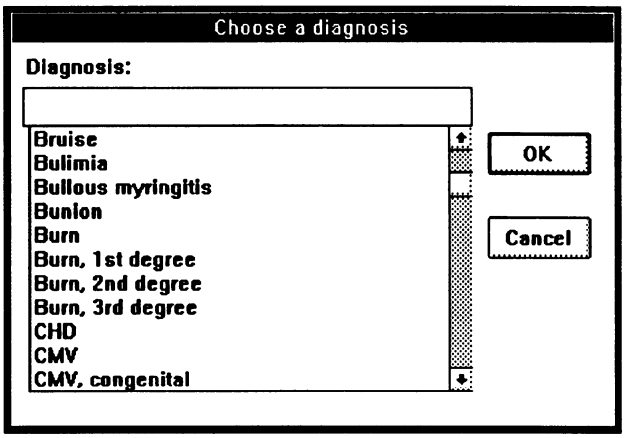

Figure 3. *Selection list for problem entry. This list of common problems appears on the screen at the time the problem list is updated.*

Each keystroke causes the list to scroll to the selection that matches what is being typed (see Figure 4). When the list reaches the desired selection, a single keystroke enters the entire problem text into the computer system. In this way, most problems are entered using only a few keystrokes. Only problems not in the list must be typed in full.

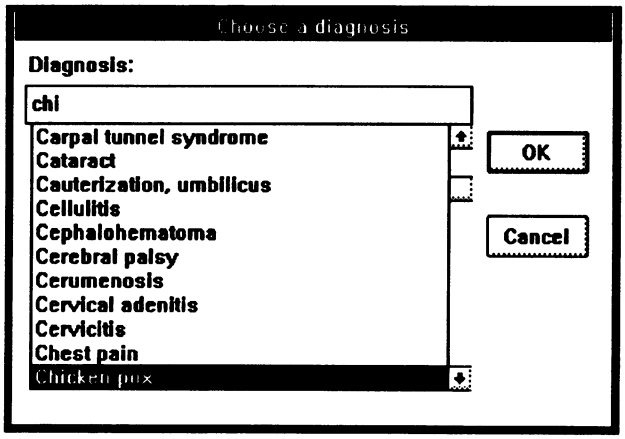

Figure 4. *The list of common problems scrolls to a selection as each letter is typed. In this example, "Chicken pox" is selected by typing the letters "chi."*

The use of prompted free text alleviates several of the drawbacks associated with more traditional data-capture strategies such as associating "comment fields" with coded information. With prompted free text, there is no need to apply a coding scheme at the time information is input into the computer system. Information can therefore be entered without arbitrary, categorical codes and without the use of nondescriptive codes such as "other" or "unspecified."

Problem coding and classification

All of the problems entered by prompted free-text entry can be encoded by reference to a database that associates plain-text problems with their numerically-coded ICD-9 equivalents. This design allows for synonyms and common abbreviations to be encoded automatically. In this way, a variety of descriptive terms can be used in the permanent electronic record, yet all of them can be associated with the same ICD-9 code by reference to the database.

For example, one of the most common medical problems encountered in a pediatric primary-care setting is that of acute otitis media. In practice, physicians may use several different synonyms and abbreviations to describe this condition, including "otitis media, acute" or "BOM" (bilateral otitis media). All of these different terms can be recorded in the patient-tracking database as written by the physician, yet all can be assigned the same ICD-9 codes because the synonyms are included in the reference database.

This strategy allows reports on frequency of diagnoses to be generated. The report uses the reference database to list all synonyms as well as the ICD-9 codes themselves (see Figure 5). Other reports, including patient-record summaries for individual physicians, can also be generated.

382.00	BOM (otitis media, acute, bilateral)	67
	LOM (otitis media, acute, left ear)	51
	Otitis media, acute	132
	ROM (otitis media, acute, right ear)	59
	All 382.00	309
460	URI	125
	URI, viral	87
	Upper respiratory infection	3
	All 460	215
493.9	Asthma	88
	Reactive airway disease	16
	All 493.9	104
691.8	Atopic dermatitis	3
	Dermatitis, atopic	8
	Eczema	92
	All 691.8	103
558.9	Diarrhea, acute	16
	Diarrhea, chronic	1
	Gastroenteritis, acute	47
	All 558.9	64
381.1	Otitis media, chronic	43
	Otitis media, recurrent	12
	Otitis media, serous	8
	All 381.1	63
461.9	Sinusitis, acute	60
564	Constipation	51
V19.8	HIV-positive parent	1
	PPD-positive parent	37
	Parental medical problem	11
	All V19.8	49

Figure 5. *Extract from a printed ICD-9 problem summary. Problems are listed by frequency. Synonyms with the same ICD-9 code are grouped together.*

Evaluation

These data-input and coding techniques were evaluated in terms of time spent entering information into the computer system. The system was also evaluated for its ability to capture non-categorical problem-list information as recorded by physicians.

Data input

The time required for each interactive update of the patient-tracking database was recorded as a database

data item. This record indicated that approximately three minutes of time were required to enter a new patient's demographic information (age, date of birth, race, sex, address, telephone, and insurance), problem list, current medications, immunization history, continuity physician, and current encounter summary (clinic location, physician, height, weight, head circumference, and assessment). The data-entry error rate with the list-assisted free-text entry system described in this paper was less than 2% of the problem-list entries recorded. Errors occurred when transcription personnel were unable to decipher handwriting and when physicians or transcription personnel misspelled free-text information.

Non-categorical problem information

An analysis of problem lists in the pediatric outpatient clinics at UCLA was carried out in March, 1991 for 3385 pediatric patients. Of 2903 problems recorded for these patients, approximately 82% (2369/2903) of problems were entered directly by selection from the onscreen list of 328 common problems. Of the 534 problems not found in the list of common problems, 86% (457/534) were found in a more comprehensive database of ICD-9 diagnoses and codes.

The remaining 77 problems represent non-categorical but nevertheless useful observations about the health status of outpatients. Here are some examples of non-categorical observations included by physicians in outpatient problem lists:

Diagnostic possibilities:
"cholecystitis vs. PUD"
"viral infection vs. strep infection"
"keratosis pilaris or atopic dermatitis"

Historical problems:
"S/P PDA ligation"
"H/O meconium aspiration"

Abnormal nondiagnostic findings:
"elevated cholesterol levels"
"rt. axis deviation"

Descriptive observations:
"immunizations delayed"
"dysfunctional family"
"poor head growth"

Although none of these observations fits neatly into a diagnostic category, all of them are perceived as problems by the patient or the physician. In some cases, the inability to categorize the problem results from the evolutionary process of medical diagnosis--the physician is aware of a problem but is not yet able to determine a definitive diagnosis. In other cases, the problem is nondiagnostic but nevertheless important to the physician in forming a complete picture of a patient's health status. For example, some physicians include abnormal laboratory-test results in a patient's problem list not because they are diagnostic but because they may attain greater significance should the patient develop a new illness in the future.

Discussion

Traditionally, electronic medical-record systems that record problem lists have required physicians to encode individual problems in some way. There are several different reasons why this is so. Probably the most important is that free-text problems without a consistent encoding scheme cannot be tabulated, because there is too much variability in the way individual physicians record problems.

Another more prosaic constraint has been that electronic mass-storage media have often been limited in capacity. The amount of storage required for a numerically-coded diagnosis can be as little as two bytes; in contrast, the system described in this paper requires 80 bytes of storage per problem per patient. Fortunately, the cost of disk storage has decreased rapidly in recent years, while the speed and capacity of disk storage has increased. It is no longer necessarily to resort to numerical encoding or abbreviation of plain-text information simply to conserve storage.

Also, the difficulty of recording plain-text patient information is part of the broader problem of recording patient information electronically. If plain-text data entry must be performed by keyboard, the amount of time and typing required to record even one outpatient encounter can become inordinate [15]. Modern user-interface design elements such as those embodied in the current computer system--in particular, the use of pop-up, scrolling menus of plain-text data-entry options--help to minimize the time required to enter patient information into the computer system [16].

There are tradeoffs in using free-text, non-categorical problem descriptions. One difficulty is that the problems recorded by physicians do not necessarily fall into the diagnostic categories required for reimbursement by third-party payors. For example, a physician is much more likely to record a clinical diagnosis of "otitis media, acute" than to document fully the corresponding diagnosis used for billing--"acute

suppurative otitis media without spontaneous rupture of ear drum" (ICD-9 code 382.00). Although the system described here can be used to reconcile billable diagnoses with problem-list problems, the use of free-text problem descriptions implies that the process cannot be completely automated.

Also, with this system a small percentage of patient problems remain uncoded. However, these are exactly the problem descriptions that would be lost or inaccurately recorded had the system been designed to force all problems to be categorized. The value of the information included in these non-categorical problems outweighs the utility of complete problem-list categorization, and increases the usefulness of the computer system from a physician's perspective.

This system illustrates how medical software can be designed to meet the operational requirements of practicing physicians, and at the same time enhance the ability of physicians to manage medical information. The use of this computer-based system allows a problem list to become a viable component of the outpatient record. At the same time, the system preserves the value of the problem list in a problem-oriented medical record by allowing physicians to use non-categorical problem descriptions.

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