Representation of Nursing Terms for the Description of Patient Problems Using SNOMED III

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We conducted an experiment to determine if the terms recorded by nurses in the patient chart to describe patient problems could be represented using SNOMED III terms. The data sources for the patient problems were the nurses' progress notes and nursing care plans from 485 patient encounters in three diverse settings (NR02215). We entered the nursing terms into a relational database. We loaded the SNOMED III terms into a relational database and created a word index. We determined matches by identifying the English description of the SNOMED III term that best matched the term charted by the nurses. Sixty-nine percent of the nursing terms in the test subset were matched using one or more SNOMED III terms. We identified redundant SNOMED III terms for several nursing terms including fear and diarrhea. Our results suggest that terms recorded by nurses in the patient chart can be represented using SNOMED III terms. Further enhancement and refinement will improve the domain completeness of SNOMED III as a controlled health-care vocabulary and decrease redundancies.

CONTROLLED VOCABULARIES FOR DESCRIPTION OF PATIENT PROBLEMS

The Institute of Medicine report on the computer-based patient record [1] identified standardization of health-care vocabularies as a prerequisite for the patient record of the future and recommended an effort towards establishing a composite clinical data dictionary. Information system developers, health-care organizations, and governments have developed proprietary clinical data dictionaries. However, as the legitimate demands for data for internal quality management and external reporting increase, controlled vocabularies are necessary to facilitate communication among distributed information systems and among organizations [2]. Additionally, the use of controlled vocabularies allows for the exchange of computable clinical data among health-care institutions thereby facilitating clinical and outcomes research [3].

A controlled health-care vocabulary must include terms to accurately and comprehensively describe patient problems. Existing health-care classification systems include the International Classification of Diseases [4], the Diagnostic and Statistical Manual of Psychiatric Disorders [5], the Medical Subject Headings (MeSH) [6], and the Systematized Nomenclature of Medicine (SNOMED III) [7]. Controlled vocabularies designed specifically to classify nursing terms for patient problems include the North American Nursing Diagnosis Association Taxonomy 1 (NANDA) [8], the Omaha Community Health System [9], and the Home Health Care Classification Project [10].

In this paper we describe our experiment which tested the ability of SNOMED III to represent the terms used by nurses to record patient problems in the nursing care plan and nurse's progress note.

SNOMED III [7] classifies patient findings into eleven modules: 1) topography-anatomic terms, 2) morphology-changes found in cells, tissues, and organs, 3) living organisms-bacteria and viruses, 4) chemical-drugs, 5) function-signs and symptoms, 6) occupation-terms to describe occupations; 7) diagnosis-diagnostic terms used in clinical medicine, and 8) procedure-administrative, therapeutic, and diagnostic procedures; 9) physical agents, forces, and activities-devices and activities commonly associated with disease; 10) social context - social conditions and relationships of importance in medicine; and 11) general-syntactic linkages and qualifiers. NANDA diagnoses are included in SNOMED III in the function module and nursing procedures are included in the procedure module.

METHODS

Questions

We addressed two research questions: 1) What are the

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terms used by nurses to describe patient problems in the nursing care plan and nurse's progress note? and 2) Can the terms used by nurses to describe patient problems in the nursing care plan and nurse's progress note be represented with SNOMED III terms?

Sample

The data sources for the patient problems were the nursing care plans and nurses' progress notes of 201 patients enrolled in a research study (NR02215, WL Holzemer, PI) examining the quality of nursing care of AIDS' patients hospitalized for *Pneumocystis carinii* pneumonia. The purpose of the larger study is to describe the linkages among patient problems, nursing interventions, and patient outcomes over time.

The data for the experiment described in this paper represent a total of 485 patient encounters from three health-care institutions with three different types of care planning systems and three types of nurses' progress notes. In the first institution, the care plan is computer-based and the nurse's progress note is written in narrative style. In the second institution, the care plan is handwritten and the nurse's progress note is written on a flowsheet using charting by exception. A standardized printed care plan with a flowsheet and a once daily narrative note are used in the third institution.

Procedure

We manually abstracted the terms charted by the nurses to describe patient problems from the nursing care plan and nurse's progress note. We entered the nursing terms into a relational database and we classified the terms used by the nurses as NANDA diagnoses, Medical diagnoses, Signs/symptom, Patient goal, or Other. We loaded the SNOMED III terms into a relational database and created a word index. We determined matches by identifying the description of the SNOMED III term that best matched the term charted by the nurse.

RESULTS

A total of 1841 patient problems comprised of 761 unique terms were recorded from the nursing care plan and the nurses' progress notes/flowsheet. The number of unique terms was limited by the structured care planning systems in two institutions (computer-based and standardized), the use of flowsheets (two institutions), and charting by exception in the nurses' progress notes (one institution).

To test the feasibility of using SNOMED III terms to represent nursing data, a test subset of the most frequently occurring problems identified across data sources and substantive categories was selected resulting in seven problem areas (respiratory function, body temperature, activity, nutrition status, elimination, psychosocial concerns, and lack of knowledge) represented by 25 nursing terms. The 25 terms represented a total of 969 patient problems or 53% of the problems from the nursing care plan and the nurse's progress note.

The terms used by the nurses to describe patient problems in the nursing care plan and in the nurse's progress note, the frequency of the term, term type (NANDA diagnosis, Medical diagnosis, Sign/symptom, Patient goal, or Other) and the matching SNOMED III term/terms or the potential SNOMED III terms are presented in Table 1. The letter in the SNOMED III term relates to the module in which the term is located. The majority of the terms in this analysis were represented with terms from the function module and the codes begin with the letter F. A few nursing terms (e.g. cyanosis, dehydration) were represented by terms from the morphology (M) or diagnosis (D) modules. If more than one SNOMED III term was located, the multiple terms are listed and each term is labeled. If no direct match was found for the terms recorded by the nurses, alternative matches were proposed by the authors.

The patient problems described as NANDA diagnoses were exact matches with the NANDA diagnosis terms in the function module of SNOMED III. Symptoms such as shortness of breath, tachypnea, fever, fatigue/malaise, nausea, vomiting, and depression, were exact matches with terms in the function module of SNOMED III as were signs such as crackling rales and weak gait. Signs recorded as actual values such as body temperature and percent oxygen saturation did not have matching terms in SNOMED III. Patient problems described as a series of terms (e.g. anxiety, anger, depression, and/or fear) were represented by a series of SNOMED III terms without difficulty. There were redundant SNOMED III terms for fear and diarrhea. The nursing diagnosis terms added to SNOMED III duplicated an existing SNOMED term resulting in two different codes for the same term.

The frequency of matches of SNOMED III terms with the terms recorded by the nurse in the nursing care plan and nurse's' progress notes and the number of SNOMED III terms required to represent the term are presented in Table 2. Forty-four percent of the terms in the test subset were direct matches with one

Table 1
Representation of Terms Used by Nurses in the Nursing Care Plan and Nurse's Progress Note with SNOMED III Terms

Terms Charted by Nurse	Freq	Term Type	SNOMED III Terms
Problems related to respiratory function			
Impaired gas exchange	109	NANDA diagnosis	F-0A930
Respiratory distress including shortness of breath (SOB), dyspnea on exertion (DOE), tachypnea, cough, cyanosis	99	Sign/symptom, & Other	SOB=F-20040; DOE=F-20050; tachypnea=F-21003; cough= F-24100; cyanosis=M-04100 (morphology change)
Diminished breath sounds	10	Sign/symptom	Breath sounds=F-23002, diminished=G-A316 (modifier)
Cracking rales	13	Sign/symptom	F-23410
Oxygen saturation = [value]	6	Sign/symptom	No direct match; Potential match for decreased saturation is hypoxia=F-60294 (symptom)
Problems related to body temperature			
Potential for hyperthermia	55	NANDA diagnosis	F-0A420
Hyperthermia	3	NANDA diagnosis	F-0A440
Fever	114	Sign/symptom	F-03003
Temperature = [value]	16	Sign/symptom	No direct match; Potential matches for high value are fever=F-03003 (symptom) or hyperthermia= F-0A440 (NANDA diagnosis)
Problems related to activity			
Activity intolerance (specify)	40	NANDA diagnosis	F-0A810
Fatigue/malaise	47	Sign/symptom	F-01360
Weakness	3	Sign/symptom	F-01380
Unsteady/weak gait	8	Sign/symptom	F-18003
Potential for injury	25	NANDA diagnosis	F-0A160
Problems related to elimination			
Alteration in bladder/bowel elimination	21	Other	No direct match; potential matches are elimination=F-60950 if NOS; alterations in patterns of urinary elimination=F-0A690 (NANDA diagnosis); diarrhea= F-0A610 (NANDA diagnosis) or F-54400 (symptom)
Constipation	2	NANDA diagnosis	F-0A600
Diarrhea	2	Sign/symptom & NANDA diagnosis	F-54400 (symptom) or F-0A610 (NANDA diagnosis)
Elimination of body wastes (specify)	33	Other	No direct match; potential matches are elimination=F-60950; alteration in patterns of urinary elimination =F-0A690 (NANDA diagnosis; diarrhea =F-0A610 (NANDA diagnosis) or F-54400 (symptom)

Table 1 (continued)

Terms Charted by Nurse	Freq	Term Type	SNOMED III Terms
Problems related to nutrition status			
Alteration in fluid/nutrition status	45	NANDA diagnosis	F-0A320 (nutrition); F-0A360 (fluid)
Anorexia; nausea/vomiting; diarrhea; dehydration	31	NANDA diagnosis, Sign/symptom, Medical diagnosis	anorexia=F-50015 (symptom); nausea=F52760 (symptom); nausea=F52760; diarrhea = F-0A610 (NANDA diagnosis) or F-54400 (symptom); dehydration =D6-20650 (medical diagnosis)
Problems related to psychosocial concerns			
Anxiety, anger, depression, &/or fear	55	NANDA diagnosis Sign/symptom	Anxiety=F-0B320 (NANDA diagnosis) or F-92238 (symptom); depression=F-92300(symptom); fear=F-0B300 (NANDA diagnosis) or F-92246 (symptom)
Disturbance of emotional well-being	45	Other	No direct match; potential matches are ineffective coping=F-0B800 (NANDA diagnosis) or specific symptoms such as fear, anxiety
Problems related to lack of knowledge			
Knowledge deficit related to (specify)	10	NANDA diagnosis	F-0B170
Need for teaching (specify who)	113	Other	No direct match;potential match is knowledge deficit=F-0B170 (NANDA diagnosis)
Teaching related to (specify) related to (specify)	64	Other	No direct match; potential match is knowledge deficit=F-0B170 (NANDA diagnosis)

Table 2
Frequency of SNOMED III Terms Matching Terms Used by Nurses to Describe Patient Problems and Number of SNOMED III Terms Required for Match

Type of Term Charted by the Nurse	Number of SNOMED III Terms Required for Match (Frequencies of Terms Recorded)			
	1	2	>2	No Match
NANDA Diagnosis	242	45	0	0
Sign/Symptom	185	0	0	22
Other	0	0	0	276
Sign/Symptom & NANDA	4	55	0	0
Sign/Symptom, & Other	0	10	99	0
Sign/Symptom, NANDA, & MD Dx	0	0	31	0
Total	**431**	**110**	**130**	**298**

SNOMED III term. These were primarily NANDA diagnoses and single signs or symptoms. More than two SNOMED III terms were needed to match the terms in the test subset in 130 instances. NANDA terms alone provided matches for 30% of the test subset. Overall, 69% of the terms in the test subset were matched by using one or more SNOMED III terms.

DISCUSSION

Our results suggest that terms recorded by nurses in the nursing care plan and nurse's progress note can be adequately represented using SNOMED III terms. The NANDA diagnoses in the function module of SNOMED III provided exact matches for the nursing diagnoses in our test subset. As we have previously reported, nurses frequently use symptoms rather than nursing diagnoses to describe patient problems in the written record [11]. For some problems, e.g. problems related to body temperature, the nurses recorded the term "fever", which was an exact match with a symptom in the function module, more frequently than the nursing diagnosis of "hyperthemia".

Refinement of the SNOMED III to remove duplicate terms for concepts such as diarrhea and fear or a method for determining equivalency is necessary. Campbell and Musen [12] have proposed the application of conceptual-graph formalisms to SNOMED III as a method to enhance construction of statements with complex inter-relationships. Our data demonstrate that the terms recorded by nurses in the patient record can be complex and suggest that such an enhancement would facilitate the representation of nursing terms as well as medical terms in the patient record.

It is important that the profession of nursing carry on the development, validation, and refinement of nursing classification systems and the mapping of nursing terms to other classification systems. In addition, it is vital that collaborative efforts with the aim of establishing a standardized health-care vocabulary that will support the needs of various applications and represent the terms used by the myriad of disciplines providing health care to the patient continue. Additional experiments are needed to test the ability of existing vocabularies to meet the challenges posed by a computer-based patient record and to provide guidance for the refinement and enhancement of those vocabularies.

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