

Representing Critical Care Data Using the Clinical Care Classification

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Abstract: Concept-oriented terminologies require the user to combine terms, making them awkward for their direct use as a documentation tool. Therefore, classification systems are needed to serve as interface terminologies between the user and the reference terminology used to organize the computer database system. Whether nursing classification systems provide sufficient granularity to adequately capture nursing practice is controversial. In addition, no nursing classification systems have been designed specifically for or evaluated in the critical care setting. The purpose of this study was to evaluate the ability of the Clinical Care Classification (CCC) to represent data in an intensive care setting and to provide recommendations for the expansion of this classification for its use in critical care documentation.

INTRODUCTION

Knowledge is the formalization of the associations between elements of information and data¹. Organized information allows inferences to be made that answer questions greater than those answered by the information alone¹. Clinical information systems contain vast amounts of data regarding patient care. Unfortunately, these data are not organized conceptually to enable the data to be linked to events in the real world. Standardizing information system documentation could enable researchers to define the conceptual relationships necessary to use these data to generate knowledge and measure patient outcomes.

Advances in computer technology and the standardization of data organization have made the use of computerized documentation for the measurement and evaluation of patient outcomes feasible². A recent study demonstrated how a reference terminology model could be used to evaluate nursing documentation and practice patterns^{3,4}. Concept-oriented or reference terminologies have the potential to provide the necessary structure for documentation in modern computer database systems. However, concept-oriented terminologies require the user to combine terms, making them awkward for their direct use as a documentation tool⁵. Therefore, interface terminologies are needed between the user and the

reference terminology used to organize the computer database system.

The purpose of this study was to evaluate the ability of the Clinical Care Classification (CCC) to represent data in an intensive care setting and to provide recommendations for the expansion of this classification for its use in critical care documentation.

Clinical Care Classification

The CCC, previously the Home Health Care Classification (HHCC), was originally created to document nursing care in home health and ambulatory care settings⁶. Specifically designed for clinical information systems, the CCC facilitates nursing documentation at the point-of-care. The CCC was developed empirically through the examination of approximately 40,000 textual phrases representing nursing diagnoses/patient problems and 72,000 phrases depicting patient care services and/or actions. The use of the CCC has expanded into other settings in addition to home health care and it is claimed to be appropriate for multidisciplinary documentation.

The CCC consists of two interrelated terminologies categorized by 21 Care Components. The CCC Nursing Diagnoses consists of 176 concepts, and CCC of Nursing Interventions consists of 198 concepts. The Nursing Diagnoses are enhanced by using three modifiers (Improved, Stabilized, or Deteriorated) to document the Expected and Actual Outcomes. Likewise the Nursing Interventions are expanded by using four modifiers (Assess/Monitor, Care/Perform, Teach/Instruct, Manage/Refer) to document the Type Action for each Nursing Intervention creating 792 Nursing Interventions⁷. As a result each nursing intervention consists of a core concept and a type action modifier making the coding of the terminology flexible and adaptable.

Research into the structure and usage of the CCC has been conducted utilizing the North American Nursing Diagnoses Classification (NANDA) and the Omaha System,^{8,9} the International Classification for Nursing Practice (ICNP)^{9,10}, patient documentation related to the psychiatric home care setting¹¹, and patient documentation related to the care of patients with Acquired Immune Deficiency Syndrome (AIDS)¹².

Previous research designed to evaluate the representation of nursing practice in standardized terminologies has tested their ability to characterize nursing terms, either nursing problems or nursing actions. This involves dissecting the nursing term into component words or phrases that can be mapped to the concepts of the terminology¹³. Success in this endeavor is measured by the number of term components that can be meaningfully mapped to the concepts of the terminology being evaluated. This study was designed to determine the usefulness of the CCC as an interface terminology for intensive care nursing documentation by mapping actual nursing documentation to the categorial structure of the CCC.

METHODS

The research method used in this study was a variation of content analysis. The procedure for content analysis outlined by Waltz, Strickland, and Lenz¹⁴ was utilized due to the researcher's success in using this method in a previous study³.

Universe of Content

For the purposes of this study the universe of content was defined as all recorded nursing actions related to the care of adult CABG patients during their first 24 hours postoperatively. Documentation reflecting the nursing care of 50 randomly selected patients undergoing coronary artery bypass graft surgery from a total of 793 patients was analyzed using content analysis. Documentation was entered into a computerized information system during the course of care within the patients' first 24 hours postoperatively. Each entry corresponded to a code designated in the computer system. There were a total of 274,957 documented entries.

Concept to be Measured

The concept measured in this study was nursing action. Other terms used to denote nursing actions include: nursing orders, treatments, measures, therapies, strategies and interventions¹⁵. Actions are generally represented as compositional statements containing verbs or verb phrases¹⁶.

Sample

The study dataset included all nursing documentation related to the management of care, of adult CABG patients, entered into the clinical information system over the patient's first 24 hours postoperatively. The study dataset was created during the course of patient care in the cardiovascular intensive care unit (CVICU) of a large teaching hospital situated in the southeastern United States. A software program was written that selected all adult CABG patient records from the previous year. Records of 50 patients were randomly selected from this sub-set of patients. Then from these records,

documentation from the first 24 hours postoperatively was abstracted.

Categorization Scheme

Categories were taken from the CCC of Nursing Interventions taxonomy. Each of the 198 intervention concepts listed in the taxonomy served as a category. Also, documentation was mapped to the full list of interventions available through the use of CCC modifiers.

Coding Instructions

Nursing documentation was mapped to the appropriate intervention code identified in the CCC. Definitions of CCC interventions functioned as coding instructions for documentation term representation. These definitions embody the inclusion and exclusion criteria for categorization of words and phrases into specific categories. An example of a CCC intervention, definition and code is: Q47.1 Acute Pain Control, Actions performed to control physical suffering, hurting, or distress. Words and phrases related to the control of physical suffering, hurting, or distress were coded under this intervention.

Pre-test the Categories and Coding Instructions

Once the coding database had been designed, the resulting coding scheme was applied to a randomly selected sub-set of the dataset to test the ability of the coding scheme to adequately decompose the interventions. Finally, the coding scheme was applied to the entire dataset to decompose each intervention into the categories derived from the CCC Interventions Taxonomy.

Establishing Reliability of Coding

The study investigators dissected and mapped interventions from the study dataset to the intervention codes of the CCC until a CCC code was assigned to each code of the original documentation. Then, the researcher provided experts in cardiovascular care with a description of the CCC and coding instructions for review. The coding scheme was discussed between the investigators and content experts until agreement reached 100%.

Data Analysis

Documented interventions were entered into a computerized database application for decomposition and analysis. Interventions were decomposed into their corresponding CCC intervention categories previously outlined. The frequency of interventions that contained words or phrases that mapped to CCC categories were measured to evaluate the taxonomy's ability to accommodate the terms. Any interventions that could not be mapped to the CCC taxonomy were documented for possible adjustments to the terminology in the future. In addition, frequency of

use of specific descriptors and semantic terms in each category were calculated.

Protection of Human Subjects

Patient identifiers were removed from the database to protect the identity of subjects prior to receiving the data. No attempt was made to identify any subjects, and no information concerning a particular subject could be revealed. Data was secured during and after the studies conclusion. Permission to use the database and conduct the proposed study was obtained from the hospital in which the unit resides and Institutional Review Board.

FINDINGS

Care Components

The majority (79.8%) of the documented terms were mapped to the CCC. By far, most of the documentation was related to physical regulation (40.01%) and fluid volume (31.14%). Four concepts, bowel/gastric, metabolic, self-concept, and life-cycle had no documentation that mapped to a category. To map the remaining documentation (20.18%) required the creation of intervention codes in six areas: hemodynamic monitoring, balloon pump care, arterial line care, central line care, cognitive assessment, and providing information.

While the CCC does include the care component 'cognition', the sub-categories behavior care, reality orientation, wandering control, and memory loss were not sufficient to code the type of cognitive assessment performed in intensive care settings. Mapping the type of action nurses perform when providing information regarding a patient's condition to family members will require an expansion of the definition of nursing status report under the care component 'health behavior' or the addition of a new category Table 1 shows the frequency of documentation that mapped to the conceptual structure of the CCC.

Table 1. Frequency of documentation that mapped to CCC conceptual structure

Care Component	Frequency	Percent
Activity	698	0.25
Bowel/Gastric	0	0
Cardiac	765	0.28
Cognitive	227	0.08
Coping	360	0.13
Fluid Volume	85,625	31.14
Health Behavior	423	0.15
Medication	625	0.23
Metabolic	0	0
Nutritional	846	0.31

Physical Reg.	110,013	40.01
Respiratory	7,620	2.77
Role Rel.	340	0.12
Safety	2,819	1.03
Self-care	28	0.01
Self-concept	0	0
Sensory	3,425	1.25
Skin Integrity	4,270	1.55
Tissue Perfusion	206	0.07
Urinary Elim.	1,186	0.43
Life Cycle	0	0
New Coding	55,481	20.18
TOTAL	274,957	100

Interventions

Combining the major and sub-categories of the CCC care components with the classification type action qualifiers yields a possible of 792 nursing interventions. Only 93 of these interventions were needed to code the documentation in this study. New interventions codes were needed to code the approximately 20% of documentation in the categories previously discussed. However, only a total of 11 new interventions were needed to code the remaining data, 111 interventions codes to map all the documentation in the study set. The most frequently used (30.6%) intervention was under the care component 'fluid volume', the sub-category 'fluid therapy', code '15.2 intake/output', with the qualifier 'monitor'. The second most frequently used intervention (27%) was under the care component 'physical regulation', the sub-category 'Physical health care', code '31.4 clinical measurements', with the qualifier 'monitor'.

Intervention Qualifiers

The CCC contains four type action qualifiers that when combined with subcategories make up the classifications intervention scheme. Each of these qualifiers is represented by two words that describe the action type. CCC qualifier descriptors are: Assess, Monitor, Care, Perform, Teach, Instruct, Manage and Refer. In only 12.8% of the documented interventions the type action was explicitly stated, in the remaining documentation the action was implied. The type action 'care' was most likely to be explicitly stated. The most frequently occurring type action was 'monitor' (81.34%), followed by 'assess' (17%). No documented interventions mapped to the qualifier 'refer' and 'instruct' Table 2 lists the type actions and the frequency of their occurrence in the documentation.

Table 2. Occurrence of CCC type action qualifier descriptors

Qualifier descriptor	Percentage
Assess	17%
Monitor	81.34%
Care	0.32%
Perform	1.10%
Teach	0.11%
Instruct	0%
Manage	0.053%
Refer	0%

DISCUSSION

Mapping

The group that mapped the computerized documentation to the CCC are all extremely familiar with the nursing care of CABG patients, the computerized documentation system, and this particular intensive care unit. Other studies have indicated that decomposition and mapping of terms requires an understanding of the knowledge domain^{17 18 19 8 3}. In this case, knowledge of the specific documentation system and care routines became equally important.

There was discussion regarding the difference between the qualifiers 'assess' and 'monitor'. The group decided that in the critical care setting, there was a great deal of difference between the two. Nurses in critical care spend a great deal of their time watching and documenting. The group coded these behaviors under the qualifier 'monitor' and determined that assessment required a judgment of on the nurses' part. An example of an assessment behavior would be the determination that an intravenous line was patent.

No differentiation was made between the qualifiers 'instruct' and 'teach'. The mapping group could not see any difference between the two in this setting and chose to code both under the qualifier 'teach'.

Interventions

The majority of nursing care in the first 24 hours past CABG surgery involves the monitoring of patients' hemodynamic status and administering fluids and medication to correct deviations from the norm. More than 80% of terms mapped to the type action qualifier 'monitor', the most frequently occurring care components were 'physical regulation' (40%) and 'fluid volume' (31%), and the two most frequently used interventions were related to fluid volume (30%) and 'physical regulation' (27%). Another priority during this time is to wean patients from mechanical ventilation reflected in the third most frequently mapped care component 'respiratory' (2.77%). Also, as with all immobile patients 'skin

integrity' (1.55%) is a major concern. Nursing staff and cardiac surgeons work closely during this time to regulate hemodynamic parameters, rarely requiring referrals to other specialists.

Classification Level of Abstraction

In this study, the researchers chose to map all of the nursing documentation entered in the clinical information system during the care of these CABG patients. These data included physiological measures such as heart rate and laboratory data. The rationale for this approach was that the documentation of these data imply either monitoring or assessment actions on the part of the nurse. This strategy was useful in determining nursing practice patterns. In addition, it was demonstrated that the CCC would be a useful tool for itemizing nursing care for reimbursement purposes.

On the other hand, mapping the study nursing documentation to the CCC raised the level of abstraction to the point where a great deal of granularity was lost. The resulting level of granularity is insufficient for the measurement of patient outcomes in this setting. Possible solutions to this problem are to expand the classification to accommodate these types of data or use the CCC in addition to other classifications.

The discipline of nursing has accepted the notion that there is no one nursing terminology for every setting. Perhaps, we need to consider the merging of classifications to accommodate different types of nursing documentation within the electronic health record. For example, extending the CCC with the Logical Observation Identifiers Names and Codes (LOINC) could prove useful in organizing nursing documentation at a level of granularity amenable to a higher level of analysis. Using the LOINC to code laboratory and assessment data in conjunction with the CCC for interventional data would decrease the amount of lossy data and improve the representation of clinical care in intensive care.

SUMMARY

The CCC was able to accommodate the majority of nursing documentation entered into a clinical information system during the care of post-operative CABG patients. To map all of this documentation required the addition of codes in six areas: hemodynamic monitoring, balloon pump care, arterial line care, central line care, providing information, and cognitive evaluation. Using the CCC to represent these data proved useful in determining nursing practice patterns and could be used for costing and third party reimbursement of nursing care. However, the resulting level of granularity makes the measurement of patient outcomes in this setting difficult. Combining the use

of the CCC with other coding schemes for critical care documentation may prove to be a useful approach to the construction of documentation databases in the future.

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