

Representing Cardiovascular Concepts in an Electronic Health Record Using SNOMED CT®

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Introduction

The University of Kansas School Of Nursing implemented an electronic health record (EHR) as a teaching/learning strategy to provide students the opportunity to learn about EHRs, standardized terminology, clinical information, and critical thinking. Patient assessments, the first EHR function developed, required using a standardized concept-based terminology. This type of terminology provides a common language that enables a consistent way of capturing, sharing, and aggregating health data across specialties and sites of care. It supports searching patient information, triggering decision support, measuring outcomes, and exchanging information. SNOMED CT® (SCT) was selected as the terminology of choice since it contains over 366,000 health care concepts with unique meanings and formal logic-based definitions organized into hierarchies. SCT provides 993,000 unique descriptions and 1.46 million semantic relationships. These descriptions and relationships enable reliability and consistency of data retrieval.

Research Questions

Can the semantics of the cardiovascular assessment categories and terms used in the EHR be represented by SCT? If not, what are the gaps? What are the issues in modeling assessment categories and terms?

Methods and Results

Using the SCT Clue Browser®, 266 cardiovascular concepts from the EHR patient assessment database were mapped to a SCT concept and validated by two independent coders. The SNOMED Clinical Terms® user guide was used to insure accurate coding strategies.¹ Differences in mappings were adjudicated until 100% inter-rater reliability was achieved. A gap analysis and semantic/loss ratio were completed between concepts that can be coded in SCT and those that cannot. A rating scale for the quality of the mapping was developed based on previous research.² Results of coding are displayed in table 1. Only 26 concepts had no match in SCT and 23 other concepts had unacceptable matches. The semantic loss ratio was 18.5%. With the use of post-coordination of concepts, 81.5% of the concepts needed for a generic cardiovascular assessment (the traditional content learned by all healthcare professional students).

Rating Scale	# of Coded Concepts
5=exact match, pre-coordinated	167
4=match with post-coordination	50
3=close match	17
2=matches at a more general concept	0
1=match is a related concept	6
0=no match	26

Table 1. Results of mapping concepts to SCT codes.

Implications

As SCT becomes the standard for clinical terminology, having consistent, standard representations of assessment concepts becomes essential. Issues concerning the explicit and implicit meanings of common observations became critical to encoding, e.g., (1) when we assess the JVD, is it the distention or an indicator of pressure; (2) how do we represent nausea as a symptom of cardiac pain; and (3) what is the valid representation of grading a murmur and describing its characteristics? Some of these issues were addressed by having two independent coders with a process for coming to consensus. However, the coders need to have clinical experience to interpret the implicit meanings and knowing how the concepts are used in practice. As we gain experience with SCT encoding concepts, there needs to be a repository of validated encodings. Who should manage this repository and how will they be validated? Concepts not coded were submitted to the SCT for consideration of inclusion—this was seen as a professional responsibility. Finally, since this SCT coded assessment is used in the education of students, the database can be queried as part of a curricular evaluation to see what clinical concepts the students have encountered, an idea that is just now being explored.

References

1. College of American Pathologists. SNOMED Clinical Terms® user guide. Northfield, IL: College of American Pathologists, 2006.
2. Campbell JR, Carpenter P, Scheiderman C, Cohn S, Chute, C and Warren JJ. Phase II evaluation of clinical coding schemes: Completeness, taxonomy, mapping, definitions, and clarity. JAMIA 1997;4:238-251.