

# Representing Nursing Practice in EMR/EHRs

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**Abstract. Objective:** Review of the ISO 18104 technical standard for a Nursing Categorical structure to best represent nursing practice in EMR/EHRs and digital health ecosystems.

**Methods:** Application of ISO standard review guidelines in consultation with ISO member stakeholders.

**Results:** Comprehensive views of the nursing practice knowledge domain are presented as mindmaps. Groups of patients can now be identified using the 'type of subject of care' category. The collaborative role of nurses is now recognized. This high level structured information model recognises nursing diagnosis, nursing actions and nurse sensitive outcomes relative to other categories and sub-categories known to influence nursing actions and nurse sensitive outcomes.

**Discussion:** This nursing practice framework reflects the nursing process. It supports conceptual and logical analysis of patient journey related nursing practice.

**Conclusion:** This updated categorical structure is a good fit with today's information technologies. Its adoption enables the value of nursing services provided to be demonstrated.

**Keywords.** Categorical structure, Nursing Data, Semantic Interoperability, Clinical Models, Terminology

## 1. Introduction

'Differences between individual nursing terminologies prevent direct comparison and exchange of nursing information'[1]. This statement adequately summarizes a continuing problem despite a number of historical efforts undertaken since 1992 [2-4] in an effort to correct this. Our inability to formally demonstrate the value of delivering nursing services suggests we need to adopt a new methodology. Terminologies must be concept-oriented[5] to facilitate computer-based terminology management and data re-use along the entire data supply chain. The conceptual representation of any knowledge domain requires the categorization of that domain into mutually exclusive high level categories and sub-categories in the form of an information model.

This author was the only nursing participant throughout the development of standards guiding the design and development of electronic health records during the 1990s. This experience raised a concern that nursing information needs were not being

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met. At the first invitational Nursing Terminology Summit at Vanderbilt University this author's concerns were shared with participants. One of this summit's outcomes was for IMIA NI to submit a proposal to the International Organisation of Standards (ISO TC215 for the integration of a reference terminology model for nursing which was supported by the ICN[6].

With the support of Dr Chris Chute, the proposal for an ISO standard was endorsed by the American National Standards Institute (ANSI) and submitted for approval to the International Organization for Standardization (ISO) Technical Committee (TC 215). The first ISO 18104 Health Informatics- Integration of a reference terminology model for nursing was published in 2003[7]. This technical standard was revised with the overall aim of supporting interoperability in the exchange of meaningful information between information systems in respect of nursing diagnoses and nursing actions. This update was published in 2014 with a change in title to Categorical structures for representation of nursing diagnosis and nursing actions in terminological systems. The most recent review, undertaken by this author, reflects further technical advances and new knowledge acquisition associated with its link to the 'interoperability' concept. This latest 2023 publication's title now refers to nursing practice. This version includes categories and sub-categories associated with nurse sensitive outcomes[8]. This paper documents changes made to the ISO 18104:2014 standard following the latest review undertaken by this author.

## **2. Methods**

Any ISO standard represents a consensus among international experts in the field of interest. Systematic reviews are undertaken in consultation with ISO member stakeholders. Such reviews collect information about the use of the standard under review[9]. Feedback received for this latest ISO 18104 review determined that an update was required to more comprehensively represent nursing practice as a whole.

A literature review was undertaken and shared. External experts were invited to make their views known and all previous ISO member responses formed the basis for this work. This meant that the existing nursing diagnosis and nursing intervention models needed to be updated to a higher level of granularity. A new nurse sensitive outcomes model needed to be developed in a manner that showed relationships between these terminology models. All category definitions were reviewed and updated accordingly to be more consistent with how these are now described.

The inclusion of nurse sensitive outcomes required a logical analysis of the nursing process as a whole[10], a well-known systematic 5 step guide for the provision of client-centred care, representing the logical cognitive flow of information processing adopted by anyone engaged in problem solving. Nurses provide services for every possible clinical speciality, working with and for multiple types of service providers in any location. As part of this review process all associated con-founding variables and their relationships were considered and defined in a manner to meet the needs of universal potential use cases. The first draft was reviewed and commented upon by the expert committee members. Modifications were made accordingly. The final version

was distributed to ISO members for ballot. Following member approval the final version was published [8].

### 3. Results

Early evidence that the categorial structures can be used as a framework for analysing nursing practice and for developing nursing content of electronic record systems[11] was found. Nurse sensitive outcome categories and sub-categories representing confounding variables are now included. These sub-categories represent concepts over which nurses have no control, but which influence patient outcomes. Also included are references to ISO13606-2, the openEHR RIM, and the ICNP integration with SNOMED CT® terminology. The Nursing 'assessment' is represented as an 'observation' which is a sub-category of the 'nursing action' category (nursing interventions). There is recognition of the collaborative roles of nurses (and midwives) with their 'subject of care', to inform actions and assessments. There is now a 'goal/expected outcome' category. A number of specified sub-categories were included to differentiate between Nursing actions and the actions of others, as listed in a new category titled 'Outcome Causation'. All category definitions were reviewed, updated and new category definitions were added. Groups of patients can be identified using the 'type of subject of care' category. Relationships between categories and sub-categories are shown in subsequent mindmaps in the standard. Note that the sub-categories within the preferences category represent nursing diagnosis influencing factors.

The categorial structure of nursing practice is now represented in a mindmap shown in figure 1. This represents a more comprehensive view of the nursing practice knowledge domain by the inclusion of nurse sensitive outcomes, its sub-categories representing known confounding variables and their relationship with the care process.

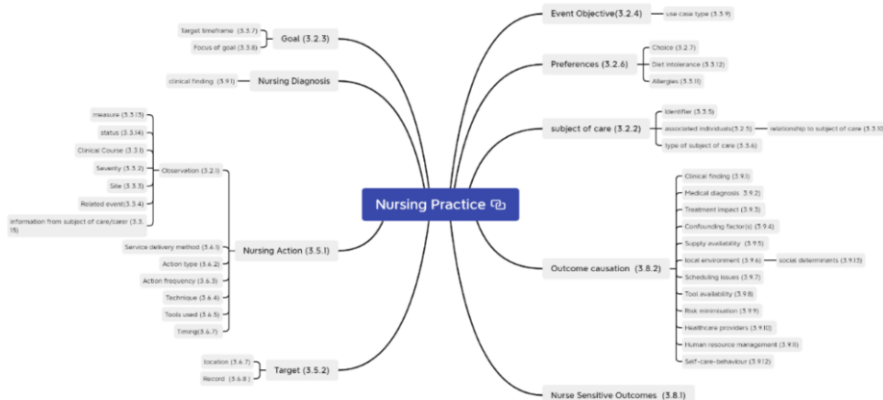


Figure 1 Mindmap representing the categorial structure of nursing practice

Amongst the comments received from the ISO member experts was the notation that many of the categories and subcategories included in this standard are equally applicable to other clinical disciplines. This categorial structure represents a common

pattern, i.e. the nursing process, that is applicable for all types of clinical practices. The terminologies’ associated with each of these categories and sub-categories are expected to differ to best represent each discipline’s knowledge domain and service protocols.

The three nursing primary categorial structures were found to have features in common with the more general framework for clinical findings [12], the domain-specific categorial structure for surgical procedures [13], the system of concepts to support continuity of care [14] as well as the WHO International Classification of Health Interventions (ICHI) [15]. This standard may therefore inform development of other general and domain-specific categorial structures in healthcare.

#### 4. Discussion

Adoption of this standard enables Nurse sensitive outcomes to be measurable, document the value of nursing services provided, and make nursing ‘visible’. It provides a suitable framework for analysing nursing practice[11]. Each of the categories and subcategories now needs to be associated with agreed standard minimum data sets (MDS) using standard nursing terminologies(SNT), to suit every specific use case, clinical specialty or patient co-horts. Such adoption is a valuable pre-requisite for learning management systems. There is a need to establish relationships between terminology models, information models, including archetypes[16] and ontologies in the nursing domain. Ideally such systems are used within digital health ecosystems that enable the collection of and access to data pertaining to entire individual health journeys per episode or lifetime. This categorial structure has features in common with the more general framework for clinical findings [13], the domain-specific categorial structure for surgical procedures[14, 15] and the WHO ICHI [17]. Attributes of clinical models that link to the standard openEHR reference information model[18], used in next generation systems, as shown in figure 2.

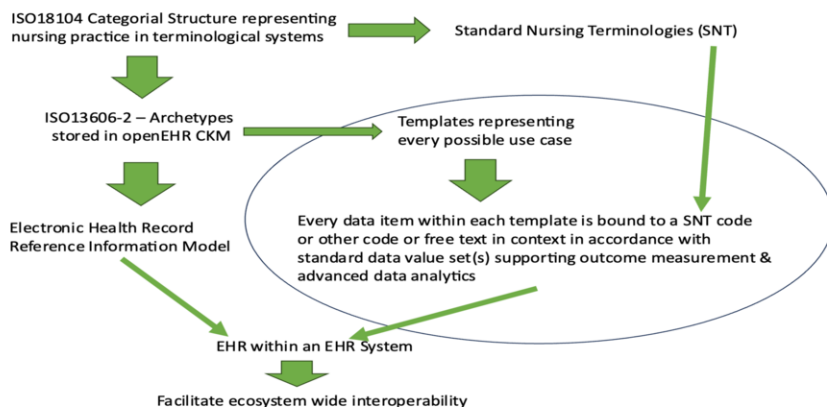


Figure 2 The Nursing practice data collection technical infrastructure

## 5. Conclusions

This ISO standard categorial structure essentially enables the nursing knowledge domain to be clearly defined and documented. The structure logically represents the nursing process as an information model clearly defining the structures and relationships between data elements representing nursing practice, and its influencing factors, to facilitate the recording of concepts required to be represented in EHRs/EMRs. The advantage of using unambiguously defined categories able to represent the nursing practice knowledge domain, is the certainty of (semantic) interoperability in clinical practice. Mapping to the standard terminology of choice is facilitated, enabling comparisons to be made and providing insights regarding consistencies and differences between terminologies.

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