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Health informatics — Categorial structures for representation of nursing diagnoses and nursing actions in terminological systems

Informatique de santé — Structures catégoriques pour la représentation des diagnostics de soins et des actions de soins dans les systèmes terminologiques

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 215, *Health informatics*.

This second edition cancels and replaces the first edition (ISO 18104:2003), which has been technically revised. For the history of the revision and a summary of the changes, see the Introduction and Annex A.

Introduction

Development of terminological systems (also referred to as terminologies) to support nursing has been motivated by multiple factors including the need to

— describe nursing in order to educate and inform students and others,

— represent nursing concepts in electronic systems and communications, including systems that support multiprofessional team communications and personal health records, and

— analyse data about the nursing contribution to patient care and outcomes — for quality improvement, research, management, reimbursement, policy and other purposes.

Multiple terminologies exist to support representation of concepts for healthcare purposes; some of these are relevant to the nursing domain. In the context of health informatics, there is a clear requirement for both domain coverage and for interoperability among computer-processable terminological systems that support nursing. Nursing terminologies, or those parts of healthcare-related terminologies that are relevant to nursing, include concept representations for nursing diagnoses and nursing actions.

A nursing diagnosis is a label assigned to an assessment finding, event, situation or other health issue to indicate that it is considered to be noteworthy by the nurse and, where possible, the subject of care. Nursing actions are acts performed by or under the direction of a nurse, with the intention of directly or indirectly improving or maintaining the health of a person, group or population, the precise scope of nursing actions being delineated in each jurisdiction. These concepts and the scope of nursing practice are further elaborated in Annex B.

The first edition of this International Standard[1] focused on the conceptual structures that are the basis of nursing terminologies in order to support interoperability. A major purpose was "to establish a nursing reference terminology model consistent with the goals and objectives of other specific health terminology models in order to provide a more unified reference health model". This purpose is still relevant to this revision of the standard, to support interdisciplinary communication, for example, where single, shared records are used, including records held by patients.

Following ISO rules, a review of ISO 18104:2003 was undertaken during 2008/09; ISO national member bodies, nursing organisations, industry representatives and experts provided comment. In addition to evaluation of the purpose, target groups, definitions and provisions of the standard, the review considered the implications of relevant International Standards published since 2003. The main findings/recommendations of the review were as follows.

a) The standard was being used in at least 11 member countries and by several international terminology development organizations.

b) Any revision should be based on a clearly articulated value proposition supported by evidence from the review. Published examples of use and value are provided in the Bibliography, linked to the specific purposes stated in Clause 1. There is anecdotal evidence of other uses, including supporting design of terminology content in electronic record systems.

c) Normative references and definitions to be updated. Other relevant international work needed to be considered, such as the World Health Organization Family of International Classifications (WHO-FIC) International Classification of Healthcare Interventions (ICHI).[2]

d) A review of relevant International Standards confirmed that the naming of some categories might need to be revised and that some categories could have been more appropriately designated as semantic links.

e) Responses indicated that "dimension" and "potentiality" in the diagnosis model and "target" in the action model were not applied reliably by different users and required further consideration.

f) It was recommended that a model for outcomes be considered and that informative annexes clarify the relationship between the model for diagnoses and the model for actions, as well as points of intersection between terminology models and information models.

g) A number of reviewers recommended that the standard be supported by implementation guidance/examples, and that the title and the language used be revised, so that it would be better understood by target groups.

This second edition addresses these findings and recommendations. In the main body of the standard, two redundant categories have been removed (*dimension* and *recipient of care*) and changes have been made to correct errors, clarify meaning and update definitions. Annex A summarizes the changes. The standard defines the structure of terminological expressions for nursing diagnoses and nursing actions; the professional meaning of these constructs and their relationship to other record components is addressed in Annex B along with points of intersection between terminology models and information models. An informative description of categorial structures and their implementation is provided by Annex C.

Health informatics — Categorial structures for representation of nursing diagnoses and nursing actions in terminological systems

1 Scope

This International Standard specifies the characteristics of two categorial structures, with the overall aim of supporting interoperability in the exchange of meaningful information between information systems in respect of nursing diagnoses and nursing actions. Categorial structures for nursing diagnoses and nursing actions support interoperability by providing common frameworks with which to

a) analyse the features of different terminologies, including those of other healthcare disciplines, and to establish the nature of the relationship between them,[3]–[8]

b) develop terminologies for representing nursing diagnoses and nursing actions,[9]–[12]

c) develop terminologies that are able to be related to each other,[3] [8] [13] and

d) establish relationships between terminology models, information models and ontologies in the nursing domain.[14]–[16]

There is early evidence that the categorial structures can be used as a framework for analysing nursing practice[17] and for developing nursing content of electronic record systems.[18] [19]

This International Standard is applicable to the following user groups:

— developers of terminologies that include nursing diagnosis and nursing action concepts;

— developers of categorial structures and terminologies for other healthcare domains, to support clarification of any relationship to or overlap with nursing concepts;

— developers of models for health information management systems such as electronic health records and decision support systems, to describe the expected content of terminological value domains for particular attributes and data elements in the information models;

— developers of information systems that require an explicit system of concepts for internal organization, data warehouse management or middleware services;

— developers of software for natural language processing, to facilitate harmonization of their output with coding systems.

It is not intended for use by clinical nurses without health informatics expertise. However, Annex C provides an introduction to categorial structures to assist those without health informatics expertise to contribute to its development, review, implementation and evaluation.

NOTE 1 Although the scope of testing and review of the first edition of this International Standard has been limited to nursing, the two categorial structures have features in common with the more general framework for clinical findings [ISO/TS 22789 and the domain-specific categorial structure for surgical procedures (ISO 1828) [20] as well as with the WHO ICHI].[2] The standard may therefore inform development of other general and domain-specific categorial structures in healthcare.

Topics considered outside the scope of this International Standard include

— complete categorial structures that would cover all the potential details that could appear in expressions of nursing diagnoses and nursing actions,

— a detailed terminology of nursing diagnoses or nursing actions,

— a “state model” for diagnoses or actions — for example, provisional diagnosis or absent diagnosis, planned action or action not to be done — see Annex A,

— diagnoses made and actions undertaken by nurses working in other professional roles — see Annex B — and

— knowledge relationships such as causal relationships between concepts — see Annex B.

NOTE 2 Throughout the main body of this International Standard, where terms such as nursing diagnosis and nursing action are used, these refer to representation of these concepts in electronic systems, not to the professional activity of making a diagnosis or performing an action.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17115, *Health informatics — Vocabulary for terminological systems*

ISO/TS 22789, *Health informatics — Conceptual framework for patient findings and problems in terminologies*

EN 12381, *Health informatics — Time standards for healthcare specific problems*

EN 12264, *Health informatics — Categorial structures for systems of concepts*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Where terms used in this document are not defined in this clause, they are considered to be generic to the English language or not specific to this document. In cases where they are not defined in this document nor generic to the English language, terms can be found using the Joint Initiative for Global Standards Harmonization Health Informatics Document Registry and Glossary’s standards knowledge management tool (SKMT): www.skmtglossary.org.

3.1 General

3.1.1
concept
unit of knowledge created by a unique combination of *characteristics* (3.1.4)

Note 1 to entry: A concept can have one or more names. It can be represented using one or more terms, pictures, icons or sounds.

3.1.2
categorial structure
minimal set of *domain constraints* (3.1.5) for representing concept systems in a subject field

Note 1 to entry: Annex C provides further explanation.

3.1.3
category
division of sets of *entities* (3.1.6) regarded as having particular shared *characteristics* (3.1.4)

EXAMPLE Oral route, subcutaneous route and all other routes share characteristics particular to the category *route* (3.4.3).

Note 1 to entry: Categories may be more or less general. Where one category is subsumed by another, the isA relation is asserted to obtain a hierarchy between the more specific or subsumed category and the more general or subsuming category. For example, parenteral route is more general than intravenous route.

Note 2 to entry: Each *entity* (3.1.6) instantiates some category.

3.1.4
characteristic
abstraction of a property of an *entity* (3.1.6) or of a set of *entities* (3.1.6)

EXAMPLE Fever is a *characteristic* symptom of flu.

Note 1 to entry: Characteristics are used for describing *concepts* (3.1.1) and for differentiating *categories* (3.1.3).

3.1.5
domain constraint
rule prescribing the set of *sanctioned characteristics* (3.1.8) that are valid to specialize a concept representation in a subject field

EXAMPLE *Administration of drug* possiblyhasRoute *subcutaneous* describes the fact that drugs can be administered subcutaneously in the specific context that the terminology applies to.

Note 1 to entry: Different levels of sanctioning are possible, e.g. conceivable, sensible, usuallyInTheContextOf, normal, necessary.

3.1.6
entity
any concrete or abstract thing of interest

EXAMPLE Aspirin, environment, parent, symptom, mobility

Note 1 to entry: This definition is similar to that for *object* in ISO 1087-1: anything perceivable or conceivable. ISO 1087-1 notes that objects may be material (e.g. an engine, a sheet of paper, a diamond), immaterial (e.g. conversion ratio, a project plan) or imagined (e.g. a unicorn). However, the term *object* is normally interpreted as representing a material thing, therefore *entity* is preferred.

3.1.7
representation relation
semantic link
formal representation of a directed associative relation or partitive relation between two *concepts* (3.1.1)

EXAMPLE hasFocus; actsOn.

Note 1 to entry: A *representation relation* (3.1.7) always has an inverse, i.e. another representation relation with the opposite direction. The inverse may or may not be explicitly stated. For example, isFocusOf (inverse of hasFocus); isTargetOf (inverse of actsOn).

3.1.8
sanctioned characteristic
formal representation of a type of *characteristic* (3.1.4)

EXAMPLE hasFocus symptom; hasSite altered structure.

3.1.9
terminological system
terminology
structured human and machine-readable representation of clinical *concepts* (3.1.1) required directly or indirectly to describe health conditions and healthcare activities, and allow their subsequent retrieval or analysis

Note 1 to entry: It also refers to the relationship of the terminology to the specifications for organizing, communicating and interpreting such a set of concepts.

3.2 Categories of healthcare entities for nursing diagnoses

3.2.1
clinical course
onset and/or duration

EXAMPLE Acute, chronic, sudden.

Note 1 to entry: See Annex A for discussion of clinical course

Note 2 to entry: Does not include time related expressions [see *timing* (3.2.9)].

3.2.2
clinical finding
any state observed directly or indirectly concerning a subject of care and their relationship with the environment

Note 1 to entry: A single descriptor (e.g. anxiety, pain) can serve the role of both *focus* (3.2.4) and *judgement* (3.2.5). Such clinical finding expressions are also valid for representation of nursing diagnoses.

3.2.3
degree
relative severity or intensity

EXAMPLE Mild, moderate, severe.

3.2.4
focus
area of attention

EXAMPLE Tissue integrity, body temperature, activity of daily living.

Note 1 to entry: Focus *categories* (3.1.3) that are valid for representation of a nursing diagnosis include, but are not limited to property, process, structure, state, and behaviour.

Note 2 to entry: Focus may be qualified by *site* (3.2.7), for example, movement of leg, tissue integrity of left heel.

3.2.5
judgement
opinion or discernment related to a *focus* (3.2.4)

EXAMPLE Impaired, reduced, ineffective.

Note 1 to entry: Judgement *categories* (3.1.3) that are valid for representation of a nursing diagnosis include, but are not limited to, alteration, adequacy, and effectiveness.

3.2.6
potential
inherent capacity for coming into being

Note 1 to entry: Descriptors for potential are limited to *risk for* and *opportunity for* and their synonyms.

3.2.7
site
anatomical structure

Note 1 to entry: Site *categories* (3.1.3) that are valid for expressions of nursing diagnoses are body component, and altered structure (e.g. a wound).

3.2.8
subject of information
type of *entity* (3.1.6) to which the nursing diagnosis refers

Note 1 to entry: Subject of information *categories* (3.1.3) valid for representation of a nursing diagnosis are individual, group and physical environment.

Note 2 to entry: The implied subject of information is the *subject of record* (3.4.4) which is not generally expressed in the terminological phrase. A term for subject of information should be used when necessary to disambiguate the subject of information from the (implied) subject of the record, e.g. sibling distress vs. (patient) distress.

3.2.9
timing
occurrence or a point or period in time

EXAMPLE After meals, in childhood, morning.

Note 1 to entry: For representation of time-related concepts, refer to EN 12381.

3.3 List of authorized representation relations for nursing diagnoses

NOTE Inverse representation relation for *hasX* is i*sXFor* unless otherwise noted.

3.3.1
hasClinicalCourse
representation relation (3.1.7) between the nursing diagnosis and qualifier *clinical course* (3.2.1)

EXAMPLE In the expression *sudden reduction in body weight*, the nursing diagnosis *reduction in body weight* hasClinicalCourse *sudden onset*.

3.3.2
hasDegree
representation relation (3.1.7) between the nursing diagnosis and qualifier *degree* (3.2.3)

EXAMPLE Severe pain — hasFinding *pain,* hasDegree *severe*.

3.3.3
hasFinding
representation relation (3.1.7) between the nursing diagnosis and the *clinical finding* (3.2.2)

EXAMPLE Risk for infection — hasFinding *infection,* hasPotential *risk for.*

3.3.4
hasFocus
representation relation (3.1.7) between the nursing diagnosis and the *focus* (3.2.4)

EXAMPLE Excessive calorie intake — hasFocus *calorie intake,* hasJudgement *excess.*

3.3.5
hasJudgement
representation relation (3.1.7) between the nursing diagnosis and the *judgement* (3.2.5)

EXAMPLE Unable to perform activities of daily living — hasFocus *performance of activities of daily living,* hasJudgement *unable.*

Note 1 to entry: Inverse representation of hasJudgement relation is *isAppliedTo*.

3.3.6
hasPotential
representation relation (3.1.7) between the nursing diagnosis and the descriptor of *potential* (3.2.6)

EXAMPLE Risk for pressure ulcer — hasFinding *pressure ulcer,* hasPotential *risk for.*

3.3.7
hasSite
representation relation (3.1.7) referring to the anatomical structure that further specifies the position of a *focus* (3.2.4)

EXAMPLE Reduced movement of arm — hasFocus *movement,* hasSite *arm,* hasJudgement *reduced.*

3.3.8
hasSubjectOfInformation
representation relation (3.1.7) between the nursing diagnosis and the *category* (3.1.3) of type of *entity* (3.1.6) to which the nursing diagnosis refers

EXAMPLE Sibling distress — hasFinding *distress*, hasSubjectOfInformation *sibling.*

3.3.9
hasTiming
representation relation (3.1.7) between the nursing diagnosis and the qualifier *timing* (3.2.9)

EXAMPLE Postoperative nausea — hasFinding *nausea*, hasTiming *postoperative.*

3.4 Categories of healthcare entities for nursing actions

3.4.1
action
act performed by a healthcare actor with the intention of directly or indirectly improving or maintaining the health of a person, group or population

[SOURCE: EN 13940-1:2006, modified.]

EXAMPLE Observation, injection, teaching, dressing, removal.

3.4.2
means
entity (3.1.6) or technique used in performing a nursing *action* (3.4.1)

Note 1 to entry: *Categor*ies (3.2.3) that are valid for expressions of means are resource, method, device, and substance.

3.4.3
route
path through which something may pass

EXAMPLE Oral, subcutaneous, epidural.

3.4.4
subject of record
type of *entity* (3.1.6) about which the health record is made; normally the individual patient / client

Note 1 to entry: included for completeness as a sub type of *target* (3.4.5). A terminological expression might not include an explicit descriptor for target when the target is the subject of record. For example, *four hourly observation, mobilization following surgery.*

3.4.5
target
entity (3.1.6) that is affected by the *action* (3.4.1) (Example 1) or that provides the content of the action (Example 2)

EXAMPLE 1 Wound, foreign body or insulin: as in débridement of wound, removal of foreign body, injection of insulin.

EXAMPLE 2 *Vital signs or diabetes self care:* as in assessment of vital signs, diabetes self care education.

Note 1 to entry: *Categor*ies (3.1.3) that are valid for expressions of *target* are body component, device, substance, resource, process, physical environment, individual, group, *clinical finding* (3.2.2), and other categories that have the role of *focus* (3.2.4) in the nursing diagnosis categorial structure. A nursing diagnosis can also be the target of an *action* (3.4.1).

3.5 List of authorized representation relations for nursing actions

NOTE Inverse *representation relation* (3.1.7) for *hasX* is *isXFor* unless otherwise noted.

3.5.1
actsOn
representation relation (3.1.7) between the *action* (3.4.1) and the *target*(s) (3.4.5) which is affected by the action or provides the content of the action

EXAMPLE 1 Removal of wound dressing — action *removal* actsOn *wound dressing*.

EXAMPLE 2 Parent education about weaning diet — action *education* actsOn *weaning diet*, actsOn *parent*.

Note 1 to entry: isTargetOf is the inverse *representation relation* (3.1.7) of actsOn.

3.5.2
hasMeans
representation relation (3.1.7) between the categories *action* (3.4.1) and *means* (3.4.2)

EXAMPLE Feeding via cup and spoon — action *feeding* hasMeans *cup and spoon*

3.5.3
hasRoute
representation relation (3.1.7) between the categories *action* (3.4.1) and *route* (3.4.3)

EXAMPLE Subcutaneous injection of insulin — action *injection* actsOn *insulin,* hasRoute *subcutaneous route*

3.5.4
hasSite
representation relation (3.1.7) between the categories *target* (3.4.5) and *site* (3.2.7)

EXAMPLE Removal of wound dressing — action *removal* actsOn *dressing* hasSite *wound.*

Note 1 to entry: In the categorial structure for nursing actions, *site* (3.2.7) is used to further specify the position of a *target* (3.4.5). hasSite shall not be used in place of *actsOn* (3.5.1) when the *target* is an anatomical structure, i.e. body component or altered structure. In the case, for example, of assessment of skin on heel:

CORRECT: action *assessment* actsOn *skin of right heel*;

INCORRECT: action *assessment* hasSite *skin of right heel.*

3.5.5
hasTiming
representation relation (3.1.7) between the categories *action* (3.4.1) and *timing* (3.2.9)

EXAMPLE Administration of anti-emetic drug before meals — action *administration* actsOn *anti-emetic drug* hasTiming *before meals*.

4 Categorial structures — Conformance principles

Any categorial structure for representation of nursing diagnoses and nursing actions in a terminological system shall conform with the requirements specified in EN 12264 and ISO 17115 and shall provide the following information:

a) categories that organize the healthcare entities for representation of nursing diagnoses and actions in the terminology and subdividing their representation in the domain;

b) a list of the representation relations authorized by domain constraints;

c) the goal (purpose and scope) of the terminology for which the categorial structure is set;

d) a list of minimal domain constraints required by the goal of the categorial structure.

The categories that organize the healthcare entities and the representation relations for representation of nursing diagnoses and nursing actions in terminological systems are defined in 3.2 to 3.5.

5 Categorial structure for representing nursing diagnoses

A nursing diagnosis shall be expressed either as a judgement on a focus, or as a single clinical finding expression representing an altered state, altered process, altered structure, altered function or altered behaviour observed about a subject of care. Examples of the first type of expression (i.e. a judgement on a focus) include limited mobility, poor nutrition, and lack of knowledge. Examples of the second type of expression (i.e. a clinical finding) include wound, nausea, pain, and depression.

For the first type of expression a descriptor for judgement and a descriptor for focus are mandatory. Focus may be qualified by site.

Clinical findings shall be represented as specified in ISO/TS 22789.

A nursing diagnosis expression may have an associated potential which indicates that there is a *risk for* or *opportunity for* a nursing diagnosis. Note that *risk of* is sometimes used instead of *risk for.* A risk is a potential for a negative diagnosis; an opportunity (or chance) is a potential for a positive diagnosis. For example, risk of depression, risk for pressure ulcer; opportunity for weight reduction, opportunity for improved social interaction.

A nursing diagnosis expression may also be associated with a subject of information other than the subject of the record, for example, caregiver stress, poor parenting skills.

A nursing diagnosis expression may be qualified by degree, clinical course and timing .

The categorial structure for nursing diagnoses is shown in Figure 1.

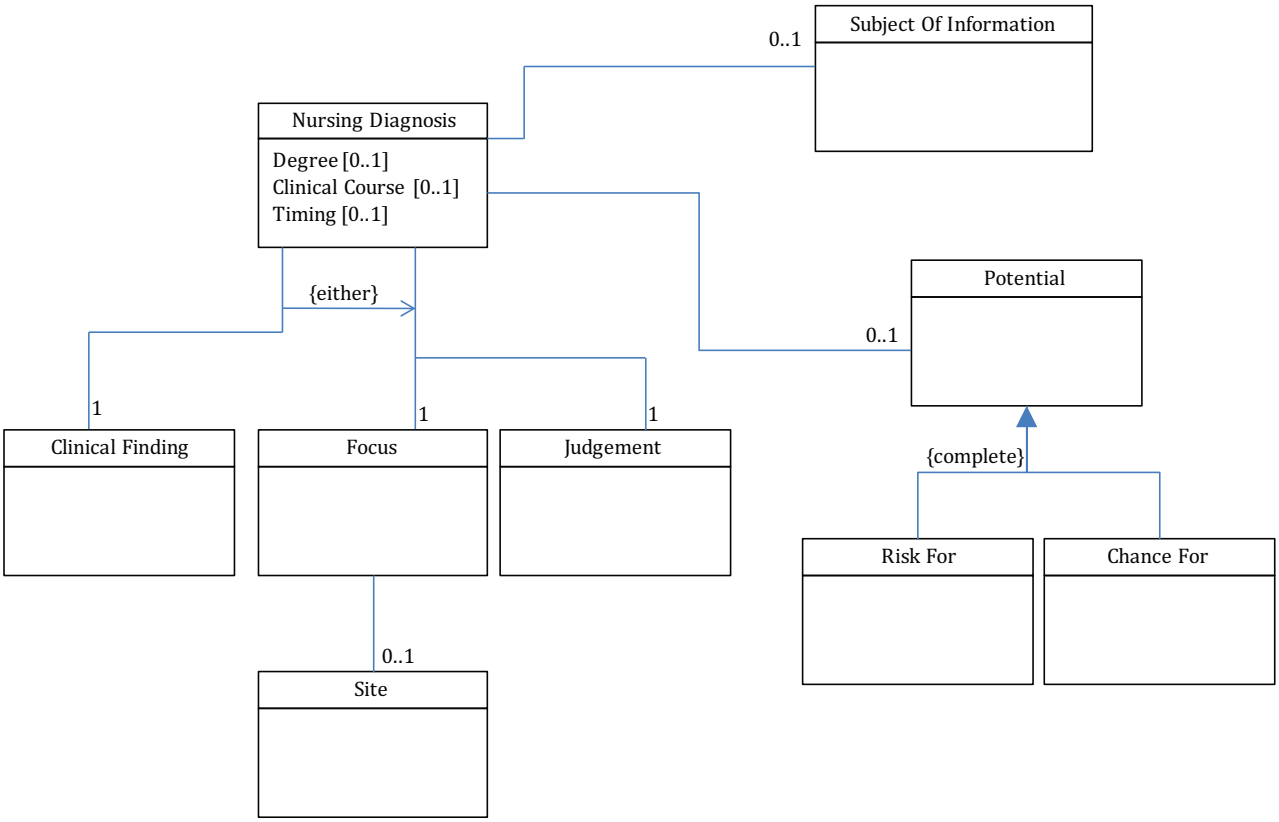

Figure 1 — Categorial structure for nursing diagnosis

6 Categorial structure for representing nursing actions

For the purposes of this International Standard, a nursing action is considered to be an intentional act applied to one or more targets through an action. A nursing action expression shall have a descriptor for action and at least one descriptor for target, except where the target is the subject of record and implied in the expression.

Nursing actions may be qualified by means, route and timing. The category site may be used to further specify the position of a target.

Actions are frequently represented in compositional expressions as verbs or verb phrases. Past tense verbal forms and order/instruction forms shall not be used in expressions of nursing actions. For example, *observation* shall be used rather than *observed* or *observe* (see Annex B).

Some nursing actions are expressed at an abstract level, for example: *mouth care*. Others are at a more detailed level, for example, *removal of sutures*. This International Standard applies to nursing action concepts at all levels of abstraction where these are included in terminological systems. The relationship between the high level expression and the detail of what is actually done to, for or with the subject of care is not in scope for this standard. Such relationships are specified in evidence based guidelines/resources and are managed, if required, within the information model of healthcare systems (see Annex B).

A graphical representation of the categorial structure for nursing actions is shown in Figure 2.

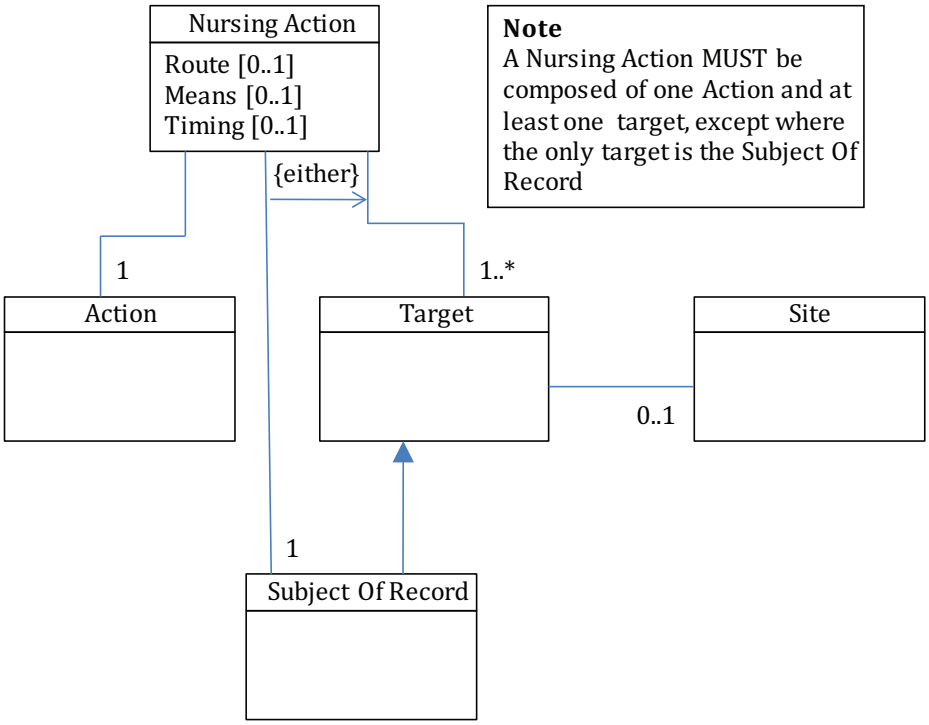

Figure 2 — Categorial structure for nursing actions

Annex A
(informative)

Summary of changes to ISO 18104:2003

A.1 Summary of changes to nursing diagnosis categorial structure

A.1.1 Overview

ISO 18104:2003	A single expression for nursing diagnosis is an exception to the "judgement and focus" model, for example, *nausea*, *pain*
Revision	The single expression is an alternative rather than a special case. Clinical finding expression is introduced. Mandatory requirement is for descriptors of focus and judgement OR descriptor for clinical finding. Categories for focus are revised to remove the "altered" examples that belong in clinical findings.
Rationale	"Special case" was confusing; whereas "single expression" fits with ISO/TS 22789.

A.1.2 Judgement

ISO 18104:2003	Qualifiers of degree, acuity and timing are qualifiers of judgement
Revision	Qualifiers of degree, clinical course and timing are qualifiers of diagnosis
Rationale	These qualifiers can apply to clinical finding types of diagnoses, not just to those that have a focus and judgement e.g. severe pain.

A.1.3 Dimension

ISO 18104:2003	Dimension is a quality possessed by an individual or group which provides a perspective on, but is not limited to: process, structure, other semantic categories taking the role of focus, and nursing diagnosis
Revision	Dimension and isPerspectiveOn removed
Rationale	Ongoing confusion about use of this category and no evidence of use in terminologies in the way it was intended i.e. to allow for post co-ordination of concepts to reduce combinatorial explosion. For example: combination of "ability to" with every self care activity; combination of "knowledge about" with every disorder. There is evidence that terminology developers are using "ability" and "dependency" as measures or scores rather than as they were in 18104:2003.

A.1.4 Subject of information

ISO 18104:2003	Defined as *an entity to which a diagnosis refers* Associated with focus in the diagrammatic model
Revision	Defined as *type of entity to which a nursing diagnosis refers* Notes amended to clarify use.
Rationale	Confusion over when to use; Lack of reproducibility

Subject of information, subject of record and subject of care in EN 13940-1

In EN 13940-1[21], subject of care is defined as *the person seeking to receive, receiving, or having received healthcare*. An informative annex discussed the situation where the subject of care was a group of persons rather than an individual. This meaning of subject of care as an individual, group or population is the one most commonly accepted in nursing. For example, a nursing diagnosis may be about a family or a mother-child dyad.

Subject of care is not defined in this International Standard, as it is not included in the required categories for expressions of nursing diagnosis and nursing action. However, two related categories are defined:

— *Subject of information* — type of entity to which a diagnosis refers e.g. “parent”, “caregiver”. The default is the patient - this category is used when a nursing diagnosis about someone other than the patient is recorded in the record of the patient.

— *Subject of record* — type of entity about which the health record is made; normally the individual patient. In this International Standard, this category is included for completeness as a sub type of target. A terminological expression might not include an explicit descriptor for target when the target is the subject of record. For example: *four hourly observation, mobilization following surgery.*

Both of these may be the same as the *subject of care* as defined in EN 13940-1, however, they may also be another “type of entity” such as a family member, a family or group.

A.1.5 **Site** (also used in the categorial structure for nursing actions)

ISO 18104:2003	Defined as *A physical structure that further specifies the position of a focus or a target*. Example categories included body component, altered structure (e.g. a wound), and device.
Revision	Defined as *anatomical structure*. Device removed from examples
Rationale	— Site appeared to be interpreted as a geographical location type perhaps instead of physical environment such as a school - not intended in the 2003 version. — Alignment with ISO/TS 22789 and ISO 1828[20]. — The 2003 definition included how to use it, not permitted in ISO definitions.

A.1.6 Potentiality

ISO 18104:2003	Potentiality is associated with judgement. Descriptors of potentiality (possibility) include *risk for*, *actua*l, *possibility of*, and *potential*.
Revision	Potential (preferred to potentiality — same meaning) is now associated with nursing diagnosis. Defined to exclude *possibility* and *actual*. New definition: *inherent capacity for coming into being* with descriptors limited to *risk for* and *opportunity for.*
Rationale	Potential can apply to clinical finding expressions also. Possibility is a kind of certainty, not a kind of potential. The descriptor *actual* is not a potential – it is the implied context for any nursing diagnosis in the record that is not a potential for a nursing diagnosis.

A.1.7 Acuity

ISO 18104:2003	Defined as *duration* — examples include acute, chronic
Revision	Renamed as *clinical course* and defined as *course and or onset*
Rationale	"Acute", "chronic" and similar terms are used sometimes to mean whether something happened quickly or slowly (onset) or how long it lasted (duration or course). ISO/TS 22789 has both *onset* and *course*. The SNOMED Clinical Terms (SNOMED CT) model reflects experience of the challenges of the concepts such as *acute onset*, *chronic course*, *sudden onset*, etc. — the attribute in SNOMED CT is *clinical course* which includes *onset* and *duration*.[22]

A.1.8 Timing

ISO 18104:2003	Defined as *a point or period in time*
Revision	Defined as *an occurrence or a point or period in time*
Rationale	Descriptors that are used for *timing* are more diverse than points or periods. ISO/TS 22789 uses *onset, episodicity, course* and *occurrence* with the latter meaning *temporal period*. EXAMPLE Morning nausea HasOccurrence Morning period. SNOMED CT uses *occurrence* as *periods of life* e.g. childhood.[22] Keeping the word *timing* is deemed acceptable provided the complexity is revealed in the definition and examples. See EN 12381.

A.2 Summary of changes to nursing action categorial structure

A.2.1 Overview

ISO 18104:2003	Defined as *a nursing action is considered an intentional act applied to a target through an action* Nursing action expressions must have an action and a target
Revision	Nursing action expressions must have a descriptor for action and at least one descriptor for target.
Rationale	See Target (A.2.3)

A.2.2 Action

ISO 18104:2003	Defined as *the process by which an intentional service is applied to a recipient of care*
Revision	Now defined as *deed performed by a healthcare actor with the intention of directly or indirectly improving or maintaining the health of a person, group or population*
Rationale	Revised to reflect nursing world view and to align with EN 13940–1. See also Annex B for consideration of the term *intervention.*

A.2.3 Target

ISO 18104:2003	Defined as *entity that is affected by the nursing action or that provides the content of the nursing action*
Revision	Separation of examples for the two kinds of targets (entity affected and entity that provides content).
Rationale	Confusion about how to use; Lack of reproducibility. Separation and examples intended to clarify that either or both can be used.

A.2.4 Means

ISO 18104:2003	*entity used in performing a nursing action*
Revision	*entity or technique used in performing a nursing action*
Rationale	Confusion about whether means included method (technique)

A.2.5 Recipient of care

ISO 18104:2003	*person, family, group, or other aggregate to whom the action is delivered. ...should be used when necessary to avoid ambiguities in a set of descriptors within a terminology.*
Revision	removed
Rationale	Redundant and confusing — there were no use cases identified where the type of recipient of care (individual, family group or environment) was not also a target of the action. Users appear to confuse Recipient of Care with Subject of Record i.e. the patient rather than someone other than the patient who was the target.

A.2.6 Subject of record

ISO 18104:2003	Not present
Revision	*type of entity about which the health record is made; normally the individual patient / client*
Rationale	Included for completeness as a sub-type of target. A terminological expression might not include a descriptor for target when the target is the subject of record. For example: *four hourly observation, mobilization following surgery.*

See also A.1.4.

A.3 Other changes

A.3.1 Title

Since the first editiion was published in 2003, considerable advances have taken place in the field of health informatics terminology standards and in terminology standards work in general. *Categorial Structure* is the term now used to represent the high level models of *types of concepts* and the relationships among them for the purposes of international standardization (see Annex C for further explanation).

A core aim of the initial standard was integration or harmonization with “evolving terminology and information model standards outside the domain of nursing”. Although this goal is still important, it has largely been achieved and it is therefore no longer a need to reflect the aim in the title of the standard.

A.3.2 Beneficiary, recipient of care and target

In certain instances, the recipient of care is an individual or group other than beneficiary. For example, *teaching the family caregiver to perform diabetic foot care* for the patient. The family caregiver is the recipient of care for the action of teaching and the patient is the beneficiary in whose health record the action will be noted. Categories of beneficiary (entity which stands to benefit from a nursing action) and recipient of care were considered for inclusion in the first edition. In this revision, recipient of care is subsumed within target as no expression for nursing actions were identified where the recipient of care was not also the target of the action. Beneficiary, normally the subject of the record, is generally implicit rather than explicit in expressions of nursing actions. However, if required this can be modelled as a further target for the action.

A.3.3 Additional attributes or qualifiers

In the first edition, additional attributes or qualifiers related to nursing diagnoses and actions were recommended to be represented in the information model rather than pre-coordinated in the reference terminology model (see Annex B for further explanation of these terms). For example, attributes such

as ActPriority, ActReason, ActStatus, Actcontext, dose_quantity, and healthcare_provider in the Health Level 7 Reference Information Model.

For this revision, it should be noted that:

a) additional attributes to the ones specified in this International Standard may be useful for the complete representation of nursing diagnoses and nursing actions

b) status of an action or diagnosis and other contextual qualifiers may be represented in either the terminology or the information model. For example: possible or provisional diagnosis, absence of a diagnosis (e.g. *no pain*, *no limitation of movement*); planned action, action not to be done. The provider of the terminology should make clear how the relationship between the terminology and standard information models are managed.

c) Action terms can be used in expressions for the past and future tense as well as the (default) present tense. Past tense verbal forms should not be used in a terminology nor should order/instruction forms of words. For example, *observation* should be used rather than *observed* or *observe.*

A.3.4 Nesting of diagnoses and actions

"Nesting" refers to relationships between concepts where one or more concepts can be parts of another concept. For example, *eye care* may be made up of a number of sub-actions such as *assessment of eye*, *cleansing of eye* and *instillation of eye drops*. As in the 2003 standard, this revision does not support representation of nesting of nursing diagnoses or nursing actions within the categorial structure. ISO 1828[20] supports nested representation of surgical "sub deeds" related to a surgical procedure; ISO/TS 22789 relates clinical findings to each other through the relation "hasAssociatedFinding"; ISO 13940-1 uses "activity bundles" to manage nesting of healthcare activities and "need for healthcare" to accommodate high level descriptors of care provision activity.[23] However, at this time it is recommended that associations between one nursing action and another and between one nursing diagnosis and another are represented through the information model.

Although not the same as nesting, it should be noted that a nursing diagnosis which hasPotential *nursing diagnosis*, i.e. a risk for a nursing diagnosis is also a nursing diagnosis.

Annex B
(informative)

Nursing diagnosis and nursing actions in context

B.1 General

NOTE Examples used in Annex B are illustrative and do not imply ISO support for any specific terminological system.

B.1.1 The scope of nursing practice

Nursing encompasses autonomous and collaborative care of individuals of all ages, families, groups and communities, sick or well and in all settings. Nursing includes the promotion of health, prevention of illness, and the care of ill, disabled and dying people. Advocacy, promotion of a safe environment, research, participation in shaping health policy and in patient and health systems management, and education are also key nursing roles.[23] Most definitions of nursing reflect the broad scope conveyed in this statement from the International Council of Nurses (ICN) and adopted by the World Health Organization. Although most often an individual, the subject of nursing care may also be a family, group or community, for example, community health assessment is a nursing role in some countries. The primary focus of nursing is people's responses to actual or potential health problems/life events.[24][25] Several definitions emphasize the clinical decision-making and diagnostic reasoning skills required for nursing practice. [25][26]

Although based on definitions of nursing from regulatory or professional bodies, the scope of nursing practice in each country is governed by laws, Practice Acts and professional regulations. Within the boundaries set by these rules, practice will vary depending on clinical need, service setting, local policies and the individual educational level and competence of the nurse. Irrespective of these variations, nurses are accountable to their patients and to regulatory bodies for the judgements and decisions they make and the actions they take or delegate to others. It is these judgements, decisions and actions which make up nursing practice and which are at the core of the care process.

B.1.2 The care process

Nurses generally work as part of a multidisciplinary team which in some cases will include the person or group receiving healthcare (and those who support them) as equal partners. All healthcare professionals follow a similar process of data collection, interpretation of findings, deciding on actions, acting and then evaluating the effects of what has been done. A nursing assessment, whether it is comprehensive and holistic or rapid and focused, provides the information needed to agree with the patient and caregivers what needs to be done, when and by whom. Clinical reasoning is used to interpret assessment data and identify appropriate actions, using evidence-based guidelines where these exist. Evaluation of care is an important and ongoing part of the care process, finishing with overall outcome evaluation.

Standards for nursing stipulate that accurate documentation of the care process is critical to patient safety and for continuity and quality of care. This International Standard applies to electronic records. The purpose of this Annex is to describe the main elements of nursing practice, providing a basis for the requirement to have terminologies that support electronic recording of nursing diagnoses and nursing actions. Professional (rather than technical) definitions are provided for these concepts and the relationships between them are described. B.1.3 and B.1.4 elaborate additional relevant concepts i.e. information models and terminologies and pre and post coordinated expressions.

B.1.3 Information models and terminologies

An information model is *a structured specification, expressed graphically and/or narratively, of the information requirements of a domain. An information model describes the classes of information required and the properties of those classes, including attributes, relationships, and states* (www.skmt.org)]. An example of an information model is the HL7 Reference Information Model (Health Level Seven International: http://www.hl7.org).

The interface between the information model for a particular application, such as an electronic health record system, and the terminology used to populate the content of the system needs to be carefully managed to minimize the risk of inaccurate communication. For example, if the information model for a system includes the field name "family history", populating that field with the term "diabetes" means: the *patient has a family history of diabetes*. However, if this relationship between the information model and the terminology is not carried through when data are retrieved, for example, to populate a message, the meaning could be changed to *the patient has diabetes*.

A number of standards organisations are working together to develop a general approach to resolving issues related to the interface between information models and terminologies — see the TermInfo project on the HL7 website: http://www.hl7.org/special/committees/terminfo/index.cfm.

In many instances it is clear which classes, attributes, relationships and states do not belong in the terminology, for example, the names of individual patients and staff, dates when data are entered into a system, or the link between a nursing diagnosis and all possible causes of that diagnosis. This includes links between assessment findings and other information supporting a nursing diagnosis for an individual patient, for example, the link between a weight measurement and a diagnosis of overweight; or the link between a family history of a diagnosis and the patient's risk for that diagnosis. In other instances it is less clear — presence, absence and negation are examples of where the information model and the terminology often overlap. B.2–B.4 make clear where there could be overlap between information models and terminologies when representing nursing diagnoses and nursing actions.

B.1.4 Pre and post coordinated expressions

NANDA-International[27] and other terminologies include diagnostic labels such as "Sleep pattern disturbance" that have already been "composed" as nursing diagnoses in order to support the clinical application of the terminology. This kind of composed expression in a terminology is referred to as "pre co-ordinated". Terminologies may also provide opportunities for post co-ordination - allowing greater detail but with fewer expressions. For example, the nursing interventions scheme of the Clinical Care Classification (www.sabacare.com) includes elementary expressions for concepts, for example, subcategories such as "Dressing Change" and action types such as "Teach/Instruct". Users can combine these elementary expressions to compose a nursing intervention. These composed expressions are often referred to as post coordinated expressions. A definition of a post coordinated concept representation is: *a compositional concept representation using more than one concept from one or many formal systems, combined using mechanisms within or outside the formal systems* (http://www.skmtglossary.org/).

B.2 Assessment and nursing diagnosis

Assessment is a process during which data are collected about the subject of care's health state and their responses to actual or potential health problems/life events. Assessment actions such as listening, observing and measuring are used to collect data. Frameworks and tools are often used to structure nursing assessments. For example, an holistic, generalized framework would be used for a first home visit; a validated scale or tool appropriate to the clinical context would be used to assess level of consciousness or pain. Representation of assessment findings is part of the subject of ISO/TS 22789.

Nurses may undertake diagnostic assessments related, for example, to growth and development, behaviour, parenting capacity, family functioning etc., often in collaboration with mental health or social care professionals. In assessing the subject of care's responses to health problems and as part of their collaborative role with doctors, nurses often address aspects of illness or injury management in their assessments. Examples include: assessing risks for complications of treatment; monitoring treatment progress; assessing the person's ability to carry out treatment plans. With appropriate education, nurses

in some countries perform assessments and investigations for the specific purpose of diagnosing and treating "medical" disorders. Representation of such diagnoses is not in scope for this International Standard.

Assessment data are interpreted by the nurse, usually in discussion with the subject of care, and a conclusion is reached i.e. a clinical judgement is made. In many countries, this judgement is called a nursing diagnosis. In others it is referred to as a nursing problem or nursing need. In this International Standard, these latter terms are regarded as synonyms for nursing diagnosis which is defined as: *a label assigned to an assessment finding, event, situation or other health issue to indicate that it is considered by the nurse and the subject of care to be noteworthy.*

The record of a nursing diagnosis may include, in addition to the diagnostic statement, the causes / contributing factors and the assessment data that support the judgement. NANDA-International refers to these as "related factors" and "defining characteristics" respectively.[27] The complete statement informs decisions about what action to take, for example, "pain in the arm related to the splint rubbing" would require different action than "pain in arm related to fracture".

Given the wide variety of possible causes of each diagnosis, terminologies supporting representation of nursing diagnoses would not generally include pre-coordinated expressions for these related factors and defining characteristics — representation of these relationships are handled in the information model of applications. Decision support tools that aid practitioners in making clinical judgements may use the coded representation of the nursing diagnosis to create links between the diagnosis in the electronic record and the knowledge support function.

B.3 Goals / expected outcomes

The nursing diagnosis is used as the basis for agreement of goals or expected outcomes with the subject of care when this is appropriate. Explicit goal statements enable a shared understanding of what can be expected by all parties. Expressions of goals can be seen as future findings or diagnoses, for example, "body temperature less than 38°"; "no pain"; "able to manage stairs". The Nursing Outcome Classification uses the notion of "target outcome rating"[28]. As for actual outcomes (see B.5), an expected outcome/goal can be expressed as a (future) assessment finding or a (future) nursing diagnosis and defined as: *a label assigned to an assessment finding or a nursing diagnosis to indicate the expectation that it will be achieved by performance or explicit non-performance of specified actions.*

In the electronic record, the goals (future findings or diagnoses) must not be confused with current or past findings and diagnoses. Differentiating these is normally managed in the information model, for example, using the HL7 mood code.

B.4 Care planning and nursing actions

B.4.1 Care planning

Nursing care planning is a process of decision making that results in an agreed schedule of actions to be taken to address the subject of care's nursing diagnoses. As with other elements of the care process, planning is often collaborative and frequently involves the subject of care and those who support them. Decisions about nursing actions are based on evidence-based guidelines (where these exist), as well as on knowledge of what is effective for these diagnoses and what has been effective for the subject of care in the past. It should be noted that assessment, planning and action may be virtually instantaneous in an emergency situation so there may not be an explicit plan.

The term "care plan" usually refers to the written record of the schedule of actions to be taken. The nursing care plan is a communication tool that is used to make clear to all concerned who will be doing what, when and how. It can be as simple as a checklist or as complex as a step-by-step statement of a procedure with timed goals and expected outcomes: the detail and complexity of the plan depends on the communication need. Care plans may be based on standard plans or pathways of care - these set out detailed steps for the management of patients with a particular problem or who are undergoing a specific procedure. These can be imported into the record (instantiated) and may be adapted to the

specific needs of the subject of care. In some countries, this kind of *schedule of actions to be taken* in a specific context is referred to as an "order set".

A format for recording care plans will vary depending on professional regulations, practice standards and clinical settings. Among the elements that may be found in a recorded care plan are:

— Goals/expected outcomes

— Conditional actions (If…..then….)

— A review date

— Names of individuals responsible for carrying out specific actions

— Identification of equipment/products required by the service user

— Locations for actions

Where there is a requirement for coded nursing actions, action expressions from an appropriate terminology may be used to populate the relevant parts of the plan.

B.4.2 Nursing actions

The schedule of actions to be taken will include different kinds of actions such as investigations, assessments, care, treatment, education and referral. It may include explicit statements about "no action" and "actions not to be done". These latter kinds of actions are not in the scope of the IS as solutions for managing these kinds of expressions in terminologies and information models is limited. They are not addressed to any significant degree in any of the nursing terminologies reviewed as part of the development and revision of this International Standard. The context model in SNOMED Clinical Terms (SNOMED CT)[29] includes aspects of negation and this is another area where the relationship between the terminology and the information model needs to be made clear.

The record may contain actions that happened in the past, are currently in progress, were stopped before completion, are planned for the future etc. Differentiating these "action statuses" needs to be managed either in the terminology or in the information model. To support use in all these contexts, past tense verbal forms should not be used, nor should order/instruction forms of words such as *monitor* and *remove*. Examples: *performance* rather than *performed* or *perform*; *assessment* rather than *assessed* or *assess*.

The term "nursing intervention" is sometimes used as a synonym for nursing action. For example, in Version 1 of the International Classification for Nursing Practice (ICNP), a nursing intervention was defined as *an action taken in response to a nursing diagnosis in order to produce a nursing outcome*.[30] Saba defines a nursing intervention as *a single nursing action — treatment, procedure or activity - designed to achieve an outcome to a diagnosis*.[31] The definition from the Nursing Interventions Classification[32] is *any treatment, based upon clinical judgment and knowledge that a nurse performs to enhance patient/client outcomes*. These examples do not explicitly include assessment or evaluation actions which are key components of nursing practice and are included in nursing records. Nor do they include care planning and other care co-ordination activities. It is for this reason that the term "nursing action" is used in this International Standard to include assessment, evaluation and planning actions as well as those more direct interventions, for example, those that include the actions of "caring for", "administration", "removal", "teaching", "feeding", "performance".

The International Council of Nurses (ICN) notes that the scope of nursing practice includes "*promotion of a safe environment, research, participation in shaping health policy and in patient and health systems management*"[23]. These are broader nursing activities that would not normally be recorded in the health record and are therefore out of scope for this standard.

B.5 Evaluation and outcomes

Evaluation of progress and of the effectiveness of care is an ongoing part of the care process. Monitoring the subject of care's responses to nursing actions enables these to be changed or discontinued if they are ineffective or no longer needed. In nursing, outcome evaluation is a process that involves re-assessing the relevant aspects of the subject of care's state, behaviour, knowledge, etc. and comparing the findings with previous findings or goals/targets. The person's own evaluation of progress and outcomes is an essential consideration for nurses. Differentiating outcomes that are the result of nursing actions from those that result from actions by others (including by the person) is a complex issue and out of scope for this discussion.

In the Nursing Outcomes Classification (NOC)[28], an outcome is defined as *a variable concept representing a patient or family caregiver state, behaviour, or perception that is measurable along a continuum and responsive to nursing interventions*. Indicators and rating scales relevant to the outcome are used to evaluate positive or negative changes or no change in status as a result of nursing interventions. A similar approach is used in the Omaha System[33] where a problem rating scale for outcomes is specified. The International Classification of Functioning, Disability and Health (ICF) uses qualifier scales to support measurement at individual and population levels, including for outcome evaluation.[34] In the ICNP and Clinical Care Classification outcomes are defined in relation to nursing diagnoses i.e. a nursing outcome is the "*measure or status of a nursing diagnosis at points of time after a nursing intervention*"[35].

Analysis of NOC and Omaha System outcome expressions according to the models in this International Standard and ISO/TS 22789 indicate that they comprise a focus (for example, *Knowledge: treatment regimen*) and a measurement result (for example, *extensive*). In SNOMED CT these would be identified as "observable entity" and "value" concepts.[22] Completing the outcome evaluation requires a comparison to be made with previous ratings to evaluate change / no change in status. Expressions for recording this status evaluation are not described in the literature but can be assumed to be general outcome statements such as improved, no change, worsened. For example, *Knowledge: treatment regimen — improved*.

Based on this analysis, an outcome of nursing can be described as *a judgement that identifies the extent of change in a finding or nursing diagnosis or the achievement of goals/expected outcomes*. Several patterns for expressions of outcomes of nursing can therefore be identified:

1. Change/no change in a finding measured or observed before and after nursing action

Example 1:

Finding 1: *sleeps 2-3 h per night*;

Finding 2: *sleeps 6 h per night*

Outcome = *improved sleep pattern*

Example 2 (based on "scale" models):

Initial rating: *knowledge: treatment regimen – limited (e.g. scale score 2)*

Subsequent rating: *knowledge: treatment regimen – extensive (e.g. scale score 5)*

Outcome = *improved knowledge about treatment regimen*

2. A measure of status in a nursing diagnosis at a point in time after a nursing intervention

Example:

Diagnosis 1: *extremely disturbed sleep*

Diagnosis 2: *mildly disturbed sleep*

Outcome = *improved sleep pattern*

3. Achievement of, or progress towards, a goal/expected outcome. This will be identified by change/no change in a finding measured or observed before and after action.

Example:

Goal: *to sleep at least 5 h per night*.

Finding after intervention: *sleeping 6 h per night*.

Outcome = *goal achieved.*

These patterns mean that the categorial structure for nursing diagnosis (including clinical findings) is sufficient to guide representation of outcomes and expected outcomes of nursing in health informatics terminological systems; therefore a separate categorial structure is not required. There may be a need for general expressions in terminologies supporting recording of achievement of or progress towards goals/expected outcomes e.g. “goal achieved”, “goal partially achieved”.

B.6 Relationships among diagnoses, actions and outcomes

B.6.1 In practice

Types of concepts that are important for representing nursing practice in electronic health records and communications (and therefore for inclusion in terminologies) are listed below with their relationships noted:

— **Assessment findings**: data that result from nursing assessment actions.

— **Nursing diagnoses**: judgements about assessment data; they form the basis for setting goals and deciding on nursing actions

— **Goals** (expected outcomes): findings or nursing diagnoses that are anticipated as future results of assessments; Goals are based on diagnoses and assessment data and help inform decisions about actions

— **Nursing actions** that are planned and carried out (or abandoned, partially completed etc.). They are based on nursing diagnoses and goals.

— **Outcomes:** judgements about changes in findings or nursing diagnoses or achievement of goals/outcomes identified through assessment following nursing actions.

B.6.2 In terminologies

Patient record systems and decision support functionality may require linkages between: findings and diagnoses; diagnoses, goals and outcomes; diagnoses, actions and outcomes; etc. For example, nurses may want to be prompted to consider specific evidence based actions for a particular diagnosis. Researchers may wish to investigate the relationship between one nursing action and different outcomes. These kinds of linkages are specified in knowledge resources such as practice guidelines and relationship specifications[36]. Linkages among these different elements in electronic applications are managed in the information model, not in terminological systems.

In summary:

— Representation of nursing diagnoses and nursing actions is the subject of this International Standard.

— Representation of findings is the subject of ISO/TS 22789:2010, *Health informatics: Conceptual framework for patient findings and problems in terminologies.*

— Designation or labelling of findings or nursing diagnoses as goals or outcomes are normally managed through the information model e.g. HL7 mood code.

— "States" of findings and diagnoses (presence, absence, negation, certainty, past or present occurrence etc.) are out of scope for the Standard. They may be managed in the terminology or in the information model – where terminologies include this component, there needs to be implementation guidance for managing any overlap.

— Statuses for nursing actions (planned, started, completed etc.) may be managed in the terminology or in the information model – where terminologies include this component, there needs to be implementation guidance for managing any overlap.

— Knowledge relationships among the elements of the care process are managed in the information model, not in terminological systems.

Annex C
(informative)

Guidance notes for using categorial structures

NOTE Examples used in Annex C are illustrative and do not imply ISO support for any specific terminological system.

C.1 What are categorial structures?

Everyday understanding of the world is based on our ability to group things according to their common characteristics. We can visualize and talk about trees because we know the characteristics that trees have in common – wooden roots, trunks and branches. Being able to categorize things according to their shared characteristics helps us to organize our thoughts and makes communication possible.

The categorial structure is one approach to organizing concepts that represent things of interest in a particular subject field (such as nursing). It was first considered in Europe as a practical way to support the harmonization of clinical terminologies that existed already and were continuing to be developed[37].

Categorial structures can be seen as high level models of categories, or *types of concepts* and the relationships among them. In the tree example, the hypothetical category "plant" (e.g. tree) might be related to another category "substance" (e.g. wood). In the categorial structure for nursing diagnosis "subject of care" is a type of concept that can be related to a "focus". Types of concepts (i.e. categories) that can take the role of "focus" include: "property" (e.g. colour, height) and "behaviour" (e.g. treatment compliance, risk taking).

A categorial structure describes the main properties for a terminology in the stated subject field, covering:

a) the list of categories (e.g. "subject or care", "behaviour", "judgement")

b) the list of representation relations between the categories (e.g. hasFocus, hasSite)

c) the goal (purpose and scope) (e.g. representation of nursing diagnoses in terminological systems)

d) the minimal constraints (rules) for the generation and validation of well formed terminological phrases.[38]

An example of a minimal constraint is: "*all nursing diagnosis expressions must have either a descriptor for a clinical finding or descriptors for both focus and judgement*".The categories represented in health informatics terminologies need to be organized in ways that will support the specific requirements that users have. For example, "routes of drug administration" need to be listed separately from "devices for drug administration" so that a system designer can correctly populate picking lists in a prescribing system. Organizing all the different "routes of administration" in a parent/child (isA) hierarchy supports the requirement to, for example, analyse data by whether the route was enteral or parenteral.

All health informatics terminologies have an underlying structure (sometimes referred to as a "terminology model"), which ideally should be explicitly stated. Specifying a standard, high level categorial structure (a "model for terminology models") for a specific subject field supports interoperability among health informatics systems in that field (see Clause 1).

C.2 Use of categorial structures

C.2.1 For terminology development and review (conformance)

A category in a categorial structure might provide the heading for a hierarchy or list of concepts within a terminology. For example, in the 7-axis representation of the International Classification for Nursing Practice (ICNP), there is a hierarchy ("axis") for focus terms and one for judgement terms[35]. In any terminology that claims conformance to the categorial structure for nursing actions, for example, you would expect to see, at a minimum, hierarchies of concepts, either explicitly or implicitly organized along the following axes: actions, targets, sites, routes and means.

The rules (constraints) for relationships in the terminology should also be consistent with those in the Standard, as in the ICNP example where those developing nursing diagnoses for ICNP catalogues must include a term from the focus axis and a term from the judgement axis[37].

The first step in reviewing a terminology for conformance is to identify the components of the terminology model i.e. its categorial structure. In many cases, the model may be implicit - the goal of this standard is to drive interoperability by requiring terminology developers to make their models explicit. Note that the names for categories / hierarchies may differ, for example, in SNOMED CT[22] the "observable entity" hierarchy is similar to the "focus" category in this standard. As when mapping between elements in terminologies, the comparison must be done on the concepts (as clarified in definitions) rather than on the name of the hierarchy. Note also that terminologies supporting representation of nursing diagnoses and nursing actions in electronic records may have more categories than those specified in the Standard.

C.2.2 For establishing relationships between terminologies (supporting mapping)

Mapping means "*assigning an element in one set to an element in another set through semantic correspondence*" (www.skmtglossary.org). There are a number of reports where "semantic correspondence" has been established between two or more terminologies using the categorial structure to undertake dissections of pre-coordinated expressions from the terminologies.

Dissecting an expression reduces it to its atomic content, allowing easier comparison between expressions in one terminology and those in another. Some examples:

urethral catheterization
- hasAction: insertion
- actsOn: urethral catheter

insertion of urethral catheter
- hasAction: insertion
- actsOn: urethral catheter

risk of raised body temperature
- hasFocus: body temperature
- hasJudgement: raised
- hasPotential: risk for

risk of pyrexia
- hasFocus: body temperature
- hasJudgement: raised
- hasPotential: risk for

removal of tracheal tube
- hasAction: removal
- actsOn: tracheal tube

tracheal extubation
- hasAction: removal
- actsOn: tracheal tube

It also allows comparison to identify when expressions are not the same as in this example:

ineffective family coping
- hasFocus: coping
  - hasSubject of Care: family
- hasJudgement: ineffective

ineffective coping
- hasFocus: coping
  - hasSubject of Care: individual
- hasJudgement: ineffective

Published reports on the use of ISO 18104:2003 for establishing relationships between terminologies are included in the Bibliography. In addition, a number of unpublished reports were made available to the expert group preparing this revision. Work by Bousquet et al.[38] to relate two terminologies for representing adverse drug reactions is another example of the use of categorial structures for this purpose. These works were undertaken for different reasons but the process was similar and the lessons learnt about the process are useful to others attempting mapping work. In summary:

— Licences may be required to use particular terminologies for mapping purposes.

— Mapping may be undertaken to produce maintained mapping products in a form that can be implemented in applications or it may be undertaken as a "paper exercise" for a specific purpose such as comparing coverage for a specific domain.

— Comparison between elements must be based on the concept meaning (as clarified in definitions) not on the term.

— Independent comparison by more than two experts followed by consensus activity leads to a better result.

— Those undertaking the mapping should have expertise in both source and target terminologies and in doing dissections.

— Mapping activity provides useful quality checks on terminologies leading to improvement ("mutual enhancement")[39] — results should be fed back to the terminology owners.

C.2.3 For informing design of system content

Informal feedback during the review of the 2003 edition of this International Standard indicated that providers of health informatics systems valued the categorial structure for nursing diagnoses and nursing actions, as it provides a nursing model framework for use as the foundation for the internal terminology structure in the system. It also allows the system provider to explain and justify the rationale behind the terminology infrastructure.

The categorial structure itself is a foundational element for the necessary categorial structures expressed within information models and other content models (e.g. clinical decision support rules, clinical process definitions) that utilize a terminology to consistently express their content. It helps define a minimum data set and data relationships. The underlying terminology model drives data collection of terminology-based, standardized, structured data essential to driving system behaviour, communicating consistently with end users, supporting secondary data use, and the sharing of actionable data with other health informatics systems. By converging on a standardized categorial structure for terminology within health informatics systems, the interoperability of nursing data, a key objective of this ISO Standard, is facilitated.

The immediate and direct assimilation and use of a standard categorial structure is not often practical, however. Existing health informatics system implementations are difficult and expensive to change at the data and content levels. But at some level, system content can be informed by such a standard. Specifically, it provides a common reference point for mapping to external systems, each with their own varying terminologies. End users of the health informatics system can continue to use their existing local vocabularies, and still consistently communicate with other systems, end users, organizations, and patients. However, if there are severe discontinuities between existing system content and the standard, an effective and accurate mapping may not be possible without losing meaning.

Design strategies that may be considered include:

— The simplest case is where the development of new health informatics function allows the direct assimilation of a complete categorial structure for terminology. By directly adopting the Standard, analysis and development time and expense are reduced. Also, the more that a solution conforms to the Standard, the easier it will be to support interoperability and multidisciplinary care.

— Where gaps in categories exist within existing system structures, they can be added in conformance to those in the categorial structures in the Standard. The additional data provides richer content for driving decision support, general performance management, and research.

— Where finer grained categories than those in the Standard exist in the system, maps can be defined to more general categories within the Standard, as described in C.2.2, for interoperability.

— Where coarser grained categories exist in the system, the finer grained categories in the Standard can possibly be added. This decomposition will ultimately be necessary to achieve interoperability across systems. The Standard Categorial Structure represents a minimum. In the interim, mapping may not be possible, and meaning is lost in the transfer of data across systems.

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