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Chapter 15

The Role of Standardized Terminology and Language in Informatics

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Learning Objectives

After completing this chapter, you should be able to:

- Explain standardized healthcare terminology and its importance to nursing.
- Describe the American Nurses Association (ANA) criteria established for recognizing standardized terminologies.
- Describe each of the ANA-recognized terminologies and the benefits of use when implemented within an electronic healthcare record system.
- Discuss standardized terminologies used for the different parts of the nursing process and their similarities and differences.
- Define the different types of terminology structures, such as a classification system (e.g., NANDA, NIC, or NOC) versus a reference terminology (ICNP, or SNOMED CT).
- Demonstrate how standard terminologies facilitate the use of evidence-based practice and decision-support rules.
- Illustrate how using standardized healthcare terminologies correlates to the US meaningful use criteria.
- Identify the benefits of using structured terminologies within electronic healthcare record systems.

Introduction to Terminology

Person-centered care requires treating patients in a variety of settings across the entire healthcare continuum, and necessitates the ability to share the most accurate and up-to-date information among a multitude of providers and care settings (Payne et al., 2015). The current state of information use in the healthcare community is evolving from paper-based

to computerized records. The introduction of computerized information systems and their increasing use has amplified the need for structured and controlled vocabularies that can be used to represent care.

Standardized Terminology

Standardized terminologies have been developed for use within electronic health record systems (EHRSs). **Standardized terminologies** are structured and controlled languages developed according to terminology-development guidelines and approved by an authoritative body (Healthcare Information and Management Systems Society, 2013). These terminologies are often referred to as controlled terminologies.

Healthcare-terminology standards are designed to enable and support widespread interoperability among healthcare-software applications for the purpose of sharing information. The use of standardized terminology is a means of ensuring that the data collection is accurate and valid (Payne et al., 2015; Westra, Delaney, Konicek, & Keenan, 2008). The requirement for standardized-terminology development has increased tremendously to support the use of national and international health-information standards.

Standardized terminology is essential for successful development and implementation of an EHRS. Terminology is required to represent, communicate, exchange, manage, and report data, information, and knowledge. It enables safe, patient-centric, high-quality healthcare that optimizes data collection for the measurement of patient outcomes. EHRSs can no longer be developed or implemented without standardized terminologies. Data exchange between EHRS must take place without loss of meaning. Data sharing and reuse that address the effectiveness and efficiencies of care are greatly enhanced when data are defined using common terminologies (McCormick et al., 2015).

The implementation of standardized terminology within an EHRS is essential for healthcare organizations to meet the criteria of meaningful use. The American Recovery and Reinvestment Act of 2009 defined **meaningful use** as a certified EHRS used in a meaningful way. Meaningful use was one piece of a broader health information technology (HIT) infrastructure needed to reform the healthcare system and improve healthcare quality, efficiency, and patient safety (Health Information Technology, 2015). One of the primary criteria identified for meaningful use is the use of standardized terminologies. The goal of meaningful use is to exchange clinical structured data in a manner that is accurate and complete to improve patient care in a cost-efficient way.

TERMINOLOGY DEFINITIONS Before discussing specific terminologies, some basic elements need to be explained: concepts, codes, and the different types of terminologies. A **concept** is an expression of an idea with a single unambiguous meaning (International Organization for Standardization/International Electrotechnical Commission 17115, 2007). Clinical concepts are used to document ideas related to patient care or express orders, assessment, and outcomes within an EHRS. A concept can have one or more representations, called synonyms or terms. Concepts have unique identifiers known as codes. **Codes** are made up of letters or numbers, or a combination of both. Codes are used to designate concepts in a computer system (de Keizer, Abu-Hanna, & Zwetslook-Schonk, 2000). A concept with an assigned code is considered **codified.** Concept codes facilitate the development of evidence-based practice and decision-support rules; reporting of administrative and financial standards for diagnoses, procedures, and drugs; and the core quality measures. Codified data is used to track key clinical data such as disorders, nursing problems, allergies, procedures, and signs and symptoms. Providers use the collected data for activities such as care coordination, data mining, reporting of clinical-quality measures, and public-health information. Although many individuals

working within the healthcare industry recognize coded data only as a source for determining reimbursement, health-information-management professionals have always understood the many uses of coded data.

Clinical terminology enables the capture of a patient's data at the level of detail necessary for patient-care documentation, and is used to describe health conditions and healthcare activities (International Organization for Standardization/International Electrotechnical Commission 17115, 2007). Clinical terminologies consist of concepts that support diagnostic studies, patient history, physical examinations, visit notes, ancillary-department information, nursing care, assessments, flow sheets, vital signs, and outcome measures. A clinical terminology can be mapped to a broader classification system for administrative, regulatory, and fiscal reporting requirements (Giannangelo, 2014).

TYPES OF TERMINOLOGIES Different types of clinical-terminology systems used in healthcare were described by de Keizer et al. (2000), and are still referenced and relevant today. Table 15-1 outlines the terminology types.

A **classification system** is used to categorize the details of a clinical encounter. It does not capture the level of detail necessary to document specific items at the point of care. Classifications consist of mutually exclusive categories that can be used for specific purposes. An example would be to group data to determine costs and outcomes of treatment. This kind of classification could provide data to consumers on costs and outcomes of treatment options. The International Classification of Diseases (ICD), which is a classification system, does not consist of definitions or definitional relationships between terms such as "has body location."

The term **ontology** is frequently used within the HIT world. Ontologies help to facilitate interoperability because concepts are organized by their meanings to describe the definitional structure-relationship. Ontologies contain machine-processable definitions in the form of relationships; for example, the concept of *finger* is a part of the concept of *hand*. Ontologies also organize concepts for storage and retrieval of consistent well-formed data. Using the previous example, the ontology can be queried to find the concepts that are defined as *a part* of the *hand*. The concepts returned would include "thumb," "pointer finger," and so on. The concepts in the ontologies have unique codes.

REFERENCE VERSUS INTERFACE TERMINOLOGY Terminologies are used two different ways within EHRSs: first, as a reference terminology, and second, as an interface (point of care) terminology. A **reference terminology** consists of a set of concepts with definitional relationships. A reference terminology is necessary to analyze data, develop evidence-based practice, and improve the quality of care. A reference terminology is frequently an ontology and can, therefore, be used to support data aggregation, disaggregation, and retrieval.

Table 15-1 Types of Standardized Healthcare Terminologies

Types of Terminology	Description	Example
Nomenclature	A set of terms composed according to pre-established rules	LOINC, NANDA-I
Terminology	A set of terms representing concepts in a particular field or domain; for example, nursing problems and nursing observations	
Vocabulary	A terminology accompanied by definitions or descriptions	NANDA-I
Classification	An arrangement of concepts based on essential characteristics and arranged in a single hierarchy	ICD, CPT, NIC, NOC
Ontology	A set of concepts formally organized by meaning	SNOMED CT, ICNP

A reference terminology is used to retrieve data across healthcare settings, domains, and specialties in a standardized manner. In a work that remains relevant through the present, Rosenbloom, Miller, Johnson, Elkin, and Brown (2006) stated that an **interface terminology** is what the clinicians see on the screen, and it consists of terms with which clinicians are familiar. It is usually made up of synonyms from the reference terminology and supports the entry of patient-related information into EHRSs. To illustrate: the reference term for a prothrombin-time blood test is "Coagulation tissue factor induced" and the interface term the providers see on their screens is "Protime."

TERMINOLOGY-DEVELOPMENT GUIDELINES Standard terminologies are developed according to terminology-development guidelines. These guidelines, or rules, were clearly articulated by Cimino (1998) and have been adopted as a gold standard in the healthcare industry for evaluating terminologies. Table 15-2 depicts these guidelines.

TERMINOLOGY AND NURSING For years, nurses have expressed nursing care using different terms to say the same thing. Standardized nursing language is a common language, readily understood by computers and nurses, that is used to describe care (Thede & Schwirian, 2014). A uniform representation of nursing care supports a complete and unambiguous description of how nursing problems, interventions, and outcomes are documented. The use of coded standardized terminology for nurses is vital to bedside nursing and to the nursing profession. It is essential because it enables consistent use of terminologies across clinical settings and specialties. The use of standardized nursing terminology will result in better communication to the interdisciplinary team, an increase in the visibility of nursing interventions, enhanced data collection used to evaluate and analyze patient-care outcomes, and

Table 15-2 Cimino's 12 Terminology Development Guidelines

Guideline	Explanation
1. Content	Healthcare terminologies should be rich in content.
2. Concept orientation	Healthcare terminologies should be based on concepts, rather than on terms. Terms must correspond to at least one meaning (nonvagueness) with no more than one meaning (nonambiguity). The meanings correspond to no more than one term (nonredundancy).
3. Concept permanence	Once a concept enters a terminology, it should not be deleted or reused.
4. Nonsemantic concept identifier	Concept identifiers are the codes that identify concepts in a terminology. The code must have no meaning, and each concept must have a unique identifier.
5. Polyhierarchy	A strict hierarchy consists of a root concept used for traversing the hierarchies.
6. Formal definition	Formal definitions add semantic exactness to a terminology by making the relationship between concepts explicit.
7. Reject "not elsewhere classified"	The problem with such terms is that they can never have formal definition other than one of exclusion.
8. Multiple granularities	Terminologies should not restrict users or applications to terms at some particular level of granularity.
9. Multiple consistent views	It should be possible to view the concept hierarchies in multiple consistent ways.
10. Beyond healthcare concepts representing context	Terminologies should not specify how different pieces on clinical information are related.
11. Evolve gracefully	The terminology should allow for long-term growth.
12. Recognize redundancy	Redundancy is the condition in which the same information can be stated in two different ways.

greater support of adherence to the standards of care. Furthermore, the use of standardized nursing terminology can be used to assess nursing competency.

The need for standardization in nursing documentation is critical to support interoperability—the ability to share comparable data with other healthcare organizations via electronic transmission. The collection of standardized nursing-care documentation can enable a comparison of different terminologies that can be used to research patient-care outcomes nationally and worldwide. Given the federal requirements to EHRSs, there is a need to establish standards for the implementation of terminologies within an EHRS. Healthcare terminology needs to be universally understood across all healthcare providers and organizations in order for healthcare systems to be interoperable and to uniformly exchange data. To accomplish interoperability, standardized clinical terminologies must be implemented within EHRs (McCormick et al., 2015).

Languages and Classification

Billing Codes

Healthcare encounters are coded for billing by code sets mandated by the Health Insurance Portability and Accountability Act (HIPAA). HIPAA mandates that all electronic transactions include only HIPAA-compliant codes (Giannangelo, 2014). The code sets described here are the ICD, Current Procedural Terminology (CPR) codes, and the Alternative Billing Codes (ABC). These codes are used to classify and catalog diseases and procedures. These code sets are reviewed and subject to modification annually. Use of billing codes at the point of care is discouraged, but some systems use them to build problem and procedure lists. This chapter will give only a brief overview of the code sets and is not intended for training of health-information-management professionals.

INTERNATIONAL CLASSIFICATION OF DISEASES The **International Classification of Diseases (ICD-10)**, developed by the World Health Organization (World Health Organization, 2016) is the international standard diagnostic classification for health-management purposes, and clinical use. The ICD diagnoses are used to classify mortality and morbidity data from inpatient and outpatient records. They are used to classify diseases and other health problems recorded on many types of health- and vital-statistics records, including death certificates. In addition to enabling the storage and retrieval of diagnostic information for clinical, epidemiological, and quality purposes, these records also provide the basis for the compilation of national mortality and morbidity statistics used throughout the world.

The original intent of ICD was the creation of diagnostic and procedural coding for statistics and research. Since 1983, ICD has also been used for reimbursement. In October 2015, the United States transitioned to a US-specific version known as ICD-10-CM/PCS. ICD-10 contains two different code sets: *International Classification of Diseases, 10th Revision: Clinical Modification (ICD-10-CM)*, and *International Classification of Diseases, 10th Revision: Procedure Coding System (ICD-10-PCS)*.

ICD-10-CM replaces ICD-9-CM volumes 1 and 2. ICD-10-CM is the version used in the United States to identify diagnosis reimbursement codes in all healthcare settings. Two departments within the Department of Health and Human Services (DHHS)—the Centers for Medicare and Medicaid Services (CMS) and the National Center for Health Statistics (NCHS)—develop and maintain the ICD-10-CM official Guidelines for Coding and Reporting. The guidelines should be used as a companion document to the official version of ICD-10-CM. WHO requires that mortality data be submitted as ICD-10. ICD-10-CM contains

more than 69,000 codes, whereas ICD-9 contained more than 14,000 codes. The official ICD-10-CM is currently comprised of the following three volumes:

Volume 1: Tabular List—contains an alphanumeric list of ICD-10 codes arranged by chapter

Volume 2: Instruction Manual—contains instructional materials as to how to use volumes 1 and 3

Volume 3: Alphabetical Index—contains alphabetical index to diseases, disorders, injuries, and other conditions found in volume 1.

ICD-10-PCS replaces ICD-9 Volume 3 Procedure Codes. ICD-10-PCS is used by facilities to report procedures in the hospital inpatient setting. The PCS codes are not required for outpatient settings.

The ICD classification system consists of a monohierarchy, which means that the concepts are classified by a disease header with the disease variations underneath. The monohierarchy provides a means of data collection against one point of view. The collection of the ICD data does not support the specificity necessary for clinical description of patients, research, quality analysis, and health-policy development. The structure of ICD-10-CM codes has increased from three to seven characters. Table 15-3 provides some examples of ICD-10-CM codes and one example of an ICD-10-PCS code.

CURRENT PROCEDURAL TERMINOLOGY CODES The American Medical Association (AMA) **Current Procedural Terminology (CPT)** is a classification system used for billing and reimbursement of outpatient procedures and interventions. CPT is the most widely accepted medical nomenclature used to report medical procedures and services under public and private health-insurance programs. CPT codes are used to code all medical procedures performed in healthcare, except for alternative medicine. CPT code sets are copyrighted by the AMA and are released once each year.

Table 15-3 Examples of ICD-10-CM Codes (Version: 2016)

ICD-10-CM	Diagnosis
P00-P96	Chapter XVI—Certain conditions originating in the perinatal period
P00-P04	Fetus and newborn affected by maternal factors and by complications of pregnancy, labor, and delivery
P02	Fetus and newborn affected by complications of placenta, cord, and membranes
P02.7	Fetus and newborn affected by chorioamnionitis
E00-E90	Chapter IV Endocrine, nutritional, and metabolic diseases
249-259.99	Diseases of other endocrine glands
E10	Type 1 diabetes mellitus
E10.1	Type 1 diabetes mellitus with ketoacidosis
ICD-10-PCS	**Procedure**
	Resection of Gallbladder, Percutaneous Endoscopic Approach
1 = Section	B = Medical and Surgical
2 = Body System	F = Hepatobiliary System and Pancreas
3 = Root Operation	0 = Resection (Cutting out or off, without replacement, all of a body part)
4 = Body Part	3 = Gallbladder
5 = Approach	Y = Percutaneous Endoscopic
6 = Device	Z = No Device
7 = Qualifier 3	Z = Qualifier

Source: From International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)-WHO Version for; 2016. Published by WHO.

Table 15-4 Examples of CPT Codes

CPT Code	Description
Level 1: 80000–89398	Pathology and laboratory tests
Level 2: 81000–81099	Urinalysis procedures
81015	Urinalysis; microscopic only
81005	Urinalysis; qualitative or semiquantitative, except immunoassays
Level 2: 80100–80103	Drug testing
80100	Drug screen, qualitative; multiple drug classes, chromatographic method, each procedure

Source: From CPT Code.Published by AMA.

The CPT listings have divisions including: evaluation and management, anesthesia, surgery, radiology, pathology, and laboratory and medicine. Within these divisions are subsections that include section headings, subsections, categories and subcategories, guidelines, symbols, colons, semicolons, modifiers, appendices, indices, and examples. For example, CPT codes that fall under the pathology and laboratory category range in number from 80048 to 89356. If a urinalysis was done under this category, the code would range from 81000 to 81099, and is classified according to the specific type of urinalysis performed, for example: urinalysis microscopic. The range's specific details or procedures dictates the precise number. When trying to locate a surgery code (10000 to 69999), locate that section's heading and find the corresponding subheading to classify what type of procedure was conducted and where on the body it was performed. For example, if a procedure took place within the patient's integumentary system (10040 to 19499), and an excision was done on a benign lesion (11400 to 11471), detail should be coded regarding where the incision was made and how big it was. Table 15-4 displays some examples of CPT codes.

Clinical Terminologies

Clinical terminologies are those used for documenting patient care within an EHRS. This section will give a brief overview of two categories of clinical terminologies: multidisciplinary and nursing specific.

Most of the terminologies discussed here are listed as source vocabularies within the **Unified Medical Language System (UMLS)** developed by the National Library of Medicine (NLM). The UMLS is a large metathesaurus that contains more than a hundred source vocabularies (National Library of Medicine, 2016a). The NLM provides a web-based application to the UMLS with which users can do multiple types of searches, such as finding synonymous terms from two or more sources and the association between concepts (NLM, 2016b).

The American Nurses Association (ANA) recognizes terminologies appropriate for use by nursing (American Nurses Association, 2014). Terminologies must meet defined criteria for approval. The criteria specify that terminologies must be used to support nursing practice that reflects the nursing process. The nursing-process data elements include assessment, diagnosis, outcome identification (goal), planning, implementation (interventions), and evaluation. The terminologies have to contain concepts that are clear and unambiguous, with a unique identifier. The terminology developer should have outlined processes for maintenance and growth. The Nursing Management Minimum Data Set (NMMDS), Nursing Minimum Data Set (NMDS), and ABC are data sets approved by the ANA, but will not be discussed in this chapter. All of the approved terminologies are outlined in Table 15-5. The ANA-released a position statement supporting documentation using the

Table 15-5 ANA-Recognized Languages that Support Nursing Practice

Terminology	Website	Diagnosis/ Problem	Intervention	Outcome	Other
Alternative Billing Concepts (ABC Codes)	www.abccodes.com				Billing Codes
Clinical Care Classification (CCC)	www.sabacare.com	X	X	X	
International Classification of Nursing Practice (ICNP)	www.icn.ch/icnp.htm	X	X	X	Assessment
Logical Identifiers Names and Codes (LOINC)	http://loinc.org/			X	Assessment
North American Nursing Diagnosis International (NANDA-I)	www.nanda.org	X			
Nursing Interventions Classification (NIC)	www.nursing.uiowa.edu/cncce/nursing-interventions-classification-overview		X		
Nursing Outcomes Classification (NOC)	www.nursing.uiowa.edu/cncce/nursing-outcomes-classification-overview			X	
Nursing Management Minimum Data Set	www.nursing.umn.edu/ICNP/USANMMDS/home.html				Nursing Management Codes
Nursing Minimum Data Set	www.nursing.umn.edu/ICNP/				
Omaha System	www.con.ufl.edu/omaha	X	X	X	
Perioperative Nursing Data Set (PNDS)	www.aorn.org	X	X	X	
SNOMED CT	www.ihtsdo.org/SNOMED CT	X	X	X	

ANA-recognized terminologies, but for comparison across health systems and/or transmission, the ANA-recognized terminologies should be mapped to LOINC and SNOMED CT (American Nurses Association, 2015).

In 2015, the NLM developed a new web resource entitled *Nursing Resources for Standards and Interoperability* (Warren, Matney, Foster, Auld, & Roy, 2015). This resource provides detailed information about why particular standards are pertinent and necessary for use in nursing and nursing-care documentation. The new web page supports synonymous mappings between SNOMED CT, LOINC, and other ANA-recognized terminologies, thus providing a valuable resource for nurses.

The Office of the National Coordinator (ONC) identifies the best-available standard vocabularies, messaging structures, and implementation specifications for the healthcare industry, and outlines them in the Interoperability Standards Advisory (ISA) (Office of the National Coordinator for Health IT. 2015). The ISA functions as a roadmap to interoperability and includes standard-terminology specifications. The ISA is not a ruling in itself, but a reference, illustrating a single public list of the best-available standards and implementation specifications available for clinical health-information-interoperability needs. The most recent roadmap includes draft-terminology recommendations for nursing. The ISA endorses encoding data, collected by nurses, with LOINC and SNOMED CT.

Multidisciplinary Terminologies

SNOMED CLINICAL TERMS **SNOMED Clinical Terms (SNOMED CT)** is a globally recognized, controlled-healthcare vocabulary that provides a common language for electronic health applications. SNOMED CT enables a consistent way of capturing, sharing, and

aggregating health data across specialties and sites of care. The use of SNOMED CT within EHRSs facilitates interoperable data collection, which can be analyzed and used in the implementation of evidence-based practice, decision-support rules, reporting of quality measures, and administrative billing.

SNOMED CT is in conformance with federal regulatory standards and the Consolidated Health Informatics Initiative (Department of Health and Human Services, 2005). In 2007, the College of American Pathologists transferred the SNOMED CT intellectual property to the International Health Terminology Standards Development Organization (IHTSDO) to support the development of an international effort to produce and enhance a global clinical terminology standard (IHTSDO, 2016). The IHTSDO has developed a set of principles that guide decision making for the SNOMED CT. The IHTSDO initially consisted of nine founding-country members; this number recently increased to over 20 member-countries. Each member country has a SNOMED CT release center responsible for managing concept requests and distributing SNOMED CT. SNOMED CT is continually updated to meet the needs of users around the world. Revisions to the international version of SNOMED CT are released twice a year, once at the end of January and again at the end of July. Each release includes the core of the terminology (concepts, descriptions, and relationships), together with works to support the implementation of SNOMED CT.

SNOMED CT updates are driven by users of the terminology, who can request new concepts and submit them through the IHTSDO. Examples include refinements to descriptions, remodeling of new concepts to place them into the correct hierarchy, or the addition of new concepts. Prior to a release, SNOMED CT undergoes a clinical-quality-review process to ensure that concepts have been defined accurately.

SNOMED CT is recognized by the ANA as one of the standardized terminologies for supporting nursing practice. It is a clinical terminology comprised of codes, concepts, and relationships used in recording and representing clinical information across the scope of healthcare. It is concept-based, meaning that each concept has a distinct definition with a unique code identifier. SNOMED CT consists of 19 top-level hierarchies: procedures (medical and surgical procedures, laboratory and radiology procedures, interventions, education, and management procedures), clinical findings (nursing diagnoses, disorders, diseases that are necessarily abnormal, and signs and symptoms also known as assessments), body structures, observable entity (questions being asked during an assessment), devices, substances, and medications.

SNOMED CT hierarchies are created through defining relationships linking one concept to another concept for the purpose of defining each concept down to its specific meaning. Defining concepts by using a parent-child relationship begins to build vertical hierarchies within SNOMED CT. Concepts lower in the hierarchy are more specific in meaning than those higher up in the hierarchy, creating multiple levels of granularity. Specifying the attributes (characteristics) of each relationship further defines a given concept's meaning by connecting all the necessary and sufficient relationships between concepts required to fully represent a given concept's definition. An example of how the concept of *ineffective breathing* is mapped within SNOMED CT is illustrated in Table 15-6.

SNOMED CT is used to document care by clinicians, specialists, and practice domains using an interdisciplinary approach. It is used to document patient care across all sites of care and healthcare facilities (acute care, home care, hospice care, spiritual health, long-term care, and healthcare-clinic visits, as well as community and public health). The documentation of assessments, flow sheets, care plans, task lists, order sets, education plans, problem lists, allergies and allergic reactions, task lists, and medication-administration records can be encoded to SNOMED CT.

Table 15-6 SNOMED CT Example: Ineffective Breathing

SNOMED CT: Ineffective breathing pattern (finding)
SNOMED Concept ID: 20573003
Is_A Clinical finding
Is_A Finding related to ability to perform breathing functions (finding)
Is_A Respiration alteration (finding)
Finding Site: Structure of respiratory system (body structure)
Interprets: Ability to perform breathing functions (observable entity)

Source: Copyright by SNOMED International.

SNOMED CT updates are driven by users of the terminology, who can request new concepts and submit them through the IHTSDO. Examples include refinements to descriptions, remodeling of new concepts to place them into the correct hierarchy, or the addition of new concepts. Prior to a release, SNOMED CT undergoes a clinical-quality-review process to ensure that concepts have been defined accurately.

In March 2010, a collaboration agreement was signed between the International Council of Nurses (ICN) and IHTSDO to establish a harmonization board with the objective of future integration between ICNP and SNOMED CT (eHealthNews, 2010).

LOGICAL OBSERVATION IDENTIFIERS NAMES AND CODES **The Logical Observation Identifiers, Names, and Codes (LOINC)** is a terminology that includes laboratory and clinical observations. The laboratory portion of the LOINC database contains the usual laboratory categories such as chemistry, hematology, and microbiology. The domain and scope of clinical LOINC is extremely broad. Some of the sections of terms include vital signs, obstetric measurements, clinical-assessment scales, outcomes from standardized-nursing terminologies, and research instruments (Matney et al., 2016a). LOINC is also used for document and section names (Hyun, 2006; Richesson & Chute, 2015).

Terminology content used to document nursing assessments are contained within clinical LOINC (Matney et al., 2016a; Matney, 2003). In 2002, LOINC was recognized by the ANA. The ANA determined that both laboratory and clinical LOINC are appropriate for use by nursing. Because of their breadth and the early focus on laboratory testing, nursing-assessment observations are not yet well represented.

LOINC provides identifiers and names for observations, not values. Each LOINC record corresponds to a single observation, measurement, or test result. The record includes the axis fields specified in Table 15-7.

Nursing Terminologies

CLINICAL CARE CLASSIFICATION The **Clinical Care Classification (CCC) System** is a nursing classification designed to document the six steps of the nursing process across the care continuum (Saba, 2012). It facilitates patient-care documentation at the point of care. CCC was developed in 1991 and was last revised in 2012. The CCC consists of two interconnected terminologies, the CCC of nursing diagnosis and outcomes and the CCC of nursing interventions. The two taxonomies are tools that support the documentation of nursing care. Both terminologies are classified by 21 care components that represent the functional, health, behavioral, physiological, and psychological patterns of a patient.

CCC nursing diagnoses consist of 182 diagnostic concepts classified into 59 major categories and 123 subcategories. Outcomes are assigned by expanding the nursing diagnosis concepts with one of three qualifiers: improved, stabilized, or deteriorated.

Table 15-7 LOINC Axes with Examples

Axis	Description of the Axis	Sample Values
Component (analyte)	The substance or entity measured, evaluated, or observed	Systolic blood pressure, pain onset, and sodium
Kind of property	The characteristic or attribute of the component measured, evaluated, or observed	Length, volume, time stamp, mass, ratio, number, and temperature
Time aspect	The interval of time over which the observation or measurement was made	Point in time, and over an 8-hour period
System	The system (context) or specimen type with which the observation was made	Urine, serum, fetus, patient (person), and family
Type of scale	The scale of measure	Quantitative (a true measurement), ordinal (a ranked set of options), nominal, or narrative
Type of method	The procedure used to make the measurement or observation. Method is the only axis that is optional and is only included when different methodologies would significantly change the interpretation of the result.	Patient reported, measured

CCC uses a five-character code to codify the terminology. Each code can be decomposed to determine the meaning. The syntax of the code categorization is as follows:

Code 1 = care component

Codes 2 and 3 = major category (followed by a decimal point)

Code 4 = one digit code for a subcategory (followed by a decimal point)

Code 5 = one of three expected outcomes, *or* one of four nursing intervention types.

CCC nursing interventions consist of 198 categories classified into 72 major categories and 126 subcategories that represent interventions, procedures, treatments, and activities. The interventions can be modified by one of four intervention types: (1) assess or monitor; (2) care, direct, or perform; (3) teach or instruct; or (4) manage or refer.

CCC is an open-source terminology with no license fees. The terminology tables can be freely downloaded from www.sabacare.com. CCC is copyrighted, and its use within an EHRS requires written permission.

CCC has mappings to SNOMED CT. CCC codes can be obtained from the CCC terminology developer. CCC outcomes are mapped to LOINC and are freely downloadable from the LOINC database.

INTERNATIONAL CLASSIFICATION OF NURSING PRACTICE The **International Classification of Nursing Practice (ICNP)** is a unified nursing language system developed by the ICN in Geneva, Switzerland (International Council of Nurses, 2015). ICN is responsible for ensuring that the content reflects the domain of nursing. ICNP Version 2.0 was released in 2009. ICNP is a compositional terminology for nursing practice that facilitates the development of, and the cross-mapping among, local terms and existing terminologies. ICNP has been implemented as both an interface (ICNP Catalogues) and reference terminology.

ICNP contains nursing phenomena (diagnoses), nursing actions, and nursing outcomes (International Council of Nursing, 2015). ICNP is represented using a seven-axis model. The ICNP has developed specific guidelines for using the seven-axis model to develop nursing diagnosis, outcome, and intervention statements. The seven axes and a short description of each are listed here:

- *Focus.* The problem area or concern. Examples could include, but not be limited to, self-care abilities, pain, or knowledge deficits.
- *Judgment.* The assignment of priority to the area of concern by the nurse.

- *Means*. The method by which an intervention to address the problem area or concern is accomplished. For example, the patient with mobility issues can use a cane, crutch or walker to enhance mobility.
- *Action*. The intentional process to accomplish an intervention. With the above mobility example, the action would be to teach the patient how to use the mobility aid.
- *Time*. The relevant period or duration of the problem area or concern, whether that might be upon admission, post-operatively, or discharge. The patient with mobility issues after an injury would require instruction on crutch-walking prior to discharge.
- *Location*. The anatomical or spatial designation for a problem area or concern. As an example, the location could designate where a patient experiences pain or that the patient was sent to the physical therapy department for rehabilitation after a right total-knee replacement.
- *Client*. The individual, family, or community recipient of focus and interventions.

ICNP DIAGNOSIS

- A term from the focus axis is required.
- A term from the judgment axis is required.
- Additional terms from the focus, judgment, and other axes are included as needed.

INTERNATIONAL CLASSIFICATION OF NURSING PRACTICE

- A term from the action axis is required.
- At least one target term is required. Target terms come from all of the other seven axes except for judgment.

ICN recognized early that the terminology would need to be organized so it could be used at the point of care (Coenen & Bartz, 2010). In an ongoing process, ICNP catalogues are developed by interested parties to address specific health concerns or healthcare needs. ICNP catalogues are designed to support clinical documentation in an EHRS. The first two catalogues published by ICN were "Partnering with Individuals and Families to Promote Adherence to Treatment" and "Palliative Care for Dignified Dying." More catalogues are in development and testing. These catalogues will generate more content that nurses can use to document care.

NORTH AMERICAN NURSING DIAGNOSIS INTERNATIONAL **North American Nursing Diagnosis International (NANDA-I)** dates back to 1970 and was the first terminology to be recognized by the ANA (Gordon, 1994). A nursing diagnosis is a clinical judgment about individual, family, or community experiences and responses to actual or potential health problems and life processes.

NANDA-I diagnoses are used to identify human responses to health promotion, risk, and disease (Herdman, & Kamitsuru, 2014). Each nursing diagnosis has a description, a definition, and defining characteristics. The defining characteristics are manifestations, signs, and symptoms that assist the nurse in determining the correct diagnosis to assign.

NANDA-I is classified into 13 domains. Within each domain are two or more classes. The domains and classes have formal definitions. The following is a list of the domains. For each domain, up to two examples of the classes are shown:

Domain 1: Health Promotion—Health Awareness and Health Management

Domain 2: Nutrition—Ingestion and Digestion

Domain 3: Elimination/Exchange—Urinary Function and Gastrointestinal Function

Domain 4: Activity/Rest—Sleep and Rest

Domain 5: Perception/Cognition—Attention and Orientation

Domain 6: Self-Perception—Self-Concept and Body Image

Domain 7: Role Relationship—Caregiving Roles and Role Performance

Domain 8: Sexuality—Sexual Identity and Sexual Function

Domain 9: Coping/Stress Tolerance—Post-Trauma Responses and Coping Responses

Domain 10: Life Principles—Values and Beliefs

Domain 11: Safety/Protection—Infection and Physical Injury

Domain 12: Comfort—Physical Comfort and Environmental Comfort

Domain 13: Growth/Development—Growth

The first NANDA-I taxonomy was an alphabetical listing of the nursing diagnosis. In 2001, NANDA-I released NANDA-I Taxonomy II in which the nursing diagnoses were formatted using a multiaxial structure. The seven axes of the taxonomy are dimensions of the human response (Herdman, 2011). Table 15-8 depicts the NANDA-I axes with examples.

NANDA-I is used to document nursing diagnoses within all settings and across the care continuum. The coding system can be used within an EHRS. NANDA-I has been linked to the NIC interventions and NOC outcomes. The NANDA-I coding system can be used within an EHRS either by mapping the nursing problems that nurses document directly, or by mapping to the NANDA-I, NIC, and NOC linkages. The linkages can be loaded into an EHRS and can be used together to document the elements of the nursing process within the care plan.

NURSING INTERVENTIONS CLASSIFICATION The **Nursing Interventions Classification (NIC)** is a standardized classification of interventions that describes the activities that nurses perform. NIC is used in all care settings. An intervention is described as, "any treatment, based upon clinical judgment and knowledge that a nurse performs to enhance patient/client outcomes" (The University of Iowa, 2016a). The current NIC edition has 542 interventions (Butcher, Bulechek, McCloskey Dochterman, & Wagner, 2013). The interventions are grouped together by 30 classes and 7 domains. Each intervention includes a label name, a definition, a unique code, and associated nursing activities. There are more than 1,200 activities. Below is a list of the NIC domains:

Domain 1: Physiological: Basic

Domain 2: Physiological: Complex

Domain 3: Behavioral

Domain 4: Safety

Table 15-8 NANDA-I Axes with Examples

Axis	Description of the Axis	Sample Values
Axis 1: The diagnostic concept	The principle element or root of the diagnostic statement. May consist of one or more nouns.	Activity intolerance Fatigue Fear Pain Sorrow
Axis 2: Time	Duration of a period or interval.	Acute, chronic, short-term, long-term
Axis 3: Unit of care	Person or population for which the nursing diagnosis is determined.	Individual, family, community
Axis 4: Age	Physical development stage.	Fetus, adolescent, young adult, old, old adult
Axis 5: Health status	State of health or illness.	Wellness, actual, risk for
Axis 6: Descriptor	A modifier that limits or defines the nursing diagnosis meaning.	Ability, decrease, delayed, excessive, impaired
Axis 7: Topology	Parts or regions of the body.	Auditory, bowel, urinary, skin

Domain 5: Family

Domain 6: Health System

Domain 7: Community

The NIC coding system can be used within an EHRS either by mapping the nursing interventions and activities that nurses perform directly, or by mapping to the NANDA-I, NIC, and NOC linkages. The linkages can be loaded into an EHRS. They were developed to be used together to document the elements of the nursing process within the care plan.

NURSING OUTCOMES CLASSIFICATION The **Nursing Outcomes Classification (NOC)** is a classification system that describes patient outcomes sensitive to nursing interventions. The NOC is a system to evaluate the effects of nursing care as a part of healthcare. NOC consists of outcomes for individual patients, families, and communities. An outcome is, "a measurable individual, family, or community state, behavior, or perception that is measured along a continuum and is responsive to nursing interventions" (The University of Iowa, 2016b). NOC can be used across all clinical settings and specialties. The NOC classification is structured using three levels: domains, classes, and outcomes. The outcomes are organized into 31 classes and 7 domains (Moorhead, Johnson, Maas, & Swanson, 2013). Each outcome concept consists of a definition, a measurement scale, a list of associated indicators, and supporting references. The following is a list of the NOC domains:

Domain 1: Functional Health

Domain 2: Physiological Health

Domain 3: Psychosocial Health

Domain 4: Health Knowledge and Behavior

Domain 5: Perceived Health

Domain 6: Family Health

Domain 7: Community Health.

Each outcome, associated indicators, and measurement scale(s) are coded for use in EHRSs.

The NOC coding system can be used within an EHRS either by mapping the nursing outcomes directly, or by mapping to the NANDA-I, NIC, and NOC linkages. The linkages can be loaded into an EHRS. They were developed to be used together to document the elements of the nursing process within the care plan.

THE OMAHA SYSTEM The **Omaha System** is a taxonomy that provides a framework for integrating and sharing clinical data. As noted by Martin (2005), and still true today, it is widely used in settings such as home care, hospice, public health, school health, and prisons. ANA initially recognized the Omaha System in 1992 as a standardized terminology to support nursing practice.

The Omaha System consists of three relational components: an assessment component (problem classification scheme), an intervention component (intervention scheme), and an outcomes component (problem rating scale for outcomes) (Topaz, Golfenshtein, & Bowles, 2014). The three components are designed to be used together and create a comprehensive problem-solving model for practice, education, and research. Concepts from the components can be assigned to an individual, family or group, or community (Correll & Martin, 2009). Table 15-9 provides an overview of the Omaha System.

PERIOPERATIVE NURSING DATA SET The **Perioperative Nursing Data Set (PNDS)** language, developed by the Association of periOperative Registered Nurses (AORN), is a standardized perioperative-nursing vocabulary that provides nurses with a clear, precise, and universal language for clinical problems and surgical treatments. PNDS provides wording

Table 15-9 Omaha System Overview

Component	Terms	Purpose
Problem Classification Scheme	• Four domains • Forty-two problems • Two sets of modifiers • Clusters of problem-specific signs or symptoms	Organize assessment (needs and strengths) for individuals, families, and communities
Intervention Scheme	• Four categories • Seventy-five targets and one "other" • Client-specific information	Organize multidisciplinary practitioners' care plans and the services they deliver
Problem Rating Scale for Outcomes	• Three concepts • Five-point Likert-type scale	Individual, family, and community

A full description of the components is available online at www.omahasystem.org.

and definitions for nursing problems, interventions, and outcomes, thus, furnishing clinicians with the same terms to describe patient care in the perioperative setting. The AORN's initial goal was to develop a unified language for nursing care that could be systematically quantified, coded, and easily captured in a computerized format in the perioperative setting (Morton, Petersen, Chard, & Kleiner, 2013). The PNDS provides a systematic approach to define and recognize the contributions of the perioperative nurse in healthcare.

The second edition of the *Perioperative Nursing Data Set* (PNDS) was superseded by the third edition (PNDS 3) in 2011 and the PNDS fourth edition (PNDS 4) in 2016. The PNDS 4 terminology is only distributed through AORN and AORN Syntegrity licensed vendors (Hunt, Howard, Hill, & Hillanbrand, 2015). The PNDS language is mapped to SNOMED CT, meaning that terms in the PNDS correlate with the terms and coding in SNOMED CT, and allow the PNDS to provide data that can be exchanged (Maxwell-Downing, 2013).

The PNDS vocabulary is structured using four domains. Three of the four domains are patient-centric and the other represents the perioperative settings administrative or performance concepts that affect patient care. Each domain has three levels: patient outcomes or performance measures, actual or potential nursing problems or measurement/analytical reporting, and nursing interventions or standardized data elements. Each patient-outcome concept consists of a unique identifier, a definition, an interpretive statement, and a domain. Below is a list of the PNDS domains:

Domain 1–Safety: **0-199**
Domain 2–Physiological Response: **200-499**
Domain 3A–Behavioral Responses-Individual & Family Knowledge: **500-699**
Domain 3B–Behavioral Responses-Individual & Family Rights/Ethics & Competency: **700-899**
Domain 4–Health System: **900-1100**
Interventions:
- Assessment–**A.xx** (e.g., A.30)
- Implementation–**Im.xx** (e.g., Im.240)
- Evaluation–**E.xx** (e.g., E.550)

Outcomes–**O.xx**
PNDS Nursing Problems–**NP.xx** (SNOMED CT Nursing Problem List)

SOURCE: Janice Kelly.

In summary, this section has described the terminologies used within an EHRS. The ANA-recognized nursing classifications codify data used during the nursing process such as assessments, nurse-sensitive problems, interventions, and outcomes. One or more terminologies can be used for nursing documentation. The next section will illustrate a use case showing how the nursing terminologies can be used for documenting nursing care.

Storyboard Illustrating Terminology Use

The following storyboard illustrates the use of SNOMED CT, LOINC, CCC, ICNP, NANDA, NIC, and NOC. Examples show encoding concepts used in the nursing process, and not everything can be encoded within the storyboard (e.g., gender = male):

> Joe is a 24-year-old male paraplegic admitted to an inpatient unit from his home with right lower-lobe pneumonia. During his admission assessment, the nurse notes that he has no sensation from the shoulders down. He is confined to a wheelchair and requires two-person assistance with movement. He could move himself with his upper body before this illness. His oxygen saturation is 85% on room air by pulse oxymetry. Evaluation of his vitals shows a temperature of 101°F. His skin is moist and clammy.

ASSESSMENT The process of nursing assessment includes items such as vital signs, physiological signs, and patient symptoms within the realm of nursing practice (Matney et al., 2016b). Assessments are observations documented as a name-value or question-and-answer pair. Assessment name-value pairs depicted in the storyboard are oxygen saturation = 85%, temperature = 101°F, skin type = moist and clammy, and skin temperature = cold. SNOMED CT and LOINC both include content that supports the encoding of point of-care assessments. Table 15-10 illustrates how the assessments can be encoded.

Table 15-10 Nursing Assessment Coding Examples

Assessment Measure	SNOMED CT	LOINC	Assessment Value
Oxygen saturation	**Fully Specified Name:** Hemoglobin saturation with oxygen (observable entity) **Concept Code:** 103228002 **Defined as:** Is A: hematologic function	**Name:** Oxygen saturation in capillary blood **Code:** 2709-4 **Fully Specified Name:** Oxygen saturation:MFr:PT:BldC:QN:: Component = Oxygen Property = Mass fraction Time = Point in time System = Blood mixed venous Scale = Quantitative	**Numeric value = 85** **Units of measure = Percent**
Temperature	**Fully Specified Name:** Body temperature (observable entity) **Concept Code:** 386725007 **Defined as:** Is A: body temperature measure Is A: vital signs	**Name:** Body temperature **Code:** 8310-5 **Fully Specified Name:** Body Temperature:Temp:PT: ^Patient:QN:: Component = Body temperature Property = Temperature Time = Point in time System = Patient Scale = Quantitative	**Numeric value = 85** **Units of measure = Degrees Fahrenheit**
Skin moisture	**Fully Specified Name:** Moistness of skin (observable entity) **Concept Code:** 364532007 **Defined as:** Is A: skin observable	**Name:** Moisture of Skin **Code:** 39129-2 **Fully Specified Name:** Moisture:Type:PT:Skin:Nom:: Component = Moisture Property = Type Time = Point in time System = Skin Scale = Nominal	**Coded Value** **SNOMED CT Code = Fully Specified Name:** Clammy skin (finding) **Concept Code:** 102598000 **Defined as:** Is A: Finding of moistness of skin

NURSING DIAGNOSIS/PROBLEM AND ICD-10 CODING After the patient has been assessed, a nursing diagnosis or problem is determined. Even though Joe is a paraplegic, he has impaired mobility because he could move himself with his upper body before his pneumonia. Other nursing diagnoses for Joe include impaired gas exchange and hypothermia. Table 15-11 illustrates NANDA, ICNP, and CCC coding examples. It should also be noted that Omaha System, PNDS, and SNOMED CT contain nursing diagnoses.

Joe will be assigned an ICD-10-CM billing code for his pneumonia by the medical coders of the hospital after discharge. The ICD-10-CM code for "Pneumonia, organism unspecified" is "J18.9."

NURSING INTERVENTIONS Nursing interventions are acts planned by the nurse and performed by the nurse for the client, by the client, or by the nurse and client acting together. Nursing interventions include acts such as assess, evaluate, educate, and monitor. Using the example of Joe, the interventions on his care plan included: assist with transfer, oxygen therapy, and monitor temperature. Table 15-12 shows NIC, ICNP, and CCC examples. It should also be noted that the Omaha System, PNDS, and SNOMED CT contain nursing interventions.

GOALS AND POTENTIAL NURSING OUTCOMES A goal is the desired outcome for the future. It is a scheduled observation in the future. Based on Joe's diagnoses, the nurse sets measurable goals that include improved mobility, improved gas exchange, and normothermia. The assessment data, diagnoses, and goals are written in the care plan for other care providers to access. When the goal is evaluated and given an outcome-measurement value, such as improved, it is then considered an outcome. Table 15-13 shows NOC, ICNP, and CCC examples. It should also be noted that the Omaha System, PNDS, and SNOMED CT contain nursing outcomes.

Benefits of Implementing Standardized Terminologies

Implementing standardized terminology has many benefits to multiple beneficiaries. Beneficiaries include the patient, the provider, the organization, and the healthcare industry in general. Using standardized terminologies ensures compliance with standards coming forth

Table 15-11 Nursing Diagnosis/Problem Coding Examples

Diagnosis/Problem	NANDA-I	ICNP	CCC
Impaired mobility	Impaired physical mobility **Axes:** **The diagnostic concept** = Physical mobility **Descriptor** = Impaired	Impaired mobility **Concept Code:** 10001219 **Axes:** **Focus** = Ability to mobilize **Judgment** = Impaired	Physical mobility impairment **Concept Code:** A01.5 **Concept Categorization:** Component 'A' = Activity Major category '01' = Alteration
Impaired gas exchange	Impaired gas exchange **Axes:** **The diagnostic concept** = Gas exchange **Descriptor** = Impaired **Defining Characteristic:** Hypoxia	Impaired gas exchange **Concept Code:** 10001177 **Axes:** **Focus** = Gaseous exchange **Judgment** = Impaired	Gas exchange Impairment **Concept Code:** L26.3 **Concept Categorization:** Component 'L' = Respiratory **Major Category** '26' = Alteration
Hyperthermia	Hyperthermia **Axes:** **The diagnostic concept** = **Descriptor** = **Defining Characteristic:** Body temp above normal range	Hyperthermia **Concept Code:** 10000757 **Axes:** **Focus** = Hyperthermia **Judgment** = Negative	Hyperthermia **Concept Code:** K25.2 **Concept Categorization:** Component 'K' = Physical regulation Major category '25' = Alteration

TABLE 15-12 Nursing Intervention Coding Examples

Nursing Intervention	NIC	ICNP	CCC
Assist with transfers	Transfer **Domain:** Physiological domain: Basic **Class:** Immobility management **Definition:** Moving a patient from one location to another	Transferring act **Concept Code:** 10020030 **Axes:** **Action:** Transferring **Description:** Positioning: Moving somebody or something from one place to another	Transfer care **Concept Code:** A03.3 **Categorization:** **Component:** 'A' = Activity **Concept:** '03.3' = Transfer care **Definition:** Actions performed to assist in moving from one place to another
Oxygen therapy	Oxygen therapy **Domain:** Physiological domain: Complex **Class:** Respiratory management **Definition:** Administration of oxygen and monitoring of its effectiveness	Oxygen therapy **Concept Code:** 10013921 **Axes:** **Action:** Therapy **Description:** Therapy	Oxygen therapy care **Concept Code:** L.35 **Categorization:** **Component:** 'L' = Respiratory **Concept: 35** Oxygen therapy care **Definition:** Actions performed to support the administration of oxygen treatment
Monitor temperature	Temperature Regulation: Fever treatment **Domain:** Physiological domain: Complex **Class:** Thermoregulation **Definition:** Attaining and/or maintaining body temperature within normal range	Monitoring body temperature **Concept Code:** 10012165 **Axes:** **Focus:** Body temperature **Action** = Monitoring **Description:** Monitoring	Temperature **Concept Code:** K33.2 **Categorization:** **Component:** 'K' = Physical regulation **Concept:** '33.2' = Temperature **Definition:** Actions performed to measure body temperature

TABLE 15-13 Nursing Goal/Potential Outcome Coding Examples

Nursing Goal/Outcome	NOC	ICNP	CCC
Improved mobility	Immobility consequences: Physiological **Domain:** Functional health **Class:** Mobility **Definition:** Severity of compromise in physiological functioning due to impaired physical mobility	Effective mobility **Concept Code:** 10028461 **Axes:** **Focus** = Ability to mobilize **Judgment** = Positive	Physical mobility impairment improved **Concept Code:** A01.5.1 **Concept Categorization:** Improved = Fifth digit. '1' added to the diagnosis
Improved gas exchange	Respiratory status: Gas exchange **Domain:** Physiologic health **Class:** Cardiopulmonary **Definition:** Alveolar exchange of carbon dioxide and oxygen to maintain arterial blood gas exchange	Effective gas exchange **Concept Code:** 10027993 **Axes:** **Focus** = Gaseous exchange **Judgment** = Positive	Gas exchange impairment improved **Concept Code:** L26.3.1 **Concept Categorization:** Improved = Fifth digit. '1' added to the diagnosis
Normothermia	Thermoregulation: Vital sign status **Domain:** Physiologic health **Class:** Metabolic regulation **Definition:** Balance among heat production, heat gain, and heat loss	Thermoregulation **Concept Code:** 10014973 **Axes:** **Focus** = Thermoregulation **Judgment** = Positive	Hyperthermia improved **Concept Code:** K25.2.1 **Concept Categorization:** Improved = Fifth digit. "1" added to the diagnosis

for meaningful use, quality measures, and interoperability. Terminology facilitates the monitoring of trends and problems in the health of populations, developing clinical-decision support, and expanding our knowledge of diseases, treatments, and outcomes through research and clinical data mining.

Patient-Specific Benefits

Patient-care benefits include decreased costs, increased quality across the continuum of care, improved outcomes, and improved safety. Standard terminologies provide a means of sharing chart data electronically between other departments, facilities, and settings. The use of collected interoperable data can be analyzed to identify ways to reduce errors of omission via reminders and alerts (clinical-decision support), which are developed within an EHRS. Costs can be reduced by eliminating redundant testing and diagnostic investigation. Value is derived by maintaining continuity of care. With standardized clinical terminology, patient data will be available across the full spectrum of healthcare settings: Family history, medications, allergies, diseases, treatments, and interventions can be coded and shared among clinicians, sites of care, and even across national and international geographic boundaries, which improves communication, resulting in improved patient safety and outcomes. The ability to track a patient's health maintenance, follow-up activity, compliance, and progress will provide important information regarding quality of care outcomes.

Provider and Nursing Benefits

Providers and nurses will benefit by having access to complete data along the continuum of care. Healthcare organizations around the world are working to integrate EHRSs. Using structured vocabularies within and between systems will provide access to complete and accurate healthcare data. Lack of complete and accurate data is currently a frustration to providers who want to give the best patient care. This frustration occurs when important clinical information for the patient is unavailable at the point of care. These systems will provide access to healthcare records that will gain better control over healthcare information quickly, and when the information is needed most—at the point of care.

Nurses will benefit from using a standardized nursing language due to enhanced efficiency, accuracy, and effectiveness, resulting in a significant improvement in patient care. McCormick et al. (2015) described three examples in which the implementation of a standardized nursing terminology made a significant impact on patient outcomes. The study reported how standardized nursing terminology is structured and incorporated into the electronic nursing-documentation tools.

Organizational Benefits

The organization can benefit by cost savings, decision-support rules, outcomes measurement, and the ability to use the data for data mining. Using standardized-clinical terminology allows sharing of accurate health information across departments and facilities. The necessity of streamlining care processes to capture efficient gains that require fewer provider and staff hours devoted to administrative care will result in reduced hospital costs. Organizations that implement EHRSs using standard terminologies will observe benefits, such as the ability to measure an improvement in patient-care outcomes and cost efficiency. For example, healthcare organizations will experience a reduction in transcription errors and reduced coding and billing errors, resulting in reduced healthcare-claim denials. The ability to track a patient's health maintenance, follow-up activity, compliance, and progress will provide important information regarding the quality of patient-care outcomes.

Standardized terminologies support the development of **decision-support software (DSS)**. Decision support is the alerts and reminders used within an EHRS. The ability to collect codified data provides vital information that can be used for decision support (Lopez, Febretti, Stifter, Johnson, Wilkie, & Keenan, 2017). Clinical decision-support software is highly dependent

on clinical information to function. To be useful, the clinical information must contain sufficient detail with respect to the right variables, the right wording and codes, and the right information modeling, and must, thus, be structured in a way that the decision-support software can use. DSS is used to prevent negative outcomes and support positive outcomes of patient care.

Documentation of healthcare using a standardized terminology is vital to support **data mining**. Data mining is the process of analyzing healthcare data from different perspectives and summarizing it into useful information that can be used to improve patient safety and quality of care and cut costs. It is becoming an important tool to transform data into information. Data mining is a key component in the analysis of workflow in complex healthcare organizations. It is also used for research (Salanterä, 2015). The data-mining process is carried out by the collection of standardized data with their associated codes from EHRSs. Analyzed results from data mining can identify patterns or trends in patient care and outcomes. The use of data mining by organizations can provide analysis for the identification of important questions that are directly related to increased errors, causing a reduction in patient safety and resulting in high healthcare costs. For example, a hospital organization may want to analyze questions, such as how many patients are at risk for falls and how many actually fall while in the hospital resulting in injury. The data collected and mined for these important questions can provide important information regarding patient falls and identify an improvement in the interventions provided for patients who are at risk for falls, and education that can lead to a reduction in the occurrence of falls.

National Healthcare Reporting Requirements

The Health Information Technology for Economic and Clinical Health (HITECH) Act seeks to improve American healthcare delivery and patient care through the adoption of interoperable EHRSs. The provisions of the HITECH Act are specifically designed to work together to provide the necessary assistance and technical support to providers, enable coordination and alignment within and among states, establish connectivity to the public health community in case of emergencies, and ensure that the workforce is properly trained and equipped to be meaningful users of EHRs (Health Information Technology, 2015).

Medicare is leading several eHealth initiatives to facilitate the triple goals of improving the health of populations, reducing the cost of healthcare, and improving the quality of care. CMS is collaborating with public agencies and private organizations, including the National Quality Forum (NQF), The Joint Commission, the National Committee for Quality Assurance, and the Agency for Health Care Research and Quality, to improve the quality of care (Centers for Medicare and Medicaid Services, 2013). The use of standardized terminology is mandatory for data collection and reporting of established quality measures for CMS-eligible hospitals and physicians (Centers for Medicare and Medicaid Services, 2014). For example, smoking status and venous-thrombosis prophylaxis are required to be tracked and collected. Also, the Health IT Standards Committee has established that hospitals are required to maintain an active-problem list mapped to SNOMED CT (Centers for Medicare and Medicaid Services, 2014). HL7 is a standards-development organization (SDO) accredited by the American National Standards Institute (ANSI) and dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information (Health Level Seven, 2016a). Healthcare organizations are required to send HL7-formatted messages containing patient demographic and clinical data. Messages sent containing laboratory-test names and results are required to be sent using

LOINC codes. Messages sent containing allergies should use SNOMED CT and RxNorm, a standardized nomenclature for clinical drugs and drug-delivery devices, developed by the NLM (Health Information Technology, 2009). In summary, to meet the CMS incentives, as well as provide safer patient care with improved quality, the implementation of standardized terminology is required.

Issues and Concerns

It is not easy to use standardized terminology within systems. Rector (1999), in his foundational article, described why "terminology is hard"; the issues he described still stand true today. He discussed challenges related to the implementation and maintenance of standardized terminologies, and we will address three high-level issues next in this chapter. First, there are numerous systems in use today with locally defined concepts; these will need to be mapped or linked to standardized terminology. Second, determining which terminology or terminologies to use is still a challenge. Third, data entry, presentation, and retrieval for clinical tasks must be considered. The mandate for the use of standardized terminologies in EHRSs for meaningful use has increased the need for systems to use standardized terminologies. Many systems in use today, both home grown and vended, have been created without using standard terminologies. The applications will have to be rewritten to use standardized terminologies. Methods will need to be developed to convert stored data, or retrieve data from the old system, so that patients' data will not be lost. Developers will need to determine how terminologies will be maintained and updated when new versions are released.

Specific terminologies have been mandated for laboratory and clinical systems, but the only nursing mandate is that SNOMED CT be used to message nursing data between systems. This causes two challenges: First, nurses need to determine which nursing terminologies they want to use to support the nursing process. Second, the terminology they choose will have to include a mapping to SNOMED CT to send patient data to other systems, such as a nursing home.

Finally, interface terms and synonyms for data entry, presentation, and retrieval for clinical tasks must be locally developed. Clinicians use different terms for the same concept across specialties and even between nursing units and settings. For example, a pediatrician or advanced nurse practitioner in an office setting will want to know that a newborn experienced transient tachypnea of the newborn. The screen display should specify this phrase for them, but providers in the NICU would rather see this information as TTN. Both of these are synonyms of the same concept and should be created based on context of use. The terms for medical and common items are different from country to country. For example, the American word, diaper, is called a nappy in the United Kingdom. Operational resources will be required for the development of the synonyms.

Future Directions

HIT allows comprehensive management of clinical information and its secure exchange between healthcare providers. Broad use of HIT has the potential to improve quality, prevent healthcare errors, increase administrative efficiencies, decrease paperwork, expand access to affordable care, and improve population and community health. The HITECH Act of 2009 sets forth a plan for the advancement of the Meaningful Use of HIT to improve the quality of care and to establish the foundation of the US health reform. The Office of the National Coordinator for Health Information Technology (ONCHIT) is at the forefront of the administration's

HIT efforts and is a source that supports the adoption of HIT and the promotion of a nationwide health-information exchange to improve healthcare (Health Information Technology, 2015). To meet the standards defined by the HITECH Act, an EHRS will need to provide complete, accurate, and searchable health information available at the point of diagnosis and care, permitting more informed decision making to enhance the quality and reliability of the healthcare delivery. Other HITECH Act requirements needed to meet the standards include the need to develop a more efficient and convenient functionality, without waiting for the exchange of records or requiring unnecessary or repetitive tests or procedures. EHRSs are required in order to support reduction in adverse events through a stronger understanding of a patient's health history and potential for drug-drug interactions, providing an improvement in patient safety. Finally, healthcare information systems are required to support more efficient administrative duties, allowing for more interactions with, and the transfer of information to, patients, caregivers, clinical-case managers, and the monitoring of patient care.

To have good semantic interoperability, patient data needs to be encoded using standard terminologies and structures using pre-defined syntax (Matney, Dolin, Buhl, & Sheide, 2016b). Structured data facilitates computer processing by making data identifiable for tracking, trending-decision support, quality measures, data mining, and analytics (Dolin & Alschuler, 2011). The C-CDA (mentioned previously) and an emerging HL7 standard, called Fast Health Interoperability Resources (FHIR), are two examples of structured data syntax. CDA defines reusable patterns, called templates, using extensible mark-up language (XML) and standard terminologies (Dolin, Alschuler, & Boyer, 2006). Resources simulate paper forms by replicating different types of clinical and administrative information, and are the most important parts of the FHIR specification (Health Level Seven, 2016b). The FHIR resource specification defines a generic form template for types of clinical information such as observations, health conditions, and procedures.

Significant advances in the development and adoption of clinical terminologies and terminology standards has been illustrated in this chapter. In the last decade, and with the requirement to build EHRSs that meet the 2009 Meaningful Use criteria, the use of coded data has expanded to include pay for performance initiatives, care coordination, patient-safety monitoring, and public-health surveillance. Many benefits have yet to be realized from point of care to research and the development of evidence-based practice. There are still hurdles that need to be jumped in order for health-information systems to fully use terminologies. We will know we have succeeded when clinical terminologies are used and reused to capture healthcare data in a standardized format that has global meaning, and can be applied at both the individual and aggregate levels.

Summary

- Standardized terminologies have been developed for use within electronic health record systems (EHRS) as a means to ensure accurate, consistent meaning of data that is collected and shared across the healthcare-delivery system.
- The implementation of standardized terminology within an EHRS is essential for healthcare organizations to meet the criteria of Meaningful Use.
- Concept codes, used to designate concepts in a computer system, facilitate the development of evidence-based practice, decision support, and reporting.
- Clinical terminology enables the capture of data at the level of detail necessary for patient care documentation. Clinical terminologies consist of concepts that support diagnostic studies, history, physical examinations, visit notes, ancillary-department information, nursing notes, assessments, flow sheets, vital signs, and outcome measures.