Standard Nursing Terminologies:
A Landscape Analysis

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I.   Introduction

With the rapid adoption of health IT and the promotion of interoperability to improve health, consistent standards and common data elements are the foundation for the advancement of care models. This advancement is based on objectives such as capturing sharable patient and care information across disciplines and care settings, enabling more accurate and less burdensome measurement of the quality of care delivered, and supporting ongoing research and analysis. Within this context, the nursing profession can contribute an enormous amount of valuable data related to the care of the patient and the nursing process. However, if nursing data are not stored in a standardized electronic format, or easily translated to a vocabulary used by interdisciplinary care team members, the value and contributions of nursing to patient outcomes may not be measurable or retrievable (Welton & Harper, Measuring Nursing Care Value, 2016). With more than 3.6 million members, nurses constitute the largest workforce in health care, and hospital-based nurses spend as much as 50 percent of their time in direct patient care (Hurst) (Nursing Fact Sheet, 2011) (McMenamin, 2016). As we move forward with innovative strategies to optimize the health of patients and communities, the omission of nursing data due to a lack of agreement on a standardization strategy would be unfortunate.

To this end, the Office of the National Coordinator for Health IT (ONC) is working with MBL Technologies and Clinovations Government + Health, Inc. (Clinovations GovHealth) (hereafter the project team) to conduct a landscape assessment to better understand the current state and challenges associated with using terminologies and classifications to support nursing practice within health information technology (health IT) solutions. Through a literature review and interviews with terminology owners, this assessment examines the current state of development and usage within the 12 Standard Nursing Terminologies (SNT) recognized by the American Nurses Association (ANA).

This report:

- Defines a brief history of the development of standard nursing terminologies and efforts to gain consensus on a strategy for their use;
- Includes the level of advancement and interoperability of individual terminologies with electronic health records (EHRs); and
- Identifies themes in the form of challenges and opportunities.

II.   Background

Nursing terminologies and vocabulary structures first developed in 1973, and many have changed significantly since their inceptions. Realizing that the standardization of nursing care documentation was a critical component to support interoperable health information, the ANA in 1989 created a process to recognize languages, vocabularies and terminologies that support the nursing practice (ANA, 2015). Current action plans and guidelines, descending from the work of individuals such as James J. Cimino and organizations such as the National Committee on Vital and Health Statistics (NCVHS) and the ANA, continue to be refined (Cimino J. , 1998) (Cimino, Hripcsak, Johnson, & Clayton, 1989) (Sujansky, 2002). However, the inability to ensure the availability of sharable and comparable nursing data remains an issue. Increased focus on longitudinal and interdisciplinary documentation, care quality and value

precipitates a need to accurately quantify the contribution of each care team member for optimization of care workflows across settings. Further, high-quality nursing data can assist in the optimal integration of registered nurses into high-value, lower-cost approaches to longitudinal care (Welton & Harper, Measuring Nursing Care Value, 2016). Figure 1 below provides a high-level timeline of significant events that have occurred in the evolution and development of SNTs. A detailed and expanded events timeline is in Appendix A.

Figure 1. Consolidated SNT timeline
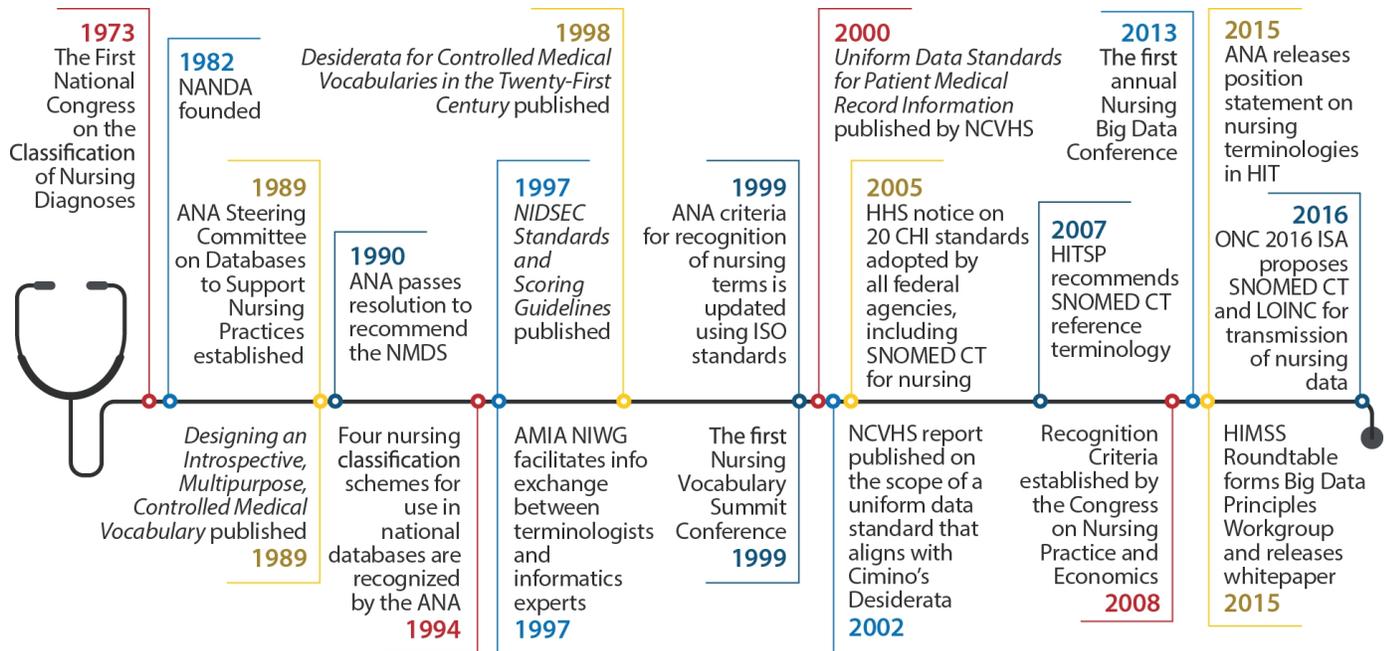
Currently, the ANA recognizes two minimum data sets, two reference terminologies and eight interface terminologies for facilitating documentation of nursing care and interoperability of nursing data between multiple concepts and nomenclatures within IT systems (ANA, ANA Recognized Terminologies that Support Nursing Practice, 2012). The definitions of each of these types of terminologies are as follows:

- Minimum data sets are "…a minimum, essential set of data elements with standardized definitions and codes collected for a specific purpose, such as describing clinical nursing practice or nursing management contextual data that influence care" (Westra, Delaney, Konicek, & Keenan, Nursing standards to support the electronic health record, 2008).
- Interface terminologies (point-of-care) include the actual terms/concepts used by nurses for describing and documenting the care of patients (individuals, families and communities) (Westra, Delaney, Konicek, & Keenan, Nursing standards to support the electronic health record, 2008).
- Reference Terminologies are designed to "…provide common semantics for diverse implementations" (CIMI, 2013) and ideally, they enable clinicians to use terms appropriate for their discipline-specific practices, then map those terms through a reference terminology to

communicate similar meaning across systems (Westra, Delaney, Konicek, & Keenan, Nursing standards to support the electronic health record., 2008).

Table 1 below includes the 12 SNTs by category.

Table 1. ANA-Recognized Standard Nursing Terminologies

Interface Terminologies	Minimum Data Sets
1. Clinical Care Classification (CCC) System 2. International Classification for Nursing Practice (ICNP) 3. North American Nursing Diagnosis Association International (NANDA-I) 4. Nursing Interventions Classification System (NIC) 5. Nursing Outcomes Classification (NOC) 6. Omaha System 7. Perioperative Nursing Data Set (PNDS) 8. ABC Codes	1. Nursing Minimum Data Set (NMDS) 2. Nursing Management Minimum Data Set (NMMDS)
	Reference Terminologies
	1. Logical Observation Identifiers Names and Codes (LOINC) 2. SNOMED Clinical Terms (SNOMED CT)

III.   Landscape Analysis Approach

The project team first performed an internet search to obtain background on standard nursing terminologies. Using information gathered in the search and focusing specifically on ANA-recognized SNTs, the project team proposed a list of interview contacts within each ONC-validated SNT organization. Interviews were conducted using an interview guide (Appendix B). For accuracy purposes, the project team used standardized definitions for the variables of current usage, existing interoperability and major barriers or issues to implementing and using SNT. Data on the following topics was collected for analysis:

- SNT goals and objectives for the terminology ;
- Terminology versioning and release schedules;
- Latest version of SNT as well as update timing and methodology;
- Current usage and activities;
- Maintenance and sustainability issues;
- Level of interoperability with electronic health records;
- Major issues or barriers associated with integration and implementation; and
- The future state of the SNT.

Discussions touched on each SNT's perceived or actual barriers to interoperability, how easily an SNT is implemented within an EHR, and the typical process for that implementation. Details of those interviews are in Section IV: Summary of Background Data, below.

After completion of interviews with terminology representatives, the project team approached three electronic health record developers to provided background on how SNTs are implemented and used in hospital and ambulatory health information technology applications. Although these interviews were

unstructured, the project team developed a framework for guiding the discussion (Appendix C). Developer interviews were collated and overarching perspectives were identified for further discussion in Section VI: Health IT Developers - Perspectives. When all data collection was complete, the project team evaluated the information to identify gaps, similarities, barriers, challenges and opportunities related to the current status and use of SNTs. This information is in Section VII: Emerging Issues in Using SNTs.

IV.   Summary of Background Data

The table below summarizes the background data collected during the landscape analysis.

Table 2. Summary of Background Data

Terminology	Latest Update via UMLS	Original Publication Date	Publication Schedule
SNOMED Clinical Terms (SNOMED CT)	2017	SNOMED (1975) SNOMED II (1979) SNOMED CT (2002)	Twice annually: January and July.
Logical Observation Identifiers Names and Codes (LOINC)	2017	1994	Twice annually: December and June.
Alternative Billing Concepts (ABC) Codes	2009	2000	Schedule based on availability of resources.
Clinical Care Classification (CCC) System	2012	1991	CCC System National Scientific Advisory Board meets annually.
International Classification for Nursing Practice (ICNP)	2015	Alpha v. (1996)	Released in May or June of the second year.
NANDA International (NANDA-I)	2002	1973	Every three years.
Nursing Interventions Classification System (NIC)	2008	1992	Every five years.
Nursing Outcomes Classification (NOC)	2008	1997	Every five years.
Omaha System	2005	1975	Reviewed every two years.
Perioperative Nursing Data Set (PNDS)	2011	1999	Every five years.
Nursing Minimum Data Set (NMDS)	NMDS is not in UMLS.	1983	No
Nursing Management Minimum Data Set (NMMDS)	NMMDS is not in UMLS. *However, it is fully encoded with LOINC, which is in UMLS.*	1996/1997	No

V.   Findings

A. Reference Terminologies

Reference terminologies are designed to "…provide common semantics for diverse implementations" (CIMI, 2013) and ideally, they enable clinicians to use terms (synonyms) appropriate for their discipline-specific practices (Westra, Delaney, Konicek, & Keenan, Nursing standards to support the electronic health record., 2008) (Westra, et al., 2015). The mapping of interface terminologies to reference terminologies allows a standard, shared vocabulary to communicate data across settings.

The ANA-recognized reference terminologies are SNOMED CT and LOINC (characterized by the ANA as "multidisciplinary" terminologies). The Centers for Medicare and Medicaid Services (CMS) and the Office of the National Coordinator for Health Information Technology (ONC) require the use of a reference terminology (SNOMED CT and LOINC) for Meaningful Use incentive payments and for certification, respectively.

1. SNOMED CT

SNOMED CT	
Latest Update via UMLS	2017
Original Publications	SNOMED (1975) SNOMED II (1979) SNOMED CT (2002)

Owned and distributed by SNOMED International, SNOMED CT is a comprehensive, multilingual clinical health care terminology used in more than 50 countries. When implemented into health IT, SNOMED CT provides a multidisciplinary approach to consistently and reliably represent clinical content in EHRs and other health IT solutions. SNOMED CT is important in health IT development and implementation as it supports the development of high-quality clinical content and provides a standardized way to record clinical data that enables meaning-based retrieval and exchange (Westra, Delaney, Konicek, & Keenan, Nursing standards to support the electronic health record., 2008).

SNOMED CT content is represented using three different types of components, including concepts representing clinical meaning; descriptions that link terms to concepts; and relationships to link each concept to other related concepts. It is augmented by reference sets that support customization and enhancement of SNOMED CT, including subsets, language preferences and mapping from or to other terminologies. SNOMED CT maps provide explicit links to other health-related classifications and coding systems, e.g., to International Classification of Diseases (ICD-10).

The U.S. Edition of SNOMED CT is the official source of SNOMED CT for use in the United States and is a standalone release that combines content of both the U.S. extension and the International release of SNOMED CT. For example, the U.S. Edition of SNOMED CT contains subsets representing Clinical Observations Recordings and Encoding (CORE) Problem list subset, as well as a Nursing Problem List subset to facilitate use of SNOMED CT as the primary coding terminology.

Process for Updating/Publishing Standard

SNOMED International provides its members with the ability to request changes to SNOMED CT through National Release Centers (NRC) in member countries. In some cases, changes may only be implemented in a national extension. If the change has international relevance, it is forwarded to SNOMED International for consideration of inclusion in the next release cycle. A new version of SNOMED CT is released to SNOMED International members in July and in January yearly. As the U.S. member of SNOMED International, NLM distributes SNOMED CT at no cost through the Uniform Medical Language System (ULMS) Metathesaurus via a licensing program.

Usage/Activity

SNOMED CT is required in the ONC Health IT Certification Program; specific certification criteria vary by edition (e.g., 2014, 2015). Detailed information on each edition's specific SNOMED CT criterion requirements are in the respective regulations and referenced in the "Standards Hub" on ONC's website:
https://www.healthit.gov/policy-researchers-implementers/meaningful-use-stage-2-0/standards-hub

Challenges

Before SNOMED International purchased SNOMED CT from the College of American Pathologists (CAP), many ANA-recognized interface terminologies for nursing were integrated into SNOMED CT through the mapping of the nursing terms to valid concepts within SNOMED CT. However, SNOMED International did not purchase these maps from CAP, so they are not included in the international version of SNOMED CT. In addition, the NLM does not maintain mappings in the U.S. Edition as new editions are released. Therefore, any existing maps from nursing-specific terminologies to SNOMED CT are likely outdated and/or incorrect.

Opportunities

SNOMED CT has a broad scope of coverage, including concepts across a wide range of multidisciplinary clinical information while maintaining the relationships between the concepts and supporting important capabilities such as clinical decision support, quality measurement and research initiatives. With greater inclusion of nursing content, SNOMED CT could be utilized at the user interface, eliminating the need for mapping and integration with other interface terminologies.

2. Logical Observation Identifiers Names and Codes (LOINC)

LOINC	
Latest Update via UMLS	2017
Original Publication	1994

The Regenstrief Institute maintains LOINC as a comprehensive clinical terminology for identifying tests, measurements and observations. LOINC includes terms for laboratory test orders and results, clinical measures such as vital signs, standardized survey instruments and other patient observations. Comprised of more than 71,000 observation terms that primarily represent laboratory and clinical observations, it is available at no cost, and it is used extensively within U.S. health IT systems for the exchange of clinical information.

In 1999, it was identified by the Health Level Seven (HL7) Standards Development Organization (SDO) as the preferred code set for laboratory test names in transactions between health care facilities, laboratories, laboratory testing devices and public health authorities (Logical Observation Identifiers Names and Codes (LOINC), 2015). LOINC's initial purpose was to develop a common terminology for laboratory and clinical observations that could be used in HL7 messages. However, it has been expanded to other areas, including additional clinical observations such as nursing assessment questions. In 2002, the Clinical LOINC Nursing Subcommittee was developed to provide LOINC codes for observations at key stages of the nursing process, including assessments, goals and outcomes, as well as administrative and regulatory data related to nursing care (Nursing Resources for Standards and Interoperability, 2015).

Along with SNOMED CT, LOINC is multidisciplinary. It is available in several file formats for ease of implementation (Regenstrief and the SNOMED International are working together to link LOINC and SNOMED CT., 2013). As part of a cooperative agreement between the Regenstrief Institute and SNOMED International, guidance on the use of SNOMED CT and LOINC together is published with LOINC-SNOMED CT Mappings and Expression Associations to provide a common framework for the use of LOINC with SNOMED CT (Vreeman, 2016).

Process for Updating/Publishing Standard

LOINC updates are published every June and December. As a companion to LOINC, the Regenstrief Institute publishes a software tool called Regenstrief LOINC Mapping Assistant (RELMA) to search terminology, assist in the mapping of LOINC to local codes and suggest updates to the LOINC terminology.

Usage/Activity

It is estimated that LOINC has more than 44,000 registered account users. LOINC is interoperable with most EHR developer products. When purchased, the user agrees to LOINC's "Terms of Use" which binds the user and gives notice of LOINC copyright and licensing policy. In the current policy, LOINC permits "in perpetuity, without payment of license fees or royalties, to use, copy or distribute" licensed materials "for any commercial or non-commercial purpose" (Copyright Notice and License). LOINC is a required vocabulary in the ONC Health IT Certification Program; specific certification criteria vary by edition (e.g., 2014, 2015). Detailed information on each edition's specific LOINC criterion requirements is in the respective regulations and is referenced in the "Standards Hub" on ONC's website, here: https://www.healthit.gov/policy-researchers-implementers/meaningful-use-stage-2-0/standards-hub.

Challenges

Because no license is required, it is hard to track specific usage of LOINC. In addition, there is no formal mechanism to monitor the use of LOINC to ensure consistent use and accurate mapping, although the "Terms of Use" state that the "users shall not use any of the Licensed Materials for the purpose of developing or promulgating a different standard for identifying patient observations, such as laboratory test results" (Copyright Notice and License).

Opportunities

The study done by Matney to align a minimum set of nursing assessment data with LOINC and SNOMED CT provides a framework for a systematic approach for the standardized representation of nursing assessments (Matney, et al., 2016).

B. Interface Terminologies

Interface terminologies are defined as "a systematic collection of health care-related terms that supports clinicians' entry of patient-related information into computer systems" (Rosenbloom, Miller, Johnson, Brown, & Ekin, 2006). Seven recognized terminologies in this category were designed specifically for use in nursing, but some have evolved to include other disciplines. In addition, ABC Codes are included in this category, although the ANA recognition process originally grouped ABC Codes as a "multidisciplinary" terminology.

1. Clinical Care Classification (CCC) System

CCC System	
Latest Update via UMLS	2012
Original Publication	1991

A 1991 research project conducted by Dr. Virginia Saba and colleagues from Georgetown University resulted in the development of the Home Health Care Classification System (HHCC), which evolved into the Clinical Care Classification (CCC) System (Saba V. , Nursing Classifications: Home Health Care Classification System (HHCC): An Overview., 2002). The research focused on creating a process to identify and classify patients to determine resources and measures for outcomes of care. The result was the original version of CCC of Nursing Diagnoses and CCC of Nursing Interventions terminologies that were classified by 20 care components, ultimately establishing a standard framework for assessing, documenting and evaluating nursing care (Saba V. , Nursing Classifications: Home Health Care Classification System (HHCC): An Overview., 2002). SabaCare Incorporated currently maintains the nursing terminology. The codes are structured within an implicit information model to link nursing diagnoses to interventions and outcomes. There is no license fee for using CCC.

Process for Updating/Publishing Standard

The National CCC Advisory Scientific Board, part of SabaCare Incorporated, meets annually to review all submitted concepts, terms or labels for consideration. However, the terminology is not regularly published. Recommendations regarding development of new versions are made only after the Advisory Board has evaluated new ideas. CCC is considering the release of a Plan of Care (PoC) for new users in the future.

Usage/Activity

Dr. Saba states that the CCC System can be used in all clinical settings for documenting nursing practice. Such settings include point-of-care nursing documentation, nursing education, nursing research and nursing administration. The CCC System is being implemented into EHR systems in three different methods (Saba V. , Clinical Care Classification System Version 2.5 User's Guide, 2012):

- Health care facilities obtain CCC System permission to integrate the CCC concepts into the respective facility's data dictionary. The health care facility uses the CCC System to develop and code its plan of care.
- An EHR developer obtains CCC System permission and uses the CCC System to develop a proprietary standardized set of care plans, which is marketed commercially to health care facilities.
- An EHR developer obtains CCC System permission and inputs the CCC System's concepts into its proprietary data dictionaries for use by customers to adapt and develop care plans.

Challenges

It can be dificult to implement the CCC System into multiple software applications created by different software developers, all using different structure and information models. For example, a large health care organization uses three different software applications from two different EHR developers. Each software application requires a different strategy to configure the CCC terminology and information model within the EHR database and applications. These configurations are developed and used only within this particular health care organization, making interoperability and harmonization difficult across different health care organizations.

Opportunities

CCC System is used by a variety of U.S. health systems. There is no licensing fee with CCC, so health systems can use the terminology without incurring that type of expense.

2. International Classification for Nursing Practice (ICNP)

ICNP	
Latest Update via UMLS	2015
Original Publications	Alpha version (1996)
	Beta version (1999)

ICNP is an international terminology that provides description and comparison for nursing practice and allows for cross-mapping between other terminologies. The classification includes nursing diagnoses, nursing-sensitive patient outcomes and nursing interventions. Specifically, ICNP describes nursing care of people in a variety of settings and enables comparison of nursing data across clinical populations, settings and geographical areas and time ((ICN), n.d.). The International Council of Nurses (ICN) developed ICNP in 1990 (formalized in 2000) to be a unifying framework in which local language and existing nursing terminologies and classifications could be cross-mapped to support data interoperability. ICN owns and copyrights ICNP; permission for use is required. Commercial use involving distribution of a product for-profit (e.g. software products or publications) requires a small licensing fee; non-commercial use (e.g. research in education) is free (Coenen A. , 2003). Other uses, such as

government use within a national health information system, are negotiated on a case-by-case basis. ICN anticipates discounted pricing for developing countries. Besides protection of copyright, ICN is most concerned about facilitating access to ICNP for use by nurses (Coenen A. , 2003).

Process for Updating/Publishing Standard

The alpha version released in 1996; the Beta version followed in 2000. The last updated publication is June 2015. ICNP, along with translations and other derived products, is disseminated every two years to maintain currency and keep pace with nursing practice advances. Maintaining terminology is a major task that includes tracking recommendations and suggestions, expert reviews and revisions to the ICNP as well as organizing committee meetings, conference presentations and ad hoc groups (Coenen A. , 2003).

Usage/Activity

ICNP is an international nursing standard; nursing associations can become members to access terminology for further dissemination. The terminology was established as an international standard for description and comparison of the nursing practice (2015AB UMLS ICNP Source Information, 2016). The ICNP translations are produced with the cooperation of the National Nursing Association. Translations are available in Arabic, German, Italian, Japanese, Korean, Norwegian, Polish, Portuguese and Spanish with additional translations in Farsi (Persian), French, Greek and Mandarin. Thai and Turkish versions are being developed.

In September 2015, ICN and SNOMED International announced the delivery of a diagnoses equivalency table between ICNP and SNOMED CT, with a focus on nursing diagnoses, to provide transformation of ICNP-encoded data to SNOMED CT (International Council of Nurses (ICN) and IHTSDO deliver collaborative product., 2015). The collaboration ensures that users can continue to use ICNP while participating in the wider implementation of SNOMED CT globally. In April 2016, an equivalency table of ICNP to SNOMED CT nursing interventions was released. Any usage of the equivalency tables must comply with the licensing agreement of both ICNP and SNOMED CT (International Council of Nurses (ICN) and IHTSDO deliver collaborative product., 2015). The ICN has collaborated with SabaCare to develop linkages between the CCC and ICNP concepts (Hardiker & Saba, 2016).

Challenges

SMEs interviewed said ICNP was not used within the United States. Many countries using ICNP are implementing it on a national level.

Opportunities

ICN is working in conjunction with SNOMED International to deliver equivalency tables; a nursing interventions equivalency table (August 2015) and a nursing diagnoses equivalency table (April 2015) have been released, which will help support international users (Coenen A. , 2003).

3. NANDA International (NANDA-I)

NANDA-I	
Latest version of terminology standard available through UMLS	2002
Original Publication	1973

Collaboration at the 1973 National Conference Group task force resulted in the creation of NANDA (North American Nursing Diagnosis Association) in 1982. In 2002, NANDA became NANDA International (NANDA-I) to reflect the worldwide use of the terminology. The initial NANDA terminology was developed to allow nursing to identify and classify health problems within the domain of nursing (Jones, Lunney, Keenan, & Moorhead, 2010). Today, NANDA includes more than 216 nursing diagnoses, published by NANDA-I. NANDA-I's mission is to:

- Facilitate the development, refinement, dissemination and use of standardized nursing diagnostic terminology by providing the world's leading evidence-based nursing diagnoses for use in practice and to determine interventions and outcomes.
- Contribute to patient safety through the integration of evidence-based terminology into clinical practice.
- Fund research through the NANDA foundation.
- Support a global network of nurses who are committed to the good quality of nursing care and improvement of patient safety through evidence-based practice.

NANDA–I maintains that a standardized language representing any profession should provide, at a minimum an evidence-based definition; a list of defining characteristics (signs/symptoms) and related factors (etiologic factors); risk diagnoses that should include an evidence-based definition; and a list of risk factors (International, n.d.).

NANDA-I is commonly used with Nursing Interventions Classification (NIC) and Nursing Outcomes Classification (NOC), referred to as NANDA/NIC/NOC (NNN), as a means of providing comprehensive, research-based, standardized classifications of nursing diagnoses, nursing interventions and nursing-sensitive patient outcomes. These classifications provide a set of terms to describe nursing judgments, treatments and nursing-sensitive patient outcomes (NANDA-I NIC NOC for Safe Patient Care, n.d.). NANDA-I was previously mapped to SNOMED CT, but the mapping is now outdated.

Process for Updating/Publishing Standard

The Diagnosis Development Committee (DDC) formulates and conducts review processes of proposed diagnoses and revisions of diagnoses. DDC reviews the literature/submission and has a stringent process to ensure that new terminology is reflective of correct standards of care. The standard is revised every three years.

Usage/Activity

Interviewees noted that NANDA-I is widely used across all care settings, published in multiple countries and has been translated into 18 languages; it is in use worldwide. The electronic version of NANDA-I is available through licensure. An exact number regarding usage is difficult to obtain because license information does not accurately reflect the number of sites using NANDA-I. In addition, because

NANDA-I is also published in a text format, it is estimated that more than 40percent of all NANDA-I use is done without a license to use the electronic version (Interview, 2016). Even though NANDA-I reports a high percentage of illegal use, it also claim that it attempts to enforce its licensor agreement vigorously. A licensor agreement is meant to ensure consistent use of the terminology.

Challenges

NIC and NOC have a separate licensure from NANDA-I, though NNN is frequently proposed to be used together in a terminology framework for use in EHRs. NANDA-I is less expensive for a licensee, which sometimes leads to smaller health care organizations implementing NANDA-I without NIC or NOC. Software developers, in turn, package their products to allow customization resulting in a partial use of a terminology, deteriorating the quality of the standard. Such a practice directly leads to a lack of consistent use of NANDA-I since each user might not be getting the same content.

Opportunities

Many nurses are familiar with NANDA–I due to the widespread use of NANDA-I in nursing education programs.

4. Nursing Interventions Classification System (NIC) and Nursing Outcomes Classification (NOC)

NIC and NOC	
Latest Update via UMLS	NIC- 2008
	NOC- 2008
Original Publications	NIC- 1992
	NOC- 1997

NIC and NOC were initially developed through funding from the National Institutes of Health by research teams at the University of Iowa. The Center for Nursing Classification and Clinical Effectiveness (CNC), housed within the University of Iowa College of Nursing, supports the ongoing research and development of NIC and NOC. These terminologies are comprehensive, research-based and standardized classifications of nursing interventions and nursing-sensitive patient outcomes. The use of NIC and NOC provides terms for documenting nursing care, including:

- Communicating nursing care across settings;
- Evaluating outcomes;
- Conducting effectiveness research;
- Measuring nursing productivity;
- Evaluating nursing competencies;
- Facilitating reimbursement; and
- Designing curriculum.

Process for Updating/Publishing Standard

NIC and NOC were originally updated on a four-year cycle, but now that the terminology has matured, they are moving to a five-year cycle. NIC and NOC are published and copyrighted by Elsevier, which provides the resources and the contacts to protect the copyright, produce the book, maintain the

electronic version of the terminologies and market them. Copyright is especially important with a standardized language where alteration of terms will impede the goal of communication among nurses across specialties and between delivery sites (Dochterman & Bulechek, 2004).

Usage/Activity

Practicing nurses use the terminologies in various clinical settings – from acute care hospitals, outpatient, and ambulatory settings to rehabilitation and long-term care facilities. Elsevier provides NIC and NOC licensing and implementation support to software developers and agencies. Fifteen licensed software developers have integrated NIC and NOC into electronic nursing care systems, and several of the largest EHR software developers offer it as part of their EHR products.

Challenges

The licensing process for NIC and NOC is complex. Large shares of licensing come through vendor distribution, making it difficult to accurately quantify user numbers and differentiate between implemented licenses versus purchased licenses.

The inability to quantify user numbers and differentiate implementations also presents the challenge of ensuring correct implementation of the terminology. NIC and NOC have a labeled series of discrete, customizable language. It is important that intervention labels, or names, and the definitions of each label remain unaltered during implementation. If the terminology is altered, it can be difficult to normalize the data for system interoperability and comparative research.

Opportunities

NANDA–I, NIC and NOC have linkages created that helps in the usage of the three terminologies (NNN Fact Sheet, 2016). In educational settings, NIC and NOC are often taught in conjunction with NANDA–I.

5. Omaha System

Omaha System	
Latest Update via UMLS	2005
Original Publication	1975

The Omaha System includes terminology and an implicit information model. In the 1970s, the Visiting Nurse Association (VNS) of Omaha revised its home health and public health client records to adopt a problem-oriented approach. This new approach, with the goal of providing a guide for practice, a method for documentation and a framework for information management, yielded Omaha System. Based on rigorous development, it incorporated an integrated, valid and reliable computerized clinical information system organized around the clients receiving services (Frequently Asked Questions, 2016) (Learning about the Omaha System, n.d.). Today, Omaha System is a "research-based, comprehensive practice and documentation standardized taxonomy" designed with three relational components (Solving the Clinical Data-Information Puzzle):

- Problem Classification Scheme: Client assessment;
- Intervention Scheme: Care plans and services; and
- Problem Rating Scale for Outcomes: Client change/evaluation component.

Omaha System exists in public domain and is not under copyright. The terms, definitions and codes are available for use without permission or a licensing fee from the publisher or software developer; however, parts of the 2005 book are under publisher copyright. Companies which design and sell software based on Omaha System are required to observe copyright laws. Individual customers must use the taxonomy as published.

Process for Updating/Publishing Standard

The most recent publication of Omaha System is 2005 and a new version is in use. The update process requires a multi-step, triangulated approach and includes the presentation of user-submitted suggestions at the biennial Omaha System International Conference. In addition to that process, a 12-member international board of directors reviews and revises Omaha System on an ongoing basis using the results of current research, expert opinion and user experience and feedback (Frequently Asked Questions, 2016). It was noted that the update process, intended to maintain the integrity and consistency of the taxonomy, is time-consuming, with some revisions taking years to complete.

Usage/Activity

Originally developed for home care, public health and school health settings, Omaha System today is a multidisciplinary or inter-professional system used across the continuum of care. In 2015, a survey indicated more than 22,000 multidisciplinary clinicians use the Omaha System. User types include "nurses, physicians, occupational therapists, physical therapists, registered dietitians, recreational therapists, speech and language pathologists, and social workers" (Garvin, Martin, Stassen, & Bowles, 2008).

By 2000, Minnesota had 87percent of its counties - both public and private sector - using the Omaha System in one of three software EHRs (Meaningful Use of the Omaha System for Program Evaluation in Public Health Nursing, 2010). In 2001, state and county public health nurses started the Minnesota Omaha System Users Group, now the Omaha System Community of Practice (OSCOP). OSCOP is a "collaborative working group of public health and home care agencies, educators and software vendors who use the Omaha System…it is also an active workgroup with the purpose of improving and standardizing public health practice, documentation, data collection and outcome reporting" (Learning about the Omaha System, n.d.). Under the Minnesota e-Health Initiative and the Minnesota Department of Health (MDH), Minnesota recommends the use of one of the ANA-recognized standard nursing terminologies within the EHR. The state has designated the Omaha System for exchange between public health entities or community-based reporting if both are already using the Omaha System (e-Health Standards, n.d.). Exchange between providers not using the Omaha System should use SNOMED CT and LOINC.

Several EHR developers are using Omaha System and have given permission to be listed on Omaha's website (Links, 2005). Without a prescribed, standardized implementation process, each EHR developer implements Omaha System differently; however, per the subject matter expert, a common consultant ensures correct usage.

Challenges

The Omaha System is reported to be widely used; however, there is no way to track use since taxonomy is in public realm. Many EHR developers may be implementing the system differently and allowing user customization.

Opportunities

Omaha System has no licensing fee and is interdisciplinary across the continuum of care, regardless of setting or timeframe.

6. Perioperative Nursing Data Set (PNDS)

PNDS	
Latest Update via UMLS	2011
Original Publication	1999

Created in 1993, PNDS is maintained by the Association of periOperative Registered Nurses (AORN) Board of Directors (Taulman & Latz, 2011). PNDS is a "standardized language that addresses the perioperative patient experience from pre-admission until discharge; and describes the nursing diagnoses, interventions and patient outcomes that make up the nursing processes" (Taulman & Latz, 2011). It provides a consistent method for classifying and documenting perioperative patient care across the surgical continuum, allowing for the monitoring and benchmarking of patient outcomes and operating room efficiency. The PNDS provides a framework to standardize clinical documentation within an EHR. PNDS is the only perioperative nursing language recognized by ANA.

Process for Updating/Publishing Standard

A change in evidence-based practice per AORN standards and guidelines triggers the need for an update. Once a change is identified, AORN board members review the concept for relevancy and appropriateness. Updated concepts are then either:

- Reviewed by an AORN-PNDS task force; or

- Reviewed at the PNDS Annual Conference by the Educator Specialty Assembly, which rates new concepts for their relevancy and appropriateness to perioperative practice.

PNDS is typically revised every four years to five years; the latest version is the third edition, released in 2009, which added new concepts. A new version dealing with interventions for the surgery "timeout" process is in development; release date will be determined based on priority of information.

Usage/Activity

The current usage demographic includes more than 400 hospitals, research facilities, surgery centers and educational institutions. A license is required, and cost varies between hospitals and researchers. Researchers can use PNDS free, but health care organizations pay based on the number of operating rooms (ORs) and operative procedures performed.

Challenges

PNDS concepts have not been maintained in SNOMED CT since 2000. In addition, as SNOMED CT nursing content has expanded, there may be new concepts in SNOMED CT that better

represent the PNDS concepts, so the PNDS subject matter experts do not recommend using the existing maps.

Opportunities

PNDS is the only nursing language focused on perioperative nursing process and practice.

7. Alternative Billing Concepts (ABC) Codes

ABC Codes	
Latest version of terminology standard available through UMLS	2009
Original Publication	2000

ABC Codes do not include an implicit information model and were designed for computerized documentation and measurement of non-physician and alternative medicine health services. They allow health care disciplines not reimbursed using standard billing codes to submit health care claims (ABC Coding Solutions). They consist of five-digit HIPAA compliant alpha codes with both a short description and an expanded definition.

Process for Updating/Publishing Standard

ABC Coding Solutions (formerly Alternative Link Incorporated) publishes ABC Codes. User inputs and practitioner requests have prompted updates and refinements of existing code that are needed to supplement codes on standard CMS 1500 claim. The initial code manual was available in 2000. Regular publications occurred in 2015 and 2016; however, between 2010 and 2015, there was a publishing gap due financial issues.

Usage/Activity

The codes are used to supplement Current Procedural Terminology (CPT) or Healthcare Common Procedure Coding System (HCPCS) Level II codes on standard Centers for Medicare and Medicaid Services (CMS)-1500 paper claims and ANSI ASC X12N 837P standard electronic claims when filing to health insurers (Association A. M.) (Medicare Billing: 837p and Form CMS-1500, 2012). ABC Codes have not been widely adopted and are not considered valid billing codes by Medicare.

In the absence of data from specific users, the table below illustrates different health care areas that the codes could support.

ABC Code Support Areas	
• Clinical Nurse Specialist (all specialties) • Clinical Social Worker • Doctor of Chiropractic • Doctor of Oriental Medicine • Doctor of Osteopathy (holistic) • Holistic Nurse/Marriage and Family Therapist • Massage Therapist • Midwife (Certified and Lay) • Medical Doctor (holistic, all specialties) • Naprapath • Naturopathic Doctor	• Nurse Midwife (all specialties) • Nurse Practitioner (all specialties) • Nutritionist • Occupational Therapists • Physical Therapists • Professional Counselor • Reflexologist • Registered Dietician • Registered Nurse (all specialties) • Spiritual Advisor/Pastor/Priest (all faiths) • Spiritual Nurse (all faiths)

Challenges

ABC Codes are not mapped to SNOMED CT or LOINC. Interfacing with SNOMED CT lacked source of financial support, an issue echoed by other terminology owners. In addition, ABC codes do not represent clinical concepts, as they are oriented to the revenue cycle.

Opportunities

ABC Codes represent services supplied by non-traditional providers, including nurse practitioners and other advanced practice nurses, outside of current valid billing codes; they offer a potential avenue for billing for these services. Today, most insurance companies and Medicare will not reimburse for these services.

C. Minimum Data Sets

The general concept of a Uniform Minimum Health Data Set (UMHDS) can be defined as "a minimum set of items [or elements] of information with uniform definitions and categories, concerning a specific aspect or dimension of the health care system, which meets the essential needs of multiple data users" (Werley, Devine, Zorn, Ryan, & Westra, 1991). A minimum data set typically is organized around a specific type of data in order to support data sharing, comparison and analyses. Possible values for each data element must be determined, such as lists of agreed terminology. ANA recognizes two minimum data sets: the Nursing Minimum Data Set (NMDS) and the Nursing Management Minimum Data Set (NMMDS).

1. Nursing Minimum Data Set (NMDS)

NMDS	
Latest Update via UMLS	NMDS- Not in UMLS
Original Publication	NMDS- 1983

The NMDS is a set of elements developed consistent with the general concept of a Uniform Minimum Health Data Set (UMHDS) and specifically intended for the collection of essential nursing care data. Under the leadership of Harriet Werley and Norma Lang, a national group of experts in nursing used a

consensus process to develop the NMDS (Interview, 2016). It was published in 1988 and recognized by ANA in 1999. The NMDS includes 16 items organized into categories of nursing care (diagnoses, interventions and outcomes and intensity of nursing care), patient demographics and service elements (e.g. facility identifier, nurse identifier, admission and discharge dates). The elements of NMDS can be used as a framework by other nursing terminologies such as NANDA, NIC and NOC.

Process for Updating/Publishing Standard

The NMDS has not been updated since 1983. The original version stands as the accepted standard.

Usage/Activity

Currently the NMDS is not in widespread use.

Challenges

The NMDS is designed to encompass the minimum core data elements regularly used by nurses across all care settings. The potential applicability and use of the minimum data sets are thus extremely broad.

Opportunities

Adoption of NMDS as a core standard throughout the health care system, in conjunction with other relevant standards, such as terminologies, may ensure that elements are captured and recorded to follow the patient across care settings. Further, that continuity would support safer, better care for patients by providing robust, semantically interoperable documentation of nursing care that could have secondary uses for researching the efficacy and outcomes of nursing care.

Notably, NMDS calls for a unique number to identify the primary nursing care provider. This aligns with the growing need to:

- Provide a measurement method for the individual nurse-patient care provided in value-based care; and
- Better understand the relationship between nursing costs and resources with the quality and outcomes of care (Welton & Harper, Measuring Nursing Care Value, 2016).

Since the NMDS was last published, HIPAA established the National Provider Identifier (NPI). The broad definition of eligibility for assignment of an NPI (individuals or organizations that render health care as defined in regulation), may represent an opportunity for nurses throughout the health care system to obtain unique identifiers without incurring application, issuance or maintenance expense (NPI: What You Need To Know, 2004). However, this opportunity would require exploration and potentially issuance of clarifying educational guidance by HHS. Current guidance materials refer to individual providers as "sole proprietors," and it may be unclear to many nurses who are not able to enroll in and bill insurers independently if or how they should apply for an NPI considering they do not furnish care as sole proprietors in the most commonly understood sense of the term.

2. Nursing Management Minimum Data Set (NMMDS)

NMMDS	
Latest Update via UMLS	Not in UMLS
Original Publication	1996/1997

The NMMDS is a uniform minimum health data set that "specifically identifies variables essential to nursing administrators for decision-making about nursing care effectiveness" (Gardner-Huber, Delaney, Crossley, Mehmert, & Ellerbe). It was developed to provide a framework for the data needs of nurse executives and provides a "…collection of core data elements needed by nurse administrators to make management decisions and compare the effectiveness of institutions" (Gardner-Huber, Delaney, Crossley, Mehmert, & Ellerbe). The NMMDS framework is guided by the work of Werley and Lang's NMDS, the Iowa Model of Nursing Administration and Donabedian's components for measuring quality (Gardner-Huber, Delaney, Crossley, Mehmert, & Ellerbe). The NMMDS is structured around 18 elements associated with nursing environment, nursing care resources and financial resources.

NMMDS variables of interest include, but are not limited to:

- Staffing;
- Client/ patient population;
- Model of care delivery; and
- Type of nursing unit (Delaney, Westra, & Pruinelli, 2015).

From an activity standpoint, NMMDS can "link to and augment the other minimum health data sets by providing information uniquely important to nursing administrative decisions, and thus the evaluation of nursing services for cost and quality" (Delaney, Westra, & Pruinelli, 2015). All updated elements for the environment and nurse components are mapped to LOINC.

Process for Updating/Publishing Standard

NMMDS used a descriptive survey approach as the process for the original version. The survey used a Delphi technique in order to "elicit the opinions and consensus of experts in the identification of essential elements for the NMMDS" (Delaney, Westra, & Pruinelli, 2015) (Gardner-Huber, Delaney, Crossley, Mehmert, & Ellerbe). Following the completion of the survey processes, a proposed list of 18 NMMDS elements were established. Over the years, updates have been made to the NMMDS following a similar process of the original version. The updating processes include:

- Expert review panels;
- National Delphi surveys;
- Focus groups;
- Cross-sectional descriptive surveys; and
- A national consensus working conference (Huber, Schumacher, & Delaney, 1997).

The last version of NMMDS was published in 2015; there is no plan to update NMMDS in the near future.

Usage/Activity

NMMDS has not achieved widespread usage.

Challenges unknown

Opportunities

NMMDS has the potential to provide nurse executives access to important data for decision-making and benchmarking of services across care delivery settings, which contributes to both quality and outcomes of care. The implementation guide is available online (Delaney, Westra, & Pruinelli, 2015).

VI.   Health IT Developers - Perspective

To gain an additional perspective on usage of SNTs within health IT, the project team surveyed three EHR developers, using the questionnaire in Appendix C, sampled from those serving the acute care nursing domain. Developers were chosen at the discretion of the contract team generating the report and although anonymity was not a requirement for discussion with the project team, the comments from vendors have been blinded and collated for the purposes of this report. Discussions focused on understanding how SNTs are used within each developer's software applications, the process used to implement any SNT, and the benefits and challenges of implementation and usage of SNTs. Identified themes are highlighted below:

- Mapping and the maintenance of maps is a resource-intensive endeavor. Some customers employ third-party resources to maintain their terminology mappings. Many facilities have a clear lack of mapping expertise.
- Most vendors do not align with a single SNT due to customer requests for customization and varying nursing leadership philosophies on SNTs. Due to the ONC certification requirement, most workflows and clinical content are mapped to SNOMED CT and LOINC.
- Developers try to find balance between offering customization options and providing data standardization and mapping. The variability across nursing standards makes basic integration with EHRs difficult, and developers must maintain flexibility in the marketplace, with regard to customer requests for customization.
  - One vendor gave a specific example of how customized documentation affects the ability of an organization to retrieve data, citing a facility that customized more than 200 forms without mapping any data elements SNOMED CT or LOINC. Although the forms are highly specific to a care setting or patient population, no data mining is possible with those forms in their current state.
- Licensing fees represent a barrier to the widespread distribution of some terminologies through a vendor platform.
- Some customers find the language in some terminologies awkward and difficult to implement; this becomes more apparent as customers move to implement an interdisciplinary care plan and other types of clinical documentation.
- Some assessment scales have copyrights and fees associated with use. This is reported to be a barrier for customers and makes it difficult to standardize assessment data across settings.

- Often, facility-specific customization affects widespread data mining efforts. Although data may be usable for a single facility, it is difficult to interconnect this system to other systems. One vendor referred to clients being "data rich but information poor."

VII. Emerging Issues in Using SNTs

1. Lack of Alignment on Terminology Standards for Nursing Content Definition

Standardization is critical for sharable, comparable data needed to effectively deliver care and conduct research. Our analysis identified the need for a common language that captures the nursing process, including actions and outcomes to determine the contribution of nurses to good quality and outcomes across care settings. Although some facilities have mapped nursing content to one or more SNTs in their electronic health records, a lack of harmonization across standards inhibits the goal of interoperable, shared data that moves with the patient across care settings.

With regard to nursing documentation and content, multiple nursing assessment scales exist to represent the same concepts. The lack of standardized assessment tools and forms make it difficult for software developers and their customers to standardize their clinical content. Most EHR developers report that lack of standardization in their products results from lack of harmony and agreement in field. All three developers interviewed agreed they would welcome the adoption of standardized nursing content and would prefer this to the individual client site customizations that affect interoperability as well as data integrity and validity.

2. Customized Development and Implementation of EHR Systems

A lack of data standardization in nursing content, and clinical content in general, exists within many installed electronic health record sytems. Sometimes this lack of standardization is due to customer demands for customized content. It could also demonstrate the need to perform "spring cleaning" (Effken & Weaver, 2016) of longstanding nursing documentation that does not provide value. Problematic customization may include the deployment of unique data elements or non-standard, non-mapped vocabularies to meet local preferences or prior practices, rather than using standard clinical data element templates linked to specific terminologies. Individual facilities may also fail to deploy templates with robust and effective user-centered design of the user interface and workflows in juxtaposition with the clinical care workflow. Finally, different customers often prefer one SNT to another; it is difficult to obtain agreement across a software developer's customer base on the use of a single standardized terminology.

The variation currently seen negatively affects the ability to share clinical data across settings of care in a meaningful way to ensure safer, better care for patients or to use the data for analytics. It also affects the accuracy of clinical quality measures and outcome analysis.

3. Resource-Intensive Mapping Requirements, Curation and Maintenance

The process of mapping local content to reference terminologies, specifically SNOMED CT and LOINC, is a resource-intensive one. Whether mapping is performed and maintained by the software developer, a third-party vendor or the individual health care organization, the process is complex and carries a cost burden. It also requires clinical "informaticists" with deep expertise and proficiency as experts with the

needed training and skills in terminology and mapping techniques are in short supply throughout the market. Further, expert terminologists may not always perform their mappings in exactly the same way, creating an issue with interoperability while imprecise mapping creates issues with the reliability and validity of data. Finally, mappings must be updated when new versions of an SNT are released, new content is created or new quality measurement specifications are determined.

In addition to mapping concerns, the curation and maintenance of terminology maps and nursing documentation continues to present a barrier to progress. The establishment of curation parameters, the maintenance of standardized maps and nursing documentation, and the governance of those processes are beyond the scope of this paper. However, arriving at a consensus on a terminology strategy will only support progress if the issues of curation, housing, dissemination and communication are also established.

4. Licensing Fees, Copyrights and Associated Pricing Challenges

Licensing fees are charged for some SNTs, which rely on these fees to support operations. In addition, most assessment scales are copyrighted and the copyright owners charge a licensing fee for use, potentially serving as a barrier for integration at many customer sites.

SNTs that do not employ a licensing fee represent a different set of challenges, as they often lack the resources to perform regular maintenance and updates to terminology. It is also difficult to monitor for, and take action to discourage, the misuse of the terminologies. The absence of licensing can also present a challenge in tracking the usage of terminology.

5. Incomplete Electronic Documentation of Nursing Care

There are many reasons for the absence of nursing data in the EHR, including the lack of a widely adopted approach to standard terminologies, high patient workload, low integration of required documentation with nursing decision support, poor design and the absence of a motivating value proposition. On the topic of design and value, one chief nursing informatics officer performed an intensive analysis of the nursing admission assessment at her facility and discovered that nurses completed 153 required fields across 14 different screens but only 25 percent of the nursing data in the EHR was useful to them (Effken & Weaver, 2016). Frustration with documentation can be exacerbated by workflow and usability issues within the EHR, as well as the lack of inclusion of some nursing components and nursing-sensitive data to support quality measurement and outcome analysis. The documentation burden on nurses could potentially be alleviated through the redesign and streamlining of their existing documentation, much of which was patterned after historical (i.e., paper-based) processes and forms. The combination of efficient, value-based documentation and a standardized terminology strategy could be significant for nurses and patients.

VIII. Conclusion

In addressing the need to capture nursing data, Welton and Harper (2016) stated, "…as we move toward a value- oriented health care system, there is a growing need to address the largest human capital component of the system, nursing care, and devise methods and actions to understand better how nursing costs and resources are expended for each patient and how these relate to the quality and outcomes of care" (Welton & Harper, Measuring Nursing Care Value, 2016). Without commitment from nursing on a comprehensive strategy for data standardization, the vision of representing nursing care in the data will never be realized fully. More importantly, the interdisciplinary care team interacting with the patient may not be privy to nursing data across the care continuum and ultimately, patient outcomes may be negatively impacted.

In order to realize the full potential of health IT, the ability to achieve interoperability using consistent standards and common data elements is paramount. The increasing amount of data available to perform sophisticated analytics and support clinicians in their delivery of good-quality patient care presents a tremendous opportunity to improve the health of patients and represent the work performed by registered nurses across care settings.

The purpose of this report was not to solve the problem of how to best capture nursing data; we recognize there are many talented individuals who are working to achieve this goal of data capture. Rather, we hope to provide readers with a baseline analysis of the current state of standard nursing terminologies, including their challenges and opportunities, and perhaps foster further discussion in this knowledge domain. Despite decades of work in this field, perspectives have failed to align while the landscape of patient care has changed dramatically with the advent of alternative payment models, payment for quality and outcomes, a focus on population health, and increasing requirements for interdisciplinary care planning and documentation. The ability to move forward with a comprehensive nursing terminology strategy could play a key role in the increased visibility of registered nurses in this new world of changing care models. More important, that visibility and measurement of "what nurses do" both individually and as a member of the care team could significantly improve outcomes for patients.

Appendix A: Expanded Nursing Terminologies Timeline

1973. The First National Congress on the Classification of Nursing Diagnoses takes place in St. Louis.

1982. The North American Nursing Diagnosis Association (NANDA) is founded.

1989. James J. Cimino et al authors "Designing an Introspective, Multipurpose, Controlled Medical Vocabulary" which describes seven features that a controlled health care vocabulary should possess. See Exhibit A below for additional information.

Exhibit A: Seven Properties of a Controlled Vocabulary
1. <u>Domain Completeness:</u> The ability to accommodate appropriately all necessary concepts. Schemes should not limit depth or breadth of hierarchies. Compositional approaches allow complex concepts to be represented.
2. <u>Unambiguous:</u> Terms should clearly represent only a single concept (see semiotic triangle). Synonyms should be pure.
3. <u>Non-redundancy:</u> There must be only one way of representing a concept in the vocabulary, or equivalences between alternative representations should be detectable.
4. <u>Synonymy:</u> More than one term (synonym) may describe the same concept.
5. <u>Multiple Classification:</u> Entities from the vocabulary should be placed in more than one hierarchy location if appropriate. For example, Carcinoma of the colon is both a Malignant disease and a Large intestinal disease.
6. <u>Consistency of Views:</u> Cimino identified the problem of multiple classification being inconsistent or incomplete and that qualifiers or modifiers might vary between different parts of the hierarchy.
7. **<u>Explicit Relationship:</u>** The nature of relationships between concepts in the vocabulary structure should be explicit and usually sub-class.

1989. The ANA establishes the Steering Committee on Databases to Support Nursing Practices to develop criteria for recognition of nursing terminologies.

1990. The ANA House of Delegates passes a resolution recommending that the Nursing Minimum Data Set (NMDS) be used as the essential data elements to define the cost and quality of nursing practice.

1994. The ANA Steering Committee on Databases to Support Clinical Nursing Practice recognizes four nursing classification schemes for use in national databases in the United States.

1997. The ANA publishes a book titled "Nursing Information & Data Set Evaluation Center (NIDSEC): Standards and Scoring Guidelines." In this book, the ANA publicizes the early stages of guidelines to use to evaluate information systems that support the documentation of nursing practice. The information systems are evaluated based on four dimensions: 1) Nomenclature – terms must be contained in the UMLS and reflect the current recognized SNTs; 2) Clinical Content – representing the nursing process; 3) Data Repository – existence of a clinical data repository (CDR) to store data longitudinally; and 4) General System Characteristics– characteristics of the hardware/software system to support storage of nursing data and the processing requirements of the CDR.

1997. Beginning in 1997, the American Medical Informatics Association (AMIA) Nursing Informatics Working Group (NIWG) sponsors activities to support the facilitation of information between nursing terminology experts and other informatics stakeholders. This includes tutorials, workshops and panels as well as publication of articles.

1998. James J. Cimino publishes an extension of his 1989 work, titled "Desiderata for Controlled Medical Vocabularies in the Twenty-First Century." In this work, Cimino expands upon his earlier work and describes 12 common themes that every terminology needs to achieve to be considered standardized. Cimino emphasized the "sharability of vocabulary" which refers to the ability of the vocabulary "to be used to record data for one purpose and then be used for reasoning about the data usually through a variety of views or abstractions of the specific codes used in data capture." See Exhibit B for additional information.

Exhibit B: Cimino's Twelve Desiderata Points
1. <u>Content</u>: To most users "What can be said" is more important than "how it can be said." Omissions are readily noticed and timely, formal and explicit methods for plugging gaps are required.
2. <u>Concept Orientation</u>: The unit of symbolic processing is the concept, and each concept in the vocabulary should have a single, coherent meaning.
3. <u>Concept Permanence</u>: A concept's meaning cannot change, and it cannot be deleted from the vocabulary.
4. <u>Meaningless Concept Identifiers</u>: Concepts typically have unique identifiers (codes), and these should be non-hierarchical to allow for later relocation and multiple classifications.
5. <u>Polyhierarchy</u>: Entities from the vocabulary should be placed in more than one hierarchy location if appropriate.
6. <u>Formal Definitions</u>: Semantic definitions of concepts, for example, Streptococcal tonsillitis = Infection of tonsil caused by streptococcus.
7. <u>No residual categories</u>: Traditional classifications have rubrics that include not otherwise specified (NOS), not elsewhere classified (NEC), unspecified or other. These are not appropriate for recording data in an electronic health record.
8. <u>Multiple Granularities</u>: Different users require different levels of expressivity. A general (family) practitioner might use myocardial infarction while a surgeon may record acute anteroseptal myocardial infarction.
9. <u>Multiple Consistent Views</u>: Although there may be multiple views of the hierarchy required to support different functional requirements and levels of detail, these must be consistent.
10. <u>Content Representation</u>: There is a crucial relationship between concepts within the vocabulary and the context in which they are used. Cimino defines three types of knowledge: Definitional (how concepts define one another), Assertional (how concepts combine) and Contextual (how concepts are used).
11. <u>Graceful Evolution</u>: Vocabularies must be designed to allow for growth and change to incorporate new advances in health care and to correct errors.
12. <u>Recognized Redundancy</u>: Where the same information can be expressed in different ways, a mechanism for verifying equivalence is required.

1999. The ANA upates its criteria for recognition of nursing terminologies using the International Standards Organization (ISO) standards for terminologies.

June 1999. Vanderbilt University convenes the Nursing Vocabulary Summit Conference with the objective of reaching consensus on characteristics of a nursing terminology standard. One of the primary outcomes of this summit is a realization that no one classification system can serve as the standard, but rather efforts need to be made to develop a reference terminology to harmonize existing standards. Held annually until 2008, the work of the conference contributes to the adoption of standards for nursing.

July 2000. The National Committee on Vital and Health Statistics (NCVHS) publishes a report titled "Uniform Data Standards for Patient Medical Record Information" to the U.S. Department of Health and Human Services (HHS) regarding the adoption of uniform data standards for patient medical record information (PMRI) and the electronic exchange of such information. The report establishes four guiding principles for PMRI terminology:

- Terminology should enable interoperability between information systems;
- Terminology should facilitate the comparability of data;
- Terminology should have aspects that support data quality, accountability and integrity; and
- Terminology should have a degree of market acceptance.

December 2002. NCVHS publishes a subsequent report that focuses on the appropriate scope and criteria of a uniform data standard. Within this report, NCVHS recognizes essential and desired technical and organizational criteria that mirror Cimino's "Desiderata." Some essential technical criteria include ideas around concept orientation (each concept having a single coherent meaning) and permanence (a concept meaning should not be changed). Some organizational criteria include the establishment of a governance structure and development of a funding mechanism.

NCVHS Technical Criteria

Four Essential Technical Criteria
1. <u>Concept Orientation</u>: Elements of the terminology are coded concepts, with possible multiple synonymous text representations, and hierarchical or definitional relationships to other coded concepts.
2. <u>Concept Permanence</u>: The meaning of each code concept in a terminology remains forever unchanged. If the definition of a concept needs to be changed or refined, a new code concept is introduced. No retired codes are deleted or re-used.
3. <u>Non-Ambiguity</u>: Each coded concept in the terminology has a unique meaning.
4. <u>Explicit Version Identifiers</u>: Each version of the terminology is designated with a unique identifier, such that parties exchanging data can readily determine if they are using the same set of terms.

Nine Desired Technical Criteria
1. <u>Comprehensive Domain Coverage</u>: The terminology includes most of the concepts and terms needed for primary clinical documentation in the defined domain area.
2. <u>Meaningless Identifiers</u>: The unique codes used to identify concepts in the terminology are unrelated to the meaning of the concepts or their locations in the concept hierarchy.
3. <u>Multi-Hierarchies</u>: A coded concept may be the "child" of more than one other coded concept in the terminology's hierarchy.
4. <u>Non-Redundancy</u>: Each unique meaning is represented by just one coded concept in the terminology. Each concept may have multiple synonymous terms, but the relationship of the terms to the concept must be explicitly represented.
5. <u>Formal Concept Definitions</u>: The terminology includes logical definitions of coded concepts, allowing redundancy to be automatically detected and appropriate hierarchical relationships to be automatically inferred.
6. <u>Infrastructure/Tools for Collaborative Terminology Development</u>: The terminology is maintained using tools that allow many people to work on a terminology at the same time, and support the assignment, scheduling, collection and integration of their work.
7. <u>Change Sets</u>: Each new version of the terminology includes a complete accounting of the added, retired and modified concepts and terms (i.e., a "delta" file).
8. <u>Mappings to Other Terminologies</u>: The content of the terminology includes mappings to other relevant terminologies, and these mappings have been validated.
9. <u>Support for Local Customization</u>: Tools and processes exist that allow users of the terminology to make local additions and customizations, and later to merge these changes with the subsequent version of the terminology.

NCVHS Organizational Criteria

Desired Organizational Criteria for Core Terminologies
1. Establish intellectual property and licensing terms for the core terminologies (perhaps as a group) that allow the widest use while preventing the proliferation of local, non-standard "dialects."
2. Provide the governance structure of the core terminology developers (perhaps as a group) that guarantees responsible stewardship of the standard and responsiveness to all stakeholders within the defined scope.
3. Incorporate a funding mechanism for the core terminology developers and their development activities (perhaps as a group) that guarantees professional support, timely updates and long-term viability.
4. Appropriate policies and processes for maintenance of the core terminology that preserve high quality while maximizing the rate of enhancement. These policies may entail ANSI-accredited balloting procedures, less formal consensus-based processes or other methods.

2005. HHS notice on 20 CHI standards is adopted by all federal agencies, including SNOMED CT for nursing.

2007. The Healthcare Information Technology Standards Panel (HITSP) recommends SNOMED CT reference terminology to communicate interoperable information among and between systems. In

addition, the HITSP Interoperability Specification Pre-condition specifies that the sending and using systems must use formal coded nursing terminologies such as the Clinical Care Classification (CCC) System and the Omaha System that are integrated in SNOMED CT.

2008. The ANA establishes a six-point framework to describe the basic requirements for a standardized nursing terminology. This framework is entitled "Recognition Criteria Approved by the Congress on Nursing Practice and Economics." See Exhibit C for summary of the six-point criteria.

Exhibit C: ANA Recognition Six-Point Criteria Approved by the Congress on Nursing Practice and Economics

1. The terminology supports one or more components of the nursing process.
2. The rationale for development supports this terminology as a new terminology itself or with a unique contribution to nursing/health care.
3. Characteristics of the terminology include:
   - Support of one or more of the nursing domains;
   - Description of the data elements;
   - Internal consistency;
   - Testing of reliability, validity, sensitivity and specificity;
   - Utility in practice showing scope of use and user population; and
   - Coding using unique context-free identifier.
4. Characteristics of the terminology development and maintenance process include:
   - The terminology's intended use;
   - The centricity of the content (patient, community, etc.);
   - Research-based framework used for development;
   - Open call for participation for initial and ongoing development;
   - Systematic, defined ongoing process for development;
   - Relevance to nursing care and nursing science;
   - Collaborative partnerships;
   - Documentation of history of decisions;
   - Defined revision and version-control mechanisms;
   - Defined maintenance program; and
   - Long-term plans for sustainability.
5. Access and distribution mechanisms are defined.
6. Plans and strategies for future development are defined.

2013 through 2016 (annually). The University of Minnesota School of Nursing – Center for Nursing Informatics begins hosting the Nursing Knowledge: Big Data Research to Transform Health Care consensus conference. The conference's main purpose is to create "a national action plan for implementing and using sharable and comparable nursing data for quality reporting and translational research." At the 2014 conference, the National Action Plan for Sharable and Comparable Nursing Data for Transforming Health and Healthcare (National Action Plan) is created. The 2014 National Action Plan addresses the top four "challenges" that have the most impact on achieving a sharable and comparable nursing data system. Exhibit D provides a breakdown of the four "challenge" areas and the major tasks associated with each area.

Exhibit D: 2014 National Action Plan Challenge Areas and Major Tasks	
Challenge Areas	**Major Tasks**
Education	• Develop a standardized curriculum for nursing informatics faculty and students. • Foster advancements in certification, credentialing and accreditation systems within nursing informatics programs.
Practice	• Transform nursing documentation by identifying the information structures and infrastructures needed within EHRs and clinical data repositories (CDRs) to enable the storage, aggregation and querying of nursing data at an organizational level. • Develop strategies to measure the value of nursing by developing a national consensus model and identifying new business intelligence/analytic tools.
Policies/Incentives	• Advance the National Database of Nursing Quality Indicators (NDNQIs) to promote HIT policy. • Coordinate efforts to engage nurses in HIT policy. • Build an infrastructure for the collection and dissemination of standardized workforce data.
Research	• Develop and disseminate LOINC/SNOMED CT framework for integration into EHRs. • Promote harmonization and standardization of nursing data and models. • Advancing/engaging nurse research and the science of big data.

2015. The Healthcare Information and Management System Society (HIMSS) CNO-CNIO Vendor Roundtable forms the Big Data Principles Workgroup, which is tasked with developing a white paper to identify big data principles, barriers and challenges; develop a framework for requirements; identify differences in the context of nursing outcomes; address the impact of HIT system versions/configurations; analyze the variation in quality measures; and discuss implementation challenges. The resulting white paper on the "*Guiding Principles for Big Data in Nursing*" identifies 10 recommendations within three major areas of Promoting Standards and Interoperability, Advancing Quality eMeasures and Leveraging Nursing Informatics Experts. The recommendations that are focused on Promoting Standards and interoperability are the most relevant to the topic of SNTs, and include the following:

• Promote the use of standardized and accepted terminologies to address documentation needs of entire care teams regardless of setting. This should include a plan for implementing an ANA-recognized nursing terminology mapped to a national standard, i.e. SNOMED CT or LOINC.
• Recommend consistent use of assessment scales standardized through an international consensus body.
• The ANA-recognizes nursing terminologies should be updated consistently and made available to international standards organizations for translation and complete, comprehensive mapping.

- Minimize the use of free text documentation and use discrete data elements to enable decision suppport, research, analytics and knowledge generation.

2015. The ANA publishes a position statement reaffirming its support for the use of recognized terminologies supporting nursing practice within the EHR and other health information technology solutions.

2016. ONC assigns a landscape assessment to understand better the current status and associated challenges with the current 12ANA-recognized terms.

Appendix B: Pre-Determined Landscape Assessment Questionnaire

Area of Analysis	Questions
Background Information	- What is the latest version available through the Unified Medical Language System Metathesaurus? - Who is the person of contact?
Publishing	- When was the original publication? - When was the last publication? - Is there a regular publishing schedule?
Usage/Activity	- Who currently uses your SNT? - Do you have a list of health systems using your SNT? - Do different pricing options exist for profit organizations vs. non-profit organizations vs. academic institutions? Is there different pricing depending on usage (e.g., research vs. health care). Please describe your cost and pricing structures. - Are there any trademark and copyright constraints? Please describe.
Interoperability	- Is your SNT interoperable with any electronic health records (EHRs)? - If so, which ones? - What is the process for having your SNT built into a health system's EHR?
SNT Maintenance	- What maintenance is required by the software developer? What maintenance is required by the health system? - Why should health systems invest in this? Why should software developers invest in this?
Integration/Representation/Mapping	- Is your SNT integrated within Systematized Nomenclature of Medicine -- Clinical Terms (SNOMED CT)? - Is your SNT represented by Logical Observation Identifiers Names and Codes (LOINC)? - Is your SNT mapped to any other standard terminologies?
Other	- What does the future look like for your SNT? - How do you work with other SNTs?

Appendix C: EHR Developer Assessment Questionnaire

Area of Analysis	Questions
Implementation of SNT with EHR	• What are the major challenges that your (software developer) nursing informatics lead person faces when implementing SNTs for your EHR system for the nursing associated modules (care plans, etc.)? • Does your company employ "terminologists" or do you rely on the customer to manage that part of the EHR implementation? • In your nursing related software applications (clinical documentation, plan of care, surgical services, home care, etc.), which standardized nursing terminologies are used in each area? • How did you make the decision to use that terminology? • Does your system allow the use of more than one of the SNTs?

Appendix D: List of Abbreviations

ABC Codes   Alternative Billing Concepts Codes

ANA   American Nurses Association

AORN   Association of Perioperative Registered Nurses

CAP   College of American Pathologists

CCC System   Clinical Care Classification System

CMS   Centers for Medicare and Medicaid Services

CNC   Center for Nursing Classification and Clinical Effectiveness

CORE   Clinical Observations Recordings and Encoding

CPT   Current Procedural Terminology

DDC   Diagnosis Development Committee

EHR   Electronic Health Record

HCPCS   Healthcare Common Procedure Coding System

HIT   Health Information Technology

HL7   Health Level Seven

ICD-10   International Classification of Diseases – 10TH version

ICN   International Council of Nurses

ICNP   International Classification for Nursing Practice

LOINC   Logical Observation Identifiers Names and Codes

MDH   Minnesota Department of Health

NANDA   North American Nursing Diagnosis Association

NANDA-I   NANDA International

NCVHS   National Committee on Vital and Health Statistics

NEC   Not elsewhere classified

NIC	Nursing Interventions Classification System
NLM	National Library of Medicine
NMDS	Nursing Minimum Data Set
NMMDS	Nursing Management Minimum Data Set
NNN	NANDA/NIC/NOC
NOC	Nursing Outcomes Classification
NOS	Not otherwise specified
NRC	National Release Centers
OJIN	Online Journal of Issues in Nursing
ONC	Office of the National Coordinator for Health Information Technology
OSCOP	Omaha System Community of Practice
PNDS	PeriOperative Nursing Data Set
PoC	Plan of Care
RELMA	Regenstrief LOINC Mapping Assistant
SDO	Standards Development Organization
SMEs	Subject Matter Experts
SNOMED CT	Systematized Nomenclature of Medicine - Clinical Terms
SNTs	Standard Nursing Terminologies
ULMS	Uniform Medical Language System
UMHDS	Uniform Minimum Health Data Set
v.	Version
VNS	Visiting Nurse Association

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