

Developing an NLM Nursing Terminology Resource

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Abstract

OBJECTIVE:

The objective of this project is to develop a resource webpage that provides information on nursing terminologies, demonstrates use of the Unified Medical Language System (UMLS) to extract synonymy between nursing terminologies, and link resources from the National Library of Medicine (NLM) and relevant outside organizations and resources related to nursing terminologies.

METHODS:

To develop the resource page, the Associate performed the following tasks: determined the scope and audience of the webpage, drafted and finalized resource webpage content, produced a video tutorial, and created a mockup of the resource page for webpage development.

RESULTS:

The primary outcome of this project was the development of a resource webpage entitled *Nursing Resources for Standards and Interoperability*. This resource describes the role of SNOMED CT and LOINC in implementing Meaningful Use in the United States, details international efforts to harmonize nursing terminologies and facilitate interoperability, and links to resources from the NLM and other relevant organizations. The webpage also includes a video tutorial that explains how to extract synonymy between SNOMED CT and other nursing terminologies from the UMLS. Finally, a mockup of the resource page was created to guide the design of the webpage.

DISCUSSION:

During the course of the project, the Associate gained significant knowledge about nursing terminologies, SNOMED CT, UMLS, and Meaningful Use. The project also provided the Associate with insight into NLM's involvement, both nationally and internationally, with the nursing community, particularly in light of Meaningful Use. Additionally, the Associate gained experience working with tools for sound recording and editing, screen recording and video editing, and wireframing and webpage mockup.

RECOMMENDATIONS:

To encourage use of the resource webpage and ensure that content is relevant to the intended users, the Associate recommends the following: integrate resource webpage into existing NLM webpages and monitor access points through web metrics; encourage discovery of webpage and feedback on page content from the nursing community by coordinating with project consultants, Susan A. Matney (3M Health Information Systems) and Judith J. Warren (Warren Associates, LLC), to disseminate the resource webpage to relevant national and international groups.

Background

Nursing terminologies are vocabularies of terms specific to the nursing profession that facilitate standardized documentation of nursing care. These terminologies allow documentation of nursing specific diagnoses, interventions, and outcomes as they appear in clinical settings. Nursing terminologies allow terminology that is clinically relevant to nurses, and other nursing professionals, to be included in clinical documentation as well as electronic health information systems. Several nursing terminologies are included in the Unified Medical Language System (UMLS), including: Clinical Care Classifications (CCC), International Classification for Nursing Practice (ICNP), NANDA International (NANDA-I), Nursing Interventions Classifications (NIC), Nursing Outcomes Classification (NOC), The Omaha System (OMS), and Peri-Operative Nursing Data Set (PNDS).[1] Each of these terminologies cover an area of nursing practice (e.g., diagnoses, interventions, etc.) and are recognized by the American Nurses Association (ANA) as terminologies that support nursing practice.[2] However, there exists overlap in the concepts and terms covered by these individual terminologies. Additionally, nursing terminologies are not used consistently in clinical settings, which adds difficulty to the exchange of health information across electronic health information systems.

In the United States in 2009, the Health Information Technology for Economic and Clinical Health ACT (HITECH) ACT, as part of the American Recovery and Reinvestment Act (ARRA), outlined the adoption of electronic health record (EHR) systems with an emphasis on health care providers demonstrating "Meaningful Use". Providers comply with Meaningful Use through adoption of a certified EHR system and by demonstrating significant use of the EHR system through quality and quantity measures. A suite of vocabulary standards, applications, and tools are specified for inclusion in EHR systems to achieve certification and adhere to Meaningful Use.

Systemized Nomenclature of Medicine - Clinical Terms (SNOMED CT) is one of the vocabulary standards adopted for the purposes of Meaningful Use. SNOMED CT is a clinical terminology that covers a broad spectrum of clinical specialties and disciplines. Specific to nursing, SNOMED CT contains concepts for nursing diagnoses, interventions, and patient outcomes. The International Health Terminology Standards Development Organisation (IHTSDO) owns, maintains, and distributes SNOMED CT. The United States is a member country of the IHTSDO and as the National Release Center for the US, the National Library of Medicine (NLM) provides free access to SNOMED CT through the UMLS, downloads of the International Edition or through the United States Edition of SNOMED CT.

In the United States, SNOMED CT must be used for recording problems in patient problem lists in EHR systems. One way that NLM provides assistance with this criterion is by developing the Clinical

Observations Recording and Encoding (CORE) Problem List Subset of SNOMED CT. This subset allows for the coding of medical diagnoses and findings. The CORE Problem List Subset contains over 5,000 medical diagnoses and findings, however, it is not inclusive to nursing documentation. As a result, the Nursing Problem List Subset of SNOMED CT was developed, which can be used in conjunction with CORE, to facilitate the use of SNOMED CT for coding terminology related to nursing diagnoses.[3]

The development of these SNOMED CT subsets facilitates adherence to Meaningful Use. However, the subsets also encourage interoperability between terminologies. In the case of nursing terminologies, the variety of nursing terminologies available is not necessarily conducive to the exchanges of health information that take place through electronic health systems. Recognizing this, the IHTSDO has formed a Special Interest Group (SIG) for nursing in order to support the representation of nursing in SNOMED CT.[4] Other standards, such as the Logical Observations Identifiers Names and Codes (LOINC) clinical terminology, have also formed groups or committees focused on nursing coverage.[5]

Additionally, the IHTSDO collaborates with other international standards groups, such as the International Council for Nurses (ICN), in order to promote harmonization of terminologies.[4] Due to the increasing emphasis on SNOMED CT as a terminology standard in health information systems, the collaborations primarily revolve around promoting the use of SNOMED CT with other international standards.

Project Objective

Currently, the NLM does not have a webpage that includes information and details about nursing terminologies or that lists the resources available to the nursing community from the NLM and other significant organizations. The primary objective of this project is to create a resource webpage that provides information on select nursing terminologies, demonstrates use of the UMLS to extract synonymy between nursing terminologies, and links to NLM resources on nursing terminologies and to relevant outside organizations and resources. Additionally, the Associate is responsible for creating a mockup of the webpage to facilitate the HTML coding of the webpage.

Two other expected deliverables included in the original proposal were 1) to HTML code the webpage and 2) assist with press releases related to the new subset release and page update. These outputs were to be completed as time permitted and not considered as integral deliverables of the project.

Methods

Determine scope and audience of resource webpage

Prior to developing webpage content, the Associate consulted with project sponsors, Suzy Roy and Vivian Auld, about the scope and users of the resource webpage. The scope of the webpage was primarily based around the objectives of the project, however the specific information included in the resource page needed to be defined. Due to the impact of Meaningful Use on nursing care documentation, as discussed in the Background, the decision was made to focus primarily on SNOMED CT and include information on how to uncover synonyms between SNOMED CT and other nursing terminologies from the UMLS. Information about international efforts to support interoperability and harmonize nursing terminologies would be included as well as links to relevant resources from the NLM and external organizations.

Additionally, project consultants, Susan A. Matney (Medical Informaticist, 3M Information Systems) and Judith J. Warren (Consultant, Warren Associates, LLC) recommended that the webpage include a section about LOINC, which is part of the suite of standards required by the United States government for electronic exchange of health information. LOINC is a clinical terminology comprised of codes that specify laboratory test orders and results. The ANA recognized LOINC as a terminology used by nursing in 2002; since then, efforts have been made to highlight LOINC codes relevant to the nursing care process.

Determining the users of the resource webpage was based, again on consultation with the project sponsors, but also through completion of background reading. Ultimately, the primary users of the resource webpage were determined to be nurses, nursing students, nursing informaticists, and those exploring nursing terminologies for systems development and/or integration purposes.

Develop webpage content

Once the scope and audience were determined, the Associate began drafting the content of the webpage. The initial draft of the content was written by the Associate and reviewed by project sponsors, Suzy Roy and Vivian Auld. Subsequent drafts primarily focused around developing the SNOMED CT section. After the SNOMED CT section was completed, along with modifications to other sections of the resource page, a draft was sent to project consultants, Susan A. Matney and Judith J. Warren, for feedback. Based on the feedback and revisions received from Matney and Warren, the Associate consulted with the project sponsors and made additions and adjustments to the webpage as suggested.

Record and produce video tutorial

As the objective states, the resource webpage will demonstrate how to use the UMLS to extract synonymy between nursing terminologies. The Associate and project sponsors, along with project

consultant, Steve Emrick (Head, Terminology QA and User Services Unit, MEDLARS Management Section), discussed possible methods of communicating this process to users of the webpage. The most straightforward method of accessing synonyms in the UMLS is through use of the UMLS Metathesaurus Browser so the decision was made to create a brief instructional video of the process.

To complete the tutorial, Emir Khatipov, (Technical Information Specialist, MEDLARS Management Section) was recruited to assist due to his expertise in recording and producing video tutorials. The final storyboard of the tutorial is included here as Appendix I: Final storyboard of video tutorial. The Associate recorded the video's narration using Audacity software, which is free, open source software used for recording and editing sounds. The production of the tutorial was completed using Camtasia software used for screen recording and video editing.

Create mockup of the resource webpage

The Associate used Balsamiq, a wireframing and mockup tool, to create a mockup of the webpage. Based on the decisions regarding page content, the webpage would include sections for information about SNOMED CT, LOINC, and other nursing terminologies. Sections for links to NLM resources and external organizations' resources and webpages would also be components of the webpage. Finally, the production of the video tutorial necessitated that an additional section be added to the webpage.

The Associate designed several iterations of the webpage – the majority of modifications made to the webpage's design and structure were based on feedback from project sponsors and project consultants. Additionally, as the content of the resource page developed so did the mockup of the webpage. Both project sponsors also directed the Associate to existing NLM webpages for ideas about structure and style.

Results

As a result of this project, a nursing terminology resource webpage was created, entitled *Nursing Resources for Standards and Interoperability*. This webpage includes descriptions of SNOMED CT, LOINC, and other nursing terminologies; a tutorial demonstrating the use of the UMLS Metathesaurus Browser to extract synonymy between nursing terminologies and SNOMED CT; and links to NLM Resources and Related Links (i.e., external organizations) (see Appendix II: Final draft of resource webpage content).

The descriptions of SNOMED CT and LOINC highlight these existing standards and provide background on the applications of these standards to nursing. These sections also include information about current national and international efforts to increase representation of nursing practice and nursing

care documentation methods in these standards. Additionally, descriptions of other nursing terminologies are included on the webpage under the "Other Nursing Terminologies" section. The other nursing terminologies included in this section are those seven recognized by the ANA as terminologies that support nursing practice (see Background). This section also includes links to other terminologies and tools (e.g., RxNorm, Value Set Authority Center) that nurses will use in the exchange of health information.

The completed video tutorial is entitled "Leveraging UMLS Synonymy to Extract Nursing Terms from SNOMED CT". The tutorial demonstrates how to use the UMLS Metathesaurus Browser to extract concept-level synonyms between SNOMED CT and nursing terminologies. These synonyms are important for nursing care documentation purposes. To show this, the tutorial uses two examples from the NANDA-I terminology to illustrate how to find synonyms between NANDA-I and SNOMED CT. One justification for using NANDA-I in the tutorial is based on a 2011 survey of registered nurses, which indicated that, of the roughly 1,500 respondents, most were familiar with the NANDA-I classification system.[6] The tutorial also shows how to find Concept Unique Identifiers (CUIs) and SNOMED CT Concept IDs for the terms searched.

To provide webpage users with additional resources, links to relevant resources from the National Library of Medicine and selected external organizations were identified for inclusion in the resource page. Two sections were created for "NLM Resources" and "Related Links". The "NLM Resources" section includes links to the UMLS Video Learning Resources, NLM Tools for EHR Certification and Meaningful Use, LOINC, RxNorm, and the Value Set Authority Center (VSAC) webpages. The "Related Links" section includes links to webpages about the IHTSDO, the IHTSDO Nursing Special Interest Group, LOINC from the Regenstrief Institute, the Clinical LOINC Nursing Subcommittee, and the American Nurses Association.

The final draft of the mockup provides a design template for the webpage (see Appendix III: Final draft of webpage mockup). The final mockup includes sections about SNOMED CT, LOINC, and Other Nursing Terminologies. Additional sections for NLM Resources, Related Links, and the video tutorial are part of the final mockup as well.

Following the conclusion of the project, the Associate will assist project sponsor, Suzy Roy, in coding the webpage. Additionally, the Associate may assist in presenting the webpage to nursing groups as requested.

Discussion

The *Nursing Resources for Standards and Interoperability* webpage is a valuable resource for the nursing community. Not only are resources highlighted from the NLM and from significant organizations such as the IHTSDO, the content of the resource page provides detailed information about why particular standards are pertinent and necessary for use in nursing and nursing care documentation.

In building the resource webpage, particularly its content, the Associate gained significant knowledge about existing nursing terminologies as well as the impact of Meaningful Use on nursing and nursing professionals. This knowledge was gained through discussion with project sponsors and project consultants, but also through background reading as suggested by the project sponsors. Additionally, the Associate attended a panel, held at the 2014 annual American Medical Informatics Association (AMIA) symposium in Washington, D.C., entitled "Nursing Data to Support the C-CDA, eMeasures, and Big Data Science – Ready or Not?" This panel reinforced the Associate's understanding of SNOMED CT's role in Meaningful Use and the importance of interoperability between SNOMED CT and other nursing terminologies for clinical documentation purposes. The panel also exposed the Associate to additional efforts around standardization of data and the development of data structures related to nursing data.

Relatedly, this project gave the Associate insight into the national and international position of the NLM in relation to SNOMED CT and standardization efforts. The NLM is the United States (US) distributor of SNOMED CT and a member of the IHTSDO. Other IHTSDO Member countries are implementing SNOMED CT as a standard and, while Meaningful Use is specific to the US, the implementation of SNOMED CT in the US due to federal mandate contributes to larger international efforts toward standardization. As a result, the *Nursing Resources for Standards and Interoperability* webpage provides information that the national and international nursing communities will find relevant and useful.

Developing the video tutorial required the Associate to learn about the UMLS and the UMLS Metathesaurus Browser in order to create a storyboard of the tutorial and execute the video. The Associate viewed several tutorials on searching the UMLS Metathesaurus Browser, included in the UMLS Video Learning Resources collection, to gain familiarity with using the UMLS Metathesaurus Browser. Additionally, the Associate obtained a license to access the UMLS Metathesaurus and use the UMLS Metathesaurus Browser, which allowed the Associate to create the video tutorial.

Throughout the course of the project, the Associate gained experience working with several tools for sound recording and editing, screen recording and video editing, and wireframing and webpage mockup. The Associate had prior experience with Camtasia for screen recording and video editing, but gained

increased exposure working with Emir Khatipov on the production of the video tutorial. Both Audacity, for sound recording and editing, and Balsamiq, for wireframing and webpage mockup, were tools the Associate had no prior experience with, but through use of online tutorials, the Associate learned the basic principles of the tools and was able to complete the necessary work.

Recommendations

Following the posting of the webpage, these recommendations are made to encourage use of the resource page and ensure that the content is relevant to the needs of the identified users.

Integrate resource webpage into existing NLM webpages

To support discoverability, the resource page should be strategically linked to existing NLM webpages. This resource page is unique among NLM webpages and provides valuable information to nurses and other nursing professionals. To ensure that the intended users put the webpage to good use, the Associate recommends providing a link to the resource page from relevant NLM webpages, such as the SNOMED Clinical Terms page and Nursing Problem List Subset of SNOMED CT page. Additionally, use of the resource webpage should be monitored through web metrics with a focus on how users access the resource page. This monitoring can assist with determining if there are additional locations from which to link to *the Nursing Resources for Standards and Interoperability* webpage.

Encourage discovery and feedback on resource webpage from nursing community

Both Susan A. Matney and Judith J. Warren are esteemed nursing informatics experts and heavily involved in efforts to increase representation of nursing in national and international standards and promote harmonization of nursing terminologies. As such, their knowledge of the nursing community and its needs is an invaluable resource in promoting the *Nursing Resources for Standards and Interoperability* page and encouraging its use. For example, Susan A. Matney expressed interest in presenting the resource webpage to the Alliance of Nursing Informatics (ANI). Matney indicated this as a method of gaining recognition and input on the page from potential users. Due to their expertise and familiarity with the resource page, the Associate recommends consulting with Susan A. Matney and Judith J. Warren about methods to encourage discovery and feedback on the *Nursing Resources for Standards and Interoperability* page.

References

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[2] American Nurses Association. (2010). *ANA recognized terminologies that support nursing practice*. Retrieved from <http://www.nursingworld.org/Terminologies>

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[5] Regenstrief Institute, Inc. (n.d.). *LOINC Development*. Retrieved from <http://loinc.org/background/loinc-development>

[6] Thede, L. Q., & Schwiran, P. M. (2011). Informatics: the standardized nursing terminologies: a national survey of nurses' experiences and attitudes - survey I. *The online journal of issues in nursing*, 16(2). doi:10.3912/OJIN.Vol16No02InfoCol01

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Appendices

Appendix I: Final storyboard of video tutorial

SCRIPT: Leveraging UMLS Synonymy to Extract Nursing Terms from SNOMED CT

Step	Action on Screen	Narration
1	Show the first slide with the title.	Leveraging UMLS Synonymy to Extract Nursing Terms from SNOMED CT
2	Show UMLS Metathesaurus Browser, blank search, zoomed out.	The UMLS Metathesaurus Browser allows users to search these controlled vocabularies and classification systems for specific concepts and/or names.

	[include splash/call out of link to UTS link]	You will need a UMLS Terminology Services (UTS) account to access the UMLS Metathesaurus Browser.
3	Show UMLS Metathesaurus Browser, blank search, zoomed out.	The terms used in our examples are from the NANDA-International, or NANDA-I, classification system.
4	Zoom in closer to search interface. Enter “fatigue” into search box. Select "NAN" in source list.	For the first example, enter “fatigue” into the search box. Specify “NAN” for NANDA-I in the source list. And click the “go” button.
5	Show result of search. Highlight “Report View” tab.	Here is the result of that search. The results default to "Report View".
6	Highlight CUIs in “Search Results” box and in record.	In this view, we can see the CUI assigned to this term in the UMLS.
7	Highlight “Atoms” section in record.	The section entitled “Atoms” is where you can view synonymy between nursing terminologies and SNOMED CT. The atoms are arranged alphabetically by terminology or classification system.
8	Scroll down to SNOMED CT terms. Point out SNOMED CT terms. [use of arrow]	Here are the SNOMED CT synonyms for the NANDA-I term “fatigue”. The synonym you use depends on the clinical situation.
9	Highlight SNOMED CT Concept IDs.	The associated SNOMED CT Concept IDs are also available in this section.

	[use of mask or circle shape]	
10	Show UMLS Metathesaurus Browser, blank search, zoomed in to search interface. Select “NAN” in source list.	That concludes our first example. The second example will also use a term from the NANDA-I classification system.
11	Enter “hyperthermia” into search box.	For the second example, enter “hyperthermia” into the search box.
12	Show results of search. Highlight CUI.	Note the associated CUI in the search results.
13	Scroll down to SNOMED CT terms in “Atoms” section. Highlight SNOMED CT terms.	Once again, SNOMED CT synonyms for “hyperthermia” can be found in the “Atoms” section.
14	Switch back to the UMLS Metathesaurus Browser, blank search, zoomed out.	This concludes the tutorial.
15	Click on “Documentation” tab. Hover on “UTS Video Learning Resources”. [include splash/call out of link to NLM Customer Service]	For additional information on how to search the UMLS Metathesaurus Browser, please view the video tutorials included in the UTS Video Learning Resources. You can also send us your questions through NLM Customer Service.

16	Transition to the final slide with the UMLS Metathesaurus Browser URL and the thank you message.	Thank you for watching!
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Appendix II: Final draft of resource webpage content

Nursing Resources for Standards & Interoperability

Part 1 - Introduction

This page is a resource for nurses, nursing students, nursing informaticists, and those exploring nursing terminologies for systems development or integration purposes. The information provided describes:

- The role of SNOMED CT and LOINC in implementing Meaningful Use (MU) in the United States (US).
- International collaboration to harmonize nursing terminologies and facilitate interoperability.
- How to find Concept Unique Identifiers (CUIs) and extract synonymy from the Unified Medical Language System (UMLS) Metathesaurus between SNOMED CT and CCC, ICNP, NANDA-I, NIC, NOC, The Omaha System, and PNDS.
- Additional resources for nursing clinical documentation purposes.

This resource page is designed to highlight nursing terminologies and their use.

Part 2 - About SNOMED CT

SNOMED Clinical Terms (SNOMED CT) is a standardized terminology used for clinical documentation in electronic health information systems. [The International Health Terminology Standards Development Organisation \(IHTSDO\)](#) owns, maintains, and distributes SNOMED CT. The National Library of Medicine, the United States National Release Center for the IHTSDO, provides access to SNOMED at no cost for use within the US. SNOMED CT is the most comprehensive, multilingual clinical healthcare terminology in the world. The terminology covers a wide range of clinical specialties, disciplines and requirements. This range of coverage allows for wider sharing and reuse of structured clinical information. With over 2 million components in SNOMED CT, domains such as nursing are generally well-covered with concepts specific for nursing diagnoses, interventions, and patient outcomes.

In the United States, SNOMED CT is one of the standards named for Federally Mandated use for the electronic exchange of clinical health information. Additionally, SNOMED CT is being implemented internationally as a standard within other IHTSDO Member countries. Specifically in the US, the [US Edition of SNOMED CT](#) must be used for the reporting and problem lists in the patient summary record. One way that NLM has provided assistance with this criterion is with the [Clinical Observations Recording and Encoding \(CORE\) Problem List Subset](#) of SNOMED CT. Additionally the [Nursing Problem List Subset](#) of SNOMED CT may be beneficial. The primary purpose of the Nursing Problem List Subset is to facilitate the use of SNOMED CT for coding terminology related to diagnoses. The Nursing Problem List Subset is updated regularly.

Additionally, the IHTSDO and the International Council for Nurses (ICN), producers of the International Classification of Nursing Practice (ICNP), are collaborating in an effort to harmonize nursing terminology and emphasize interoperability between health information systems. Currently, IHTSDO and ICN are developing an equivalence table of nursing diagnoses and interventions between ICNP and SNOMED CT. This equivalence table will be made available on the SNOMED CT downloads page.

The [IHTSDO Nursing Special Interest Group](#) is a community of practice for the nursing profession, supporting worldwide nursing participation in the development, validation, uptake, implementation, and correct use of SNOMED CT and related products. They welcome participation from anyone interested in ensuring that SNOMED CT supports nursing requirements for electronic documentation and communication of patient care in any setting.

Part 3 – About LOINC

[Logical Observation Identifiers Names and Codes \(LOINC\)](#) is a clinical terminology for clinical and laboratory observations. The Regenstrief Institute owns, maintains, and distributes LOINC. The NLM provides access to LOINC via the UMLS. LOINC provides the formal names and standardized codes for laboratory and other clinical observations. The data covers laboratory terminology, vital signs, hemodynamics intake/output, EKG, obstetric ultrasound, cardiac echo, urologic imaging, gastroendoscopic procedures, pulmonary ventilator management, and selected survey instruments such as the Braden Scale.

LOINC, along with SNOMED CT, is part of a suite of designated standards for use in US Federal Government systems for electronic exchange of clinical health information. For nursing the LOINC terminology should be used to encode assessments and clinical outcomes.

In 2002, LOINC was recognized by the ANA as a terminology for use by nursing. At that time, the [Clinical LOINC Nursing Subcommittee](#) was developed. The mission of the subcommittee is to provide LOINC codes for observations at key stages of the nursing process, including assessments, goals, and outcomes, and to meet the needs for administrative and regulatory data related to nursing care. The committee's scope of responsibility includes: 1) triage content related to nursing and assist with understanding; 2) fill in the identified "gaps" in LOINC; 3) work with those that are requesting nursing content so the request will be in a "fit" condition to use; and 4) educate nursing regarding LOINC development and use.

Part 4 – Other Nursing Terminologies

These are additional terminologies used by nursing for nursing care documentation:

Clinical Care Classifications (CCC)

CCC is a standardized terminology that provides a coding structure to assess, document, and classify patient care. Virginia Saba and colleagues at Georgetown University School of Nursing developed CCC. Please see the link for additional information about CCC in the UMLS and the current version of CCC in the Metathesaurus: <http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/CCC/>

International Classification for Nursing Practice (ICNP)

ICNP is an international standardized terminology that provides description and comparison of nursing practice (e.g. nursing diagnosis, actions, and outcomes) and allows for cross-

mappings between other terminologies. The International Council of Nurses (ICN) produces and maintains the ICNP. Please see the link for additional information about ICNP in the UMLS and the current version of ICNP in the Metathesaurus.:

<http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/ICNP/index.html>

NANDA International (NANDA-I)

NANDA-I is a standardized classification system for nursing diagnoses. NANDA International currently develops and maintains NANDA-I. Please see link for additional information about NANDA-I in the UMLS and the current version of NANDA-I in the Metathesaurus:

<http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/NAN/>

Nursing Interventions Classifications (NIC)

NIC is a standardized terminology to classify nursing interventions. The University of Iowa College of Nursing develops and maintains NIC. Please see the link for additional Information about NIC in the UMLS and the current version of NOC in the Metathesaurus:

<http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/NIC/>

Nursing Outcomes Classification (NOC)

NOC is a standardized classification system of nursing patient outcomes for evaluation of nursing interventions. The University of Iowa College of Nursing develops and maintains NOC. Please see the link for additional information about NOC in the UMLS and the current version of NOC in the Metathesaurus: <http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/NOC/>

The Omaha System (OMS)

Omaha is a standardized taxonomy used to document needs, describe interventions, and measure outcomes. The Omaha System Board of Directors maintains Omaha. Please see the link for additional information about Omaha in the UMLS and the current version of Omaha in the Metathesaurus:

<http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/OMS/>

Peri-operative Nursing Data Set (PNDS)

PNDS is a standardized nursing vocabulary that includes nursing diagnoses, interventions, and patient outcomes. The Association of periOperative Registered Nurses (AORN) develop and maintain PNDS. Please see the link for additional information about PNDS and the current version in the Metathesaurus:

<http://www.nlm.nih.gov/research/umls/sourcereleasedocs/current/PNDS/>

Additionally, nurses need to be aware of other terminologies that are used in health information technology solutions. The most common terminologies in this category are: [RxNorm](#), [Current Procedural Terminology \(CPT\)](#), [International Classification of Diseases](#) (ICD and the clinical modification used in the USA), and terminologies used in specific situations (HL7 has numerous standardized terminologies for use in its models), and others. Finally, NLM hosts the [Value Set Authority Center \(VSAC\)](#). VSAC contains values sets that populate electronic quality measures and other Meaningful Use artefacts.

Part 5 – Video Tutorial

Title: Leveraging UMLS Synonymy to Extract Nursing Terms from SNOMED CT

The video below demonstrates how to use the Metathesaurus to find CUIs and extract concept-level synonyms between SNOMED CT and other nursing terminologies.

Part 6 – NLM Resources

- UMLS Video Learning Resources: http://www.nlm.nih.gov/research/umls/user_education/learning_resources.html
- NLM Tools for EHR Certification and Meaningful Use: http://www.nlm.nih.gov/healthit/meaningful_use.html
- LOINC: http://www.nlm.nih.gov/research/umls/loinc_main.html
- RxNorm: <http://www.nlm.nih.gov/research/umls/rxnorm/>
- Value Set Authority Center: <https://vsac.nlm.nih.gov/>

Part 7 – Related Links

- IHTSDO home page: <http://www.ihtsdo.org/>
 - IHTSDO Nursing Special Interest Group: <http://www.ihtsdo.org/participate/special-interest-groups>
- LOINC from Regenstrief: <http://loinc.org>
 - Clinical LOINC Nursing Subcommittee: <http://loinc.org/background/loinc-development>
- American Nurses Association (ANA) webpage: <http://www.nursingworld.org/>

Appendix III: Final draft of webpage mockup

The screenshot shows a browser window with the URL www.nlm.nih.gov/research/umls/nursingresourcesforstandardsandinteroperability. The page title is "Nursing Resources for Standards and Interoperability". The content includes a breadcrumb trail: Home > Biomedical Research & Informatics > Nursing Resources for Standards and Interoperability > ...

The main heading is "Nursing Resources for Standards and Interoperability". Below it, a paragraph states: "This page is a resource for nurses, nursing students, nursing informaticists, and those exploring nursing terminologies for systems development or integration purposes." This is followed by a list of bullet points describing the information provided, such as the role of SNOMED CT and LOINC, international collaboration, and how to find CUIs.

Below the text, there are three tabs: "About SNOMED CT", "ABOUT LOINC", and "Other Nursing Terminologies". The "Other Nursing Terminologies" tab is active, showing a list of terminologies with dropdown arrows: Clinical Care Classifications (CCC), International Classification for Nursing Practice (ICNP), NANDA International (NANDA-I), Nursing Interventions Classifications (NIC), Nursing Outcomes Classification (NOC), The Omaha System (OMS), and Peri-operative Nursing Data Set (PNDS).

Below the list, a paragraph explains that nurses need to be aware of other terminologies used in health information technology solutions, such as RxNorm, CPT, ICD, and HL7.

On the right side of the page, there is a video player titled "Leveraging UMLS Synonymy to Extract Nursing Terms from SCT". The video player shows a play button and a progress bar. Below the video player, there are two sections: "NLM Resources" and "Related Sites".

The "NLM Resources" section lists: UMLS Video Learning Resources, NLM Tools for EHR Certification and Meaningful Use, LOINC, RxNorm, and Value Set Authority Center.

The "Related Sites" section lists: IHTSDO home page, IHTSDO Nursing Special Interest Group, LOINC from Regenstrief, Clinical LOINC Nursing Subcommittee, and American Nurses Association (ANA) home page.