Title: Understanding the use of standardized nursing terminology and classification systems in published research: A case study using the International Classification for Nursing Practice®

Abstract:

Background: In the era of evidenced based healthcare, nursing is required to demonstrate that care provided by nurses is associated with optimal patient outcomes, and a high degree of quality and safety. The use of standardized nursing terminologies and classification systems are a way that nursing documentation can be leveraged to generate evidence related to nursing practice. Several widely-reported nursing specific terminologies and classifications systems currently exist including the Clinical Care Classification System, International Classification for Nursing Practice®, Nursing Intervention Classification, Nursing Outcome Classification, Omaha System, Perioperative Nursing Data Set and NANDA International. However, the influence of these systems on demonstrating the value of nursing and the professions' impact on quality, safety and patient outcomes in published research is relatively unknown.

Purpose: This paper seeks to understand the use of standardized nursing terminology and classification systems in published research, using the International Classification for Nursing Practice® as a case study.

Methods: A systematic review of international published empirical studies on, or using, the International Classification for Nursing Practice® were completed using Medline and the Cumulative Index for Nursing and Allied Health Literature.

Results: Since 2006, 38 studies have been published on the International Classification for Nursing Practice®. The main objectives of the published studies have been to validate the appropriateness of the classification system for particular care areas or populations, further develop the classification system, or utilize it to support the generation of new nursing knowledge. To date, most studies have focused on the classification system itself, and a lesser number of studies have used the system to generate information about the outcomes of nursing practice.
Conclusions: Based on the review published literature that features the International Classification for Nursing Practice, standardized nursing terminology and classification systems appear to be well developed for various populations, settings and to harmonize with other health-related terminology systems. However, the use of the systems to generate new nursing knowledge, and to validate nursing practice is still in its infancy. There is an opportunity now to utilize the well-developed systems in their current state to further what is know about nursing practice, and how best to demonstrate improvements in patient outcomes through nursing care.

Keywords: terminology, nursing, International Council of Nurses, standards, International Classification for Nursing Practice (ICNP)

Manuscript:

1. Introduction:

Today's healthcare context internationally is one in which quality, safety and patient outcomes have become a focal point (Institute of Medicine, 2006; Porter, 2010). In an effort to achieve such endeavours, investments in technologies within health settings and among health care providers are increasingly common. These investments have been made to support, track and identify opportunities to continually improve, and provide evidence to support practice (McBride, Delaney & Tietze, 2012; Ovretveit et al., 2007). Electronic health records (EHRs) are one of the most frequently discussed health information technologies aimed at improving clinical care (Chaudhry et al., 2006). Where this technology is present, nurses and other health professionals are often required to document care and outcomes within the EHR. With all clinical documentation stored within a computer system, a large reservoir of data is accumulated in an easily extractable form.

Within the nursing profession, there is an opportunity to evaluate and generate knowledge through capturing information input through documentation into the EHR. An example of knowledge generation through this method is the work done through the Canadian Health Outcomes for Better Information and Care (C-HOBIC) project, which captures patient outcomes in relation to care provided by nurses (Hannah et al., 2009). Upon standardizing inputs, such as what was done with C-HOBIC, large datasets can be generated with comparable types of information captured between different patients, hospital units, healthcare settings, communities and beyond, that represent nursing (Rutherford, 2008). These datasets can then be utilized for analysis among research and quality improvement

initiatives aimed at better measuring the effectiveness of nursing care, and providing an evidence base for the profession (Westra et al., 2015). Additionally, datasets such as those used by C-HOBIC, may allow for the measurement of patient outcomes in relation to nursing care (Hannah et al., 2009; VanDeVelde-Coke et al., 2012) thus showing where nursing has or has not made a difference.

To date there has been significant work developing standardized inputs both for nursing and for healthcare broadly in the form of terminology and classification systems (International Council of Nurses, 2015; Schwirian, 2013). The purpose of creating these systems is to ensure that a uniform language is used to describe and document care so that data can be easily understood and aggregated to produce knowledge. Originally, several of these systems were developed for paper-based documentation, and have transitioned to being captured electronically given the increasing use of EHRs and related technology in healthcare organizations today (Hardiker, Saba & Kim, 2015).

Currently, both nursing specific and interdisciplinary terminologies exist, with many of these nursing specific terminologies being integrated into the Metathesauraus of the Unified Medical Language System (UMLS) in the US National Library of Medicine. Common interdisciplinary terminologies include the Systematic Nomenclature of Medicine-Clinical Terms (SNOMED-CT), Logical Observation Identifiers Names and Codes (LOINC), and ABC Codes. Within nursing, the Clinical Care Classification System (CCC System), International Classification of Nursing Practice® (ICNP®), Nursing Intervention Classification (NIC), Nursing Outcome Classification (NOC), Omaha System, Perioperative Nursing Data Set (PNDS) and

NANDA International (NANDA) have been developed. Data element sets include the Nursing Minimum Data Set (NMDS), and the Nursing Management Minimum Data Set (NMMDS). Efforts to harmonize and link nursing specific terminology and classification systems into broader healthcare and interdisciplinary systems have been done in an effort to support interoperability and data continuity across healthcare systems (Hardiker, Hoy & Casey, 2000; Kim, Hardiker & Coenen, 2014). Despite the existence of such terminology and classification systems, the impact on nursing practice remains relatively unknown.

2. Purpose:

The purpose of this paper is to better understand, through a case study of ICNP®, the use of modern day nursing terminology and classification systems in published research. This will be achieved by reviewing the aims, purposes and results of studies completed using ICNP® over the last decade.

ICNP® was chosen as the case terminology and classification system for two main reasons. First, ICNP® would appear to have international relevance given that its been translated into 18 different languages and was developed by the International Council of Nurses (International Council of Nurses, 2016). Second, upon conducting a search of each of the previously mentioned terminology and classification systems, ICNP® had the greatest number of combined search result findings in Medline and the Cumulative Index for Nursing and Allied Health (CINAHL). For example, when the CCC System was used as a keyword in these two databases, 48 articles were discovered. When the Omaha System and ICNP® were used as keywords, 439 and 504 articles were uncovered respectively. These

findings suggests that a review of empirical work utilizing ICNP® should provide an understanding of the general impact that these systems have had on nursing globally.

3. Methods:

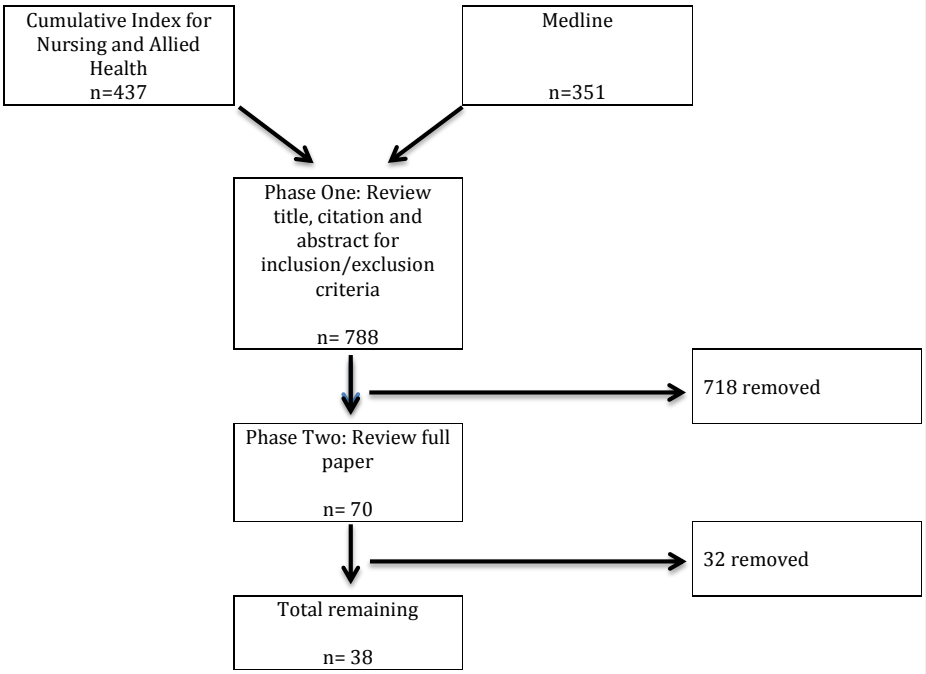
Literature searches were conducted using two databases that are known for indexing journals specific to nursing, or that contain journals that would publish articles of this nature. These databases were Medline and CINAHL. A total of 788 citations were discovered when using the search terms 'ICNP' and 'International Classification of Nursing Practice' in both databases. Inclusion criteria included articles published in English, those published within the last ten years, and those that present the findings of empirical work. Duplicates and articles that did not meet the inclusion criteria were eliminated. Papers were considered to be empirical when a research question was asked, and the researchers followed a methodological process to obtain an answer to the research question. Symposium papers, and journal articles that met the previously mentioned inclusion criteria were obtained for review.

Initially, articles were screened by their title and abstract. In this phase, 190 were removed as they were identified as duplicates and 140 were eliminated as they were written in Portuguese, Chinese, Italian, Swedish or German. An additional 240 were also not included, as they did not meet the inclusion criteria, mainly because many of them were commentaries or editorials to generate awareness about ICNP®, and were aimed at explaining the theoretical value of the classification system to readers.

Once this phase was complete, 70 articles remained. In the next phase, the established inclusion and exclusion criteria were applied once again after reviewing each of the papers in full. Three additional articles were removed as one had been published in Japanese and two in Portuguese. In the case of these three articles, their citation and abstracts were translated into English in CINAHL and therefore it was not known until a full article review was done that the articles were not available in English. Additionally, 29 articles were removed, as they did not meet the inclusion criteria. The main reason for exclusion, other than language, was that an empirical approach was not utilized. Once this final step was complete, 38 articles were obtained for review and analysis. Figure 1 shows the number of articles removed at each stage of inclusion and exclusion criteria application.

All included articles were reviewed and data was collected relating to the source journal , country of origin, author(s), year of publication, purpose, methods and relevant key findings. This information was then utilized to generate themes relating to the purpose of the published work.

Figure 1. Application of Inclusion and Exclusion Criteria



4. Results:

4.1 Themes:

The search of the literature uncovered 38 empirical studies that had been published since 2006 and that referred in some manner to ICNP®. Three main themes were identified.

4.2 Theme One: Validating Appropriateness

The first theme related to validating or assessing the appropriateness of ICNP® to be utilized in a particular care area or patient population. Twenty-four of the discovered studies served this purpose (Ausili et al., 2012; Cardoso & Paiva e

Silva 2010; Carvalho, Dal Sasso & Paese, 2015; Cho & Park, 2006; Chung, Choi & Myung, 2006; Doorenbos, Coenen & Borse, 2006; Doorenbos et al., 2011; Dykes et al., 2009; Hardiker & Coenen, 2007; Hardiker, Sermeus & Jansen, 2014; Hong & Ruknuddin, 2012; Hou et al., 2013; Jo et al., 2011; Kang et al., 2015; Kennedy & Hannah, 2007; Kim & Park, 2011; Kuo & Yen, 2006; Laukvik, Molstad & Fossum, 2015; Lee , Lee & Jung, 2006; Rotegaard & Ruland, 2009; Rotegaard & Ruland, 2010 & Simoes et al., 2011). Validation in clinical environments included studies that reviewed the possible use of ICNP® in palliative (Doorenbos, Coenen & Borse, 2006; Doorenbos et al., 2011), obstetrical (Hong & Ruknuddin, 2012), surgical (Chung, Choi & Myung, 2006), oncological (Konig 2006), dementia (Laukvik, Molstad & Fossum, 2015), critical (Dal Sasso, Peres & Silviera, 2006) and gynaecological (Kuo & Yen, 2006) clinical care settings.

In a study by Konig and Siller (2006), 67 nursing care plans from oncology centres in Germany were reviewed. Terms used to describe nursing diagnosis and outcomes related to nursing care were mapped to ICNP®. Findings suggested that by extending ICNP®, there may an appropriate set of statements to begin to develop a catalogue specific to oncology.

A different methodology was utilized by Laukvik, Molstad and Fossum (2015) to validate the use of ICNP® for patients with dementia. In this Norwegian study, a Delphi process was utilized to review and score concepts that could constitute a subset of ICNP® that represents nursing care for this population. Two sets of subject matter nursing experts with postgraduate education in geriatric psychiatry and dementia participated in each round of the concept development and

review. Results of this study indicated that there are a number of relevant nursing concepts, including nursing diagnoses, outcomes and interventions. The authors reported that the findings of this study could be utilized to develop a subset of ICNP®, and that a continued focus on the psychosocial needs of patients with dementia would be of value.

In a Taiwanese study, ICNP® terms were cross-mapped to nursing documentation in a gynaecological care setting. Sixty-two patient records with more than 6000 sentences were reviewed utilizing a Chinese version of ICNP®. The researchers assessed the fit of nursing phenomena and actions embedded in these sentences, to ICNP®. Additionally, the top ten nursing phenomena and actions were identified. Although 71.1% of the sentences were cross-mapped to ICNP®, the authors suggested that further validation work, and the development of certain gynaecological specific terms may be required.

Other studies reviewing the appropriateness of ICNP® did so in different geographical locations including China (Hou et al., 2013), Pakistan (Hong & Ruknuddin, 2012), Canada (Kennedy & Hannah, 2007), India (Doorenbos, Coenen & Borse, 2006), Philippines (Doorebos 2011), Thailand (Doorenbos et al., 2013), Korea (Cho & Park, 2006), the USA, Kenya and Ethiopia (Coenen 2007). Some of these studies included validating the classification system in other languages. One study looked at how ICNP® was validated in Chinese (Hou et al., 2013). Hou et al., (2013) utilized a modified Delphi strategy to ensure the semantic and cultural translation of ICNP® from English to traditional Chinese. A translation was initially completed by a nurse with expertise in nursing informatics. Then, five subject

matter experts in nursing validated and finalized the translation using a consensus process. When consensus was not reached, the researchers recommended utilizing all of the synonyms in the translated version. In total, 1863 terms were translated from English to traditional Chinese.

Another study looked to identify if a translated Coma Recovery Scale in Portuguese using ICNP® would be reliable (Simoes et al., 2011). First, the scale was translated into European Portuguese and adapted using the ICNP®. Then, the translated scale was utilized amongst 20 patients in an intensive care unit over two days, with two nurses performing ratings on each day. Inter-rater reliability was high, indicating that the scale could be utilized reliably in Portuguese.

Studies that aimed to validate and review the appropriateness of ICNP® for a specific use other than care areas or patient populations, were also completed. One study looked at how ICNP® may be used to provide data for the Belgian Minimum Data Set (Hardiker, Sermeus & Jansen, 2014). In this study, the authors searched for ICNP® equivalent concepts to 91 care descriptions in the Belgian Minimum Data Set. Results of this cross-mapping study showed that 8% of the care descriptions could be matched exactly to ICNP®, 23% could not be matched, and that 69% were either broader or narrower within ICNP®.

Two studies investigated if ICNP® could be used in a clinical setting in a practical way (Dykes et al., 2009; Chung, Choi & Myung, 2006). Dykes et al., (2009) aimed to understand if ICNP® could be utilized for nursing assessment documentation as a representational model. A model was developed utilizing 30 ICNP® concepts and 17 additional concepts to represent nursing admission

assessments. The other study that reviewed the practical application of ICNP® in a clinical setting did so at Seoul National University Bundang Hospital (Chung, Choi & Myung, 2006). This hospital had embedded ICNP® into their nursing record system. Nursing records utilizing ICNP® concepts from 186 surgical patients were compared to nursing records not utilizing ICNP® concepts from 69 surgical patients. Nursing phenomena and actions were separated and compared between the two groups. There were no significant differences between the two groups of nursing documentation, suggesting that ICNP® could be utilized appropriately in this clinical setting. In general, findings of validation-type studies suggest that with minor modifications, ICNP® as a standardized terminology can be appropriately used, and nursing concepts can be accurately captured.

4.3 Theme Two: Further Development

The second theme discovered upon reviewing the literature was the further development of ICNP® to better represent certain clinical or geographical care areas (Cardoso & Paiva e Silva, 2010; Dal Sasso, Peres & Silveira, 2006; Dykes et al., 2009; Kennedy & Hannah, 2007; Konig & Siller, 2006; Lee et al., 2009; Lee & Park, 2010; Matney et al., 2008; Müller Staub et al., 2007; Park et al., 2006; Park et al., 2011; So & Park, 2011; Wieteek 2008 & Yu et al., 2006). These studies often emerged from those looking to validate the appropriateness of ICNP® as described in the first theme. For example, further development of ICNP® was suggested in a study conducted in a maternal/obstetrical setting in northern Portugal (Cardoso & Paiva e Silva, 2010), a critical care setting in Brazil (Dal Sasso, Peres & Silveira, 2006), a review of nursing assessment documentation in the US (Dykes et al., 2009),

the examination of the effectiveness of using ICNP in Canada (Kennedy & Hannah, 2007), the development of clinical models for nursing problems related to perinatal care in Korea (Kim 2011), and in an oncology setting in Germany (Konig & Siller, 2006). A total of 15 articles were identified as furthering the development of ICNP® in some clinical or geographical care setting.

In Kennedy & Hannah's 2007 study, ICNP® was reviewed for its appropriateness of representing nursing care and outcomes in Canada. Nursing documentation from various clinical settings including acute care, mental health, home care and long term care were reviewed. The authors discovered that there was wide variation in the documentation completed by nurses in these separate care settings. Recommendations were made to the International Council of Nurses to include missing professional and natural language terms that were identified in this study. Like Kennedy & Hannah's (2007) research, most studies under theme two resulted in a recommendation to the International Council of Nurses on the further development of ICNP®.

4.4 Theme Three: Development of Nursing Knowledge

The third theme was the use of ICNP® to conduct research relating to the development of nursing knowledge in a particular care or speciality area. This theme in a sense is the goal of creating nursing terminologies, as it uses ICNP® to generate information specific to nursing from extracted standardized data. However, only two articles' main purpose was to do just this (Coenen 2007; Doorenbos et al., 2013).

In Coenen et al.'s (2007) study, nursing knowledge was generated on the topic of dignified dying using the Dignity-Conserving Care Model. The purpose of the study was to understand the interventions that nurses used to promote dignified dying in Ethiopia, India, Kenya and the United States. A cross sectional survey comprising items utilizing ICNP®, was distributed to 560 nurses who worked in palliative care settings, or who cared for patients who were dying. Findings of the study showed that nurses in all four countries utilized interventions based on illness-related concerns, a dignity-conserving repertoire, and a social-dignity inventory.

In a study by Doorenbos et al. (2013), the topic of dignified dying was further studied, however in a different geographical location than that described by Coenen et al. (2007). In this study, 247 nurses in Thailand who self identified as caring for dying patients completed a survey. The survey was developed utilizing the ICNP® catalogue, *Palliative Care for Dignified Dying.* Participants were provided with a list of the previously identified terms translated into Thai. They were asked to rate the importance of each of the terms. Results of this study show that interventions relating to illness-related concerns and the social dignity inventory were most commonly employed amongst Thai nurses. Although these studies constituted the application of ICNP®, no studies were discovered that used data generated from nursing documentation in electronic health records to conduct quantitative statistical analyses to determine any specific relationships between variables.

4.5 Other findings

The most number of articles published in a year was nine in 2006, and the least number of articles published in year was two, in 2008, 2012, 2013 and 2014 each. There does not appear to be any patterns relating to the years in which papers about ICNP® were published, or about the trend in the stated purpose of the papers.

4.6 Quality of Published Studies

Published studies utilizing ICNP® varied substantially in their employed methodologies and in their quality. However, efforts to ensure an appropriate level of rigor were discussed and demonstrated in each study. For example, research completing terminology cross-mapping often described how multiple assessors independently matched ICNP® to a particular set of terms, and then came to consensus through discussion (Hardiker, Sermeus & Jansen, 2014). Similarly, in Hou et al.'s (2013) study, the researchers used an approach to the translation of ICNP® from English to traditional Chinese through a Delphi process. This was done in an effort to ensure the semantic and cultural translation was of a high level of quality so that the translated version of ICNP® could be adequately used. Similarly, in research where information was extracted from nursing documentation, and compared to ICNP®, multiple researchers were involved in the analysis (Kennedy & Hannah, 2007). In research involving surveys, cross sectional approaches were used (Coenen, Doorenbos & Wilson, 2007; Doorenbos et al., 2013). Although cross sectional studies cannot identify causal relationships, it appears that the use of this approach in the studies included in this paper was appropriate for the research questions being asked. No randomized control trials, or studies to generate causal

findings were conducted utilizing ICNP®. There have not yet been research questions developed to warrant these kinds of methodologies.

5. Discussion:

The results of the review of the literature has shown that articles have been published to validate the appropriateness of nursing terminologies for a particular care area, further develop the terminology, and use the terminology to support a separate research objective. This case study has also shown that most of the work to date has been to ensure that nursing terminologies are sophisticated enough to support the generation of nursing knowledge. Methods of achieving this sophistication include testing it in specific geographies, patient populations or mapping it to other terminology and classification systems. Although this work may not be completely finished, it appears that significant progress has been made in the last decade. Future research should therefore focus on the utility and value of nursing terminology and classification systems through their application in real clinical settings.

Now appears to be an opportune time to utilize these terminology and classification systems to generate knowledge for nursing. In many parts of the world, healthcare organizations have adopted or are in the process of implementing EHR systems (Schoen et al., 2012), and in many cases, these systems incorporate electronic nursing documentation (Kelley, Brandon & Docherty, 2011; Whittaker, Aufdenkamp & Tinley, 2009). Additionally, the context in which nursing care is taking place is one in which the generation and use of evidence to support quality, safety and patient outcomes, is valued (Institute of Medicine, 2006; Porter, 2010).

As nursing represents one of largest workforces of healthcare providers globally (Dal Poz, Drager & Kunjumen, 2007; International Council of Nurses, 2015), it would seem that there has never been a more opportune time for organizations with these technologies in place to adopt terminology and classification systems to support the generation of nursing knowledge.

A number of challenges however still remain with the adoption and utilization of standardized systems. First, healthcare leaders including nursing leaders often lack knowledge about the value of terminology and classification systems and therefore are not well equipped to advocate for its inclusion during clinical information system implementations. Efforts have begun to ensure that nursing leaders have developed informatics competencies to augment executive leadership skills (Remus & Kennedy, 2012). Entry to practice nursing informatics competencies have been developed and integrated into undergraduate nursing curriculum in Australia and Canada (Borycki & Foster, 2014). Also, more nurses are participating in graduate programs both within and outside nursing that either focus on informatics or incorporate informatics competencies into the curriculum (Choi & De Martinis, 2013; Hunter. McGonigle & Hebda, 2013). As nurses who have developed these skills and competencies enter positions of leadership, it is hoped that nursing terminology and classification systems, and resources to support the analysis of important nursing information embedded in these systems, becomes a requirement of any health information technology implementation.

Second, the number of nursing and non-nursing terminology and classification systems currently available presents a challenge. If different

organizations decide to use different terminology and classification systems, aggregating data between organizations for generating knowledge becomes difficult as the structure and language varies between the available systems. However, progress has been made to harmonize the many terminology and classification systems to one another (Hardiker, Saba & Kim, 2015). This means that content from one terminology or classification system is cross-mapped to another to identify equivalent content. For example, a study was done to evaluate if SNOMED-CT could represent ICNP®. In this study, the researchers were able to cross map 92.5% of a sample of ICNP nursing diagnosis and interventions suggesting that with some improvements SNOMED-CT could be harmonized with ICNP® (Park et al., 2009). Much work has been done to harmonize ICNP® to other terminology and classification systems, however there is still work to do.

Third, although many organizations have implemented EHRs, there have been many challenges with their adoption in clinical practice among healthcare professionals (Strudwick, 2015; Strudwick & Eyasu, 2015). Given that these technologies facilitate the ease in which standardized terminology and classification system outputs can be captured, their optimal uptake is important for ensuring maximal data is obtained. Nurse-related, computer/software-related and context-related factors have been identified in the literature as important aspects of EHR adoption by nurses (Whittaker, Aufdenkamp & Tinley, 2009). Technologies that have been developed using the principles of human factors, and that fit within the nursing workflow, support nurse acceptance and use of these systems (Nagle & Catford, 2008). Efforts to understand the impact of these sociotechnical aspects on

data captured through the use of nursing terminology and classification systems may be explored through future research.

5.1 Limitations:

The authors are aware of several limitations of the work presented in this paper. The purpose of this paper was to better understand the use of nursing terminology and classification systems in published research; ICNP® was the only nursing terminology or classification system used to generate the discussion about the permeation of nursing terminologies and classification systems in the literature. However, a similar method was utilized to conduct a review of SNOMED-CT suggesting that the approach is informative (Cornet & de Keizer, 2008). Additionally, a number of articles were excluded from the paper that were published in languages other than English, with the greatest number being in Portuguese.

5.2 How this case study relates to other published work on terminology and classification systems:

A review of the applications of a terminology and classification system other than ICNP® has been done to better understand the use, uptake and impact of these systems. In 2008, Cornet and de Keizer conducted a review of scientific publications utilizing SNOMED-CT. Using a similar methodology to this case study, the researchers searched two electronic databases and found 250 relevant articles. Interestingly, publications utilizing SNOMED-CT until that point reflected very similar topics of research to that of ICNP® currently. Most of the research utilizing SNOMED-CT aimed to demonstrate the value of the terminology system, and only a

few studies were aimed at its usage in clinical practice. These findings mirror those found in this case study with ICNP®.

Searches were conducted to identify any reviews of nursing-specific terminology and classification systems using CINAHL and Medline. Although the authors were unable to find papers aimed at reviewing and synthesizing the various research articles using each of the systems, a scan of the titles and abstracts revealed that topics of study using other systems are similar to that of SNOMED-CT and ICNP®. The Omaha system also had several publications related to how best to teach the system, however these were not empirical in nature (Radhakrishnan et al., 2016).

6. Conclusion:

In summary, within this study ICNP® was used as a case in the exploration of the extent to which nursing terminology and classification systems have been utilized in published research. Using published empirical work on ICNP® as a way of measuring this, the authors were able to obtain a picture of the state of uptake and use of nursing terminologies and classifications systems within the last decade. Although studies may have been published that showcase the use of nursing terminologies to better understand the relationship between nursing practice and clinical outcomes in a few scenarios, in the case of ICNP® as with other nursing and healthcare terminologies, most of the publications appear to relate to the development and validation of the system. With work well-advanced on the development, validation and assessment related to the appropriateness of nursing terminologies for various care settings, now is an opportune time for nursing

terminologies to be leveraged in the generation of nursing knowledge and evidence. The authors call for organizations that have adopted nursing terminology and classification systems to use their data to answer meaningful questions about nursing practice, and to publish their findings widely. With the information available to date, it is difficult to assess what impact these systems have yet had.

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