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Article

Developing a Subset of ICNP® Terminology for NICU and Neonatology Settings

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Highlights

What are the main findings?

- ICNP® is a standardized nursing language that can represent nursing phenomena in NICU and neonatology settings, 576 terms make up a proposed Subset
- SNOMED CT can represent the ICNP® proposed Subset

What are the implications of the main findings?

- The use of ICNP® in NICUs and neonatology settings could increase patient safety, nursing research, the visibility of nursing care
- The use of the proposed Subset may facilitate the introduction of EHRs into clinical practice in NICU and neonatology settings

Abstract

Background/Objectives: The International Classification for Nursing Practice (ICNP®) is a standardized nursing terminology that enables the description of nursing care through diagnoses, interventions, and outcomes. An ICNP® Subset is a sub-group of ICNP® terms appropriate for settings of practice, facilitating the direct use of the ICNP® in nursing documentation. As far as we know, there are no Subsets concerning neonatology and Neonatal Intensive Care Unit (NICU) settings. The aim of this study is to develop a Subset of ICNP® NICU and neonatology setting, presenting terms that are validated and harmonized with SNOMED CT nomenclature. **Methods:** This is a two-phase study. In the first phase ICNP® terms were validated through a qualitative study using a four-round Delphi method and a focus group involving experts in NICU, neonatology settings, and education. The second phase focused on harmonizing the proposed ICNP® Subset with SNOMED CT. **Results:** A total of 479 ICNP® terms belonging to the Diagnosis/Outcome (DC) and Intervention (IC) axes were validated by the experts. Of these, 99.65% were found to be compatible with SNOMED CT. In addition, 97 new terms (30 Diagnoses/Outcomes and 67 Interventions) were validated and are currently awaiting approval by the International Council of Nurses. Of the newly proposed terms, 93.81% were compatible with SNOMED CT. **Conclusions:** The proposed Subset consists of 576 ICNP® terms, including 177 Diagnoses/Outcomes and 399 Interventions. Its implementation may support the adoption of electronic health records in neonatal and NICU settings and contribute to improving the quality and standardization of nursing care.

Keywords: standardized nursing language; ICNP; subset; NICU; neonatology; electronic health record

1. Introduction

Standardized Nursing Languages (SNLs) enable the structured and consistent description and documentation of nursing care across different clinical settings [1,2]. Their use has been associated with improvements in patient safety, the advancement of nursing research, and the articulation of nurses' clinical judgment and decision-making processes [2–8]. Moreover, SNLs support the integration of Electronic Health Records (EHRs) into clinical practice, enhancing the visibility, measurability, and comparability of nursing care, while ensuring a shared language that is essential for electronic information exchange [2,4,6,7,9–12].

The International Classification for Nursing Practice (ICNP®) is an agreed set of terms that can be used to record the observations and interventions of nurses across the world [13,14]. Developed by the International Council of Nurses (ICN), recognized by the World Health Organization (WHO), and currently available as a Reference Set (RefSet) within SNOMED CT, ICNP® represents a key instrument for semantic interoperability in clinical practice and electronic health documentation [4,15–17].

The 2019 release of the ICNP® is available for consultation on a free browser provided by ICN [14,18]. In the 2019 release, ICNP® terms are organized into seven axes: Focus, Judgment, Client, Action, Means, Location, Time [14]. These axes can be combined according to syntactic rules to construct nursing diagnoses, outcomes, and interventions [14]. In addition, two precoordinated axes, Diagnosis/Outcome (DC) and Intervention (IC), allow the direct use of diagnoses and interventions without the need for syntactic construction. Within ICNP®, the DC axis encompasses both nursing diagnoses and nursing outcomes [4,14].

To facilitate the implementation of ICNP® in clinical practice and to support the aggregation and analysis of nursing data, the ICN actively promotes the development of ICNP® Subsets. These Subsets consist of selected nursing diagnoses, interventions, and outcomes tailored to specific areas of practice or patient populations [5,8,14,19–21].

Newborns represent a particularly vulnerable population characterized by multiple risk factors, especially in the case of preterm infants [7,22,23]. In this context, the adoption of EHR has the potential to significantly enhance patient safety and quality of care [7,10,11,24]. Recent studies have highlighted the relevance of ICNP® in neonatal settings: an Italian study reported a high level of concordance between nursing documentation in NICUs and ICNP® terms, suggesting the feasibility of developing a dedicated subset, while a Brazilian study validated ICNP® nursing diagnoses for preterm neonates admitted to NICUs through expert consensus [7,11].

However, to our knowledge, no studies presenting a comprehensive and validated ICNP® Subsets specifically designed for neonatology and NICU settings are available. Against this backdrop, the aim of the present study is to develop a Subset of ICNP® NICU and neonatology setting, presenting terms that are validated and harmonized with SNOMED CT nomenclature.

2. Materials and Methods

This is a two-phase study.

First Phase

The first phase focused on the validation of ICNP® terms for the development of the Subset. A multicenter qualitative descriptive study was conducted using the Delphi method [8,21,25], consisting of four rounds, complemented by a focus group [26–29]. The Delphi rounds and the focus group involved experts and nurses from two third-level NICU of two big hospitals in Milan, from Bachelor Nursing School and Bachelor Pediatric Nursing School of the University of Milan, and from the ICNP® Italian Research and Development Centre. Across all phases, purposive non-probability sampling was adopted [30].

The first and second Delphi rounds, conducted in 2022, aimed to perform an initial selection of ICNP® terms belonging to the Diagnosis/Outcome (DC) and Intervention (IC) axes. For this purpose,

five experts were included, each with at least ten years of experience in NICU and neonatology, and with experience in university teaching or in the management of pediatric nursing care in neonatal settings.

The third and fourth Delphi rounds, carried out in 2023 and 2024 respectively, aimed to assess the relevance and usefulness of the previously selected ICNP® terms for NICU and neonatology settings. These rounds included nurses and pediatric nurses with at least two years of clinical experience in NICU or neonatology: 40 participants in the third round and 32 in the fourth round. In both rounds, participants were also invited to suggest additional terms they considered missing from the description of nursing care in neonatal settings.

In February 2025, a focus group was conducted to validate the new terms proposed during the four Delphi rounds and to re-evaluate terms that had received comments regarding their clinical relevance but presented linguistic or translation issues. The focus group included eight experts: two NICU and neonatology experts with at least five years of experience; three nursing education experts who use ICNP® for teaching purposes, one of whom had clinical experience in NICU; two pediatric nursing education experts who use ICNP® for teaching purposes, one of whom had clinical experience in NICU; and one member of the Italian ICNP® Research and Development Center.

After obtaining approval from the Ethics Committee, the participating hospitals, and the universities involved, all participants were informed in advance via email about the research project and the objectives of the phase in which they were participating. For each Delphi round, participants completed a structured form consisting of five columns: term identification number, ICNP® code, axis of classification (DC or IC), ICNP® term, and notes. Participants were asked to evaluate each ICNP® DC and IC term using a four-point Likert scale based on its appropriateness for NICU and neonatology settings. The Item Content Validity Index (I-CVI) and the Item Content Validity Ratio (I-CVR) were calculated. According to Lawshe [31], the minimum acceptable I-CVR values varied depending on panel size: 0.99 for five experts, 0.75 for eight experts, 0.29 for forty experts, and 0.33 for thirty-two experts. The minimum acceptable I-CVI value was set at 0.80 [4,8,32–35], terms with values between 0.70 and 0.79 were subjected to revision [35,36]. In the first and second Delphi rounds, given the early stage of Subset development and the planned continuation of the Delphi process, terms with I-CVI values between 0.70 and 0.79 were re-evaluated even when I-CVR values were below the recommended threshold.

Notes and proposals for new terms collected during the third and fourth rounds were analyzed by the research group. With the support of the Italian ICNP® Research and Development Center, new terms were constructed using ICNP® terms from the seven axes, in accordance with ICNP® syntactic rules.

For the focus group, participants received an email containing the list of terms already validated, which were not discussed during the session, and the terms to be examined, including newly proposed terms and those presenting linguistic or translation issues. The focus group was conducted via the Microsoft Teams® platform, participants were sent the access link by e-mail. During the focus group the aim and the rules of participation were explained. Each expert participated with their camera and audio active, the screen was shared allowing the ICNP® terms to be viewed for discussion regarding validation. Each term was presented and discussed until unanimous consensus was reached regarding its acceptance or exclusion; any modifications were made in real time and shared with all participants.

Second Phase

The second phase addressed the harmonization of the ICNP® proposed Subset with the SNOMED CT. An analytical approach was adopted to systematically compare ICNP® and SNOMED CT terms, in line with existing literature on terminological harmonization [37–41]. Harmonization was performed using the SNOMED CT International Edition browser, the free ICNP® browser (2019 version), and comparison tables based on the SNOMED CT–ICNP RefSet, provided by the by the ICNP® Italian Research and Development Centre. As no Italian version of the SNOMED CT browser

is currently available, the terms of the proposed Subset were compared with the English version of the ICNP® browser using ICNP® codes. An equivalence table between ICNP® and SNOMED CT was subsequently developed using Microsoft Word®.

Ethics

This study was conducted in agreement with the current privacy legislation and the principles stated in the Helsinki Declaration. The study was approved by the Ethics Committee of Niguarda Hospital on 16 February 2022 (approval number 86-16022022). The ICNP® Italian Research and Development Centre was informed about the study and provided its approval. Written informed consent to participate in the study was obtained from all participants involved in the Delphi rounds and the focus group. Written consent for audio and video recording was additionally obtained from focus group participants.

3. Results

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

3.1. First Phase

3.1.1. First and Second Delphi Round

Five experts (2 men, 3 women; mean age 41.6 ± 8.47 years) participated, with an average of 15.4 ± 6.8 years of professional experience in NICU or neonatology, and 13.6 ± 7.1 years of experience in pediatric nursing education at the university level. Two experts had 10 and 13 years of experience in NICU management, and two had at least five years of ICNP® use. During the first round, I-CVR and I-CVI analyses validated 497 ICNP® terms (DC and IC axes) with values of 1.0. An additional 305 terms, with I-CVI values between 0.70 and 0.79 and I-CVR = 0.60, were re-evaluated in the second round, resulting in 250 terms being confirmed with I-CVI > 0.79. After the first and second rounds, a total of 747 ICNP® terms (DC and IC) were selected. Experts also identified the need for new terms to better describe nursing care in NICU and neonatal settings.

3.1.2. Third Delphi Round

Forty nurses (2 men, 38 women; mean age 34.97 ± 7.15 years; mean clinical experience 10.75 ± 6.71 years) evaluated the 747 previously selected terms. Nine participants reported university teaching experience in pediatric nursing or as clinical mentors in the ward for between 1 to 25 years. I-CVR and I-CVI analyses validated 409 terms, while 225 required revisions (I-CVI 0.70–0.79; I-CVR > 0.29), and 113 terms were removed.

3.1.3. Fourth Delphi Round

Thirty-two nurses (31 women, 1 undisclosed; mean age 40.0 ± 10.6 years; mean experience 16.0 ± 11.3 years) evaluated the 225 terms from the third round. Twelve participants reported pediatric nursing teaching experience or as clinical mentors in the ward for between 1 to 22 years. I-CVR and I-CVI analyses validated 61 terms (I-CVR > 0.33; I-CVI > 0.79), while 9 IC terms with repeated translation discrepancies were suspended. Across the third and fourth rounds, experts proposed 173 new terms, which were reduced to 87 after review by the research group due to conceptual redundancy. After the fourth round, 470 ICNP® terms (146 DC, 324 IC) were validated for the Subset. The 87 new terms suggested by participants (18 DC, 69 IC) underwent further evaluation in the focus group.

3.1.4. Focus Group

Eight experts (7 women, 1 man; mean age 45.87 ± 10.62 years; mean experience 21.37 ± 11.08 years) participated. Two were pediatric nurses with more than five years of NICU experience; five were nursing educators using ICNP® in teaching, two of whom had NICU experience; one was a member of the ICNP® Italian Research and Development Centre. The session lasted 1 hour 40 minutes.

During the focus group, the 87 new terms were individually discussed, asking participants to express their agreement or disagreement with the inclusion of the term in the proposed Subset or their considerations regarding the need for modification. Experts assessed lexical clarity, contextual appropriateness, and DC references for IC terms.

54 terms were accepted without modification, 21 were accepted after discussion and minor adjustments, 2 were excluded, and 10 were addressed for overlap with existing ICNP® terms (5 reassigned to existing terms, already validated in the Delphi rounds; 5 maintained with one new proposed). Additionally, 17 new terms (4 IC, 13 DC), that were missing from the Subset and recognized as missing in relation to already validated DC or IC terms, were proposed, discussed, and validated. Nine terms with translation disagreements were revised and accepted.

At the end of first phase, the proposed Subset comprised 479 ICNP® terms from the 2019 release (147 DC, 332 IC) and 97 newly proposed terms (30 DC, 67 IC).

3.2. Second Phase

3.2.1. Harmonization with SNOMED CT

Of the 479 validated ICNP® terms, 463 (96.65%) were matched to SNOMED CT using the comparison tables provided by the ICNP® Italian Research and Development Centre. Of the remaining 16 terms (3.33%), a search in the International SNOMED CT browser identified matches for 11 terms (4 DC, 7 IC), while 5 terms (1 DC, 4 IC) had no correspondence. The DC term without a match is: "Improved electrolyte balance (10033518)", the four IC terms without a match are: "Transporting patient (10020095)", "Managing arterial blood flow (10050688)", "Managing feeding device (10050769)", "Monitoring ascites (10051658)". Thus, 475 (99.16%) validated terms out of 479 for the Subset found a possible match in SNOMED CT.

Among the 97 new ICNP® terms, 91 (93.81%) had an exact or approximate SNOMED CT match. For the 30 DC terms, 26 (86.66%) matched SNOMED CT, and 4 (13.33%) had no match: "Effective Aspiration", "Risk of Impaired Ventilatory Adaptation", "Risk of Negative Response to Non-Pharmacological Pain Management", and "Negative Response to Non-Pharmacological Pain Management". Among the 67 IC terms, 65 (97.01%) matched SNOMED CT, while 2 (2.98%) had no correspondence: "Implementation of Non-Pharmacological Pain Management Techniques" and "Secretion Monitoring".

4. Discussion

The aim of this study was to develop a Subset of ICNP® NICU and neonatology setting, presenting terms that are validated and harmonized with SNOMED CT nomenclature. The resulting proposed Subset includes 479 terms from the 2019 release of ICNP®, with 147 belonging to the DC axis (Clinical Diagnosis) and 332 to the IC axis (Clinical Intervention). Additionally, 97 new terms were proposed (30 DC and 67 IC) pending final approval by the ICN.

Overall, nurses and experts recognized the ICNP® terminology as appropriate, although some translation issues arose. These controversies led the experts in the focus group to revise certain terms, for example "Gastric tube care" or "Drainage tube care" or "Fracture cure", where the problem concerned the translation of the term "cure". These ambiguities were resolved by consulting the original English ICNP® terms, which were often clearer than the Italian equivalents.

The study allowed the use of DC and IC axes already included in SNOMED CT and the creation of new terms using the seven-axis ICNP® syntax. This approach ensures consistency with the official ICNP® terminology and ISO standards, avoiding the need to standardize the proposed terms [25].

Since the ICNP® terminology was not sufficiently complete for the neonatal context [7,11,14], nurses and experts were able to propose new terms to describe specific clinical phenomena [11,42]. The focus group enabled experts to evaluate the suggested terms in the Delphi rounds, ensuring that DC terms represented both diagnosis and outcome. When possible, related interventions were combined, for example: “Device Injury”, “No device injury”, and “Alternate the devices position”. This ability to combine terms facilitates clinical practice and paves the way for the use of artificial intelligence in EHR [43].

All terms in the proposed Subset were harmonized with SNOMED CT, the most comprehensive clinical terminology [7,16]. Collaboration with the ICNP® Italian Research and Development Centre helped the research group obtain support regarding harmonization with SNOMED CT. A total of 96.65% of ICNP® terms validated through Delphi rounds found a match in SNOMED CT. Moreover, 86.4% of newly proposed terms were potentially harmonizable. Some non-harmonized terms describe specific nursing procedures, such as “Monitoring ascites” or “Managing feeding device” or “Managing arterial blood flow” or “Negative response to non-pharmacological pain management”. The ICNP® syntax still allows for combining different terms to express complex concepts, supporting full integration with SNOMED CT [44]. Recent studies emphasize the importance of mapping ICNP® to SNOMED CT to facilitate the use of standardized nursing languages in EHR [16,44,45]. The presence of the ICNP® within SNOMED CT could facilitate the use of SNLs in EHR [37].

Previous research has investigated ICNP® use in NICU, particularly for preterm infants. Querido et al. [11] developed 145 ICNP® nursing diagnoses for preterm infants; most corresponded to a DC term in our study, either exactly (“Bradycardia”) or similarly (“Hypotension” or “Hypertension,” corresponding to “Altered blood pressure” in ICNP® and “Blood pressure alteration” in SNOMED CT). Another study [7] demonstrated that 288 ICNP® terms describe nursing phenomena documented in clinical notes. All terms validated for the proposed Subset cover these phenomena.

The proposed ICNP® Subset allows describing risks, problems, and nursing interventions for hospitalized neonates and their families in NICU. Examples include nutritional risks, like “Interrupted breastfeeding” (10000774), “Difficulty performing breastfeeding” (10001098), “Effective breastfeeding” (10001411), “Managing enteral feeding” (10031776), “Teaching about feeding technique” (10045411), “*Difficoltà nella coordinazione suzione-deglutizione-respirazione*” – “Sucking reflex equivocal” (new term, 299758003 – SNOMED CT, Finding), “*Perdita di peso oltre i limiti della norma*” – “Excessive weight loss” (new term, 309257005 – SNOMED CT, Finding). Other examples may refer to terms related to respiratory difficulties or infections or family support, like “Impaired breathing” (10001344), “Effective breathing” (10041334), “Implementing ventilatory weaning” (10050657), “Monitoring response to ventilatory weaning” (10051731), “Urinary tract infection” (10029915), “Risk for eye infection” (10032372), “*Effettuare i lavaggi nasali*” – “Irrigation of nasal passages” (new term, 69378000 – SNOMED CT, Procedure), “Family able to participate in care planning” (10035904), “Supporting family mourning process” (10026470), “*Coinvolgere nelle cure il genitore, la famiglia*” – “Hospital admission, parent, for in-hospital child care” (new term, 51501005 – SNOMED CT, Procedure). Previously undescribed phenomena [7,11], such as meconium or gastric residue issues, were validated by the focus group: “*Valutare la presenza di meconio*” – “Meconium quantitation” (new term, 17695009 – SNOMED CT, Procedure), “*Monitorare il ristagno gastrico*” – “Monitoring procedure + Volume of drainage of gastric contents (new term, 239516002 + 1162665001 – SNOMED CT, Regime/Therapy + Observable entity).

Study limitations include the small number and geographic concentration of participants, the high workload during the Delphi rounds, and the lack of an official Italian translation of SNOMED CT, which may have led to search errors in the second phase.

In conclusion, the proposed Subset represents an initial set of ICNP® terms specific to NICU and neonatal settings. This proposed Subset can facilitate the adoption of EHR, promote international comparisons, enhance the visibility of nursing work and reasoning, and support global research.

5. Conclusions

This This study aimed to develop an ICNP® Subset for NICU and neonatology settings, presenting terms validated through SNOMED CT. The proposed ICNP® Subset includes 147 diagnoses/outcomes, 332 interventions, 30 newly proposed diagnoses/outcomes, and 67 newly proposed interventions. Patients in NICU and neonatal settings, along with their families, often require complex, specialized nursing care. The proposed Subset provides a standardized terminology that can support the use of natural language processing SNL to describe nursing care in these contexts. It enables structured patient assessment, documentation, and measurement, facilitating the collection, interpretation, and recording of nursing data. This approach may enhance the visibility of nursing practice, support research, and promote the integration of nursing documentation into EHR.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org. Table S1: Equivalence table between ICNP® terms included in the proposed Subset and SNOMED CT. Table S2: Equivalence table between newly proposed ICNP® terms and SNOMED CT.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Niguarda Hospital, Milan, Italy (protocol code 86-16022022 on 16/02/2022).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original contributions presented in this study are included in the supplementary material. Further inquiries can be directed to the corresponding author.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

DC axis	Diagnosis/Outcome axis (Clinical Diagnosis)
EHR	Electronic Health Record
IC axis	Intervention axis (Clinical Intervention)
ICNP	International Classification for Nursing Practice
NICU	Neonatal Intensive Care Unit
RefSet	Reference Set (SNOMED CT)
SNOMED CT	Systematized Nomenclature of Medicine Clinical Terms
SNL	Standardized Nursing Language

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