DOI: 10.2478/pielxxiw-2023-0029

Nursing documentation of newborns with birth weight under 1500g in an Italian Neonatal Intensive Care Unit: a cross-mapping study to develop an ICNP® Subset

Dokumentacja pielęgniarska noworodków z masą urodzeniową poniżej 1500 g przebywających na Włoskim Oddziale Intensywnej Terapii Noworodków: mapowanie krzyżowe w celu opracowania podzbioru ICNP®

Valentina Tommasi[1,2,A-C,E-I,K-L], Barbara Bassola[1,A-B,E,G,I,L], Chiara Merlo[3,B,D-E,G-I], Paola Coscia[3,D-E,G-I], Marco Alessandrini[3,D-E,G-I], Giuseppe Miraglia[3,D-E,G-I], Samuele Sessa[3,D-E,G-I], Silvia Cilluffo[1,2,B,G,I], Maura Lusignani[4,G,L]

[1]School of Nursing, Niguarda Hospital, Italy
[2]PhD in Nursing Sciences and Public Health, University of Rome Tor Vergata, Italy
[3]Neonatal Intensive Care Unit, Niguarda Hospital, Italy
[4]Department of Biomedical Science for Health, University of Milan, Italy

CORRESPONDING AUTHOR:
Valentina Tommasi
School of Nursing, Niguarda Hospital
Piazza Ospedale Maggiore 3, 20162, Milan, Italy
e-mail: valentina.tommasi@ospedaleniguarda.it

A – Development of the concept and methodology of the study/Opracowanie koncepcji i metodologii badań; B – Query - a review and analysis of the literature/Kwerenda – przegląd i analiza literatury przedmiotu; C – Submission of the application to the appropriate Bioethics Committee/Złożenie wniosku do właściwej Komisji Biotycznej; D – Collection of research material/Gromadzenie materiału badawczego; E – Analysis of the research material/Analiza materiału badawczego; F – Preparation of draft version of manuscript/Przygotowanie roboczej wersji artykułu; G – Critical analysis of manuscript draft version/Analiza krytyczna roboczej wersji artykułu; H – Statistical analysis of the research material/Analiza statystyczna materiału badawczego; I – Interpretation of the performed statistical analysis/Interpretacja dokonanej analizy statystycznej; K – Technical preparation of manuscript in accordance with the journal regulations/Opracowanie techniczne artykułu zgodne z regulaminem czasopisma; L – Supervision of the research and preparation of the manuscript/Nadzór nad przebiegiem badań i przygotowaniem artykułu

STRESZCZENIE

DOKUMENTACJA PIELĘGNIARSKA NOWORODKÓW Z MASĄ URODZENIOWĄ PONIŻEJ 1500 G PRZEBYWAJĄCYCH NA WŁOSKIM ODDZIALE INTENSYWNEJ TERAPII NOWORODKÓW: MAPOWANIE KRZYŻOWE W CELU OPRACOWANIA PODZBIORU ICNP®

Cel pracy. Niniejsze badanie ma na celu weryfikację możliwości opracowania podzbioru Międzynarodowej Klasyfikacji Praktyki Pielęgniarskiej (ICNP) dla noworodków przedwcześnie urodzonych hospitalizowanych na Oddziale Intensywnej Terapii Noworodka (OITN).

Materiał i metody. To retrospektywne badanie opisowe jest leksykalnym mapowaniem krzyżowym z notatek pielęgniarek do ICNP. W badaniu przeanalizowano wygodną próbę 115 notatek pielęgniarskich noworodków z Oddziału Intensywnej Terapii Noworodków. Próba obejmowała wcześniaki z masą urodzeniową poniżej 1500 g hospitalizowane przez co najmniej trzy dni. Obliczono rozkład częstotliwości i procentowy rozkład częstotliwości terminów ICNP wraz z terminami ICNP dla każdej potrzeby włoskiego modelu koncepcyjnego pielęgniarstwa.

Wyniki. Aż 99,8% zjawisk pielęgniarskich w notatkach pielęgniarek odpowiadało terminom ICNP. Łączna liczba 203 terminów ICNP opisywała zjawiska pielęgniarskie, z czego 161 należało do wstępnie skoordynowanych osi. Częstotliwość występowania terminów ICNP została skategoryzowana zgodnie z włoskim modelem koncepcyjnym pielęgniarstwa. Potrzeba odżywiania i nawadniania, potrzeba oddychania oraz potrzeba eliminacji moczu i jelit były potrzebami pacjentów z największą liczbą terminów ICNP.

Wnioski. Wyniki badania sugerują możliwość opracowania podzbioru ICNP dla OITN. Konieczne są dalsze badania w celu walidacji podzbioru i nowych terminów ICNP.

Słowa kluczowe: opieka pielęgniarska, Międzynarodowa Klasyfikacja Praktyki Pielęgniarskiej, Standaryzowana Terminologia Pielęgniarska, wcześniak, Oddziały Intensywnej Terapii Noworodka

ABSTRACT

NURSING DOCUMENTATION OF NEWBORNS WITH BIRTH WEIGHT UNDER 1500G IN AN ITALIAN NEONATAL INTENSIVE CARE UNIT: A CROSS-MAPPING STUDY TO DEVELOP AN ICNP® SUBSET

Aim. This study aims to verify the possibility of developing an International Classification for Nursing Practice (ICNP) Subset for preterm newborns hospitalized in Neonatal Intensive Care Unit (NICU).

Material and methods. This retrospective descriptive study is a lexical cross-mapping from nurses' notes to the ICNP. The study analyzes a convenience sample of 115 newborns' nursing notes of a NICU. The sample included preterm newborns with birth weight under 1500g hospitalized for at least three days. The frequency distribution, and the percentage frequency distribution of ICNP terms, together with ICNP terms for each need of the Italian nursing conceptual model were calculated.

Results. As many as 99.8% of nursing phenomena in nurses' notes found correspondence with ICNP terms. A total number of 203 ICNP terms described nursing phenomena, of which 161 belonged to pre-coordinated axes. Frequency of ICNP terms was categorized according to an Italian nursing conceptual model. Need of Nutrition and Hydration, need of Breathing and need of Urinary and Bowel Elimination were the patients' needs with the highest number of ICNP terms.

Conclusions. Results of the study suggest the possibility of developing an ICNP Subset for the NICU. Further studies are needed to validate a Subset and new ICNP terms.

Key words: Nursing Care, International Classification for Nursing Practice, Standardized Nursing Terminology, Premature infant, Neonatal Intensive Care Units

INTRODUCTION

About 15 million newborns per year have a preterm birth [1]. Preterm newborns' number is rising, above all in late preterm births [2]. All premature newborns are at more risks compared to full-term infants [2]. Preterm infants are at increased risk for invasive procedures, such as resuscitation at birth, and other complications such as feeding difficulty, respiratory distress syndrome, retinopathy, hypothermia, hypoglycemia, necrotizing enterocolitis, hyperbilirubinemia, infections, sepsis, neurodevelopmental delay, and mortality [1,2].

Among the best practices that can contribute to the improvement of nursing care in clinical practice there is the adoption of a standardized disciplinary language [3-5]. The use of standardized nursing terminologies (SNTs) to document nursing care enables the easy retrieval and analysis of nursing data while also representing the nurse's clinical reasoning [6,7]. Nursing documentation has evolved through the introduction of Electronic Health Record (EHR) [6]. The introduction of EHR in Neonatal Intensive Care Unit (NICU) can contribute to increase of the observed communication levels and patient safety for vulnerable neonatal cohort [8].

The International Council of Nurses (ICN) describes the International Classification for Nursing Practice (ICNP) as an agreed set of terms that can be used to record the observations and interventions of nurses across the world, and it is recognized by the World Health Organization (WHO). The ICNP is a standardized terminology that names, classifies and links phenomena that describe the very elements of professional practice: what nursing does (nursing interventions), relative to the assessment of certain human and social needs (nursing diagnoses), to produce nursing sensitive patient outcomes (nursing outcomes) [9-11]. In its release of 2019, it has two special pre-coordinate axes called Diagnosis/Outcome and Intervention. Other seven axes (focus, judgment, client, action, means, location, and time) can be combined with specific syntax rules, the Seven Axis Model, to construct such diagnoses, interventions, or outcomes [12]. The online free ICNP Browser allows to consult all terms. This system can be a useful way of systemizing and standardizing nursing documentation [13].

ICN invites to create ICNP Subset, a sub-group of nursing diagnoses, interventions, and outcomes appropriate for areas of practice [14]. A Subset is designed to facilitate the direct use of the ICNP in nursing documentation for specific domains and populations of interest, and to support the aggregation and analysis of nursing data with a conceptual framework adopted when a Subset was developed [3]. Regarding neonatal care, there are two Subsets' proposal about lactation and infants in Primary Health Care [12,15]. As far as we know, there are no Subsets concerning preterm newborns in NICU. Furthermore, the nursing care in NICU with ICNP and a nursing conceptual model are not described [12,15].

The ICNP can be utilized with different nursing conceptual models [14]. There is, indeed, a specific invitation to use the ICNP with a nursing conceptual model [12,16]. In Italy, especially in the north, universities and healthcare institutions often use a nursing conceptual model developed by Marisa Cantarelli: the *Modello delle Prestazioni Infermieristiche* (MPI). The MPI belongs to the School of Nursing Models of Needs. It orients nursing practice, education, and research, and it shows eleven nursing needs: Interaction in Communication, Breathing, Maintaining Cardiovascular Function, Movement, Nutrition and Hydration, Urinary and Bowel Elimination, Personal Hygiene, Rest and Sleep, Safe Environment, Diagnostic Procedures and Therapeutic Procedures [17].

AIM

This study aims to verify the possibility of developing an ICNP Subset for preterm newborns in a Neonatal Intensive Care Unit according to a nursing conceptual model.

MATERIALS AND METHODS

This retrospective descriptive study is a lexical cross mapping from nurses' notes to the ICNP.

The study analyzed a convenience sample of nursing documentations of newborns between 2017 and 2019 in the NICU of one of the biggest hospitals in Milan, Italy: Niguarda Hospital. NICU of Niguarda Hospital is a III level NICU. Every year at least fifty newborns with birth weight under 1500g are treated. The population of interest was preterm newborns. The inclusion criterion for sample was preterm newborns with birth weight under 1500g hospitalized in NICU, the exclusion criterion was hospitalization for less than three days.

Data collection was completed between February and March 2021. The data collection was done through a document analysis to verify the registration of nursing phenomena, diagnoses, and interventions, described in documentation. The nursing documentation used in the hospital was organized according to the needs of the MPI. Each nurse, physician, and other health professional usually write during each shift a note about patients in a free text inserted in an electronic diary.

Documentations were analyzed by cross-mapping method, used to analyze data, comparing existing information in the records of the patients and the reference classifications for nursing practice [18]. Some studies used this method in different clinical context to build nursing terminology with the ICNP, or to develop an ICNP terminology subset, or to validate terms identified in nursing registers, mapping them to the ICNP [19-21]. In this study, the recovered sample of nursing documentation was analyzed, and every term and short sentence that described nursing phenomena were collected in a database. Later, a cross-mapping was performed between the collected terms and short sentences and the ICNP terms from the 2019 Italian version of the ICNP, through the ICNP browser and the program Microsoft® Excel® 2016.

Four Italian NICU nurses were enlisted to analyze nursing notes. Inclusion criteria were knowing the MPI, working in a NICU for at least five years, and knowing English language proficiently with at least Upper Intermediate level according to the Common European Framework of Reference, to allow a possible comparison with ICNP English terms in the browser. Their mean age was 30 years old, the mean of their NICU's years of work was 7 years, they stated to know the English language with a level of at least Upper Intermediate level according to the Common European Framework of Reference, and they knew and used at work the MPI. They were trained on Microsoft® Teams platform between December 2020 and January 2021 on the ICNP and research instruments by the principal researcher. During the training, the NICU nurses deepened ICNP development, ICNP pre-coordinate axes, ICNP Seven Axis Model syntax, ICNP browser, the already developed ICNP Subsets, and some examples of studies about the use of cross-mapping.

A database with the program Microsoft® Excel® 2016 was created to classify data on nursing documentation. Data collected were clinical information on every preterm newborn, terms and short sentences that described nursing phenomena written in documentation, ICNP terms for the cross-mapping, and needs of the MPI. At the beginning, terms and short sentences describing nursing phenomena were extracted and transcribed in the database. Then, they were classified in each need of the MPI. The NICU nurses started analyzing the same newborn documentations on their own and filled the database with data. Then, a concordance was found via consensus between NICU nurses and principal researcher. The recurrent and peculiar expressions of clinical contest of NICU were discussed and the disagreements were solved via consensus.

A cross-mapping was performed between terms and short sentences collected and the ICNP terms. Terms of pre-coordinate Diagnoses/Outcomes axis and of pre-coordinate Interventions axis of the 2019 Italian version of the ICNP were used for the cross mapping. The 2019 English version of the ICNP was consulted for some terms to reduce ambiguity in the translation. If a matching ICNP pre-coordinate term could not be found, new terms were formulated using the ICNP Seven Axis Model, following syntax rules given by ICN. After the analysis of the documentation, the NICU nurses and principal research compared all data and solved disagreements via consensus. Periods of interest were first, second, third and fourth weeks of NICU's newborns hospitalization.

The total number of nursing notes in preterm newborn nursing documentation was calculated. In nursing notes, the number of nursing phenomena described was detected. In this number, the frequency and percentage of corresponding nursing phenomena with ICNP diagnoses, interventions, and outcomes were calculated. The number of nursing phenomena was also divided between the 11 needs of the MPI and of Transversal terms. Transversal terms were understood as terms that can belong to more needs of the MPI according to the clinical situation, for example "vital sign" that can belong to Breathing or to Maintaining Cardiovascular Function. For each need of the MPI and for Transversal terms median and distribution of the nursing phenomena were calculated, and the terms under the 1st quartile were delayed. The percentage distribution of the ICNP terms divided in Negative Diagnoses/Outcomes (Negative-D/O), for example "Impaired Respiratory System Function", in Positive Diagnoses/Outcomes (Positive-D/O), for example "Effective Urinary System Function", and in Interventions, for example "Monitoring Respiratory Status", was calculated. Microsoft® Excel® Program was used for statistical analysis.

Nursing board, medical director of NICU, and Niguarda Hospital approved the study. This study was conducted in agreement with the current privacy legislation and the principles stated in the Helsinki Declaration and was approved by the Niguarda Hospital Ethics Committee on 02/11/2021 with number of opinions register 76-11022021.

Tab. 1. Characteristics of the newborns and devices used during hospitalization

Sex (%)	• 53% Female • 47% Male
Preterm	• 7% Late Preterm (33-37 weeks) • 56.5% Very Preterm (28-32 weeks) • 36.5% Extremely Preterm (less than 28 weeks)
Weight at birth (mean (SD))	1146g (±300.4g)
Childbirth (%)	• 24.3% Natural childbirth • 75.7% Delivered with caesarean section
Length of stay (mean (SD))	53.7 days (±37.2 days)
Umbilical venous catheter (%)	92.2%
Orogastric tube (%)	92.2%
Nasal continuous positive airway pressure (%)	83.5%
Peripheral venous catheter (%)	64.4%
Endotracheal tube (%)	44.4%
High flow nasal canula (%)	39.1%
Peripherally inserted central catheter (%)	30.4%
Central venous catheter (%)	21%
Umbilical arterial catheter (%)	Less than 20%
Urinary catheter (%)	Less than 20%
Ostomy bag (%)	Less than 20%
Surgical drain (%)	Less than 20%

RESULTS

The population study included 120 newborns. Sample consisted of 115 newborns, 5 individuals were excluded because they did not respond to inclusion criteria. All newborns had a prematurity diagnosis, in addition, 23.5% was smaller for gestational age, 2.6% had heart disorder, 29.5% were twins. Table 1. shows the characteristics of the newborns and the devices used during hospitalization.

The total number of nursing notes was 9,142 for 115 documentations of newborns. The total number of nursing phenomena described in nursing notes was 83,763. When it comes to 83,598 of them (99.8%), they found correspondence with ICNP terms. A total number of 288 ICNP terms described the 83,598 nursing phenomena.

The nursing phenomena was divided into the MPI needs, resulting as follow: 26.9% was categorized as need of Nutrition and Hydration, 25.2% as need of Breathing, 18.4% as need of Urinary and Bowel Elimination, 13.1% was categorized as Transversal terms, 4.8% as need of Diagnostic Procedures, 4.7% as need of Maintaining Cardiovascular Function, 3% was categorized as need of Interaction in Communication, and 2.9% was categorized as need of Therapeutic Procedures. Need of Movement, need of Hygiene, need of Rest and Sleep and need of Safe Environment each accounted for less than 1% of ICNP terms frequency. A total number of 567 nursing phenomena and 85 ICNP terms were excluded because their frequency was less than the value of 1° quartile of the MPI's needs. The total number of ICNP terms was 203 for 83,031 nursing phenomena. Frequency distribution of 83,031 nursing phenomena in Negative Diagnoses/Outcomes (Negative--D/O) was 12,285, in Positive Diagnoses/Outcomes (Positive-D/O) was 34,517, and in Interventions was 36,229. Percentage distribution of the 203 ICNP terms in Negative Diagnoses/Outcomes was 14.8%, in Positive Diagnoses/Outcomes was 41.6%, and in Interventions was 43.6%. The number of 42 terms over 203 (21%) were created by Seven Axis Model syntax, for example: Infant Feeding + Enteral Tube; Performing + Continuous Positive Airway Pressure; Actual + Impaired Consciousness; Effective + Sucking.

Ten most frequent ICNP terms in all nurses' notes of sample were showed in Table 2. Seven of them belonged to the ICNP pre-coordinated axes, and three terms were created with the ICNP Seven Axis Model syntax. These ten terms represent 51% of the total ICNP terms frequency.

Supplemental tables 3, 4 and 5 show distribution of ICNP terms classified with cross-mapping in nursing notes, divided by Negative-D/O, Positive-D/O, Interventions and by MPI needs. Were excluded in the tables the terms with a frequency below 0.2%.

Tab. 2. Ten more frequent ICNP terms in all nursing notes

ICNP Terms (N=203)	ICNP Code	Needs of MPI	Category	fd (N=83031)	f%
Effective Urinary System Function	10028615	Urinary and Bowel Elimination	Positive-D/O	7605	9.2
Normal + Vital Sign	10013295 + 10020829	Transversal	Positive-D/O (Judgement + Focus)	6837	8.2
Effective Defaecation	10028403	Urinary and Bowel Elimination	Positive-D/O	5348	6.4
Diet Tolerance	10036370	Nutrition and Hydration	Positive-D/O	5146	6.2
Infant Feeding + Enteral Tube	10037125 + 10046121	Nutrition and Hydration	Interventions (Action + Means)	3856	4.6
Monitoring Respiratory Status	10012196	Breathing	Interventions	3528	4.2
Impaired Respiratory System Function	10023362	Breathing	Negative-D/O	3292	4.0
Evaluating + Secretory Substance	10007066 + 10017635	Breathing	Interventions (Action + Focus)	2804	3.4
Risk For Impaired Gastrointestinal System Function	10046431	Urinary and Bowel Elimination	Negative-D/O	2225	2.7
Effective Respiratory System Function	10028160	Breathing	Positive-D/O	2057	2.5

Note: ICNP, International Classification for Nursing Practice; MPI, *Modello delle Prestazioni Infermieristiche* (Italian nursing conceptual model); fd, frequency distribution; f%, percentage distribution; Negative-D/O, Negative Diagnosis/Outcome; Positive-D/O, Positive Diagnosis/Outcome.

■ Tab. 3. Negative-D/O ICNP terms distribution in nurses' notes

ICNP Terms (N=40)	ICNP Code	Needs of MPI	Category	fd (N=12285)	f%
Impaired Respiratory System Function	10023362	Negative-D/O	Breathing	3292	26.8
Risk For Impaired Gastrointestinal System Function	10046431	Negative-D/O	Nutrition and Hydration	2225	18.1
Risk For Constipation	10015053	Negative-D/O	Nutrition and Hydration	1955	15.9
Impaired Gastrointestinal System Function	10022931	Negative-D/O	Nutrition and Hydration	844	6.9
Negative Response To Enteral Nutrition	10033415	Negative-D/O	Nutrition and Hydration	485	3.9
Vomiting	10025981	Negative-D/O	Nutrition and Hydration	400	3.3
Agitation	10025705	Negative-D/O	Interaction in Communication	331	2.7
Apnoea	10035020	Negative-D/O	Breathing	296	2.4
Bradycardia	10027274	Negative-D/O	Maintain Cardiovascular Function	287	2.3
Tachycardia	10027288	Negative-D/O	Maintain Cardiovascular Function	234	1.9
Activity Intolerance	10000431	Negative-D/O	Transversal	203	1.7
Altered Vital Sign	10050516	Negative-D/O	Transversal	189	1.5
Impaired Defaecation	10022062	Negative-D/O	Nutrition and Hydration	182	1.5
Inflammation	10029927	Negative-D/O	Maintain Cardiovascular Function	176	1.4
Actual + Regurgitation	10000420 + 10016632	Negative-D/O (Judgement + Focus)	Nutrition and Hydration	163	1.3
Impaired Peripheral Tissue Perfusion	10044239	Negative-D/O	Maintain Cardiovascular Function	154	1.3
Impaired Physiological Status	10030035	Negative-D/O	Transversal	142	1.2
Actual + Impaired Consciousness	10000420 + 10012634	Negative-D/O (Judgement + Focus)	Interaction in Communication	116	0.9
Impaired Urinary System Function	10001359	Negative-D/O	Nutrition and Hydration	104	0.8
Risk For Impaired Urinary System Function	10045453	Negative-D/O	Nutrition and Hydration	92	0.7
Potential for Risk + Altered Vital Sign	10017252 + 10050516	Negative-D/O (Judgement + D/O)	Transversal	86	0.7
Peripheral Oedema	10027482	Negative-D/O	Maintain Cardiovascular Function	80	0.7
Altered Blood Pressure	10022954	Negative-D/O	Maintain Cardiovascular Function	50	0.4
Actual + Hematoma	10000420 + 10008931	Negative-D/O (Judgement + Focus)	Maintain Cardiovascular Function	26	0.2
Impaired + Response To Procedure	10012938 + 10034466	Negative-D/O (Judgement + Focus)	Transversal	25	0.2

Note: ICNP, International Classification for Nursing Practice; MPI, *Modello delle Prestazioni Infermieristiche* (Italian nursing conceptual model); fd, frequency distribution; f%, percentage distribution; Negative-D/O, Negative Diagnosis/Outcome

■ Tab. 4. Intervention ICNP terms distribution in nursing notes

ICNP Terms (N=135)	ICNP Code	Needs of MPI	Category	fd (N=36229)	f%
Infant Feeding + Enteral Tube	10037125 + 10046121	Intervention (Action + Means)	Nutrition and Hydration	3856	10.6
Monitoring Respiratory Status	10012196	Intervention	Breathing	3528	9.7
Evaluating + Secretory Substance	10007066 + 10017635	Intervention (Action + Focus)	Breathing	2804	7.7
Feeding Infant With A Bottle	10035168	Intervention	Nutrition and Hydration	1971	5.4
Stimulating + Rectal Route	10018842 + 10016553	Intervention (Action + Location)	Urinary and Bowel Elimination	1878	5.2
Collecting Specimen	10004588	Intervention	Diagnostic Procedures	1841	5.1
Performing + Continuous Positive Airway Pressure	10014291 + 10041208	Intervention (Action + Means)	Breathing	1738	4.8
Identifying Physiological Status	10009612	Intervention	Transversal	1551	4.3
Maintaining Ventilation	10036646	Intervention	Breathing	1298	3.6
Maintaining Ventilation With A Mechanical Ventilator	10046258	Intervention	Breathing	1138	3.1
Suctioning Oral Cavity	10051978	Intervention	Breathing	1010	2.8
Monitoring Blood Oxygen Saturation Using Pulse Oximeter	10032047	Intervention	Breathing	865	2.4
Suctioning the Airway	10044890	Intervention	Breathing	731	2.0
Diagnostic Testing	10031140	Intervention	Diagnostic Procedures	659	1.8
Maintaining Intravenous Therapy	10036583	Intervention	Therapeutic Procedures	604	1.7
Monitoring + Gaseous Exchange	10012154 + 10008309	Intervention (Action + Focus)	Breathing	570	1.6

cont. Tab. 4. Intervention ICNP terms distribution in nursing notes

ICNP Terms (N=135)	ICNP Code	Needs of MPI	Category	fd (N=36229)	f%
Suctioning Endo Tracheal Tube	10051966	Intervention	Breathing	544	1.5
Managing Enteral Feeding	10031795	Intervention	Nutrition and Hydration	419	1.2
Promoting Skin To Skin Technique	10035361	Intervention	Transversal	405	1.1
Implementing Nothing By Mouth Regime	10044793	Intervention	Nutrition and Hydration	352	1.0
Monitoring Blood Glucose	10032034	Intervention	Diagnostic Procedures	331	0.9
Inserting Vascular Access Device	10034200	Intervention	Diagnostic Procedures	282	0.8
Evaluating + Bottle Feeding	10007066 + 10003582	Intervention (Action + Focus)	Nutrition and Hydration	268	0.7
Positioning Patient	10014761	Intervention	Movement	259	0.7
Maintaining + Light Therapy	10011504 + 10041778	Intervention (Action + Means)	Therapeutic Procedures	254	0.7
Restoring + Vital Sign	10017140 + 10020829	Intervention (Action + Focus)	Transversal	250	0.7
Promoting Caregiver Child Attachment	10035342	Intervention	Transversal	241	0.7
Measuring Heart Rate	10036826	Intervention	Maintain Cardiovascular Function	226	0.6
Stimulating Newborn	10051627	Intervention	Transversal	214	0.6
Initiating + Infusion Therapy	10010221 + 10010191	Intervention (Action + Means)	Therapeutic Procedures	207	0.6
Performing Enema	10043618	Intervention	Urinary and Bowel Elimination	206	0.6
Administering Medication	10025444	Intervention	Therapeutic Procedures	184	0.5
Monitoring Blood Pressure	10032052	Intervention	Maintain Cardiovascular Function	163	0.4
Removing + Intravenous Access	10016763 + 10010780	Intervention (Action + Focus)	Diagnostic Procedures	157	0.4
Managing + Vascular Access Device	10011625 + 10034484	Intervention (Action + Means)	Diagnostic Procedures	151	0.4
Initiating + Continuous Positive Airway Pressure	10010221 + 10041208	Intervention (Action + Means)	Breathing	141	0.4
Monitoring Food Intake	10036614	Intervention	Nutrition and Hydration	137	0.4
Promoting Effective Parenting	10032496	Intervention	Transversal	137	0.4
Evaluating + Sucking	10007066 + 10019001	Intervention (Action + Focus)	Nutrition and Hydration	136	0.4
Managing Parenteral Feeding	10031908	Intervention	Therapeutic Procedures	128	0.4
Managing Pain	10011660	Intervention	Transversal	124	0.3
Administering Medication + Endo Tracheal Tube	10025444 + 10006868	Intervention (Action + Means)	Therapeutic Procedures	118	0.3
Managing Feeding Device	10050769	Intervention	Nutrition and Hydration	112	0.3
Treating Injury	10033220	Intervention	Hygiene	109	0.3
Discontinuing Intravenous Therapy	10036667	Intervention	Therapeutic Procedures	109	0.3
Positioning + Light Therapy	10014757 + 10041778	Intervention (Action + Means)	Therapeutic Procedures	108	0.3
Monitoring Response To Ventilator Weaning	10051731	Intervention	Breathing	100	0.3
Weighing Patient	10033323	Intervention	Nutrition and Hydration	89	0.2
Removing + Light Therapy	10016763 + 10041778	Intervention (Action + Means)	Therapeutic Procedures	88	0.2
Assessing Cardiac Status Using Monitoring Device	10002706	Intervention	Maintain Cardiovascular Function	86	0.2
Evaluating Tubes And Drains	10034076	Intervention	Diagnostic Procedures	86	0.2
Invasive Device Site Care	10031592	Intervention	Hygiene	85	0.2
Positioning + Bed	10014757 + 10003168	Intervention (Action + Means)	Therapeutic Procedures	79	0.2
Discontinuing + Continuous Positive Airway Pressure	10036651 + 10041208	Intervention (Action + Means)	Breathing	78	0.2
Positioning + Incubator	10014757+10009988	Intervention	Safe Environment	77	0.2
Measuring Head Circumference	10035451	Intervention	Diagnostic Procedures	77	0.2
Measuring Height	10037000	Intervention	Nutrition and Hydration	73	0.2
Blood Therapy	10039311	Intervention	Therapeutic Procedures	73	0.2
Stabilising + Endo Tracheal Tube	10018729 + 10006868	Intervention (Action + Means)	Breathing	73	0.2
Skin Assessment	10041126	Intervention	Nutrition and Hydration	72	0.2
Promoting Exclusive Breastfeeding	10039437	Intervention	Nutrition and Hydration	69	0.2
Removing Endo Tracheal Tube	10051921	Intervention	Breathing	68	0.2
Skin Assessment	10041126	Intervention	Maintain Cardiovascular Function	68	0.2
Administering Prophylactic Treatment	10001827	Intervention	Therapeutic Procedures	68	0.2

cont. Tab. 4. Intervention ICNP terms distribution in nursing notes

ICNP Terms (N=135)	ICNP Code	Needs of MPI	Category	fd (N=36229)	f%
Collecting Venous Blood Specimen	10044633	Intervention	Diagnostic Procedures	67	0.2
Assessing Stoma	10040529	Intervention	Urinary and Bowel Elimination	66	0.2
Managing Specimen	10011687	Intervention	Diagnostic Procedures	65	0.2
Transferring Patient	10033188	Intervention	Transversal	65	0.2
Evaluating + Comfort + Continuous Positive Airway Pressure	10007066 + 10004655 + 10041208	Intervention (Action + Focus + Means)	Breathing	65	0.2
Evaluating Response To Thermoregulation	10007195	Intervention	Maintain Cardiovascular Function	63	0.2
Applying Ointment	10050350	Intervention	Hygiene	63	0.2
Assessing Pain	10026119	Intervention	Transversal	62	0.2
Evaluating Response To Medication	10007182	Intervention	Therapeutic Procedures	60	0.2
Positioning + Gastric Tube	10014757 + 10046132	Intervention (Action + Means)	Nutrition and Hydration	60	0.2
Administering + Sedation	10001773 + 10040156	Intervention (Action + Focus)	Therapeutic Procedures	58	0.2
Intubating + Newborn	10010831 + 10013187	Intervention (Action + Client)	Breathing	57	0.2
Maintaining + Endo Tracheal Tube	10011504 + 10006868	Intervention (Action + Means)	Breathing	57	0.2

Note: ICNP, International Classification for Nursing Practice; MPI, *Modello delle Prestazioni Infermieristiche* (Italian nursing conceptual model); fd, frequency distribution; f%, percentage distribution; Positive-D/O, Positive Diagnosis/Outcome.

Tab. 5. Positive-D/O ICNP terms distribution in nursing notes

ICNP Terms (N=28)	ICNP Code	Needs of MPI	Category	fd (N=34517)	f%
Effective Urinary System Function	10028615	Positive-D/O	Urinary and Bowel Elimination	7605	22.0
Normal + Vital Sign	10013295 + 10020829	Positive-D/O (Judgement + Focus)	Transversal	6837	19.8
Effective Defaecation	10028403	Positive-D/O	Urinary and Bowel Elimination	5348	15.5
Diet Tolerance	10036370	Positive-D/O	Nutrition and Hydration	5146	14.9
Effective Respiratory System Function	10028160	Positive-D/O	Breathing	2057	6.0
Alert	10028346	Positive-D/O	Interaction in Communication	1941	5.6
Effective Gastrointestinal System Function	10028016	Positive-D/O	Nutrition and Hydration	1621	4.7
Effective Thermoregulation	10033848	Positive-D/O	Maintain Cardiovascular Function	1278	3.7
Effective + Sucking	10014956 + 10019001	Positive-D/O (Judgement + Focus)	Nutrition and Hydration	891	2.6
Completed + Feeding Bottle	10004849 + 10007793	Positive-D/O (Judgement + Means)	Nutrition and Hydration	390	1.1
Effective Breathing	10041334	Positive-D/O	Breathing	385	1.1
Effective Tissue Perfusion	10028593	Positive-D/O	Maintain Cardiovascular Function	271	0.8
Blood Pressure Within Normal Limits	10027647	Positive-D/O	Maintain Cardiovascular Function	152	0.4
Effective Activity Tolerance	10027634	Positive-D/O	Transversal	148	0.4
Effective Breastfeeding	10001411	Positive-D/O	Nutrition and Hydration	107	0.3
Heart Rate Within Normal Limits	10029229	Positive-D/O	Maintain Cardiovascular Function	60	0.2

Note: ICNP, International Classification for Nursing Practice; MPI, *Modello delle Prestazioni Infermieristiche* (Italian nursing conceptual model); fd, frequency distribution; f%, percentage distribution; Positive-D/O, Positive Diagnosis/Outcome.

DISCUSSION

The cross-mapping classifies the 99.8% of terms written on nursing notes by NICU's nurses. The ICNP can be a standardized nursing language able to describe preterm newborns nursing practice. MPI's needs with highest number of nursing phenomena in nurses' notes are Urinary and Bowel Elimination, 25.7%, and Breathing, 25.5%. Nutrition and Hydration, with the 19.4%, represents the third need of ICNP terms in nurses' notes. Even in a study regarding the ICNP nursing diagnoses of newborns in rooming-in care, Nutrition and Elimination needs were among the most cited [19].

Among ten most frequent ICNP terms, all seven Diagnoses terms, positive or negative, relate to urinary, respiratory and gastrointestinal functions. Besides, two Intervention terms concerned actions regarding the evaluation of respiratory status. Some of higher risks related to preterm newborns involve these of apparatus functions, for example feeding difficulty, hypoglycemia, respiratory complications, apnoea, and necrotizing enterocolitis [1,2,19].

Some nursing phenomena are poorly described in nursing notes. For example, Hygiene is one of the MPI's needs with a frequency term smaller than 1%. The few Hygiene terms belong to Interventions axis and describe actions about skin or wound caring or newborns washing. Furthermore, few educational ICNP pre-coordinate diagnoses and interventions in nursing notes have been found. Mothers' education in NICU is important, indeed, mothers unprepared for NICU discharge are more likely to report difficult coping with newborns and infants' care at home [22].

The ICNP pre-coordinate diagnoses and interventions are not sufficient to describe all nursing practices in NICU newborns and infants [19,23]. It was necessary to use the ICNP syntax with Seven Axis Model to create terms that could describe diagnoses or interventions. The syntax was necessary for 42 ICNP terms over 203 ICNP terms, corresponding to the 20%. A nursing phenomenon, which is not present in the ICNP, though typical of NICU's contest and in general of the neonatal one, is "meconium". Also "gastric residual" and "non-invasive ventilation", with their specifications, are not present.

Results of the study suggest the possibility of developing an ICNP Subset for NICU, using pre-coordinated axes and syntax rules given by ICN. Validation of new ICNP terms should be necessary. The use of EHR increases constantly and it is fundamental to utilize a disciplinary vocabulary to describe elements of nursing process and nursing care, also in contexts like NICU where newborns are a cohort with multiple risks. An unambiguous language is an important prerequisite for exchanging electronic information [5,8]. A NICU Subset could be useful in clinical practice. The use of standardized diagnosis, intervention, and outcome for care and documentation can provide means of making nursing's contribution visible and quantifiable [24]. The ICNP is now available as a reference set within SNOMED CT, which is the largest clinical terminology in the word, thanks to an agreement between ICN and SNOMED International [25]. Its focus is to provide healthcare professionals with tools within EHR to document and share information worldwide [25].

The study was developed with a convenience sampling, and it was developed in a single NICU. The nursing documentations were written in Italian language, and all the nurses were educated in Italy. So, the results could not represent all the possible international nursing languages.

CONCLUSIONS

Results of the study suggest the possibility of developing an ICNP Subset for NICU. An ICNP Subset could allow the introduction of Electronic Health Record in NICU context. The ICNP pre-coordinated terms cannot describe all nursing care written in analyzed NICU nursing notes, but it is necessary to use the ICNP Seven Axis Model to create new terms. Need of Nutrition and Hydration, need of Breathing and need of Urinary and Bowel Elimination were the patients' needs with the highest number of ICNP terms. Further studies are needed to develop a NICU ICNP Subset, and to validate new ICNP terms for NICU context.

Acknowledgement

This work was supported by the Neonatal Intensive Care Unit and Nursing Management of the Niguarda Hospital in Milan. A special thanks to Brega F., Papa N., and Mocchi T. for their support and translation work.

ORCID

Valentina Tommasi https://orcid.org/0000-0001-8441-5577
Barbara Bassola https://orcid.org/0000-0001-8860-4893
Silvia Cilluffo https://orcid.org/0000-0003-2756-9929
Maura Lusignani https://orcid.org/0000-0002-5389-9879

REFERENCES

1. Oltman SP, Rogers EE, Baer RJ, et al. Newborn metabolic vulnerability profile identifies preterm infants at risk for mortality and morbidity. Pediatr. Res. 2021; 89: 1405-13. https://doi.org/10.1038/s41390-020-01148-0.
2. Cooper AL, Brown JA, O'Connor T, et al. Improving the clinical skills and knowledge of midwives and nurses caring for late preterm neonates. J. Contin. Educ. Nurs. 2019; 50: 551-556. https://doi.org/10.3928/00220124-20191115-06.
3. Cho I, Kim J, Chae J, et al. Development of ICNP-based inpatient falls prevention catalogue. Int. Nurs. Rev. 2020; 67: 239-248. https://doi.org/10.1111/inr.12566.
4. D'agostino F, Zeffiro V, Ausili D, et al. Cross-Mapping of Nursing Care Terms Recorded in Italian Hospitals into the Standardized NNN Terminology. Int. J. Nurs. Knowl. 2020; 31: 4-13. https://doi.org/10.1111/2047-3095.12200.
5. De Groot K, Triemstra M, Paans W, et al. Quality criteria, instruments, and requirements for nursing documentation: A systematic review of systematic reviews. J. Adv. Nurs. 2019; 75: 1379-1393. https://doi.org/10.1111/jan.13919.
6. Mykkänen M, Kinnunen UM, Liljamo P, et al. Using standardized nursing data for knowledge generation – Ward level analysis of point of care nursing documentation. Int. J. Med. Inform. 2022; 167. https://doi.org/10.1016/j.ijmedinf.2022.104879.
7. Macieira TGR, Smith MB, Davis N, et al. Evidence of Progress in Making Nursing Practice Visible Using Standardized Nursing Data: a Systematic Review. AMIA Annual Symposium Proceedings. 2018:1205-1214.
8. Devin J, Costello J, McCallion N, et al. Impact of an electronic health record on task time distribution in a neonatal intensive care unit. Int. J. Med. Inform. 2021;145. https://doi.org/10.1016/j.ijmedinf.2020.104307.
9. Garcia TR. ICNP®: A standardized terminology to describe professional nursing practice. Revista Da Escola de Enfermagem. 2016; 50: 378-379. https://doi.org/10.1590/S0080-623420160000400001.
10. Pietrzak K, Grabowska H. ICNP®- Why not? Nurses' opinions on the implementation of ICNP®vocabulary for clinical practice. Pielegniarstwo XXI Wieku. 2020;19: 236-243. https://doi.org/10.2478/pielxxiw-2020-0034.
11. Ronkowska J, Stefanowicz-Bielska A. Nursing care of a child with type 1 diabetes mellitus - a nursing process using the International Classification of Nursing Practice ICNP®. Pielegniarstwo XXI Wieku. 2020; 19: 174-183. https://doi.org/10.2478/pielxxiw-2020-0029.
12. Tommasi V, Vercesi G, Sannino P, et al. The use of International Classification for Nursing Practice (ICNP ®) in pediatric and neonatal settings: literature review. Prof. Inferm. 2021; 74: 195-204.
13. Ostensen E, Bragstad LK, Hardiker NR, et al. ICNP® in nursing documentation - When expectations meet reality. Nursing Informatics. 2018; 250. https://doi.org/10.3233/978-1-61499-872-3-235.
14. Bezze S, Ausili D, Erba I, et al. Development of a subset of ICNP Nursing Diagnoses for the promotion of self-care in people with diabetes mellitus: A multi-center observational study. Ann Ig. 2020; 32: 38-49. https://doi.org/10.7416/ai.2020.2328.
15. Primo Caniçali C, Resende Zanetti F, Garcia TR, et al. ICNP® terminology subset for care of women and children experiencing breastfeeding. Rev. Gaucha Enferm. 2018; 39. https://doi.org/https://doi.org/10.1590/1983-1447.2018.2017-0010.
16. Querido DL, Christoffel MM, da Nóbrega MML, et al. Terminological subsets of the international classification for nursing practice: An integrative literature review. Revista Da Escola de Enfermagem. 2019; 53. https://doi.org/10.1590/S1980-220X2018030103522.
17. Di Mauro S, Vanalli M, Alberio M, et al. Developing a subset of ICNP nursing diagnoses for medical and surgical hospital settings, informed by an italian nursing conceptual model: A multicenter crosssectional study. Ann. Ig. 2018; 30: 21-33. https://doi.org/10.7416/ai.2018.2192.

18. Thaís SL, Lima da Nóbrega MM, Leite Saparolli EC, et al. Cross mapping of nursing diagnoses in infant health using the International Classification of Nursing Practice*. Revista Da Escola de Enfermagem. 2014; 48: 247-253. https://doi.org/10.1590/S0080-623420140000100008.
19. Almeida VS de, Andrade M, Querido DL, et al. Nursing diagnoses of newborns in rooming-in care using ICNP®. Rev. Bras. Enferm. 2022; 75.
20. Prado NC da C, Menezes HF de, Sousa PAF, et al. Terms of specialized nursing language in the care of the newborn with central venous catheter. Rev. Bras. Enferm. 2022; 75: e20210572. https://doi.org/10.1590/0034-7167-2021-0572.
21. Silva LPZ, Primo CC, Prado TN do. ICNP® terminology subset for people with tuberculosis. Rev. Bras. Enferm. 2021; 74: e20200059. https://doi.org/10.1590/0034-7167-2020-0059.
22. Rochefort CM, Rathwell BA, Clarke SP. Rationing of nursing care interventions and its association with nurse-reported outcomes in the neonatal intensive care unit: A cross-sectional survey. BMC Nurs. 2016; 15. https://doi.org/10.1186/s12912-016-0169-z.
23. Clares JWB, Nóbrega MML da, Guedes MVC, et al. ICNP ® nursing diagnoses, outcomes and interventions for community elderly. Rev. Bras. Enferm. 2019; 72: 191-198. https://doi.org/10.1590/0034-7167-2018-0540.
24. Müller-Staub M, Lavin MA, Needham I, et al. Nursing diagnoses, interventions and outcomes - Application and impact on nursing practice: Systematic review. J. Adv. Nurs. 2006; 56: 514-531. https://doi.org/10.1111/j.1365-2648.2006.04012.x.
25. Thoroddsen A, Rúnarsdóttir ER, Örlygsdóttir B. Description of COVID-19 patients and mapping nursing data to ICNP 2021 reference set in SNOMED CT. Int. Nurs. Rev. 2022. https://doi.org/10.1111/inr.12824.

Manuscript received: 2023-07-24
Manuscript accepted: 2023-09-22