Office of the Nursing & Midwifery Services Director

FIVE COUNTRY NURSING and MIDWIFERY DIGITAL LEADERSHIP GROUP

Representing what we do as Nurses and Midwives

- Terminologies and Standardised Languages: Systematic Literature Review and Key Considerations

Seirbhís Sláinte Níos Fearr á Forbairt | Building a Better Health Service

Welsh Nursing Care Record (Hospital) | Cofnod Gofal Nyrsio Cymru (Ysbyty)

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Foreword

Welcome to this report Representing what we do as Nurses and Midwives – Terminologies and Standardised Languages: Systematic Literature Review and Key Considerations which highlights key considerations for developing, implementing, using and evaluating standardised terminologies in nursing and midwifery practice.

This review was commissioned by the Office of the Nursing and Midwifery Services Director, Health Service Executive, Ireland, to support one of the key priorities of the Five Country Nursing and Midwifery Digital Leadership Group as conveyed from the five Government Chief Nurses for Ireland, England, Scotland Wales and Northern Ireland, namely to advance debate across the five countries to inform a five country approach to the use of standardised nursing and midwifery terminologies.

The report highlights twenty-five key considerations under six categories: measurement properties; usability; documentation quality; patient care; knowledge generation; and education programmes (pre and post registration).

The key considerations are drawn from an extensive international literature review and the experiences of an Expert Advisory Sub Group comprised of a number of colleagues from the Five Country Nursing and Midwifery Digital Leadership Group.

The Expert Advisory Group was fundamental to reviewing and providing direction for this work. Their combined experience and insights added considerable value to this report and more specifically the derivation of the key considerations. We thank the Group for their time, energy and commitment.

We would like to thank Dr Orna Fennelly, who authored this report, for her expertise, dedication and commitment in completing this important piece of work.

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Nursing and Midwifery Terminologies Report 2020

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Glossary of terms

Aggregation terminology	A body of terms linked to a code set which facilitates simple hierarchy relationships between the terms and is used for administrative purposes.
Clinical Classification System (CCC)	Standardised nursing terminology originally developed to represent nursing diagnoses, interventions and outcomes in home health and ambulatory care settings.
Clinical decision support	Software which matches the characteristics of an individual patient to a computerised clinical knowledge base, and patient-specific assessments or recommendations are then presented to the clinician to aid decision-making.
Community or primary care	Health or social care services in the community, outside of the hospital.
Electronic Health Record (EHR)	Longitudinal record of information regarding the health status of a subject of care which follows them from one practice or specialist to the next, in computer processible form.
End-user	Person using the standardised terminology.
Healthcare professional	Provider of healthcare who may be from any discipline including medicine, nursing, midwifery, pharmacy, allied health.
Homecare agency	Provide health and social care services within the home.
Interface terminology	A terminology which provides terms with more granularity and clinical intent for a specific healthcare discipline or speciality
International Classification of Diseases (ICD)	Standard classification of diagnostic concepts for epidemiology, health management and clinical purposes and managed by the World Health Organisation.
International Classification for Nursing Practice (ICNP)	Standardised nursing terminology developed to represent nursing diagnoses, interventions and outcomes.

Nursing and Midwifery Terminologies Report 2020

Interoperability	Ability of different information systems, devices or applications to connect and 'talk' effectively to one another in a coordinated manner, within and across organisational boundaries.
Long term care	Care and support provided to people often with significant declines in capacity within a long-term care facility or nursing home.
NANDA NIC NOC (NNN)	Three standardised nursing terminologies developed to respectively represent nursing diagnoses, interventions and outcomes.
Omaha system	Standardised nursing terminology originally developed to represent nursing diagnoses, interventions and outcomes in the community setting.
Patient	Utilised in this report to describe a person using health services.
Perioperative Nursing Data Set (PNDS)	Standardised nursing terminology originally developed to represent nursing diagnoses, interventions to support evidence based perioperative nursing practice.
Reference terminology	A clinical terminology which facilitates the combination of concepts to create terms which are clinically meaningful.
Reliability	Terms used in a consistent manner.
Responsiveness	Terms distinguished between differences in patient status.
RxNorm	Provides normalized names for clinical drugs.
Standardised terminology (ST)	Defined body of words or expressions used in relation to a particular subject or activity.
Secondary care	Care provided in an acute medical facility.
Systematized Nomenclature of Medicine - Clinical Terms (SNOMED-CT)	Clinical reference terminology with thousands of codes which can be utilised to capture all clinical notes including allergies, vitals, past history, family history, symptoms, clinical findings and diagnosis.
Validity	Term captured what it intended to capture.

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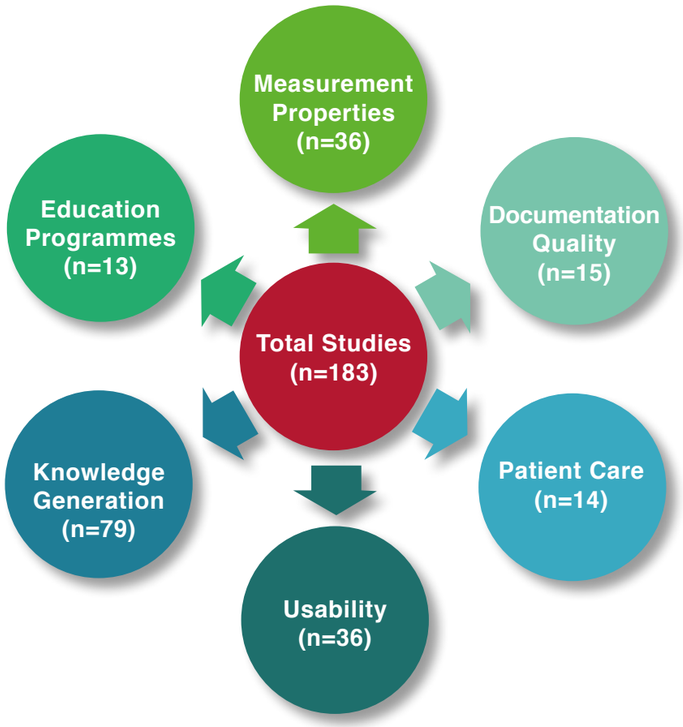
Executive Summary

As the largest workforce of healthcare providers globally, nurses and midwives collect vast amounts of patient data with huge potential to be used to optimise delivery and improve the quality of healthcare. Evolution of electronic health records (EHRs) has also enhanced the opportunities to capture and use these data. However, this is a largely untapped data source and clinical documentation has reportedly been a devalued aspect of nursing and midwifery practice. Additionally, inconsistent nomenclature utilised by nurses and midwives impacts on the quality of the data which is key to patient safety, clinical decision-making, communicating with other healthcare professionals and quality assurance. This also renders it difficult to retrieve, aggregate, interpret and use these large nursing and midwifery datasets.

To facilitate the consistent use and understanding of clinical concepts, standardised terminologies (STs) have been developed which encompass terms with agreed definitions that adequately represent the knowledge behind these terms and link them with a standardised coding and classification system. Several categories of STs exist including both nursing-specific (e.g., NANDA-I) and interdisciplinary STs (e.g., SNOMED-CT). However, no single ST has been accepted as a universal standard and several are employed internationally. The impact of these STs on nursing and midwifery practice as a whole and individually remains unknown. To fill this gap in the literature, a scoping review was conducted to investigate the use and impact of STs on nursing and midwifery practice. Having identified the research foci of these studies in collaboration with the Five Country Nursing and Midwifery Leadership Group, an expert panel of nursing and midwifery leaders and academics, the findings of the identified studies were synthesised.

Key findings from the literature:

The studies identified by the scoping review (n=183) had been undertaken in 26 different countries and evaluated the following STs: NANDA-I, Nursing Outcome Classification (NOC), Nursing Intervention Classification (NIC), International Classification for Nursing Practice (ICNP), the Omaha System, Clinical Care Classification (CCC), Perioperative Nursing Data Set (PNDS), International Classification of Diseases (ICD), Diagnostic and Statistical Manual of Mental Disorders (DSM), Read codes, several different Nursing Minimum Data Sets (NMDS) and some locally-controlled STs. These studies were heterogenous in nature and conducted across a variety of settings including primary care, long term care and hospitals, and this must be taken into account when interpreting the findings. Additionally, many of the included studies were of cross-sectional design and did not directly compare the ST with a control group (e.g., another ST or non-use of a ST). These studies evaluated the ST across six categories (Fig. 1):



(i) Measurement properties

The validity, reliability and responsiveness of specific terms from NANDA-I, NOC and Omaha system were evaluated within certain clinical scenarios (e.g., heart failure patients in the ICU). These studies demonstrated that diagnoses, clinical indicators and outcomes from these STs could accurately and consistently capture patient information as well as changes in the patient status. However, these findings depended on the specific concept from the ST used, the patient presentation and the individual nurse using the ST.

(ii) Usability

Usability of STs was evaluated in terms of time efficiency, applicability to the clinical setting, user perceptions and interoperability of the ST. As end-users became more accustomed to the ST, unsurprisingly their time efficiency improved. However, studies evaluating time efficiency of end-users using the ST co-introduced a computerised system and the usability of the system interface impacted on end-user efficiency. Although conducted across several settings, the majority of terms from the specific ST evaluated, were applicable and utilised within the given setting they were assessed in. However, in certain scenarios, free-text needed to be utilised as terms were not available. Overall, nurses and midwives perceived the ST to be beneficial as it facilitated the documentation of the nursing plan and clinical decision making, however, it could be cumbersome to use. Finally, the ST facilitated interoperability between EHR systems in one study but required use of the same format and file types as well as the ST.

(iii) Documentation quality

Overall, studies evaluating the impact of STs on the quality of documentation demonstrated positive improvements. These studies usually also included education in the use of the ST, the nursing process and clinical-reasoning which would have contributed to these improvements. The quality of documentation was usually evaluated on the basis of including a diagnosis, intervention and outcome, as opposed to being patient-centred and understood by other healthcare professionals.

(iv) Patient care

The findings from the studies evaluating the impact of the STs on patient care reported mixed results regarding the benefits. However, no adverse effect on patient care from using the ST was identified. These heterogenous studies included a range of patient presentations but the majority of these were conducted in outpatient settings. Where positive impacts were identified for patient care, these studies had often introduced evidence-based interventions in conjunction with the ST.

(v) Knowledge generation

Studies utilised a ST from the clinical documentation to characterise or evaluate nursing care. Additionally, some studies evaluated the process of generating these data. Use of an ST facilitated the aggregation of data in relation to the prevalence and frequency of diagnoses and interventions, as well as the evaluation of the impact of these on nursing-sensitive outcomes. Some studies also utilised these data to identify nursing workloads, resource consumption and predict patient outcomes. Although, the consistent use of terminology facilitated the aggregation of these data, limitations did exist where nurses omitted information, did not use the ST correctly and where the concept search was not explicit to the query.

(vi) Education programmes (pre and post registration)

STs were utilised to assess students and improve their clinical reasoning and documentation skills in pre and post nursing registration education. The Omaha system, ICNP, NANDA-I and NNN were used to identify the types of patients and interventions that the nursing students had been exposed to in their clinical placements and the Omaha system was also used to compare the decision making of students compared to their educators. Some students found that using the STs during the education programmes improved their clinical decision-making skills as the diagnoses were linked with interventions and outcomes.

Overall, the identified studies demonstrated some benefits of using a ST including valid and reliable capture of patient data, generation of knowledge, improvements in documentation quality, and facilitation of nursing student education. Additionally, no negative implications on patient outcomes or end-user efficiency were found. However, study limitations and heterogeneity in terms of the ST utilised, education provided, clinical experience of the nurse, healthcare setting and country of origin, renders generalisability of findings across settings as difficult. Further research is therefore required which compares the use of different STs with non-use, and acknowledges the impact of education and support as well as EHR system usability on the experiences of using the ST.

Key considerations for developing, implementing, using and evaluating standardised terminologies in nursing and midwifery practice

As much of the available evidence on the impact of STs in nursing and midwifery practice appears to be of low quality and conducted in specific healthcare settings and countries with discrepancies in nursing and midwifery experience and education in using the ST, it must be interpreted with caution. To support the interpretation of this heterogenous research, the Five Country Nursing and Midwifery Leadership Group along with the researcher derived the following key considerations based on a group consensus from the literature and their own experiences.

Measurement properties

1. Improvements and adaptations to STs occur over time to meet the needs of changing healthcare landscapes and this will impact on the measurement properties.
2. Good validity, reliability and responsiveness of specific terms may not be generalisable to the entire ST or to different contexts, settings and patient cohorts.
3. Valid and reliable use of the ST is influenced by the knowledge and skills of end-users.
4. Decision rules for selecting the most appropriate term help improve consistency of use.

Usability

5. Easy-to-use system interfaces to search for terms (e.g., recognising synonyms and abbreviations, and providing list of favourites', recently used or pre-set groups of interventions for specific patients) influence the usability of the ST.
6. Discrepancies in tasks undertaken by nurses across settings or countries may impact on the applicability of the ST.
7. STs need to be sufficiently broad and detailed without compromising the integrity of the ST or including more than one term to describe the same concept.
8. Option to enter free text to qualify the ST or to describe a situation which cannot be represented in a pre-defined manner is recommended to avoid fostering inaccuracies or restricting healthcare professionals.
9. Harmonisation and mapping of interface STs to reference and aggregation STs facilitates semantic interoperability and aggregation of data but this is resource-intensive.
10. Subsets of STs and discipline-/speciality-specific STs helps improve user-friendliness by reducing the number of terms available and making them more relevant and specific.
11. More medically-focused STs could be suitable for nurses and midwives, especially those undertaking advanced roles, but further research is required.
12. Use of interdisciplinary STs could help ensure consistent understanding across disciplines and reduce creation of data siloes.
13. Nursing and midwifery-specific STs help identify and separate the contribution of nurses and midwives to patient care and will likely be more applicable.

Documentation quality

14. Education on the nursing process and introduction of EHRs, in addition to the ST, contributed to the identified improvements in documentation quality.
15. Certain settings may lend themselves to or benefit more from a ST than others (e.g., renal dialysis where particular interventions repeatedly used).
16. Future evaluations of documentation quality should consider whether the ST supports patient-centred care and continuity of care across healthcare disciplines.
17. Timing of the introduction of the ST is important - coinciding with the EHR implementation increases disruptions to end-users but computer-aided selection of terms is easier to use compared to the traditional paper-based handbook.

Patient care

18. STs facilitate evidence-based linking of diagnoses to interventions and outcomes and use of clinical decision support software which could improve patient care and safety.
19. Further research is required which evaluates the impact of STs on patient safety and is conducted in inpatient settings.

Knowledge generation

20. To generate useful and accurate knowledge, healthcare professionals must adopt and correctly interpret and use the ST.
21. Resources to analyse and interpret the data generated from STs are required to drive benefits.
22. EHRs should be designed to facilitate easy-to-use reporting and analytics of the ST.

Education Programmes (pre and post registration)

23. Providing training on STs during pre and post registration education may help nurses and midwives become more accustomed to STs and promote its use in clinical practice.
24. STs may promote clinical reasoning practices amongst nursing students as well providing a consistent method of assessing their experience and knowledge.
25. Prior to incorporating STs into nursing education, it should be decided whether nurses need to be 'multilingual' or whether each healthcare setting will use the same ST.

1. Introduction

1.1.Nursing and Midwifery Practice

Nurses and midwives represent the largest workforce of healthcare providers globally [1, 2] and thus, provide the most patient contact time and collect a large volume of patient data [3, 4]. Documentation performed by nurses includes both external regulatory requirements, such as advanced directives and consent forms, and clinical forms including nurses' notes, care plans and assessment forms [5]. High quality and thorough documentation of patient care is critical for patient safety, ensuring continuity of care via communication with other healthcare professionals and supporting nurses and midwives to reflect and critically think about their patients' condition and response to interventions [6-9]. Clear, accurate, objective and timely record keeping is a fundamental part of the nursing and midwifery code of practice in both Ireland and the UK [10, 11], however, has often been devalued and untapped even within the profession itself [12]. Several studies have reported that nursing documentation was of low quality [6, 13], with patient records containing relatively few formulated nursing diagnoses [14] and only one in five nursing care plans capturing the patient's needs in their clinical audit [15]. This is despite nurses spending an estimated 13-28% of total shift time documenting [5]. Poor quality data as well as inconsistent professional vocabularies (i.e., words and terms) to describe elements of the nursing process and nursing care [16], renders it difficult to demonstrate the nursing and midwifery contribution to patient care, as well as identifying benchmarks and quality assurance [3]. Quality of care provided to patients is directly related to the quality of information available to the healthcare providers and therefore, this has safety implications [12].

1.2.Electronic health records

Development and implementation of electronic health records (EHRs) and other information technology (IT) offers tremendous opportunities to enhance clinical practice and the ability to evaluate and generate knowledge from the clinical documentation [17, 18]. EHRs can facilitate more timely-access to information, reduce duplication of tests and facilitate the retrieval and aggregation of clinical data to monitor treatment effectiveness and trends for service improvement and research [19-22]. To drive these benefits and retrieve high quality information from the EHR for patient care and quality assurance, high quality data must first be entered into the EHR [12]. Therefore, it is vital that that clinical data is represented in a shareable manner which preserves its complexity, context and richness of patient care [23], and facilitates communication between healthcare professionals [24]. However, clinical information can often be tacit, context-bound, and ambiguous [25, 26], rendering it difficult for these data to be re-used and exchanged across systems (i.e., interoperability) [16, 27, 28]. With nurses and midwives being responsible for a large amount of the data being entered into the EHR, it is critical that the quality of nursing and midwifery data is improved.

1.3.Standardised terminologies

Recognition of the importance of the consistent understanding of concepts both across and within healthcare disciplines as well as the introduction of EHRs, have instigated changes in

documentation practices [29, 30]. Standardised terminologies (STs) have been developed which are associated with codes and represent defined aspects of clinical practice [31-33] and have been defined by the World Health Organisation (WHO) as a "compilation of terms used in the clinical assessment, management and care of patients, which includes agreed definitions that adequately represent the knowledge behind these terms and link with a standardised coding and classification system" [34]. Use of STs promotes the consistent use and understanding of concepts by all healthcare professionals who are familiar with the ST across organisations and geographical boundaries (irrespective of language) [24, 32, 35, 36]. This has the potential to facilitate the monitoring of treatment effectiveness, patterns and trends [37-39] and provide additional research opportunities [24, 32, 35, 36] as it makes data more identifiable and retrievable for data analytics [40]. Additionally, consistent use of terms by healthcare professionals could improve patient understanding of their condition [24, 41]. Use of the ST within an EHR may also support semantic interoperability between systems [32, 35, 36] and enable the use of clinical decision support (CDS) software [37-39].

Whilst many STs have been developed, no single ST has been accepted as a universal standard [42]. Therefore, in the United States of America (USA) the Health Information Technology for Economic and Clinical Health (HITECH) and Affordable Care Acts have mandated the use of several STs [43]. STs have been developed for different purposes and thus, three categories exist:

Aggregation Terminologies (or Administrative Code Sets): Designed primarily as a classification system for administrative purposes to either group diagnoses and procedures, or to contain broad categories with administrative technical terms and enable only simple hierarchy relationships between concepts [31, 33, 35]. Examples include: International Classification of Diseases (ICD), International Classification of Primary Care (ICPC), Read Codes, Current Procedural Terminology (CPT), and Office of Population Censuses and Surveys Classification of Interventions and Procedures (OPCS).

Reference Terminologies (or Clinical Code Sets): Enable sensitive and specific terms to be collected at point-of-care which maintain a common reference point in healthcare and facilitate the combination of concepts (i.e., post-coordination) to create a more detailed or complex concept from a simple one [31, 33, 42]. Examples include: Systematized Nomenclature of Medicine-Clinical Term (SNOMED-CT), Logical Observation Identifiers Names and Codes (LOINC) and RxNorm.

Interface Terminology: Capture more granularity and clinical intent in the documentation by attempting to represent the common terms utilised in the specific practice in which it is employed [33, 44, 45]. Interface terminologies may be site-specific [44], domain-specific [24] or discipline-specific (e.g., nursing, dietetics) [46, 47]. Examples include: International Classification for Nursing Practice (ICNP), Clinical Care Classifications (CCC), Omaha System, Nutrition Care Process Terminology (NCPT) and Nursing Interventions Classifications (NIC).

Although all of these categories may be utilised by healthcare professionals at point-of-care, they provide different advantages. Aggregation terminologies prevent concepts from having multiple parents and are useful for administrative purposes such as national databases and informing policy but can be restrictive when used in clinical practice [31]. Reference terminologies enable the collection of more clinically-relevant information by healthcare providers as they allow the combination of terms and these are often used by all the members of the multi-disciplinary team [31, 42]. However, to facilitate the capture of all clinically-relevant terms and potential combinations, thousands of concepts usually exist in reference terminologies requiring the healthcare professional to spend time searching for the most suitable concept [39]. Interface terminologies also contain more clinically-relevant terms but the number of terms available are usually limited to those required by the site or discipline using it and are more specific [38, 47-49]. To gain all of the above benefits, multiple STs are often utilised and mapped to one another [33, 47, 50].

Since the 1970s, there has been a concerted effort to promote STs within nursing and midwifery practice [51] with the pioneering of the first standardised nursing language or terminology NANDA, formerly known as North American Nursing Diagnosis Association [29, 41]. These standardised nursing terminologies commonly systematically group, define and encode nursing care as nursing diagnoses, interventions and outcomes [27, 52-54] and link nursing diagnoses with evidenced-based interventions and outcomes [5]. This is seen as the pathway for making the nursing process more useable and visible [41] which promotes good communication, provides the basis for care planning and identification of patient problems [23] and improves data quality for research and service development planning [55]. The American Nurses Association (ANA) have approved twelve terminology sets that support nursing practice which includes both nursing-specific (i.e., ICNP, NANDA-I, Omaha System) and multi-disciplinary (i.e., SNOMED-CT, LOINC) terminologies [56, 57]. Both the UK and Ireland have adopted the use of SNOMED-CT [35, 58, 59] but their utilisation of nursing-specific STs has been more sporadic [58, 60].

1.4. Aim of report

Whilst several potential benefits of using STs have been discussed, it is important that we evaluate the actual impact STs have on nursing and midwifery practice in order to inform whether these should be employed and which STs should be utilised. Initially, the deployment of STs in nursing and midwifery practice has been uncoordinated with little convergence towards a unified nursing language system that can be integrated within the wider health-care language arena [61]. It is now acknowledged that these STs need to be integrated and understood within the broader healthcare system to support interoperability and data continuity across community and acute settings [41, 62, 63]. Previous literature reviews on STs in nursing and midwifery practice have identified and evaluated the secondary use of STs [48, 64, 65] and have included only nursing-specific STs [38, 48, 65, 66] or a single ST [18, 67]. Therefore, this scoping review of the literature aimed to identify and evaluate the impact of international and locally-controlled nursing and interdisciplinary STs on nursing and midwifery practice. Through the engagement of the Five Country Nursing and Midwifery Leadership Group throughout the entire review process, the findings of this scoping review were validated by the experts and knowledge-users [68, 69]. The overall aim of this report was to provide an overview of the existing literature and key considerations regarding STs in nursing and midwifery practice based on the available research and the experiences of key stakeholders.

2. Methods

An initial scope of the literature on STs in nursing and midwifery was performed with findings broadly categorised by research focus (Fig. 2). The preliminary findings were presented to and reviewed by the Five Country Nursing and Midwifery Leadership Group consisting of nursing and midwifery leaders and academics. The final research question was derived based on a group consensus to explore the impact of using STs in nursing and midwifery practice. Due to the heterogenous nature of the studies evaluating the use of STs in nursing and midwifery practice and the STs themselves, a scoping review was conducted to provide a broad overview of the available evidence and identify and analyse the knowledge gaps. The PRISMA-SCR guidelines guided the reporting of this review [70].

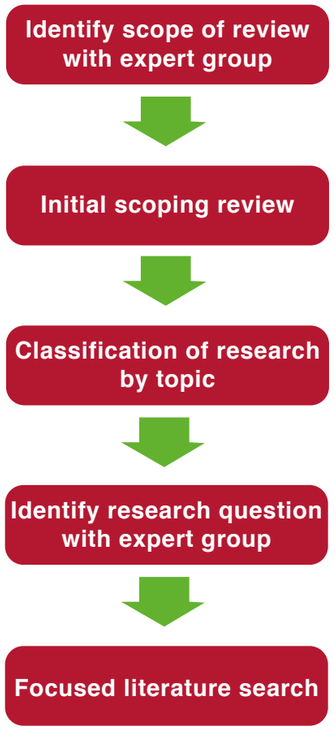


Figure 2. Process of defining the research question

Table 1. Search terms

1	SNOMED CT[Title/Abstract]	28	Iowa Nursing Outcomes Classification[CINAHL]
2	SNOMED[CINAHL]	29	Nursing Minimum Data Set*[Title/Abstract][CINAHL]
3	Logical Observation Identifiers Names and Codes[Title/Abstract][CINAHL][Embase]	30	Nursing Management Minimum Data Sets[Title/Abstract]
4	LOINC[Title/Abstract]	31	NMMDS[Title/Abstract]
5	RxNorm[Title/Abstract][Mesh]	32	North American Nursing Diagnosis Association[Title Abstract]
6	Systematized Nomenclature of Medicine[Title Abstract][Mesh]	33	NANDA-I[Title/Abstract]
7	Unified Medical Language System[Title Abstract][Mesh]	34	NANDA International[Title/Abstract]
8	Vocabulary, Controlled[Mesh NoExp][CINAHL]	35	NANDA Nursing Diagnosis[CINAHL]
9	Controlled vocabulary[Embase]	36	Omaha system[Title/Abstract][CINAHL]
10	Standardi?ed terminolog*[Title/Abstract]	37	Omaha Classification System[Title/Abstract]
11	Standardi?ed language*[Title/Abstract]	38	Perioperative Nursing Data Set[Title/Abstract]
12	Standardi?ed vocabular*[Title/Abstract]	39	Nanda-nic-noc[Title/abstract]
13	Clinical terminolog*[Title/Abstract]	40	Clinical care classification[title/abstract]
14	Interface terminolog*[Title/Abstract]	41	Saba Clinical Care Classification System[CINAHL]
15	Nurses[Mesh]	42	Home health care classification[title/abstract]
16	Nursing[Mesh]	43	Nursing outcome* classification*[title/abstract]
17	Nurse Midwives[Mesh]	44	Nursing intervention* classification*[Title/Abstract]
18	Nurs*[Title/Abstract]	45	Nursing classification[Embase]
19	Midwi*[Title/Abstract]	46	International classification for nursing practice[Title Abstract][CINAHL]
20	Nursing terminolog*[Title/Abstract]	47	ICNP[Title/Abstract]
21	Nursing terminology[Embase]	48	Iowa Nursing Interventions Classification[CINAHL]
22	Standardized Nursing Terminology[Mesh]	49	English language
23	Nursing language*[Title/Abstract]	50	OR 1-15
24	Nursing vocabular*[Title/Abstract]	51	OR 16-20
25	Nursing taxonom*[Title/Abstract]	52	50 AND 51
26	Nursing statement*[Title/Abstract]	53	OR 21-48
27	Unified nursing language system[Title Abstract]	54	52 OR 53
		55	54 AND 49

Note: [Title/Abstract], searched within the title and/or abstract of the article; [Mesh], subject headings in PubMed database; [CINHAL], subject headings in CINAHL database; [Embase], subject headings in Embase database; *, truncation i.e., locating all terms that begin with the given string of text; ?, wildcard, i.e., replaces one character within the word; CINAHL search was also restricted to journal articles only; Embase search restricted to Embase only (i.e., exclude PubMed).

2.1. Search strategy

A systematic search of the literature was conducted to identify studies evaluating the impact of STs on nursing and/or midwifery practice. Search terms were identified from prior systematic reviews [15, 18, 38, 71], other literature [47] and via consultation with the Five Country Digital Nursing and Midwifery Leadership Group (Table 1). To ensure both internationally-recognised as well as locally-developed terminologies were identified in the search, both titles of ST and terms used to describe a terminology were included in the search.

The initial search was employed using Boolean Operators across the following search engines: Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed, Embase and the Cochrane Controlled Register of Trials (CENTRAL). Following the preliminary search, it was identified that no additional articles were identified in the CENTRAL search engine so this was not included in the final search.

2.2. Identification of studies

Search results from each of the search engines were aggregated into Endnote Software X9 and duplicates were removed. Titles and abstracts of the remaining articles were screened by the researcher, followed by the full texts articles and articles not meeting the inclusion criteria (Table 2) were removed.

Table 2. Criteria for study inclusion or exclusion in literature review

Inclusion Criteria	Exclusion Criteria
A local or widely reported terminology.	Post hoc or secondary application of the ST to the clinical documentation by researchers or computer-aided.
ST utilised by a nurse or midwife as part of clinical practice.	ST utilised to collect data for research purposes only.
Study evaluates the impact of the ST on any aspect of practice.	Studies describing the development, improvement or maintenance of the ST.
Reporting primary empirical research.	Studies developing nursing documentation evaluation measures.
Any study design.	Terminologies utilised to describe inclusion criteria in a study.

2.3. Data abstraction and analysis

A standardised data abstraction form was developed and included the title, authors, year, country, study design, terminologies employed, professions, study outcome(s) and relevant findings. The synthesis included both frequency analysis of the STs and study outcomes, as well as a content analysis of the study outcomes. Using a reiterative approach, the study outcomes were categorised and these themes were reviewed for appropriateness by the expert panel. The findings of from the studies under each category were then synthesised and presented in a clear and understandable report format for knowledge-users.

3. Impact of Standardised Terminologies on Nursing and Midwifery Practice

3.1. Characteristics of studies

Of the 3,547 titles retrieved, 183 studies which evaluated the impact of a ST were identified. More than one third of these studies were conducted in the USA (n=68) and the others were conducted across Brazil (n=33), Turkey (n=14), Spain (n=12), Korea (n=10), Finland (n=7), Nigeria (n=6), China (n=5), Iceland (n=4), Switzerland (n=4), three each in the Netherlands, Portugal, Indonesia and Italy, two in Norway, Australia and the UK, and one study from Poland, Mexico, New Zealand, Canada, Australia, Jordan, Ireland, Cyprus and Belgium. Of note, some studies were conducted across several countries. Of note, some studies were conducted across several countries. The STs evaluated in these studies included NANDA-I, NIC, NOC (or a combination NANDA-I, NIC and NOC [NNN]), Omaha System, ICNP, CCC, PNDS, ICD, Read Codes as well as some local STs.

The focus of these research studies varied and the identified studies were categorised as evaluating the impact of the ST on nursing and midwifery practice in terms of (i) measurement properties, (ii) usability, (iii) documentation quality, (iv) patient care, (v) knowledge generation, and (vi) education programmes.

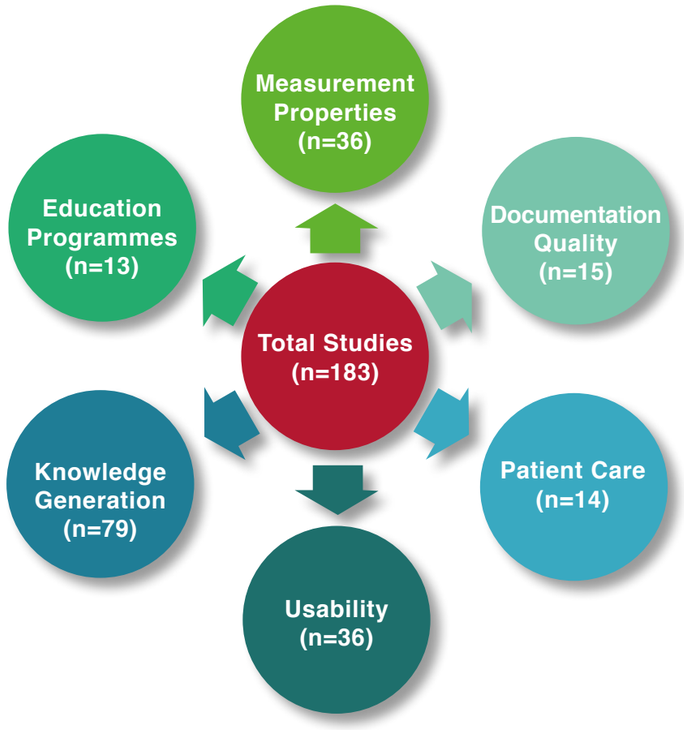


Table 3. Identified studies evaluating the use of standardised terminologies in nursing and midwifery practice

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Abed El-Rahman et al., (2017) [72]	Jordan	University	Cross sectional survey	NANDA-I	101 nursing students	Usability
Abhyankar et al., (2014) [73]	USA	Hospital (ICU)	Retrospective cohort	ICD-9 and local codes	24,506 patients	Usability
Adistya et al., (2018) [74]	Indo-nesia	Health Centre	Cross sectional	NOC ("Caregiver Performance: Direct Care")	31 caregivers of patients with mental disorders	Measurement properties
Adubi et al., (2018) [75]	Nigeria	Hospital (medical, surgical & psychiatric wards)	Retrospective pre post design	NNN	270 nursing records (30 records pre, during and post implementation)	Documentation quality
Ahn and Park (2013) [76]	Korea	Hospital	Cross sectional	ICNP	355 cancer patients	Usability
Almasalha et al., (2013) [77]	USA	Hospital (n=4) (8 medical-surgical wards)	Retrospective cohort	NNN	569 end-of-life patients	Usability
Amorim Beltrão et al., (2011) [78]	Brazil	Hospital	Cross sectional	NOC	63 children with congenital heart disease	Measurement properties
Ardahan et al., (2019) [79]	Turkey	University	Cross sectional survey	NANDA-I	644 nursing students	Education programmes
Aslan and Emiroglu (2013) [80]	Turkey	Long term care	Cross sectional	CCC	28 patients	Usability
Ateş and Ulus (2019) [81]	Turkey	Community setting	Cross sectional	Omaha system	41 students	Education programmes
Azzolin et al., (2013) 82	Brazil	Homecare	Prospective cohort	NNN	23 patients with heart failure	Patient care
Behrenbeck et al., (2005) [83]	USA	Hospital	Retrospective cohort	NOC	434 patients with cardiac issues	Measurement properties
Bitencourt et al., (2016) [84]	Brazil	Hospital	Cross sectional	NOC	103 patients assessed post-operatively for urinary retention	Measurement properties
Bjorklund-Lima et al., (2019) [85]	Brazil	Hospital (outpatients)	Prospective cohort	NOC	50 post-operative patients	Measurement properties
Burdick et al., (1993) [86]	USA	Hospital (psychiatric)	Two-group quasi-experimental	NANDA-I	60 patients (30 in each group)	Documentation quality
Caldeira de Andrada et al., (2015) [87]	Brazil	Hospital	Cross sectional	ICNP	24 elderly patients	Knowledge generation
Cárdenas-Valladolid et al., (2012) [88]	Spain	Primary health care centres (n=31)	Retrospective cohort (2 groups)	NANDA-I and NIC	23,470 patients with T2DM (18,302 in control and 5,168 in intervention group)	Patient care
Cárdenas-Valladolid et al., (2018) [89]	Spain	Primary health care centres (n=31)	Retrospective cohort with two groups	NANDA-I and NIC	4,210 patients with T2DM (2105 in each group)	Patient care
Carrington (2012) [90]	USA	Hospital (medical, surgical and psychiatric wards)	Qualitative interviews and focus groups	NNN	18 nurses	Usability
Chantal Magalhães da Silva et al., (2017) [91]	Brazil	Hospital (Outpatient clinic)	Cross sectional	NOC ("Tissue Integrity: Skin and Mucous Membranes")	100 people with DM	Measurement properties
Cho and Park (2003) [92]	Korea	Hospital (n=2)	Cross sectional	ICNP	20 nurses documenting nursing notes of 57 obstetric patients	Usability
Cho and Park (2006) [93]	Korea	Hospital	Cross sectional	ICNP	2,262 patients	Usability
Cimino et al., (2001) [94]	USA	Hospital	Cross sectional	MED	238 patient records entered by 8 attending physicians, 18 resident physicians, and 1 nurse practitioner	Usability
Coenen et al., (1996) [95]	USA	Community centre	Cross sectional	Omaha system	331 patient records	Knowledge generation
Connolly and Elfrink (2002) [96]	USA	Community mental health setting	retrospective cohort	Omaha system	30 different clients - 45 undergraduate students and 1 graduate student	Education programmes
Conrad et al., (2012) [97]	USA	Ambulatory care	Cross sectional survey	NANDA-I, NIC, NOC, Omaha system, CCC, ICNP, SNOMED-CT	703 nurses	Usability
da Silva et al., (2015) [98]	Brazil	Hospital (outpatients)	Prospective cohort	NOC	21 patients post total hip replacement	Measurement properties
da Silva et al., (2019) [99]	Brazil	Hospital	Prospective cohort	NNN	101 patients with ineffective airway clearance post surgery	Patient care
de Almeida Medeiros et al., (2014) [100]	Brazil	Hospital	Prospective cohort	NOC	50 patients at risk of venous ulcer	Knowledge generation

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
de Araújo (2014) [101]	Brazil	Hospital	Cross sectional	NANDA-I	112 elderly patients	Knowledge generation
de Fátima Lucena (2006) [102]	Brazil	Hospital (ICU)	Cross sectional	NANDA-I	991 patient admissions	Knowledge generation
de Freitas Luzia et al., (2014) [103]	Brazil	Hospital (medical and surgical units)	Cross sectional	NANDA-I and NIC	174 patients at risk of falls	Knowledge generation
de Lima Ferreira et al., (2019) [104]	Brazil	Hospital	Prospective cohort	NOC	123 patients post stroke	Measurement properties
de Lima Guimarães et al., (2017) [105]	Brazil	Hospital	Retrospective cohort	NANDA-I and NIC	57 patients undergoing haemodialysis	Knowledge generation
de Lima Guimarães et al., (2017) [106]	Brazil	Hospital	Retrospective cohort	NNN	57 patients undergoing haemodialysis	Knowledge generation
de Lusignan et al., (2003) [107]	UK	General Practice	Qualitative Study	Read Coding	Practice managers, general practitioners and primary care nurses	Usability
de Medeiros et al., (2016) [108]	Brazil	Maternity Hospital	Cross sectional	NANDA-I and NIC	1,000 patient records	Knowledge generation
de Oliveira et al., (2016) [109]	Brazil	Schools	Cross sectional	NANDA-I ("sedentary lifestyle")	564 adolescents	Measurement properties
de Queiroz Frazão et al., (2015) [110]	Brazil	Hospital	Prospective cohort	NANDA-I	178 patients with chronic renal failure	Measurement properties
de Sousa Antunes and Caeiro Roberto Manso (2017) [111]	Portugal	Psychiatric emergency service	Cross sectional	ICNP	49 patients	Knowledge generation
Di Lorenzo et al., (2018) [112]	Italy	Psychiatric hospital	Retrospective cohort	NANDA-I	501 patients (304 voluntary and 197 involuntary admissions)	Knowledge generation
Di Lorenzo et al., (2019) [113]	Italy	Psychiatric hospital	Cross sectional	NANDA-I	106 patients	Knowledge generation
Dochterman et al., (2005) [114]	USA	Hospital	Cross sectional	NIC	13,758 patients (1,435 with heart failure, 567 post hip fracture procedur, and 11,756 in fall prevention)	Knowledge generation
Eardley et al., (2018) [115]	USA and Turkey	Public health nursing	Cross sectional	Omaha system	72 nursing students	Education programmes

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Elfrink and Davis (2004) [116]	USA	Public health nursing	Retrospective cohort	Omaha system	9 student nurses	Education programmes
Ensio et al., (2006) [117]	Finland	Specialised and primary care	Cross sectional survey	CCC (Finnish Version)	19 nurses	Usability
Erci (2005) [118]	Turkey	Primary healthcare centre	Retrospective cohort	Omaha system	139 patients	Knowledge generation
Erci (2012) [119]	Turkey	Primary healthcare centre	Prospective cohort	Omaha system	76 women	Patient care
Erdogan and Esin (2006) [120]	Turkey	Primary healthcare centre	Retrospective cohort	Omaha system	70 student nurses and 157 patients	Education programmes Measurement properties Usability
Erdogan et al., (2013) [121]	Turkey	Home care centres (n=3)	retrospective cohort	Omaha system	159 nursing students and 598 patients	Education programmes Usability
Escalada-Hernandez et al., (2015) [122]	Spain	Psychiatric clinics (n=5)	Cross sectional	NNN	690 psychiatric or psychogeriatric patients	Knowledge generation
Estrada and Dunn (2012) [123]	USA	Hospital (medical, surgical and psychiatric wards)	Prospective follow-up survey	NANDA-I	55 nurses pre 68 immediately post 65 two years post	Usability
Ferreira et al., (2014) [124]	Brazil	Hospital	Cross sectional	NANDA-I	165 patients post kidney transplant	Knowledge generation
Frauenfelder et al., (2018) [125]	Switzer-land	Psychiatric hospital	Cross sectional	NANDA-I	434 patients	Knowledge generation
Frota Cavalcante et al., (2013) [126]	Brazil	Hospital	Cross sectional	NANDA-I ("Risk for Aspiration")	24 patients hospitalized with stroke	Measurement properties
Gao et al., (2016) [127]	USA	Community setting	Cross sectional	Omaha system	118 student nursing records	Usability
Garcia et al., (2013) [128]	USA	Community setting	Retrospective cohort	Omaha system	680 mothers with and without mental health issues	Knowledge generation
Gencbas et al., (2018) [56]	Cyprus	Long term care	Experimental design with randomised control	NNN	62 patients with UTIs	Patient care
Gonzalez-Rodriguez et al., (2017) [129]	Spain	Hospital (n=1) and Primary health care centres (n=3)	Cross sectional	NANDA-I	9,928 patient cases	Knowledge generation
Gonzalez-Samartino et al., (2018) [130]	Spain	Hospitals (n=2)	Cross sectional	ATIC	459 records of patients with pressure ulcers	Documentation quality

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Goossen et al., (2001) [131]	Nether-lands	Hospitals (n=9)	Cross sectional	NMDS (Netherlands)	686 patients	Knowledge generation
Griens et al., (2001) [132]	Nether-lands	Hospitals (n=9)	cross sectional	NMDS (Netherlands)	2,011 patient records	Knowledge generation
Hahn et al., (2014) [133]	USA	Home care	Cross sectional	NIC	80 patients with developmental difficulties	Knowledge generation
Hariyati et al., (2015) [134]	Indo-nesia	Hospital	Prospective (pre/post)	NNN	255 patient notes	Documentation quality Usability
Häyrinen et al., (2010) [135]	Finland	Hospital	Retrospective analysis	CCC (Finnish Version)	67 neurological & 422 surgical patients.	Documentation quality
Head et al., (2011) [136]	USA	Community hospitals (n=3)	Cross sectional	NNN	451 patients with pneumonia	Knowledge generation
Hong and Lundeen (2009) [137]	Korea	Community setting	Cross sectional	Omaha system	9,839 patient visits	Knowledge generation
Horning et al., (2018) [138]	USA	Home care	Cross sectional	Omaha system	558 patients	Knowledge generation
Johnson et al., (2003) [139]	USA	5 Hospitals, 1 long term care, 1 parish nursing practice, 1 outpatient centre and 2 home care nursing agencies	Retrospective cohort	NOC	249 patients with a diagnosis of “anticipatory grief”	Knowledge generation
Johnson et al., (2017) [140]	USA	Hospital	Retrospective cohort	NNN	1,453 end of life patients	Knowledge generation
Jukes et al., (2012) [141]	Australia	Acute and community settings	Cross-sectional survey	Australian Standardized Terminology and Definitions for Texture Modified Foods and Fluids	223 speech-language pathologists, 202 dietitians and 89 nurses managing patients with dysphagia	Usability
Junttila et al., (2010) [142]	Finland	Hospital (operating department)	Cross sectional	PNDS (Finnish version)	250 patients	Usability
Juv´e-Udina et al., (2013) [143]	Spain	Hospital (n=8)	Cross sectional	ATIC	246,400 electronic care plans	Usability
Juv´e-Udina et al., (2014) [144]	Spain	Hospital (n=8)	Cross sectional	ATIC	150,494 electronic care plans with psychosocial aspects documented	Usability

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Kagiyama Dutra et al., (2014) [145]	Brazil	Hospital	Cross sectional	NANDA-I	103 patients hospitalised with sepsis	Knowledge generation
Karaca and Aslan (2018) [146]	Turkey	University	Cross sectional survey (2 groups)	NNN	155 nursing students	Usability
Karpiuk et al., (1997) [147]	USA	Hospitals (n=8)	Cross sectional	NMDS with NANDA-I	99 patients	Usability Knowledge generation
Keenan et al., (2003) [148]	USA	Hospital	Prospective cohort	NNN	36 nurses	Usability
Keenan et al., (2003)	USA	Hospital outpatients	Retrospective cohort	NOC	319 patients	Measurement properties
Keenan et al., (2003) [149]	USA	Home care (n=2)	Retrospective cohort	NOC	16 nurses	Measurement properties
Kerr et al., (2016) [150]	Mexico, New Zealand, Norway, Turkey, and US	Community	Cross sectional	Omaha system	284 patient records	Usability Knowledge generation
Kim et al., (2012) [63]	Korea	Hospital	Cross sectional	ICNP and SNOMED-CT	759 patients	Usability
King et al., (1997) [151]	Australia	Hospitals (n=3)	Cross-sectional	NANDA-I	198 nursing records	Knowledge generation
Kuiper et al., (2009) [153]	USA	University	Retrospective cohort	NNN	66 baccalaureate nursing students	Education programmes
Laguna-Parras et al., (2013) [154]	Spain	Hospital	Prospective cohort	NNN	289 patients receiving the intervention “sleep enhancement”	Knowledge generation
Liljamo et al., (2018) [155]	Finland	Hospital	Cross sectional	CCC (Finnish version)	794 patients	Knowledge generation
Linhares et al., (2016) [156]	Brazil	Hospital	Retrospective cohort	NOC	17 patients with decompensated heart failure and nursing diagnosis of fluid volume excess	Measurement properties
Lodhi et al., (2014) [157]	USA	Hospitals (n=4)	Retrospective cohort	NNN	1,453 end-of-life patients	Knowledge generation
Lunney (2006) [158]	USA	Elementary School (n=12)	Cross-sectional	NNN	103 children 6 nurses	Knowledge generation
Lunney et al., (2004) [159]	USA	Elementary School (n=12)	Prospective cohort (2 groups)	NNN	220 children assessed by 12 public health nurses	Patient care

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Maas et al., (2002) [160]	USA	5 Hospitals, 1 long term care, I parish nursing practice, 1 outpatient centre a and two home care nursing agencies	Retrospective cohort	NOC	More than 1,000 patients reviewed by 2 nurses	Measurement properties
Maas et al., (2003) [161]	USA	Same as above	Retrospective cohort	NOC	2,333 patients	Measurement properties
Marek et al., (1996) [162]	USA	Home visits	Retrospective cohort	Omaha system	317 patient records	Knowledge generation
McGourthy et al., (1999) [163]	USA	Home care	Retrospective cohort	Omaha system	10 patients with COPD	Measurement properties
Mello et al., (2016) [164]	Brazil	Hospital (palliative care)	Prospective cohort	NOC	13 adult cancer patients in a palliative care unit	Measurement properties
Minton and Creason (1991) [165]	USA	Hospital	Cross sectional	NANDA-I	33 orthopaedic patients	Measurement properties
Monsen et al., (2010) [166]	USA	Public health agencies (n=4)	Retrospective cohort	Omaha system	Patient records from 2005	Knowledge generation
Monsen et al., (2011) [167]	USA	Public health agency	Retrospective cohort	Omaha system	79 clients	Knowledge generation
Monsen et al., (2011) [168]	USA	Public health agency home visits	Retrospective cohort	Omaha system	486 clients	Knowledge generation
Monsen et al., (2011) [169]	USA	14 home care agencies	Retrospective cohort	Omaha system	Frail (n=386) and non-frail (n=1,364) elders.	Knowledge generation
Monsen et al., (2011) [170]	USA	Public health agency	Retrospective cohort	Omaha system	720 mothers	Knowledge generation
Monsen et al., (2011) [171]	USA	Homecare agency	Cross sectional	Omaha System	1,079 clients in the maternal-child cohort and 2,309 clients in the home care cohort	Measurement properties
Monsen et al., (2013) [172]	USA	Homecare agency	Cross sectional	Omaha system	127 patient reports	Knowledge generation
Monsen et al., (2017) [173]	USA	Public health nurses	Retrospective cohort	Omaha system	4,263 clients	Knowledge generation
Moorhead et al., (2003) [174]	USA	Hospital	Retrospective cohort	NOC	Behavioural unit (n=201), birth centre (n=106) and oncology (n=47)	Measurement properties
Morais et al., (2015) [175]	Brazil	Hospitals	cross sectional	NANDA-I versus ICNP	24 nurses	Usability

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Morris et al., (2014) [176]	Ireland	Hospitals (n=6)	cross sectional	NMDS (Ireland)	337 patients	Measurement properties
Moscicki et al., (2013) [177]	USA, Canada, Australia, UK	Mental health settings	Cross sectional	DSM-V	621 clinicians (psychiatrists, psychologists, social workers, advanced practice mental health nurses, counsellors, marriage and family therapists) and 1,269 patients	Usability
Moya-Muñoz et al., (2018) [178]	Spain	Hospital (General surgery)	Cross sectional	NANDA-I	102 patients with digestive stoma	Knowledge generation
Müller-Staub (2009) [179]	Switzer-land	Hospital	Prospective cohort	NNN	444 patient records	Documentation quality
Müller-Staub et al., (2007) [14]	Switzer-land	Hospital	Pre post evaluation	NANDA-I	36 patient records	Documentation quality
Müller-Staub et al., (2008) [180]	Switzer-land	Hospital	Cluster-randomized trial	NNN	225 patient records	Documentation quality
Neff et al., (2007) 181	USA	Community setting	Cross sectional	Omaha system	334 patients	Knowledge generation
O Connor et al., (2000) [182]	USA	Ambulatory care	Cross sectional	NMDS (NANDA-I, ICD	Gordon's 11 Functional Health Patterns, the NIC, NOC)	3,733 patient visits and 19 advanced nurse practitioner students
Odutayo et al., (2013) [183]	Nigeria	Public health centre	Quasi-experimental design	NNN	40 public health nurses	Documentation quality
Ogasawara et al., (2005) [184]	Japan	Hospital	Cross sectional	NANDA-I and NIC	150 patients with end-stage breast cancer	Knowledge generation
Ogunfowokan et al., (2013) [185]	Nigeria	Community setting	Cross sectional survey	NANDA-I	Nursing students surveyed (n=290), interviewed (n=16)	Usability
Ojewole and Samole (2017) [186]	Nigeria	Hospital	Retrospective cohort	NANDA-I	959 patient records	Documentation quality
Olaogun et al., (2011) [187]	Nigeria	Hospital	Cross sectional	NANDA-I	67 nursing records	Knowledge generation
Olatubi et al., (2019) [4]	Nigeria	Hospital (n=3)	Cross-sectional survey	NNN	130 nurses	Usability
Ozkan and Ozdemir (2016) [189]	Turkey	Home visits	Cross sectional	NANDA-I	745 patients	Knowledge generation
Paans et al., (2012) [190]	Nether-lands	Hospital (n=10)	Cross sectional	NANDA-I	369 patient records	Knowledge generation

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Paganin and Rabelo (2012) [191]	Brazil	Hospital	Cross sectional	NANDA-I	250 patients with cardiac catheterization	Measurement properties
Paganin and Rabelo (2013) [192]	Brazil	Hospital	Cross sectional	NANDA-I (“Impaired Tissue Integrity” and “Impaired Skin Integrity”)	250 patients withcardiac catheterization	Measurement properties
Palanca Cámara (2017) [193]	Spain	Hospital	Prospective cohort	NNN	46 patients with epilepsy	Knowledge generation
Palese et al., (2009) [194]	Italy	University	Retrospective cohort	NANDA-I	3,784 nursing students	Education
Park and Tucker (2017) [195]	USA	Hospital	Retrospective cohort	NANDA-I	272 records of patients with heart failure	Knowledge generation
Park et al., (2004) [196]	USA	Hospital	Cross sectional	NNN	41,891 patients with hospital acquired pressure ulcers	Knowledge generation
Park et al., (2004) [61]	Korea	Hospital	Cross sectional	ICNP	597 elders with dementia	Knowledge generation
Park et al., (2009) [197]	Korea	Hospital	Retrospective pre post design	ICNP	35 patients having gastrectomy	Documentation quality
Park et al., (2011) [198]	Korea	Hospital	Cross sectional	ICNP (extended Korean)	64 patients with pressure ulcer	363 at risk of pressure ulcer 355 patients treated with cisplatin for cancer
Pascoal et al., (2014) [199]	Brazil	Hospital (n=2)	Cross sectional	NANDA-I (“ineffective airway clearance”)	136 children with acute respiratory infection	Measurement properties
Pascoal et al., (2016) [200]	Brazil	Hospital (n=2)	Prospective cohort	NANDA-I (“ineffective airway clearance”)	136 children with acute respiratory infection	Measurement properties
Pérez Rivas et al., (2015) [201]	Spain	Primary healthcare centres (n=34)	Cross sectional	NNN	217 nurses (127 in one group) and 379,601 patients	Patient care
Rabelo-Silva et al., (2017) [202]	Brazil	Hospitals (n=2)	Retrospective cross sectional	ICNP (paper) and NANDA-I and NIC (EHR)	138 records of oncology patients	Documentation quality
Rios et al., (1991) [203]	USA	Hospital	Cross sectional	NMDS (“alterations in fluid volume”)	191 patient care plans	Measurement properties
Rivera and Parris (2002) [204]	USA	Public health nurses	Cross sectional	NANDA-I and NIC	1500 family records	Knowledge generation

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Sampaio et al., (2018) [205]	Portugal	Psychiatric outpatient service	RCT	NNN	Intervention (n= 29) and treatment-as-usual control group (n= 31)	Patient care
Sampiao et al., (2018) [206]	Portugal	Hospital	Cross sectional	NOC (“Anxiety level” and “Anxiety self-control”)	167 patients	Measurement properties
Saranto et al., (2006) [207]	Finland	Hospital	Cross sectional	CCC (Finnish Version)	1,157 patient records	Usability
Saranto et al., (2010) [208]	Finland	Hospital	Cross sectional	CCC (Finnish Version)	379 records and 269 patients	Knowledge generation
Scherb et al., (2002) [209]	USA	Hospitals (n=2)	Retrospective cohort	NNN	302 patients with heart failure	Knowledge generation
Scherb et al., (2011) [210]	USA	Hospitals (n=3)	Cross sectional	NNN	512 patients with pneumonia, total joint replacement (hip or knee), or heart failure	Knowledge generation
Scherb et al., (2013) [211]	USA	Hospital (n=3)	Retrospective cohort	NNN	216 patients with pneumonia and 67 patients with heart failure	Knowledge generation
Schneider and Slowik (2009) [212]	USA	Home care	Cross sectional	NIC	103 patients	Knowledge generation
Schneider et al., (2008) [213]	USA	Home care	Quasi-experimental, before-after design	NOC and OASIS	106 patients being treated for a cardiac condition	Measurement properties
Schwiran and Thede (2012) [214]	USA	Acute, community and schools	Cross sectional survey	NANDA-I, NIC, NOC, Omaha system, CCC, ICNP, PNDS, SNOMED-CT, LOINC, ABC	Varied across STs	Usability
Sermeus et al., (2008) [215]	Belgium	Hospital	Cross sectional	NMDS (Belgium)	298,691 patients	Knowledge generation
Shever (2011) [216]**s**	USA	Hospital	Retrospective cohort	NIC	7,851 patients	Knowledge generation
Shever et al., (2007) [217]	USA	Hospital	Cross sectional	NIC	Patients hospitalised with heart failure (n=127), hip procedure (n=62) or risk for falling (n=825)	Knowledge generation
Silva et al., (2017) [218]	Brazil	Hospital	cross sectional	NANDA-I (“non-compliance”)	113 people with HIV	Measurement properties
Sousa et al., (2015) [219]	Brazil	Hospital	Cross sectional	NANDA-I	93 patients post cardiac surgery	Measurement properties

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Souza et al., (2015) [220]	Brazil	Hospital	Cross sectional	NANDA-I ("activity intolerance", "decreased cardiac output" and "excess fluid volume")	25 patients with decompensated heart failure	Measurement properties
Thede and Schwiran (2013) [221]	USA	Acute, community and schools	Cross sectional survey	NANDA-I, NIC, NOC, Omaha system, CCC, ICNP, PNDS, SNOMED-CT, LOINC, ABC	Varied across STs	Usability
Thede and Schwiran (2013) [222]	USA	Acute, community and schools	Cross sectional survey	Same as above	Varied across STs	Usability
Thede and Schwiran (2013) [223]	USA	Acute, community and schools	Cross sectional survey	Same as above	Varied across STs	Usability
Thede and Schwiran (2015) [224]	USA	Acute, community and schools	Cross sectional survey	Same as above	Varied across STs	Usability
Thomé et al., (2014) [214, 221, 222, 225, 226]	Brazil	Hospital	Cross sectional	NANDA-I and NIC	40 patients attending mental health appointments	Knowledge generation
Thompson et al., (2012) [227]	USA	Nurse managed wellness centres (n=9)	Retrospective cohort	Omaha system	1,252 patients	Knowledge generation
Thoroddsen et al., (2007) [228]	Iceland	Hospital	Prospective cohort (pre post design)	NANDA-I and NIC	355 patients pre and 349 post	Documentation quality
Thoroddsen et al., (2010) [229]	Iceland	Hospital	Cross sectional	NANDA-I and NIC	689 patient records	Knowledge generation
Thoroddsen et al., (2011) [230]	Iceland	Hospital	Prospective cohort	NANDA-I and NIC	291 patient records at time-point 1, 299 at timepoint 2 and 281 at timepoint 3	Documentation quality
Thorodsson and Thorsteinsson (2002) [231]	Iceland	Hospital	Cross sectional	NANDA-I	1,217 patient charts	Usability
Titler et al., (2006) [232]	USA	Hospital orthopaedics	Retrospective cohort	NIC	524 patients	Knowledge generation
Turk et al., (2013) [233]	Turkey	Hospital	Cross sectional	NANDA-I	208 plans by 44 students	Education
Vazquez-Sanchez et al., (2019) [234]	Spain	Hospital	RCT	NOC	106 patients with a diagnosis of malnutrition	Measurement properties of malnutrition

Author (Year)	Country	Setting	Study design	Standardised terminology	Participants	Impact assessed
Von Krogh et al., (2012) [235v]	Norway	Hospital (psychiatric wards)	Pre and post EHR implementation	NNN	73 patients records pre-test and 58 records post	Documentation quality
Wei et al., (2019) [236]	China	Hospital (n=3)	Controlled trial	Omaha system	367 patients with T2DM	Patient care
Westra et al., (2010) [237]	USA	Homecare agencies (n=15)	Cross sectional	Omaha System and OASIS	2,900 patients	Usability
Westra et al., (2011) [238]	USA	Homecare agencies (n=16)	Retrospective cohort	Omaha system	684 patients with urinary incontinence and 187 with bowel incontinence)	Knowledge generation
Wong and Yeung (2015) [239]	China	Hospitals (n=3)	RCT	Omaha system	108 patients post stroke (54 in each group)	Patient care
Wuryanto et al., (2017) [240]	Indo-nesia	Hospital (ICU)	Qualitative	NNN	8 nursing profession students	Education
Xiao et al., (2019) [241]	China	Hospital	RCT	Omaha system	150 patients with angina	Patient care
Yalcinturk (2018) [242]	Turkey	Hospital (psychiatry clinics)	Cross sectional	NANDA-I	16,073 patients	Knowledge generation
Yang et al., (2019) [243]	Korea	Hospital obstetrics Department	Retrospective cohort	NNN	220 patients	Knowledge generation
Yom et al., (2002) [244]	Korea	Hospital	Cross sectional	NNN	60 patients undergoing abdominal surgery	Knowledge generation
Yu and Lang (2008) [245]	USA	Outpatient rehabilitation centre	Cross sectional	Omaha system	201 patients with and without cognitive impairment	Knowledge generation
Zarzycka and Gorajek-Jozwik (2004) [246]	Poland	University	Cross sectional	ICNP	44 nursing students (2 in control and 42 in experimental group)	Usability
Zaybak et al., (2017) [247]	Turkey	Hospital, community and mental health	Cross sectional	NANDA-I	248 nursing care plans	Education programmes
Zhang et al., (2017) [248]	China	Hospital	RCT	Omaha system	Experimental (n=100) Control (n=99)	Patient care
Zhang et al., (2018) [249]	China	Hospital	RCT	Omaha system	Experimental (n=100) Control Group (n=99)	Patient care

3.2. Characteristics of terminologies

Seventeen different STs or combination of STs were evaluated across the included studies including nursing-specific, medical, multi-disciplinary and local STs (Table 4). Where non-nursing-specific STs were evaluated, other healthcare professionals such as doctors, psychiatrists and dieticians also utilised the STs. NANDA-I alone was the most commonly evaluated ST (n=45) across 11 countries, followed by the Omaha System (n=42) and NNN (n=33). Although many STs were evaluated across both hospital and community settings, the PNDS was only utilised by nurses in hospitals, the ICNP only in hospital or university settings, and the Omaha system was more commonly utilised in primary care settings.

Table 4. Characteristics of the standardised terminologies utilised in the identified studies

Standardised terminology	Information captured	Clinical settings	Country	Health professionals	Topic of evaluation
Nursing Outcomes Classification (NOC)	Nursing outcomes (34 classes and 7 domains) [43]	Hospital Long term care Primary care Homecare	USA Portugal Indonesia Spain Brazil	Nurses	Measurement properties Knowledge generation Usability
NANDA-I	Nursing diagnoses (47 classes, 13 domains, 216 diagnoses) [43]	Hospital Psychiatric Homecare University Primary care School	Iceland Switzerland Australia Netherlands Italy Spain USA Brazil Nigeria Turkey Jordan	Nurses	Measurement properties Documentation Quality Knowledge Generation Usability Education programmes
Nursing Intervention Classification (NIC)	Nursing interventions (30 classes within 7 domains)	Hospital Home care	USA	Nurses	Knowledge generation
NANDA-I, NIC, NOC (NNN)	Nursing outcomes, interventions and diagnoses	Hospital School Homecare Psychiatric Long term care Primary care University	Korea Nigeria Norway Indonesia Portugal Switzerland USA Spain Cyprus Brazil	Nurses	Documentation quality Usability Patient care Knowledge generation Education programmes
NANDA-I and NIC	Nursing diagnoses and interventions	Hospital Primary care Maternity	Brazil Iceland USA Spain Japan	Nurses	Documentation quality Patient care Knowledge generation
Clinical Care Classification (CCC)	Coded framework with 21 components modelled on the six steps of the nursing process [43]	Hospital Primary care	Finland Turkey USA	Nurses	Usability Documentation quality Knowledge generation
Perioperative Nursing Data Set (PNDS)	64 nursing diagnoses, 127 nursing interventions, 29 nurse sensitive patient outcomes [250]	Hospital	Finland USA	Nurses	Usability
International Classification for Nursing Practice (ICNP)	Nursing diagnoses, nursing actions, and nursing outcomes based on a seven axis model [43]	Hospital University Psychiatric	Brazil Korea Portugal Poland USA	Nurses	Documentation quality Knowledge generation Usability Education programmes

Standardised terminology	Information captured	Clinical settings	Country	Health professionals	Topic of evaluation
Omaha System	Nursing outcomes, interventions and diagnoses	Primary care Hospital Homecare	China Turkey USA Korea	Nurses	Documentation quality Usability Knowledge generation Education programmes
International Classification of Disease (ICD)	Tabular list containing disease codes, descriptions, associated instructional notations and an alphabetical index to the disease entries[73]	Hospital Ambulatory care	USA Ireland	Nurses Doctors	Usability Knowledge generation
Medical Entities Dictionary (MED)	More than 67,000 terms that is used to encode data on problems, adverse reactions, medications, route of and dosing frequency for medication orders [94]	Hospital	USA	Nurses Doctors	Usability
Australian Standardized Terminology and Definitions for Texture Modified Foods and Fluids	39 different labels used to describe four levels of thickened liquids and 95 different labels for four levels of texture-modified food [141]	Acute and community	Australia	Speech-language pathologists Dietitians Nurses	Usability

Standardised terminology	Information captured	Clinical settings	Country	Health professionals	Topic of evaluation
Diagnostic and Statistical Manual of Mental Disorders (DSM)	Diagnose and classify mental disorders [43]	Mental health setting	USA Canada Australia UK	Psychiatrists Psychologists Social workers Psychiatric & mental health nurses Counsellors Therapists	Usability
Nursing Minimum Data Set (NMDS)	Varied by country [131, 132, 176, 203, 215]	Hospital Ambulatory care	Ireland Belgium Netherlands USA	Nurses	Measurement properties Knowledge generation
Read codes	Signs and symptoms, treatments and therapies, investigations, occupations, diagnoses, and drugs and appliances [43]	General practice	UK	Practice managers Nurses General practitioners	Usability
Outcomes Assessment Information System (OASIS)	89-tem data set: 10 demographic identifiers, and 79 core items describe patient health and functional status [163]	Hospital	USA	Nurses	Measurement properties Knowledge generation
Architecture, Terminology, Interface Information Nursing (Infermeria) and Knowledge (Coneixement) (ATIC)	Assessment, diagnosis and interventions [143]	Hospital	Spain	Nurses	Usability Documentation quality

3.3. Measurement properties

The measurement properties of the ST refer to how well the ST measures the construct of interest. These measurement properties were assessed in 36 of the included studies (Table 3). These studies evaluated the NOC, NANDA-I, Omaha system, NMDS (Ireland) and the ICNP, and aimed to assess whether the ST:

1. Captured what the healthcare professional intended it to capture (i.e., validity)?

2. Could be used in a consistent and reliable manner (i.e., reliability)?

3. Distinguished between differences in patients' status' (i.e., responsiveness)?

3.3.1. Validity

Twenty-three studies assessed whether the ST accurately and validly represented the patient's problem as intended by the healthcare professional. Twelve of these studies evaluated the validity of NANDA-I in patients with HIV [218], cardiac issues [191, 192, 203, 219], respiratory infections (paediatrics) [199, 200], renal failure [110], post stroke [104, 126], sedentary lifestyles (adolescents) [109], and lower limb ulcers [175]. To determine the accuracy of the NANDA-I, it was compared with standardised outcome measures [109, 110, 126] or with another ST (i.e., ICNP) [175]. Additionally, other studies evaluated the validity of the clinical indicators of a specific NANDA-I diagnosis (e.g., "sedentary lifestyle") [104, 191, 192, 199, 200, 203, 218, 219]. Overall, these studies reported that NANDA-I could accurately represent the patients' diagnosis or problem, but certain diagnoses and clinical indicators from the ST were more sensitive to the specific condition than others. The study which compared the diagnostic accuracy of NANDA-I with the ICNP found that more accurate diagnoses for the presented case study were identified by the nurses using NANDA-I [175]. However, the accuracy of both STs depended on the diagnostic ability of the specific nurse.

NOC measures were evaluated across 11 sites which included hospitals, long term care, primary care and homecare [149, 150, 160, 161], or in specific patient cohorts including patients diagnosed with anxiety [206], malnutrition [234], diabetes [91] and post-operative patients [85]. Studies comparing the NOC measure to a standardised outcome measure found that many, but not all of the NOC measures used were significantly correlated with the chosen outcome measure [149, 150, 160, 161, 234]. However, not all the NOC measures were evaluated as a comparative standardised outcome measure did not exist [161]. Other studies validated NOC measures by comparing the findings of two pairs of nurses [91] or using factor loading [85, 206]. These studies also reported that the sensitivity of the NOC measures to capture patient conditions depended on the specific NOC measure and patient diagnosis. In two studies, the Omaha system was evaluated in primary care by comparing the relevance of interventions provided to two different cohorts of patients (i.e., maternal-child and homecare) [171] and by exploring student nurses perspectives [120]. This study identified that most of the students believed that the Omaha system reflected clients' needs [120]. Finally, Morris et el., (2014) [176] demonstrated the validity of the Irish NMDS which incorporated the ICD-10. Overall, positive findings were identified in relation to the ability of specific concepts from STs to capture what was intended but these studies were largely specific to the patients' condition and the individual term evaluated.

3.3.2. Reliability

The consistent use of STs helps ensure that they are interpreted as intended by the healthcare professional and the reliability of STs in nursing and midwifery practice was assessed across [13] of the included studies. Ten of these studies evaluated the inter-rater reliability (i.e., two nurses) of NOC outcomes in cardiac patients [83], post-operative patients with urinary retention [84], oncology patients [164], orthopaedic patients [98], caregivers of patients with mental disorders [74] and psychiatric patients [206]. Four further studies based on the same data collection assessed the NOC across a variety of patients and settings [149, 150, 160, 161]. Other studies evaluated the inter-rater reliability of NANDA-I in patients with cardiac issues 220 and the Omaha system in community care [120], and one study evaluated the internal reliability of the NMDS (Ireland) [176].

Overall, good to excellent reliability was identified in these studies, however, some NOC outcomes scored lower than others for specific patient cohorts. For example, Mello et el., (2016) [164] found that inter-rater reliability was lower for measurements of "pain control" and "will to live" in oncology patients and Maas et al., initially found lower levels of inter-rater reliability for "pain level", "nutritional status" and "cognitive ability" in the pilot study of their findings [160] and in their final study, found lower levels for "comfort level", "endurance", "energy conservation", "safety behaviour: fall prevention", "sleep" and "tissue integrity: skin & mucous membranes" [161]. However, the subjective nature of the 5-point Likert-type scale of the NOC measures could impact on the reliability and therefore, a one point difference was determined as near agreement [149]. Other studies evaluating the inter-rater reliability of diagnoses and/or interventions were conducted using NANDA-I 220 and the Omaha system [120] and demonstrated good to excellent reliability. Morris et el., (2014) [176] evaluated the consistent use of terms across the same patient presentations (i.e., internal reliability) in the Irish NMDS and also found that the documented nursing interventions were appropriately placed [176]. Good levels of consist use of the STs were demonstrated in these studies but the findings were also subject to the experiences and understanding of the nurses using the ST.

3.3.3. Responsiveness

For the ST to provide valuable clinical information, it should be able to distinguish between changes in the patient status as well as between patient presentations. Of the 14 studies identified which evaluated responsiveness, all but one study evaluated NOC measures and these were conducted across hospitals, community settings, long term care and home care agencies [139, 149, 150, 160, 161, 174]. Overall improvement in patient status was captured by most NOC measures with the exception of a study conducted in long term care which demonstrated negative or no change in patient status' [139]. Moorhead et el., (2003) [174] identified similar negative or unchanged outcomes in patients in oncology and a birth centre, and suspected that in these settings, nurses were focused on maintaining patients in their present state as opposed to improving outcomes. It should also be noted that NOC measures captured in outpatient departments could only be compared pre and post for patients who returned for follow-up appointments who were perhaps more likely to demonstrate improvements [150].

Other studies evaluated the responsiveness of NOC scales to detect changes in patients in orthopaedics [98], surgery [85], and presenting with malnutrition [234], cardiac issues [156] and cancer-related pain [164]. Amorim Beltrao et el., (2011) 78 compared the ability of NOC scales to distinguish between paediatric patients with congenital heart disease who presented with and without ineffective breathing patterns and they found seven NOC outcomes which were sensitive to this difference in patient presentation. The responsiveness of STs was assessed by comparing it with another ST in two studies. Schneider et el., (2008) [213] compared OASIS findings to NOC measures and included a measure of nursing intensity and found that neither OASIS nor NOC were sensitive to the effects of home healthcare nursing as measured by intervention intensity. However, NOC was responsive to patient status change in the outcome categories including "activities of daily living", "cardiopulmonary status", "coping", and "illness management behaviour" [213]. McGourthy (1999) [163] compared OASIS to the Omaha system in 10 patients and did identify some similarities in the responsiveness to change using both scales. The concepts from the STs evaluated in these studies demonstrated that they could identify changes in the patients' status or presentation but this depended on the suitable selection of the measure and the patient as not all patients demonstrated a change in the specific measure.

3.4. Usability

Thirty-six of the identified studies evaluated the usability of a ST in terms of the time efficiency, user perceptions, the applicability to a clinical setting and interoperability (Table 3).

3.4.1. Time efficiency

Three studies evaluated the impact of using the ST within a computerised system on the efficiency of end-users across hospital settings in the USA [94], Indonesia [134] and Korea [92]. Hariyati et el., (2016) [134] compared the time required by nurses to document patient care before and after the implementation of an EHR which incorporated the NNN, and demonstrated a statistically significant reduction in time taken. This was the only study which compared pre and post the introduction of a ST but as an EHR was introduced at the same time, it is unknown whether the improved efficiency was as a result of the ST, the EHR or a combination of both. Cho and Park (2003) [92] evaluated the introduction of an ICNP-based searching system and found that as the users became more experienced with the system, the time taken to find the required pre-coordinated term reduced significantly [92]. Similarly, Cimino et el., (2001) [94] evaluated the time taken by doctors and a nurse practitioner to utilise a Medical Entities Dictionary (MED) based searching system at a single time point (2-225 seconds and mean 40.4 seconds). Both of these studies reported that the response time, interface usability and the number of terms appearing from the search impacted on the time taken to utilise the ST. Therefore, the usability of the system and the number of available terms impacted on the efficiency of the end-users.

3.4.2. User perceptions

Fifteen studies evaluated the perceptions and experiences of healthcare professionals using STs via surveys or qualitative methodologies [4, 72, 90, 97, 107, 120, 123, 141, 146, 152, 160, 214, 221, 222, 226, 251]. Estrada and Dunn (2012) [123] found that nurses reported a significant improvement in their ability to find nursing diagnoses and interventions after the introduction of NANDA-I, and that this improved the individualisation of care plans and improved documentation accuracy. However, no significant improvement was identified in terms of the communication between shifts, agreement between nurses on diagnoses and status of care, or nurses' overall satisfaction [123]. Carrington (2012) [90] concurred that the use of NNN promoted more comprehensive use of language which was easy-to-use and facilitated nurse care planning and professional separation. However conversely, nurses in this study reported that the NNN often lacked descriptiveness and fostered inaccuracies [90]. Olatubi et el., (2019) [4] also found that more than 70% of nurses surveyed agreed that the NNN helped nurses to deliver quality of care, made nurses proud of their profession and facilitated problem solving and critical thinking, but more than half also agreed that use of NNN can be cumbersome.

Several surveys of nurses using STs (i.e., NANDA-I, NIC, NOC, Omaha system, ICNP, PNDS, CCC, SNOMED, ABC) conducted by Thede and Schirwan evaluated the

helpfulness, ease-of-use, experience of use and documentation benefits of several STs [214, 221, 222, 226]. Over 55% of the ST users who documented using one of these STs believed that this made their documentation more understandable to others [221] and facilitated the organisation and planning of patient care, generation of appropriate outcomes and interventions, and retrieval of information [226]. Although these studies compared STs, there were a much larger number of NOC users compared with ICNP and thus, whilst only 50% of ICNP users found it helpful this corresponded to two nurses using ICNP [226]. Erdogan and Esin (2006) [120] also evaluated the perceptions of nursing students being educated in the use of the Omaha system, and although these students were positive regarding how the terms were reflective of the care provided, some students found that the ST restricted creativity and flexibility.

According to Zarzycka and Górajek-Józwik (2004) [251], nursing students reported that the ICNP diagnoses were less detailed than traditional diagnoses, could lead to over-interpretation of facts and access to the ICNP index and computers was important for its ease-of-use. Although nurses using a ST within computerised documentation were more positive about its use as it required less time, the usability of the EHR was also important [97] and interface issues and keyboard skills were an issue for doctors and nurses using Read Codes in a UK general practice [107]. de Lusignan et el., (2003) [107] also reported that although the ability of the ST to be aggregated for payment or national audit purposes motivated the healthcare professionals to use it, the diagnoses available were often not completely accurate or required further qualification using free text.

The Australian Standardized Terminology and Definitions for Texture Modified Foods and Fluids was also implemented across several healthcare disciplines (Table 4) and according to a survey of end-users, it improved communication and collaboration across the disciplines and facilities but barriers included resistance-to-change and lack of knowledge [141]. Education in the use of STs is therefore important and Karaca and Aslan (2018) [146] and Kinnunen et el., (2014) [152] found that nurses educated in the use of the ST at university had a more positive attitude towards the ST and found it easier and quicker to use. Other benefits of the FinCC identified by Kinnunen et el., (2014) [152] included that it was more accurate, safer for patients and enabled other disciplines to read the nursing care reports as they are classified in chronological order. Although, the STs could be cumbersome to use, nurses and midwives perceived them to be beneficial to their practice overall.

3.4.3. Applicability to the clinical setting

Ten studies evaluated the applicability of the ST across different settings by identifying the proportion of terms or domains utilised from the ST. Use of the Omaha system in community centres and homecare agencies was evaluated across four studies. All the domains of the Omaha system were found to have been utilised across community centres in Mexico, New Zealand, Norway, Turkey and the USA [252] and by nursing managers within a USA community care [167]. A Turkish study identified that 70% of the Omaha system domains were used as well as 30/63 targets [120]. However, no term was available to cover family planning methods which was coded as 'other', perhaps as this was not a role of nurses and midwives in other countries [120]. When evaluated in a homecare agency, nurses were found to utilise 39/42 of the available terms to describe problems and 72/75 of the interventions [121]. The CCC was the only ST to be evaluated in a long term care setting, and Aslan and Emiroglu (2013) [80] found that only 23.6% (43/182) of the available diagnostic terms and 19.2% (38/198) of the interventions were utilised which suggests that only a small proportion of the available CCC terms were relevant to this setting. The applicability of PNDS was evaluated in a Finnish surgical unity and Junttila et el., (2010) [142] identified that of the 90 nursing diagnoses, 12 (13%) never appeared in the intraoperative documentation and 25 (28%) never appeared in the post-operative documentation. A locally-developed ST in Spain, the ATIC was evaluated by two studies and 92.3% of the diagnostic concepts were utilised [143] as well as 98.4% of the psychosocial nursing interventions with only one intervention ("infant massage") not documented [144].

Thoroddsen and Thorsteinsson (2002) [231] evaluated the use of NANDA-I in an Icelandic Hospital and identified that 57.7% of the diagnoses documented were or could have been classified according to NANDA-I, whereas 23% were not available within the ST and the other 19.3% were not nursing diagnoses (e.g., nursing interventions, medical diagnoses, complications). A study published in 1991 which also evaluated NANDA-I, found that 67% of the diagnoses were classified using NANDA-I but the second most prevalent diagnosis utilised was not a NANDA-I term [165]. NANDA-I was also evaluated within the primary care setting by Sieleman (1999) [253] who identified that only 21% of the nursing diagnoses were NANDA-I terms, 35% were close matches and 44% did not match any NANDA-I term. However, when Ogunfowokan et el., (2013) [185] interviewed nursing students regarding NANDA-I, over 80% of those interviewed (n=16) believed that the NANDA-I could be utilised in the community setting but factors hindering its use included knowledge deficit, shortage of staff and the number of clients in the community. The ICNP was evaluated in hospitals in Korea across two studies by Cho and Park, who found that 75.5% (n=401,190) of the data entries used the ICNP and 80% of the free text could have been entered using ICNP [61]. The second study reported that an appropriate ICNP term was found in 89.4% of cases and of the suboptimal/failed phrase selections, 43% could have been found, 19% were due to interface issues and 48% were not available [92].

Other aggregation or traditionally more medical STs which have been used by nurses were also evaluated. Morris et el., (2014) [176] who evaluated the NMDS in Ireland which incorporated the ICD-10, found that diagnostic information was missing for 101/236 patient records. This was thought to be related to ICD-10 index sheets not being available during completion. Moscicki et el., (2013) [177] found that the DSM-5 could be utilised for diagnosing more than 80% of patients in a mental health setting by nurses and doctors. Cimino et el., (2001) [94] who evaluated the MED-searching system identified that the required term was found in 82% of the 447 cases and where failed or suboptimal terms were found, 40% of times this was due to the MED missing the concept, an interface issue or the MED lacking the synonym or abbreviation being searched. The other extreme to not being able to find the appropriate term within the ST, is finding several terms which could be utilised. Content duplication was identified within NANDA-I (e.g., “Impaired skin integrity” and “Impaired tissue integrity”) by Morais et el., (2015) [175] and in the Omaha system (e.g., “finances” and “income”, or “residence” and “home”) by Monsen et el., (2011) [171]. Although the applicability to the clinical setting depended on the specific context and ST in use, the studies demonstrated that a ST could be applied to the majority of terms required by the nurses in these studies. However, whilst applicability is important, having more than one term which can represent the same concept could be detrimental to the secondary benefits of a ST.

3.4.4. Interoperability

Only one study was identified which evaluated the interoperability of a ST across healthcare organisations with different EHR software vendors. This study found that using the Omaha system and OASIS across 15 homecare agencies enabled aggregation of findings but challenges were identified in relation to the data (i.e., “24” versus “24.Pain”, or “IV” versus “4”) and file formats (i.e., .dbf versus ASCII text files) [237].

3.5. Documentation Quality

Fifteen studies evaluating the impact of STs on quality of nursing documentation were identified across Switzerland, Nigeria, USA, Iceland, the Netherlands, Norway, Indonesia, Spain, Finland, Brazil and Korea (Table 3). These studies evaluated the impact of NNN, NANDA-I, Nanda-I with NIC, ICNP, ATIC and CCC on documentation within the hospital setting, and one study evaluated the impact of NNN within primary care [183].

Three Swiss studies conducted by Müller-Staub et al. utilised the Q-DIO, a 29-item scale developed by their research group, which compared the use of STs with free text and included educational sessions [14, 179, 180]. The earlier study evaluated pre and post the implementation of NANDA-I and found significant improvements in the completeness and comprehensive inclusion of nursing diagnostic labels, and identification of signs/symptoms and correct aetiologies [14]. The 2009 study evaluated the introduction of NNN and in addition to significant improvements in accurately stating nursing diagnoses, they also identified improvements in naming concrete nursing interventions (i.e., what, how, how often and by whom) and documentation of nursing outcomes [179]. Müller-Staub et el., (2008) [180] utilised a cluster randomised control design to compare different NNN education types and found that whilst improvements were identified in both groups, the quality was significantly higher in the group being educated using guided clinical reasoning compared with case discussions.

Three other studies also utilised the Q-DIO. Rabelo-Silva et el., (2017) [202] was the only study identified which compared two terminologies and found that NANDA-I combined with NIC within the EHR performed better when compared with paper-based ICNP at a different site. Two Nigerian studies evaluated the introduction of NNN using an educational intervention [75, 183] with Adubi et el., (2018) [75] also identifying that the improvement in quality demonstrated was dependent on the baseline quality, type of ward (i.e., medical, surgical or psychiatric) and the level of experience of individual nurses. A third Nigerian study evaluated the impact of NANDA-I on nursing documentation using a checklist and also identified a significant difference in the number of diagnoses recorded between medical and surgical wards [186]. Contrary to these finding, Hayrinen et el., (2010) [135] who evaluated the FinCC and Gonzalez-Samartino et el., (2018) [130] who evaluated the ATIC found no significant difference in the improvements in documentation quality between medical and surgical wards. Gonzalez-Samartino et el., (2018) [130] did however report a significant difference in documentation quality between nurses who had received methodological training compared with those who didn’t. This again demonstrated that education was a major factor in the improvements identified [197, 230].

Although Von Krogh et el., (2012) [235] also identified improvements in documentation quality using a content analysis having introduced an EHR with the NNN, they also reported a reduction in the collection of patient safety information. Therefore, the benefits associated with clinical decision support software could not be demonstrated [235]. Thoroddsen and Ehnfors (2007) [228] found that when they introduced the NANDA-I and NIC, outcomes or changes in patient status captured using free text were only present in approximately one-fifth of nursing records [228]. This was perhaps unsurprising as they had not introduced an ST which captured patient outcomes, however a 1994 US study found that the nurses using NANDA-I documented more accurate and realistic patient outcome criteria compared to those not using NANDA-I [86].

Although the studies included several different STs and measured documentation quality using a variety of methods (i.e., content analysis, Q-DIO and other self-developed and/or validated instruments), benefits of the ST on documentation quality were consistently demonstrated. However, it would appear that education on the nursing process and clinical reasoning as well as the introduction of an EHR contributed to these improvements. Additionally, quality

documentation was usually considered to be based on inclusion of a diagnosis, intervention and outcomes, and no study evaluated whether the documentation was patient-centred and was understood by healthcare professionals outside of the nursing profession to facilitate continuity of care. Finally, the benefits of the ST on documentation quality will also depend on its applicability to the specific setting.

3.6. Patient care

Fourteen studies were identified which evaluated the impact of a ST on patient care across China [239, 241, 248, 249, 254], Spain [88, 89, 201], Brazil [82, 99], Cyprus [56], USA [159] and Portugal [205] (Table 3). These studies utilised the NNN, Omaha system and NANDA-I with NIC, and were most commonly conducted in hospitals and primary care centres, but also in a psychiatric outpatient department, during home visits, long-term care and in schools. Three of these studies did not include a control group and although all three reported improvements to patient outcomes, it was unknown whether these benefits were directly related to the ST [82, 99, 119]. Other studies did include a control group of usual care and four of these studies explored the impact of the ST on the outcomes for patients with type 2 diabetes mellitus (T2DM) [88, 89, 201, 254]. Wei et al., (2019) [254] evaluated the use of the Omaha system as well as clinical guidelines and demonstrated significant improvements compared to usual care in terms of blood glucose levels, quality of life and diabetes knowledge. As usual care did not incorporate the evidence-based clinical management, the identified benefits could be as result of this as opposed to the ST and the care providers were aware of who was in the intervention group. Cárdenas-Valladolid et al., authored two studies which retrospectively compared the outcomes of patients who were managed by nurses using a standardised nursing care plan which included NANDA-I and NIC with those who were not, over a period of two [88] and four years [89]. The earlier study identified that patients managed by nurses using the ST had greater improvements in their diastolic blood pressure (BP), HbA1c, Low Density Lipoprotein (LDL)-cholesterol and Body Mass Index (BMI), however, this only reached statistical significance for HbA1c [88]. The later study demonstrated no significant difference between the two groups but more patients within the ST group did achieve their BP goal [89]. Due to the nature of these studies, the two patient groups differed at baseline and the ST group were older with a higher prevalence of poor personal habits and diabetes-related complications. Additionally, the sample size of the two groups differed in the earlier study but not the later study (Table 3).

Similarly, Gencbas et al., (2018) [56] also found a significantly larger improvement in the outcomes (i.e., NOC measures, urinary distress inventory, incontinence severity index and incontinence quality of life scale) of patients with urinary tract infections managed using the NNN compared to usual care. However, these patients also had a higher life quality and lower incontinence severity/symptoms than the control group at baseline. Another limitation of these retrospective studies was that the skills of the nurses utilising the NNN in practice could also differ and impact on patient outcomes. In fact, a large retrospective study evaluating outcomes of patients with several chronic conditions did find that the 127 nurses utilising the NNN tended to be younger than those not using it (n=90) but there were no significant differences in terms of gender or qualifications [201].

Randomised controlled trials (RCTs) can help overcome these types of study limitations and two RCTs published by Zhang et al. using the same patient population with coronary artery disease (CAD) evaluated the impact of using the Omaha System combined with Pender's Health Promotion Model [248, 249]. These RCTs found statistically significant improvements compared with usual care in terms of clinical outcomes (i.e., BP, fasting blood glucose, cholesterol) quality of life, knowledge regarding CAD [248], self-efficacy to implement health-promoting behaviours and functional status [249]. Other RCTs found improvements in quality of life, the depression scale and functional measures as well as higher levels of patient satisfaction and lower levels of healthcare utilisation for patients post stroke [239] and improvements in knowledge and behaviour for patient with angina [241]. Sampaio et el., (2018) [205] compared use of the NNN and usual care by nurses on the management of patients with an anxiety disorder and reported the improvements in patient outcomes could also be attributed to the clinical reasoning ability of the treating nurse [205]. To distinguish the benefits associated with the introduction of an EHR versus a ST, Lunney et al., (2004) [159] compared nurses in a school using an EHR without a ST with those using an EHR with NNN and found no significant benefits on the outcomes of children but also no evidence of harm [159].

Based on the findings of the identified studies, a ST has the potential to improve patient care where it links nursing diagnoses with interventions. However, much of the demonstrated benefits in these studies could also be attributed to the use of evidence-based guidelines in conjunction with the ST or the clinical reasoning experience of the nurses using the ST. As no adverse effects on patient care were identified in the studies, this may be sufficient in an argument to support its use if benefits are demonstrated for other areas of nursing and midwifery practice.

3.7. Knowledge generation

As STs provide standardised terms with consistent value and meaning, they facilitate the aggregation of these terms to generate knowledge for clinical decision-making, research, audit and service evaluations. Seventy-nine cross sectional and cohort studies were identified which utilised NNN, NANDA-I, NIC, NOC, Omaha system, ICNP, CCC, NMDS with NANDA-I, NMDS (Netherlands and Belgium) and local nursing terminologies, to generate knowledge and/or evaluated the ability of the ST to aggregate knowledge (Table 3). Other STs including ICD and SNOMED-CT were utilised in these studies, however, they had been entered by medical

doctors as opposed to nurses [73, 112-114, 122, 147, 242]. Although the NNN was utilised across both the acute and community settings to generate knowledge, other terminologies were solely utilised in either hospitals (i.e., CCC, ICNP, NMDSN, BNMDS, ATIC) or primary care/outpatients (i.e., Omaha system). Additionally, in some cases where the same ST had been utilised across multiple healthcare organisations, data were aggregated from these sites [77, 144, 151, 157, 166, 210, 211, 215]. Knowledge was generated in these studies to characterise and evaluate nursing care and different processes of data retrieval were evaluated.

3.7.1. Characterisation and evaluation of nursing care

STs were commonly utilised across the identified studies to characterise nursing care including the prevalence of patient diagnoses, problems, and signs and symptoms, the frequency of interventions, the number of different diagnoses and/or interventions given to patients and the types of patient outcomes being captured or changes in a patient's condition or status. Where the ST linked diagnoses with interventions and/or outcomes (e.g., NNN, Omaha system, ICNP and CCC), this facilitated the identification of the types of interventions provided to patients with a specific diagnosis and the evaluation of these interventions and diagnoses on patient outcomes. Additionally, the ST enabled the classification of these data into domains (e.g., neurology) [108]. Studies also linked these data to other data fields including patient socio-demographics (e.g., age, gender, education level) [95, 111, 125, 157, 173, 182, 188, 211], time period (e.g., length of hospital stay, time since new drug introduced) [76, 77, 113, 140, 157, 182, 209, 211], type of admission (i.e., voluntary versus involuntary) [112], and outcome measures (e.g., cognition, nursing intensity classification system) [111, 122, 155, 168, 245]. This enabled studies to link administrative data with the clinical data for example Garcia et el., (2013) [128] evaluated whether the number of appointments attended in primary care impacted on patient outcomes using the Omaha system. Whilst most studies provided mainly prevalence and frequency data, other studies utilised these data to generate further knowledge. This knowledge included calculation of patient-facing time [216] and predicting nursing hours required during certain times of the year [162], likely-discharge based on a nursing-specific ST in conjunction with medical and pharmacy codes [232] and likely-hospitalisation based on the number of homecare interventions provided [169].

3.7.2. Data retrieval

Generation of knowledge necessitates the ability to aggregate data. Where there was no EHR, manual review of patient charts to retrieve data was used [101, 195, 229, 242] and these studies often contained a smaller number of participants [87]. An EHR made data retrieval and analytics quicker and easier using methods such as data mining or natural language processing [73, 77], however, data retrieved were not always one hundred percent accurate [73, 101, 158, 184, 255]. Kim et el., (2012) [255] found that when mining the EHR for ICNP and SNOMED-CT terms related to adverse drug reactions, the detection rate was higher than using a manual search, but the specificity and sensitivity of the electronic search were 99.6% and 66.7% respectively. Other studies also found that nurses omitted information (e.g., diagnosis of pain) [77] or did not use the ST correctly [158] or at all [184]. Another issue with using the ST in data mining was related to the nature of STs. Abhyankar et el., (2014) [73] found that when searching for patients on dialysis using ICD-9 and local codes, the results also yielded patients with a family history of dialysis and those ineligible for dialysis. Similarly, Ahn and Park (2013) [76] searched for patients who had experienced adverse drug reactions based on ICNP terms however, this search also identified patients who had been at risk of a reaction. Additionally, not all relevant patients were identified in these studies necessitating the employment of manual searching. These findings demonstrated that whilst STs facilitated data mining for knowledge generation, the STs needs to be employed correctly by the healthcare professionals and the terms within the ST need to be specific and sensitive enough to facilitate accurate and relevant data retrieval.

3.8. Education programmes (Pre and post registration)

Thirteen studies were identified which evaluated the impact of STs on the education of pre and post registration nurses within the University setting or during clinical placements. These studies were most often conducted in Turkey and/or the USA (n=10) with the other three studies conducted in Indonesia, Italy and Poland. These studies utilised the Omaha system to describe patient care in the community or long-term care and the ICNP, NNN or NANDA-I to describe patient care in the acute setting. The identified studies demonstrated benefits of using a ST for educating baccalaureate and masters nursing students which included assessing their knowledge and facilitating their clinical decision making. However, the majority of studies did not include a control group of traditional education methods.

3.8.1. Student assessment

Ateş and Ulus (2019) [81] utilised the Omaha system to compare the clinical decision made by the student with that of their educator. Other studies discussed using the ST to identify gaps in the students' knowledge or clinical experience and to evaluate the effectiveness of their interventions for patients [79, 96, 116, 121, 233, 247]. Two studies from the USA and Indonesia utilised the NNN as part of a clinical reasoning tool known as the Outcome-Present-State-Test (OPT) Model of Reflective Clinical Reasoning which was used to evaluate the student's clinical reasoning and ability to make decisions over time [153] and facilitated the supervision process [240]. However, whilst those using the NNN more frequently scored higher in the clinical placement, this did not necessarily evidence that they had better clinical reasoning skills [153].

3.8.2. Clinical reasoning and documentation

As well as assessing the students' knowledge and ability, the STs were utilised to facilitate and improve their clinical reasoning and documentation. Using the OPT model discussed above, Wuryanto et el., (2017) [240] found, using qualitative methods, that it improved students' clinical logic ability, fostered self-directed learning, encouraged collaborative learning, fostered the NNN and helped record the documentation easily. Similar findings were identified by Zarzycka and Górajek-Józwik (2004) [251] who reported that the ICNP contributed to shorter and simpler way of formulating diagnoses, facilitated nursing students to observe more nursing phenomena and stimulated critical-thinking. Additionally, educating nursing students to use the Omaha system via online and classroom-based case studies resulted in nursing students being more accurate with defining the diagnoses and interventions but not outcomes, which according to Eardley et el., (2018) [115] was similar to what is seen in clinical practice. Overall, these studies identified that nursing students have found STs difficult-to-use [79] but education and support within the University and clinical setting has reportedly made them more competent in its use [120, 194].

4. Conclusion

This is the first literature review, to our knowledge, which evaluated the impact of all nursing-specific or interdisciplinary ST on nursing and midwifery practice. Overall, these studies demonstrated benefits of using an ST which included valid and reliable capture of patient data which was applicable to the clinical setting, generation of knowledge, improvements in documentation quality and facilitation of nursing student education. Some benefits were demonstrated for patient outcomes and interoperability across systems, however, this evidence was limited. These studies were heterogenous in nature and conducted using several STs across a wide variety of healthcare settings, specialities and countries. Therefore, findings cannot be generalised for every ST within any context. Additionally, as STs may be updated, translated into different languages, adapted to specific countries or segregated into subsets, the findings must be interpreted taking this into account. The experience of the nurses and midwives using the ST, the type of education and support provided, and the use of the ST within a usable EHR also all appeared to contribute to the benefits identified in the studies.

Although no formal quality appraisal was conducted in this scoping review, it should be acknowledged that many of these studies were cross sectional and did not directly compare the ST with another ST, or include a control group. A potential limitation of this scoping review was that only one researcher performed the screening and data extraction, however, inclusion of the expert panel from the Five Country Nursing and Midwifery Leadership Group who were familiar with the literature, helped to validate the findings. Although this review identified that nursing-specific STs were more commonly utilised by nurses and midwives compared to interdisciplinary STs, further high-quality research should explore the impact of using nursing-specific STs on the practice of other healthcare professionals. Additionally, minimal research existed which evaluated the use of interdisciplinary or medically-driven STs on nursing and midwifery practice and further research is required. Overall, there is huge potential to drive benefits from the use of STs in nursing and midwifery practice but the selection of the most appropriate ST for the specific setting and implementation process of this ST will impact on its success.

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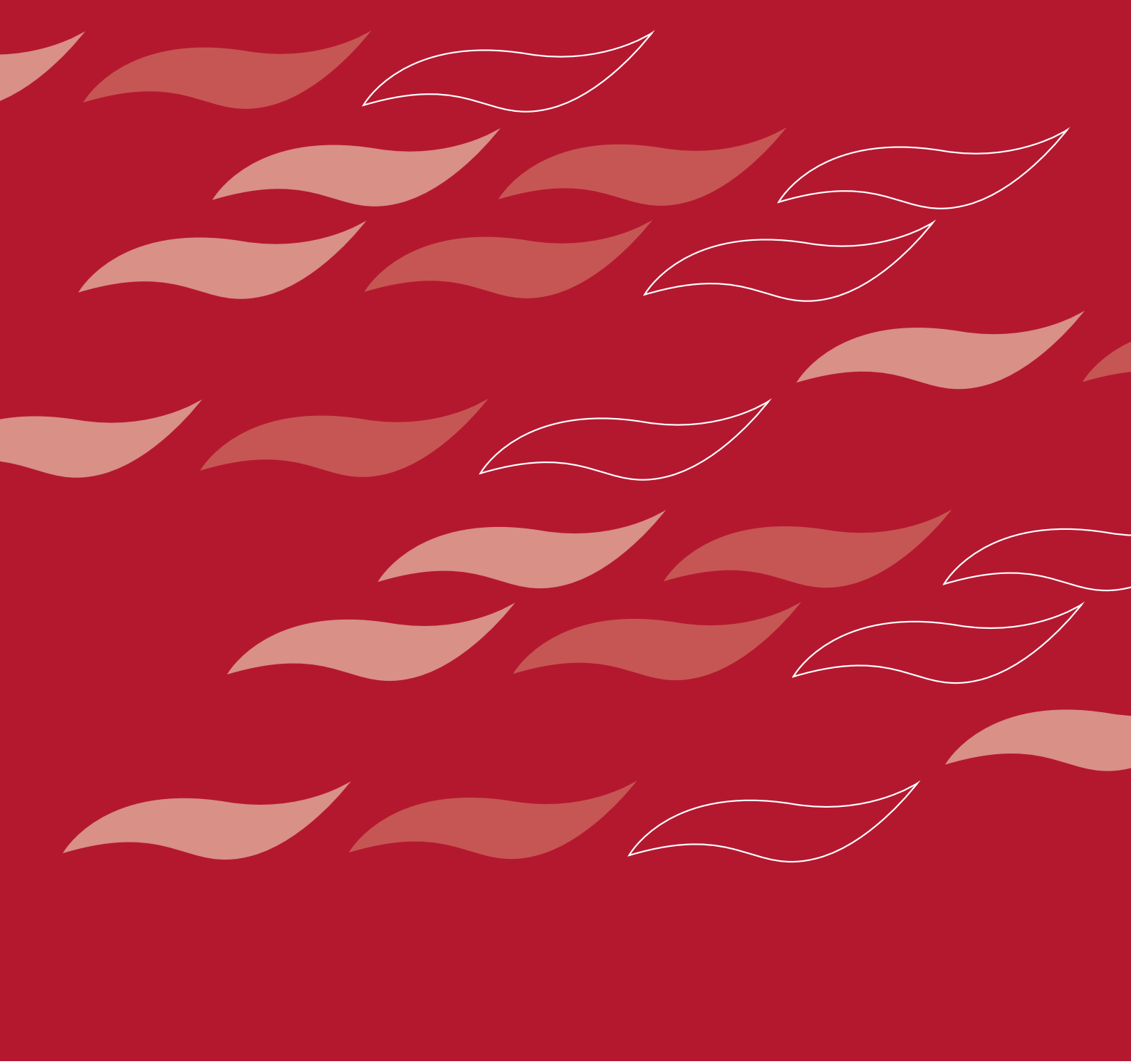

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