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Nursing minimum data sets: Findings from an umbrella review

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Abstract

Objectives: This study explores the evidence available on Nursing Minimum Data Sets (NMDSs) by summarising: (a) the main methodological and reporting features of the reviews published in this field to date; (b) the recommendations developed and published in such reviews regarding the NMDSs, and (c) the categories and items that should be included in the NMDSs according to the available reviews.

Methods: An Umbrella Review was performed. A search of secondary studies published up to November 2021 that were focused on NMDSs for adult hospitalised patients was conducted using MEDLINE (via PubMed), CINAHL and Scopus databases. The included studies were critically evaluated by using the Checklist for Systematic Review and Research Syntheses. The full review process was performed according to the Preferred Reporting Items for Systematic reviews and the Meta-Analyses statement.

Results: From the initial 1311 studies that were retrieved, a total of eight reviews published from 1995 to 2018 were included. Their methodological quality was variable; these reviews offered four types of recommendations, namely at the overall, clinical, research and management levels. Additionally, seven NMDSs emerged with different purposes, elements, target populations and taxonomies. A list of categories and items that should be included in NMDSs have been summarised.

Conclusions: Nurses are daily involved in the nursing care documentation; however, which elements are recorded is mainly defined at the local levels and relies on paper and pencil. NMDS might provide a point of reference, specifically in the time of health digitalisation. Alongside other priorities as underlined in available recommendations, and the need to improve the quality of the reviews in this field, there is a need to develop a common NMDS by establishing its core elements, deciding on a standardised language and identifying linkages with other datasets.

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nursing minimum data set, nursing care, information, data evaluation, literature review, umbrella review, digital health

Introduction

Werley & Lang (1988) defined the Nursing Minimum Data Set (NMDS) as 'a minimum set of elements of information with uniform definitions and categories concerning the specific dimensions of nursing, which meets the information needs of multiple data users in the health care system'.[1] Specifically, a NMDS is both a tool and a strategy that label and theoretically defines each essential data or element that should be used by the majority of nurses across all types of healthcare settings. Due to its non-specific nature, a NMDS can also be used by a number of health care professionals, researchers and systems.[2]

The NMDS has been established in the last forty years as a system capable of evaluating costs and the quality of the healthcare services provided, as well as to measure nursing workloads.[3] Specifically, the United States-NMDS (US-NMDS) was established in 1977[4] and was officially introduced in 1985.[5] Today, the US-NMDS and its developments are recognised as a point of reference in this field.[2] NMDS have also been established in hospital and community settings in different countries, such as in Canada,[6] Finland, Sweden, Switzerland,[7] Germany[8] and Austria.[9] Specific NMDSs have also been developed for sub-group of patients, settings or purposes, such as the Perioperative Nursing Data Elements (PNDS) approved in 1999 by the American Nurses Association's committee on nursing practice,[10] and the Society of Gastroenterology Nurses and Associates-Minimum Data Set (SGNA-MDS).[11] More recently, a NMDS has been developed to support policymakers in preventing, controlling and managing drug poisoning in Iran.[12]

According to Goossen et al. (1998), five important steps are required to develop an NMDS: (a) identification of relevant elements; (b) accurate definition of variables/elements or data; (c) determination of different values assumed by each variable; (d) adequate and standardised terminology for data recording; and (e) methods of aggregation and coding in databases created for NMDS purposes.[13] Subsequently, Sermeus and Goossen added that an NMDS must have a nursing focus with a minimal number of items capable of meeting the needs of the most possible users who may access the data and use it in a uniform manner.[14]

In those contexts in which an NMDS has been well-established at system levels, it has been documented to allow: (a) a comparison of data collected in multiple settings and heath care institutions, including the international levels; (b) an evaluation of the nursing care offered and its outcomes and also a comparison of different settings; (c) a decision-making support tool aimed at designing further services according to the prevalent needs; and (d) a decision-making processes in both clinical and administrative fields.[1] Moreover, NMDSs can be used in both paper-and-pencil and electronic records, as well as during handovers[15] and to facilitate data collection and analysis, and thus, ultimately the measurement of a nursing service.[16]

At the nursing care system level, the use of a NMDS has been documented to provide nurses with the opportunity to increase accuracy in planning and evaluating the nursing care (e.g. a Nursing Homes NMDS including falls and injury[17]), and to prevent misunderstandings given that the elements collected within it are standardised both qualitatively and quantitatively. Moreover, it has been highlighted that a NMDS allows to analyse easily accessible and comparable data, offering the opportunity to make comparisons among groups of patients as well as across nursing diagnosis, interventions and outcomes (e.g. a Primary Care NMDS, including nutritional data to monitor the

nutritional status[18]). The data collected, may increase the quality of the health care services and, ultimately, the research capacity.[2] Having uniform data can also provide evidence regarding the amount of work performed by nurses and thereby provide support for establishing the resources needed at the bedside to ensure quality and safety in patient care (e.g. a NMDS for electronic nursing handovers[15]; a NMDS regarding vascular access devices use and outcomes[19]). Furthermore, given that nowadays there is a growing interest for electronic health records (EHRs), whose goal is to collect consistent and uniform data about patients[20] in efficient manner, the concept of NMDS has increased its importance. EHRs and other technologies are designed to obtain information on defined patients' exposures and outcomes and to combine many different functionalities comprising the clinical decision support,[21] the health information exchange (HIE),[22] the administrative processes and other purposes.[23] To allow all these functions, the range of EHRs available impacting the nursing care (with some examples provided in Supplementary Table 1) should be based on a consistent NMDS: therefore there is an emergent and well-recognised connection between the EHRs and the NMDS.

Several reviews have been published to date to provide practical and research recommendations and to summarise commonalities and differences across the available NMDSs. However, no summary of these reviews has been provided, and those stakeholders or decision makers responsible to develop EHRs record's systems at the institutional, regional or the national levels are still unsupported in their attempt to base the electronic nursing records on a reliable and recognised NMDS. Driven by the reason to summarise the evidence from the available research syntheses whose information should be critically assessed, an umbrella review covering a broad spectrum of literature by encompassing different study types (e.g. systematic review, scoping review) and various conditions (e.g. minimum data sets linked to the fundamentals of care) or populations (e.g. across countries) was designed. Having an accessible summary of the reviews available in this field might support: (a) policymakers and experts in designing electronic NMDSs; (b) managers in implementing an NMDS based upon standardised data, thus ensuring comparability and the continuity of care (e.g. from the hospital to community care); and (c) researchers in identifying priorities and in increasing nursing research productivity given that the lack of accuracy in datasets requires additional data collection. Therefore, the intent of this study is to render accessible the knowledge produced to date by providing a summary of the available reviews in this field.

Methods

Study aims

The study aims to summarise the evidence available on NMDSs. Specifically, the following research questions are addressed:

(a) What are the methodological and reporting features of the reviews published to date in the field of NMDS?
(b) What recommendations have been developed and published in these reviews regarding the NMDSs? and
(c) What data, elements or information (hereafter categories and items) should be included in the NMDSs according to the available reviews?

Study design

An umbrella review protocol was designed. As reported by Aromataris & Munn (2015) on behalf of the Joanna Briggs Institute,[24] umbrella reviews are reviews aimed at incorporating all types of syntheses of research evidence, including systematic reviews in their various forms, with the intent to summarise all secondary studies available in a field.[25]

Literature review

A search strategy was performed from March to May 2019, then updated in November 2021 (last search date 15th November 2021), by using '*nursing minimum data set'* as a keyword. MEDLINE (via PubMed) and CINAHL (Cumulative Index to Nursing and Allied Health Literature) were accessed as the most relevant databases in the nursing field. The inclusion criteria were: (a) secondary studies, such as reviews, systematic reviews, narrative reviews and overviews, that had an available abstract; (b) written in Italian or English; (c) without any restriction as to year of publication to achieve a comprehensive outline of the evidence; and which focused on (d) NMDSs for adult patients cared for in hospital settings. All reviews considered appropriate have been included. Moreover, the title of each included article was entered on the Scopus database to find descendant reviews, which were also screened according to the aforementioned inclusion criteria. Their references were then screened in order to identify other relevant reviews to be included. Authors of the present review performed the entire process by working independently and then agreeing on the findings.

The search string produced 1311 eligible articles. After the removal of the duplicates, a total of 980 articles remained; 970 of these were excluded according to the inclusion criteria. Articles were excluded for a variety of reasons, such as main focus not on patient (e.g. datasets to support workforce planning in nursing[26]), non-English full-text articles (e.g. German[27]), publication type not meeting the inclusion criteria (e.g. study protocols[28]) and care not provided in hospital settings (e.g. nursing homes and community settings[29]). One of the remaining nine articles was excluded[18] upon analysis of the full text due to the specificity of the NMDS investigated in the study. Therefore, there were eight reviews included in this study as reported in Figure 1 according to the Preferred Reporting Items for Systematic reviews and a Meta-Analyses (PRISMA) 2020.[30]

Quality appraisal

The methodological quality of the included reviews was assessed according to the Joanna Briggs Institute's 'Checklist for Systematic Review and Research Syntheses' criteria.[31] The checklist used allows for a quality assessment and the identification of bias in design, conduct and analysis throughout the 11 questions.[25] Specifically, this tool explores the clearness in the explication of research questions as well as bias, the suitability of the search strategy, the evaluation of the included studies and the quality of the obtained results. The answers to each item vary between Yes (Y), No (N) and Unclear (U); the evaluation was performed by two reviewers independently (XX, XX) with disagreements resolved within the research team (no discrepancies emerged.). None of the eligible reviews has been excluded from the umbrella review according to the methodological quality emerged. This decision was based according to the following elements: (a) some reviews emerged to be designed and developed before the establishment of the methodological quality criteria (e.g. Goossen et al., 1998[13]); (b) some of them, despite the limited quality, are considered seminal works in the field – as also appears from the citation ranked in the Scopus database (e.g. Sermeus and

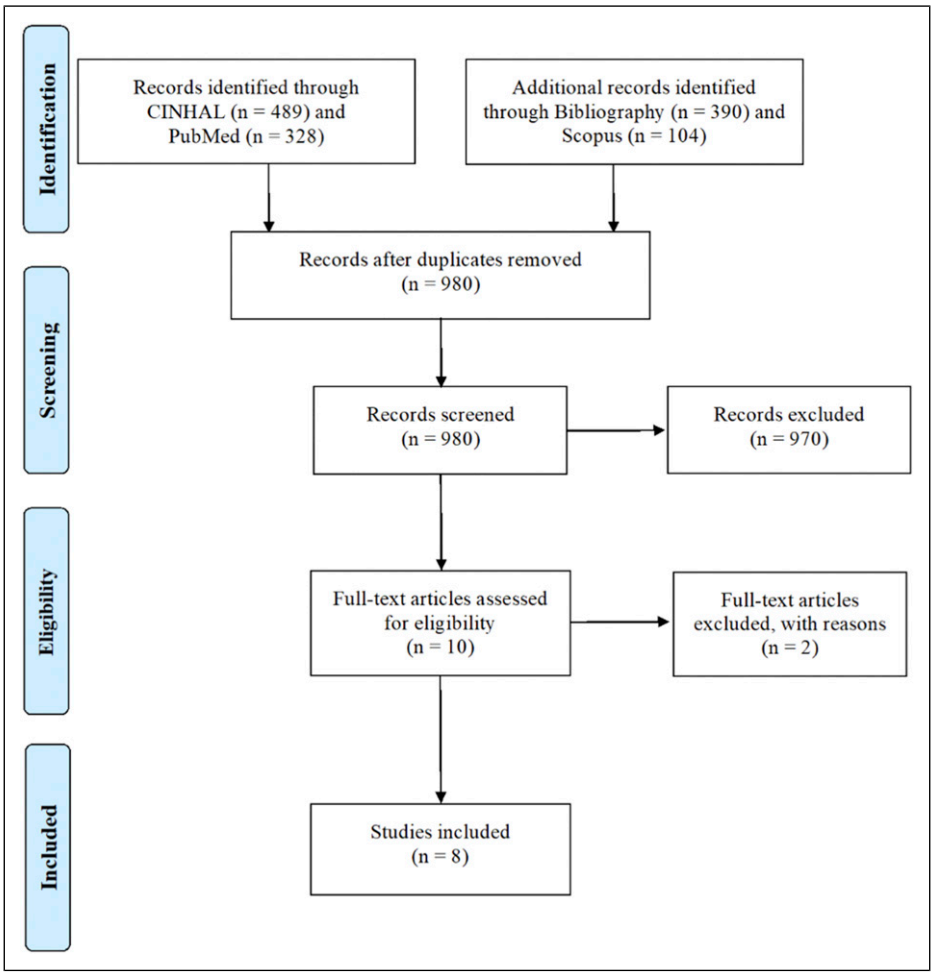

Figure 1. Flow chart of the search strategy and results according to the PRISMA[30] statement. Legend: PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; CINAHL = Cumulative Index to Nursing and Allied Health Literature.

Goossen, 2002[14]); and (c) the intent of the umbrella review was to emerge all recommendations published to date in this field of research, the categories, and the items that should be included in a NMDS. Therefore, the quality appraisal was performed to evaluate the methodological characteristics of the included reviews[32] and to gain an overview of the methodological quality achieved in this research field.

Data extraction

Data was extracted and summarised in three steps. First, the following data was extracted from each review: (a) author(s); (b) year of publication; (c) country; (d) study design; (e) databases or sources used by researchers while performing the reviews; (f) keywords used to search literature; (g) inclusion and exclusion criteria; and (h) number of studies included. Moreover, (i) the

recommendations contained in each included review were extracted and categorised in overall, clinical, managerial and research recommendations. Second, in order to describe the NMDSs identified, there were extracted data regarding (a) the country, (b) the purpose(s) of the review, (c) the terminology used, and (d) the target population (e.g. medical units). Third, in order to identify variables, data, elements (=categories and items) composing the NMDSs as documented by reviews, these were extracted. In this research step, NMDSs not for hospital purposes (e.g. the CNMDSA; Community Nursing Minimum Data Set Australia)[13] and those not regarding nursing and/or health care documentation as well as those derived from multi-method studies (e.g. the NH-MDS; Nursing Handover Minimum Data Set)[15] were not included. All elements extracted were checked by two researchers to ensure rigour and accuracy in data extraction.

Data synthesis

The included reviews were described by their main features (e.g. year and country of publication, design, inclusion and exclusion criteria, population involved); moreover, the recommendations reported were categorised according to their intent as: (1) *Overall*, concerning general recommendations; (2) *Clinical*, including suggestions for clinical practice implementation; (3) *Research*, addressing the future direction of research in the field; and (4) *Managerial*, regarding the implementation of NMDSs at the micro (units), and macro levels (policy levels).

The NMDSs that emerged were categorised according to Goossen and colleagues, both for single items reported and for macro-classification.[13] Elements that emerged have been read carefully by two researchers (XX, female, clinical nurse; and XX, female, professor in nursing science) who subsequently have analysed their correspondence (not all elements were included in communications); in order to avoid redundancies, multiple elements which were part of the correspondence and related to one of the items reported by Goossen et al. (1998)[13] were also considered one time. For those items without any correspondence, a list was created. Goossen et al.'s (1998) categorisations were taken as a point of reference; however, according to the study purposes, NMDSs not described in their review were also considered, for example, the Thai NMDS (NMDS for Thailand),[33] the NH-MDS (Nursing Handover Minimum Data Set)[15] and the NMDS for fundamentals (Nursing Minimum Data Set for nursing practice around the Fundamentals of Care).[34]

Results

Reviews: main characteristics and methodological quality

As summarised in Table 2, a total of eight reviews published from 1995[5] to 2018[34,35] met the inclusion criteria. Ryan & Delaney's (1995) review was the first that was published in the field which was aimed at summarising the available research regarding NMDSs and soliciting researchers on the use of NMDSs.[5] Later, Goossen et al. (1998) compared five NMDSs to develop and implement an NMDS system in the Netherlands.[13] Sermeus & Goossen (2002) then summarised definitions, characteristics, content, stages of development, examples and issues related to NMDSs.[14] One year later, Volrathongchai and colleagues (2003) summarised studies regarding the development and the implementation of a Thai NMDS.[33] Next, Mac Neela et al. (2006) published an overview which included a critical analysis on the development, use and validity of available NMDSs.[7] In the last 10 years, Johnson et al. (2012) developed an extensive review with the intent to develop an electronic NMDS to use along with verbal handovers[15]; moreover, Muntlin Athlin (2018) examined the link between NMDSs and the fundamentals of care in nursing practice and

identified gaps to call upon future research on terminology standardisation.[34] More recently, Jeffs et al. (2018) provided an overview of the current state of performance measurement, key trends and a methodological approach to leverage in efforts to generate a standardised data set for fundamental care.[35]

While most reviews do not explicitly report the number of studies taken into account, Johnson et al. (2012) included 10 studies published between 2008 and 2009,[15] while Muntlin Athlin (2018) included 20 studies published between 1999 and 2016.[34] Even keywords used to search the literature were not reported in each review. However, Ryan & Delaney (1995) used '*NMDS'* and a combination of two or more of the nursing care elements of the NMDS (*diagnosis, intervention, outcome* or *intensity*) or the phrase '*nursing care'*[5]; Goossen et al. (1998) chose '*nursing minimum data set'*, '*NMDS'* and '*nmds'*[13]; Muntlin Athlin (2018) employed the broad keyword '*all fields'* adding a Boolean operator '*minimum (AND) data (AND) set (AND) nursing'* and the plain keyword '*nursing minimum data set'*.[34]

As shown in Table 1, the methodological quality of studies was variable, with several unclear items: specifically, while in the item "Was critical appraisal conducted by two or more reviewers independently?" all studies reported unclear data, in that of "Were the specific directives for new research appropriate?" all provided adequate information.

Reviews: Recommendations

As shown in Table 2, all studies provided recommendations at the overall levels. Studies have recommended the establishment of the core elements to include in NMDSs to estimate the accuracy and the validity of such elements and that of the data collection method.[5,14] Specifically, the recommendation has been made to also consider psycho-social elements and those regarding the coordination of care.[7] Moreover, Jeffs et al. (2018) recommended the consideration of the fundamental care elements.[35]

Data collection should be standardised, allowing nurses and managers to discuss clinical practice and resource distribution issues without bias.[5,13] In the implementation of an NMDS, easy data availability and quality of the information should be ensured.[5,7] NMDSs should also be integrated with the electronic patient records and included in multidisciplinary databases used by multiple professionals.[13,15] The suggestion has also been made that the level of data anonymity and privacy regulations should be discussed when implementing NMDSs.[13,14] Furthermore, in order to prepare upcoming generations, it has been recommended that students be prepared to use the NMDS.[15]

As to *Clinical Recommendations*, in the review by Volrathongchai et al. (2003), the need for nurses to understand the importance of NMDSs was underlined.[33] Nurses should be not allowed to adapt the tools to their context[5] and they should be prepared to report nursing data accurately.[14] Moreover, it has been recommended that nurses become familiar with information technology to facilitate NMDS implementation.[33] In this light, MacNeela et al. (2006)[7] and Goossen et al. (1998)[13] suggested the provision of electronic feedback or a system supporting the decision-making process: in fact, when used as a tool to improve workplace quality, NMDSs can support nurses in focussing on person-centred care.[34] Moreover, Johnson et al. (2012)[15] recommended that verbal handovers should be based on an NMDS.

The *Research Recommendations* in the reviews included the development of a link with other databases with the intent to expand research capacities[14] and to analyse the comparability of data across different classification systems, settings and countries.[33] NMDS implementation has been recommended to open a new research era in which it should be easy to explore how the structure of the health system, professional profiles and the practices used can affect the contribution of nursing

Table 1. Quality appraisal of the included reviews using the 'checklist for systematic reviews and research syntheses'.[31]

Items	Included studies							
	Goossen et al., 1998[13]	Jeffs et al., 2018[35]	Johnson et al., 2012[15]	Mac Neela et al., 2006[7]	Muntlin Athlin, 2018[34]	Ryan & Delaney, 1995[5]	Sermeus & Goossen, 2002[14]	Volrathongchai et al., 2003[33]
Item 1. Is the review question clearly and explicitly stated?	Y	N	Y	N	Y	Y	N	Y
Item 2. Were the inclusion criteria appropriate for the review question?	U	U	Y	U	Y	Y	U	U
Item 3. Was the search strategy appropriate?	U	U	Y	U	Y	Y	U	U
Item 4. Were the sources and resources used to search for studies adequate?	Y	U	U	U	Y	Y	U	U
Item 5. Were the criteria for appraising studies appropriate?	N	U	U	U	N	N	U	U
Item 6. Was critical appraisal conducted by two or more reviewers independently?	U	U	U	U	U	U	U	U
Item 7. Were there methods to minimise errors in data extraction?	Y	U	Y	U	Y	N	U	U
Item 8. Were the methods used to combine studies appropriate?	Y	U	Y	U	Y	U	U	U
Item 9. Was the likelihood of publication bias assessed?	N	U	Y	N	Y	N	U	N
Item 10. Were recommendations for policy and/or practice supported by the reported data?	Y	Y	Y	Y	Y	Y	Y	Y
Item 11. Were the specific directives for new research appropriate?	Y	Y	Y	Y	Y	Y	Y	Y

Legend: Y = Yes; N = No; U = Unclear.

Table 2. Summary of included reviews.

Author, Country, Design	Aims	Databases and Sources, *Keywords for searching*	Recommendations			
			Overall	Clinical	Research	Managerial
Goossen et al., 1998[13] Netherlands Review	*To compare several NMDS systems to see what can be learned from them and applied to the successful development and implementation of an NMDS in the Netherlands.*	Medline; RN-Index; Embase; proceedings of nursing informatics and medical informatics conferences and several journals that are specialised in nursing and health informatics were studied; references in selected papers were retrieved; experts in NMDS projects were asked for supplementary reference material and questioned about the status of national developments *"nursing minimum data set", "NMDS" and "nmds"*	Items of NMDS should be integrated in the computerised patient records to provide nursing care data, and NMDSs should be available in large multidisciplinary databases because many data items are of interest to nurses and specific nursing care items could be useful also for other disciplines, paying attention to multidisciplinary development of databases, not to discipline-specific developments of data sets.	Consequences of data collection, analysis and dissemination of feedback should be disseminated among nurses.	To compare data of NMDS on an international level, researchers should use relevant questions, sampling methods and sizes, with appropriate modes of data collection, and means of data analysis.	NMDS should be available to support health care management and policy decisions. Terminology systems should be analysed to find one vocabulary and classification system that fits all purposes. The confidentiality and privacy issue should be analysed by developers of the NMDS.
Jeffs et al., 2018[35] Canada Overview	*Provides an overview of the current state of performance measurement, key trends and a methodological approach to leverage in efforts to generate a standardised data set for fundamental care.*	NA	To develop a standardised NMDS for fundamental care, items should be comprehensive and context specific, to reflect the associated outcomes and to define contribution of fundamental care to broader patient, financial, organisational and system-level outcomes.	NR	To develop NMDS around patient-centred care, patient engagement and patient experience that build on the relational aspect of fundamental care can address current gaps in this area of measurement.	NR

(continued)

Table 2. (continued)

Author, Country, Design	Aims	Databases and Sources, *Keywords for searching*	Recommendations			
			Overall	Clinical	Research	Managerial
Johnson et al., 2012[15] Australia Extensive literature review, qualitative study and observational approach	*This study presents a minimum data set designed for an electronic system to complement verbal nursing handover.*	NA	NMDS should be part of the electronic patient record to enable the collection of data that can be used also to other purposes. NMDS should be used by educators to teach student nurses, new graduates and experienced staff, about the scope of patient information to be presented at handover.	NMDS should be used to support and facilitate structured handovers. NMDS could be a valid source of information for handovers with community nurses or between different settings. NH-MDS also could be used instead of verbal handover. Moreover, MDS can be used to inform staff being oriented to the area or the patient caseload when verbal handovers are not available or pertinent.	Researchers should study in deep the association between the use of the NMDS, the electronic summary and patient outcomes.	Managers can use the MDS and electronic tools in conjunction with a structured content approach to educate new clinical staff, and to assist new graduates entering the workforce.
Mac Neela et al., 2006[7] Ireland Overview and critical analysis	*Describing the essential features and underlying principles of NMDS systems.*	NA	Researchers should focus on finding the "core" elements of NMDS, before focusing on instrument development and data quality. Researchers should extend the focus of NMDS beyond physical health, including elements of psycho-social and co-ordination work.	Researchers should improve studies of NMDS as a tool able to impact on clinical practice through the provision of feedback to clinicians, as a comprehensive clinical documentation system, or as a decision aid in clinical care.	Researchers should understand how healthcare configurations, professional roles and organisational practices influence the nursing contribution made across practice settings.	NR
Muntlin Athlin, 2018[34] Sweden Scoping review	*To examine and map research about minimum data sets linked to nursing practice and the fundamentals of care and to identify evidence gaps to provide research questions for future studies.*	PubMed, CINAHL *"ad all fields", "minimum" AND "data" AND "set" AND "nursing", "nursing minimum data set"*	To make the NMDS able to facilitate the documentation of nursing diagnosis, interventions and outcomes, researchers, nurses and leaders should develop appropriate standardised terminology.	NMDS should be useful in allowing nurses time to provide person-centred care, if used to analyse and improve the quality of the workplace.	Researchers should deepen the relationship between NMDS and clinical practice using methodological research.	The use of NMDS should highlight the work and impact nurses have on quality patient care and safety. This also emphasises the need for appropriate documentation and computer system, aimed also at avoiding unnecessary workloads of nurses.

(continued)

Table 2. (continued)

Author, Country, Design	Aims	Databases and Sources, *Keywords for searching*	Recommendations			
			Overall	Clinical	Research	Managerial
Ryan & Delaney, 1995[5] USA Review	*To identify research in which the NMDS has been tested and to provide a stimulus for future research on or including the use of the NMDS.*	CINAHL; Medline; references in Werley; thesis and dissertation titles from all accredited masters' and doctoral programmes; additional sources of articles included conference proceedings and personal communication with researchers or other colleagues; a request for works using the NMDS also was sent through Internet *"NMDS"; a combination of two or more care elements of the NMDS (diagnosis, intervention, outcome, or intensity), or "nursing care."*	All users of NMDS need to standardise the collected data to enable nurses and managers to discuss practice issues and allocation of resources across patient groups and clinical settings, without data distortion.	The NMDS should not be adapted to certain needs before testing, otherwise the standardisation is altered.	Research should be done towards solving the taxonomy problem and finding a universal language. Research is needed to determine the availability and linkage of the elements, electronic data retrieval, and estimates of reliability and validity. Researchers have to implement NMDS studies and utilisation.	Leaders should use NMDS and their data to make decisions about healthcare.
Sermeus & Goossen, 2002[14] Belgium Overview	U	NA	NMDS have to respect guidelines about privacy of patients, researchers should identify the degree of anonymity. Hospitals, politics and researchers should discuss the ownership of data and accessibility of information.	To have reliable NMDS, nurses should record nursing process in the patient record accurately.	Researchers should code properly the nursing process in the NMDS, and they should estimate the risk of alterations in the records of NMDS. They have to link NMDS with other data sets, to reduce the effort in collecting data and to empower the possibilities of research. Moreover, they should assess the reliability of the data collection and pay attention to the database layout in order to facilitate nurses.	To improve and maintain NMDS Hospitals should develop strong nursing informatic systems.

Table 2. (continued)

Author, Country, Design	Aims	Databases and Sources, *Keywords for searching*	Recommendations			
			Overall	Clinical	Research	Managerial
Volrathongchai et al., 2003[33] Thailand Overview	*To describe the recent development of the Thai NMDS; to discuss its potential implementation; and the important issues related to the Thai NMDS, including its relationship to NMDSs in other countries, particularly that of the USA.*	NA	NR	Nurses should be prepared to understand the value of nursing data and NMDS. They should also be comfortable using computer technology to facilitate the use of the NMDS.	Researchers should analyse the comparability of data across classification systems, settings, and countries. They should test the usefulness of the NMDS for stimulating nursing research, and influencing health policy, and projecting trends in nursing care.	Managers should support the familiarisation of nurses into the use of electronic resources and information technology as well as on the value of the nursing data.

Legend: CINAHL = Cumulative Index to Nursing and Allied Health Literature; NA = Not Applicable; NMDS = Nursing Minimum Data Set; NR = Not reported; RN = Registered Nurse, U = Unclear.

to patient care.[7] Moreover, implementing research to validate the NMDSs, their effectiveness[5,15,33] and their capacity to estimate patient outcomes[15] might expand the visibility of nursing care. Researchers should establish adequate search questions, sampling methods, collection and data analysis methods.[13] Furthermore, it has been recommended that the research be deepened to find the essential elements to be included in order to develop and validate an NMDS capable of capturing the nursing care in various settings and populations.[5,7] Special attention should be devoted to those invisible elements of care such as patient engagement and experiences that are not currently measured.[35] Researchers should also direct their efforts towards achieving a universal classification and language to express the nursing care.[5,13,34]

Among the *Managerial Recommendations*, the need to use NMDSs to make data-driven decisions influencing health care was highlighted.[5,13] Hospitals, administrations and researchers alike should define issues of data ownership and accessibility[14]; it is also pivotal for hospitals to develop an adequate computer system to support and facilitate the use of NMDSs.[5,13,34] Moreover, it has been recommended that managers improve the familiarisation of nurses with the use of electronic resources and information technology as well as with the value of the nursing data,[33] educating clinical staff and all new graduates.[15]

NMDSs: Main characteristics

Only four reviews documented the items composing the NMDSs, namely:

(1) Goossen et al. (1998) reported the Nursing Minimum Data Set of the United States (US-NMDS), the Minimal Verpleegkundige Gegevens/Résumé Infirmier Minimum for Belgium (MVG/RIM), the Health Information: Nursing for Canada Components (HI:NC) and TELENURSE & International Classification for Nursing Practice as well as TELENURSE & ICNP for Europe;[36]
(2) Volrathongchai et al. (2003) reported the Nursing Minimum Data Set for Thailand (Thai NMDS);[33]
(3) Johnson et al. (2011) reported the Nursing Handover Minimum Data Set (NH-MDS)[15]; and
(4) Muntlin Athlin (2018) reported the Nursing Minimum Data Set for nursing practice concerning the fundamentals of care (NMDS for fundamentals).[34]

The characteristics of NMDSs are summarised in Table 3: while the countries varied from the United States[13] to Thailand,[33] the formal purpose of an NMDS was similar. The targeted population was mainly established in general hospitals and all settings. Moreover, the taxonomies used have been slightly different from the North American Nursing Diagnosis Association (NANDA) to the Activities of Daily Living (ADL); however, above all, NANDA[13] and the International Classification of the Nursing Practice (ICNP)[33] seems to prevail.

NMDSs: Categories and items

By considering the analysis of the included NMDSs, a total of 48 items emerged as reported in Table 4. *Nursing Intervention* is the only element that is common in all the NMDSs whereas *Patient demographics*, *Nursing problems/diagnosis*, *Nursing outcomes*, *Admission date/episode/encounter date* and *Discharge date* are among the most frequently considered elements.

The NMDSs that do not report either *Nursing problems/diagnosis* or *Nursing outcomes* are the MVG/RIM and the HI:NC.[13] In addition, the MVG/RIM has included another element in the

Table 3. Characteristics of nursing minimum data set according to the classification by Goossen et al. (1998).[13]

	US NMDS[a]	MVG/RIM[b]	HI:NC[c]	TELENURSE & ICNP[d]	Thai NMDS[e]	NH-MDS[f]	NMDS for fundamentals[g]
Nation	United States	Belgium	Canada	Multinational - Europe	Thailand	U	U
Purpose	To describe and compare nursing care To demonstrate and analyse trends in nursing care To support nursing research To base policy on factual data	To bridge gap between variability of daily nursing practice and policy making To describe health status To allow for clinical nursing research To determine costs and effectiveness of nursing care To determine intensity of nursing care To determine hospital budgets and staffing	To deliver information about nursing care To demonstrate unique contribution of nurses to the health of Canadians	To determine feasibility of nursing data collection and comparison in Europe To make visible what nurses do To collect nursing data that have been documented with use of the ICNP	To project trends in nursing care To stimulate nursing research To influence health policy	To standardise the content of nursing handover across a large metropolitan health service	To meet patients' needs and values within the specific care context To provide safe, high-quality, integrated fundamental care
Terminology used	NANDA,[8] NIC,[9] Omaha, HHCC[10]	ADL[11] list (ICNP[12])	NANDA, NIC, Omaha	ICNP	ICD-9,[13] ICNP	U	ICNP, NANDA, NIC, NOC[14]
Population	All settings	General hospitals	All settings	All settings	All settings	General hospitals	All settings

[a]NMDS for the United States, Goossen et al. (1998).[13]
[b]NMDS for Belgium (Minimale Verpleegkundige Gegevens/Résumé Infirmier Minimum), Goossen et al. (1998).[13]
[c]NMDS for Canada (Health Information: Nursing Components), Goossen et al. (1998).[13]
[d]NMDS for Europe (TELENURSE & International Classification of Nursing Practice), Goossen et al. (1998).[13]
[e]NMDS for Thailand, Volrathongchai et al. (2003).[33]
[f]NMDS for general handovers (Nursing Handover Minimum Data Set), Johnson et al. (2012).[15]
[g]NMDS for nursing practice around the fundamentals of care, Muntlin Athlin (2018).[34]
Legend: ADL = Activities of Daily Living; HHCC = Home Health Care Classification; ICD-9 = International Classification of Diseases; ICNP = International Classification of Nursing Practice; NANDA = North American Nursing Diagnosis Association; NIC = Nursing Intervention Classification; NOC = Nursing Outcome Classification.

Nursing care elements (the *Activities of Daily Living)* and it held in great consideration *the Resources*, considered in terms of personnel. Among the items of the *Service elements: Agency and provider* category, the HI:NC reports multiple elements to identify the staff members who provide care (*Doctor identifier*, *Consultant identifier*, *Nurse identifier*, *Principal nurse provider*). In contrast, the Muntlin Athlin's NMDSs[34] for fundamentals care contains elements mainly pertaining to the categories of *Nursing problems/diagnosis*, *Nursing intervention* and *Nursing outcomes*; the *Clinical history* is also cited, while other categories are not reported. The NH-MDS[15] is the tool that lists multiple *Medical care items* and *Nursing care elements* that can be useful in clinical practice; among items belonging to the other categories, the *Estimated date of discharge* and *Bed number* emerged.

With the exception of the NMDS for nursing practice around the fundamentals of care,[34] all of the NMDSs reported elements of *Patient demographics*. Similarly, the same consideration can be applied to the *Episode* category, in which one or more elements regarding hospitalisation are reported: the most common found in five NMDSs (US NMDS, MVG/RIM, NI:NC, TELENURSE & ICNP and Thai NMDS)[13] are: *Admission date/episode/encounter date* and *Discharge date*. The elements listed in the *Other* category include those pertinent to the health service provision at the national level.

As reported in Table 4, the US-NMDS[2] is focussed on nursing care, its changes, and the possibilities of comparing nursing data: therefore, its report elements concerning the categories of *Patient demographics* and *Nursing care elements* are closely related to the provided care and some service aspects that complete patient care and exclude the *Medical care items*. The MVG/RIM[4] concentrates on the progression of research but focuses above all on determining the extent of nursing care, reporting more items in *Resources* to identify aspects concerning timing, financial resources and personnel.

The HI:NC[6] emphasises the nursing contribution to the health system, reporting elements that highlight what nurses do and the consequences that these actions have on patients (specifically *Nursing intervention* and *Client outcomes*); it also provides the identification of the caregiver.

The TELENURSE & ICNP's[36] focus on *Nursing problems/diagnosis*, *Nursing intervention* and *Nursing outcomes*, citing only items that are part of *Patient demographics* and *Episode*. It only mentions the *Type of institution*, thus putting minimal emphasis on the context. The Thai NMDS[33] includes items that are widespread not only among the *Nursing care elements* but also in all other categories in order to contextualise the care provided and to record those elements that could be useful in making managerial decisions. The NH-MDS[15] is aimed at standardising the nursing handovers within hospital settings and includes aspects of the *Medical care items* and the *Nursing care elements* commonly considered in daily care. Finally, the NMDS for fundamentals[34] aims to bring attention to the fundamental elements of care and patient values and has been included in the *Nursing care elements*.

Discussion

Reviews: Main characteristics and methodological quality

Eight syntheses of research evidence have been published on NMDSs to date. Different aims, study designs and methods have been used, from narrative to scoping reviews. Moreover, reviews have been conducted from 1995[13] to 2018,[34] suggesting that several primary studies have been published over these years. The critical appraisal of the reviews performed with the Checklist for Systematic Review and Research Syntheses[31] returned a variable set of findings with recommendations addressed in all studies. However, no reviews performed a critical appraisal of the primary studies

Table 4. Classification of items included in the nursing minimum data sets according to Goossen et al. (1998).[13]

Categories	Items of NMDS	US NMDS[a]	MVG/ RIM[b]	HI: NC[c]	TELENURSE & ICNP[d]	Thai NMDS[e]	NH-MDS[f]	NMDS for fundamentals[g]	Total items
Patient demographics		Y	Y	Y	Y	Y	Y		6
Medical care items	Medical diagnosis			Y		Y	Y		3
	International Classification of Diseases codes		Y						1
	Clinical history					Y	Y	Y	3
	Procedures			Y			Y		2
	Complications		Y						1
	Dates			Y			Y		2
	Dead/alive codes, resuscitation status			Y			Y		2
	Laboratory tests					Y			1
Nursing care elements	Nursing problems/diagnosis	Y			Y	Y	Y	Y	5
	Nursing intervention	Y	Y	Y	Y	Y	Y	Y	7
	Nursing outcomes	Y			Y	Y	Y	Y	5
	Intensity of nursing care	Y		Y					2
	Activities of Daily Living		Y					Y	2
	Discharge plan					Y	Y		2
	Goals of the shift						Y		1
	Client status			Y		Y	Y	Y	4
	Client outcomes			Y					1
	Care plan						Y		1
	Medical instruments use before discharge					Y			1

(continued)

Table 4. (continued)

Categories	Items of NMDS	US NMDS[a]	MVG/ RIM[b]	HI: NC[c]	TELENURSE & ICNP[d]	Thai NMDS[e]	NH-MDS[f]	NMDS for fundamentals[g]	Total items
Service elements: Agency and provider	Unique service or agency number	Y	Y						2
	Unique health record number	Y				Y			2
	Unique nurse identifier	Y							1
	Code specialty		Y						1
	Code ward		Y						1
	Number of beds		Y				Y		2
	Provincial/institution/chart no.			Y					1
	Doctor identifier			Y					1
	Consultant identifier			Y					1
	Nurse identifier			Y					1
	Principal nurse provider			Y					1
	Type of institution				Y				1
	Referral					Y			1
	Admission number					Y			1
Episode	Admission date/episode/ encounter date	Y	Y	Y	Y	Y			5
	Discharge date	Y	Y	Y	Y	Y			5
	Estimated date of discharge						Y		1
	Length of stay		Y	Y					2
	Day of stay		Y		Y				2
Resources	No. of nursing hours available		Y						1
	No. of nurses available		Y						1
	Qualification mix of nursing		Y						1
	Qualification mix		Y						1
Other	Disposition point	Y							1
	Expected payer of the bills	Y				Y			2
	Institution			Y					1
	Main point of service			Y					1

[a]NMDS for the United States, Goossen et al. (1998).[13]
[b]NMDS for Belgium (Minimale Verpleegkundige Gegevens/Résumé Infirmier Minimum), Goossen et al. (1998).[13]
[c]NMDS for Canada (Health Information: Nursing Components), Goossen et al. (1998).[13]
[d]NMDS for Europe (TELENURSE & International Classification of Nursing Practice), Goossen et al. (1998).[13]
[e]NMDS for Thailand, Volrathongchai et al. (2003).[33]
[f]NMDS for general handovers (Nursing Handover Minimum Data Set), Johnson et al. (2012).[15]
[g]NMDS for nursing practice around the fundamentals of care, Muntlin Athlin (2018).[34]
Legend: Y = item included in the NMDS.

included: reviews were conducted in different timeframes, and this might justify the lack of consideration of some aspects given that review methodology has changed over the years.[31] In terms of consistency, keywords used to retrieve the primary studies varied, suggesting the need to standardise the language in the field, which could be achieved, for example, by establishing a clear taxonomy.[5] However, according to its importance as capable to inform policies at the system (e.g. how to develop nursing electronic records), and at the nursing care levels (e.g. comparing outcomes) this research field require reviews with higher methodology.

Reviews: Recommendations

The eight reviews offered four types of recommendations—overall, clinical, research and management levels—that can be helpful in designing, validating, implementing, and disseminating the minimum data sets. First, all reviews recognised that the NMDS is a core element in the health sector because it provides access to reliable and comparable information about patients by collecting, processing and analysing data in a standard way. To achieve this goal, an NMDS should (a) be comprehensive and setting-specific[5]; (b) use a uniform terminology[13]; (c) be supported by proper information systems (e.g. computer)[15]; and (d) allow a sort of flexibility according to the possible variations across care plans.[13] Second, some reviews recommended that an NMDS should lead to the delivery of person-centred care service[7,34,35]: in this light, more emphasis should be undertaken to fully integrate the Fundamentals of Care Framework into available data sets,[37] thus allowing nursing care to become more visible and traceable. Third, research progress has been highlighted as a significant factor for a successful NMDS implementation. In our umbrella review, research insights might be summarised along two lines. On the one hand, some reviews suggested exploring the relationship between NMDSs and nursing sensitive outcomes in order to fill the gap specifically with regard to the contribution of nursing care towards patients.[15,35] On the other hand, more emphasis should be devoted to assess data comparability across different settings[13]: in other worlds, the availability of an overall NMDS capable of capturing all core elements of nursing care across settings will facilitate the continuity of care, the establishment of a common point of reference and the linkages with other health care datasets. Fourth, all reviews made the recommendation to consider the NMDS as supporting healthcare policy decisions. Moreover, at the managerial levels, strategies to promote nurse's preparedness in approaching the electronic NMDS were recommended,[33] suggesting that the work environment should be appropriately shaped. In this context, more emphasis on risk management issues should be given in the available NMDS, especially since only one study evaluated its implementation with regards to risk management (e.g. adverse events).[34]

NMDSs: Categories and items

Seven NMDSs have emerged, a number that can be considered limited given that the NMDS has been established since 1977.[4] However, we can assume that a large number of NMDSs have been established at hospitals and at the regional or country levels for practical purposes, but their degree of formalisation in primary or secondary studies have been limited. Every day, nurses devote a huge amount of time to documenting the care[38] in ad hoc prepared paper-and-pencil or electronic systems. Exploring these informal NMDSs with the intent to merge their features, as well as their advantages and disadvantages, might be useful. However, continuing to have different NMDSs mainly designed at the hospital levels prevents any form of measurement of the nursing care.[27,28]

The available NMDSs have been developed for different purposes, although all refer to support for nursing care, to make it visible and to increase the capacity of nurses to measure its impact on patients.[34] Moreover, NMDSs have also been established for internal purposes, such as increasing cultural awareness among nurses.[13,34] Therefore, they have been established to date mainly with a practical intent, and only a few of the NMDSs have been developed for research purposes,[13,33] such as to evaluate their effectiveness during handovers.[15] Non-standardised terminology is still present across the NMDSs, threatening any form of data comparison, probably because NMDSs have been established for practical purposes. Some NMDSs have been based on the NANDA, NIC and NOC classifications,[13] while others on the ICNP,[33] suggesting that international professional and scientific associations should debate this point.

With regard to the analysis of the correspondence between NMDS items and the categories identified by Goossen et al. (1998),[13] the NI:NC (the NMDS for Canada)[13] highly covered the categories, while the lowest was the NMDS for Fundamentals of Care.[34] On the one hand, the majority of tools neglected some aspects connected with service elements (e.g. number of beds) and resources (e.g. mix of nursing qualifications), mainly because these are not core elements of nursing care. On the other hand, the majority addressed elements of nursing care, such as activity of daily living and the nursing diagnosis. The categories defined by Goossen and colleagues (1998)[13] should be updated to be consistent with the needs of current patients, professionals and health care services. Moreover, some elements not strictly connected with nursing care that are not contained in the available NMDSs might be considered as elements of other linked datasets about nursing care with the aim of providing an efficient system. There is a need to develop a consistent NMDS system to ensure the support needed as main data sources of the available and that emerging EHRs technologies (e.g.[39,40]).

Limitations

This umbrella review has several limitations. First, we limited the search strategy to the major databases of the nursing discipline and some reviews may have been missed. Secondly, according to the research questions, we mapped the main aspects of the included reviews: the different methods used in conducting the reviews prevented a homogeneous extraction and synthesis of the data. Thirdly, the categorisation of the recommendations that emerged were performed by researchers and their professional background might have affected the process and the findings; moreover, the process of categorisation using the framework established by Goossen et al. (1998)[13] might have also influenced the findings. Furthermore, we have included all reviews without considering their methodological quality: with the advancements in the reporting guidelines and methods, future umbrella review should consider the methodological quality as an inclusion criterion.

Implications for practice

The overall findings of this umbrella review may have multiple implications:

- At a nursing care level, the identification of nursing minimum data categories and items as emerged, may provide a guideline on how these can be standardized both nationally and internationally and how this can inform and advance the quality of nursing practice and healthcare in general given the critical role that nursing plays in healthcare.
- At a hospital and managerial level, given the impulse to develop electronic records[39,40] also to save the extensive time required to fill in paper-and-pencil records, the emerged NMDS

categories and items might create the basis to progress in the digitalization of both nursing records and handovers.
- At a system level, the overall recommendations that emerged might support and address policies aimed at standardising languages, tools, and methods in the nursing field mainly through electronic resources and information technology.
- At a research and evaluation level, findings might help in implementing a minimum data set enabling easy comparison and benchmarking of the data, thus promoting both research and managerial decisions, for example regarding the evaluation of nursing sensitive outcomes and workloads.

Conclusions

Nurses have always recorded the care provided to patients to ensure the continuity of care, to assess the care and its effects on patients and to make their contributions visible. To date, documentation systems developed in each hospital with non-standardised language still prevail. Moreover, these systems are often based upon a paper-and-pencil approach and offer a lack of comparability of documented data, threatening both research and managerial decisions, for example, regarding the evaluation of nursing workloads.

In the context of the digitisation of care, we have critically analysed the available reviews to summarise the recommendations regarding the NMDs established to date and the elements included. Available reviews were produced from 1995 to 2018, thus revealing a continuing intent to summarise the available evidence produced by primary studies. A variability in the core elements of NMDSs as well as in the languages and in their purposes have emerged. NMDSs should be developed to not only improve the practice but also the capacity to undertake effective decisions at a clinical and managerial level. Researchers and professionals are called to establish at the worldwide level the core elements of a dataset in a standardised language. Moreover, there is a need to update the recommendations that emerged by continuing to analyse the reviews produced in the field an also establishing a periodic evaluation of their implementation.

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Supplemental Material

Supplemental material for this article is available online.

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