Impacts of structuring nursing records: a systematic review

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Aim: The study aims to describe the impacts of different data structuring methods used in nursing records or care plans. This systematic review examines what kinds of structuring methods have been evaluated and the effects of data structures on healthcare input, processes and outcomes in previous studies.

Materials and Methods: Retrieval from 15 databases yielded 143 papers. Based on Population (Participants), Intervention, Comparators, Outcomes elements and exclusion and inclusion criteria, the search produced 61 studies. A data extraction tool and analysis for empirical articles were used to classify the data referring to the study aim. Thirty-eight studies were included in the final analysis.

Findings: The study design most often used was a single measurement without any control. The studies were conducted mostly in secondary or tertiary care in institutional care contexts. The standards used in documentation were nursing classifications or the nursing process model in clinical use. The use of standardised nursing language (SNL) increased descriptions of nursing interventions and outcomes supporting daily care, and improving patient safety and information reuse.

Discussion: The nursing process model and classifications are used internationally as nursing data structures in nursing records and care plans. The use of SNL revealed various positive impacts. Unexpected outcomes were most often related to lack of resources.

Limitations: Indexing of SNL studies has not been consistent. That might cause bias in database retrieval, and important articles may be lacking. The study design of the studies analysed varied widely. Further, the time frame of papers was quite long, causing confusion in descriptions of nursing data structures.

Conclusion: The value of SNL is proven by its support of daily workflow, delivery of nursing care and data reuse. This facilitates continuity of care, thus contributing to patient safety. Nurses need more education and managerial support in order to be able to benefit from SNL.

Keywords: terminology as topic, classifications, documentation, patient care planning, nursing records, literature review.

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Introduction

The transfer from paper-based to electronic documentation has been slow worldwide, and despite advances in health information technology (HIT), nursing documentation in the delivery of care still seems to be commonly paper-based as internationally assessed (1, 2). Beyond and partly parallel to this transfer, the importance of structures and terminologies as well as coding schemas to be used in documentation has been stated. Nursing data are primarily needed in clinical settings; additionally, secondary use of data has become extensively important to be able to describe outcomes, quality or process factors in care (3–5). Advances in the meaningful use of data, highlighting the importance of fluent and safe exchange of data both for clinical and secondary purposes, have been the driving force for the recent development of electronic documentation. Without coding, clinical data cannot be exchanged in clinical settings or reused for secondary purposes, that is, administration and statistics (5, 6) (See Table 1, for abbreviations).

Over the years, there has been some concern about the usability of electronic information systems, for example user-friendliness and interoperability. Recently, usability

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Table 1 Abbreviations used in the text in an alphabetical order

Abbreviation	Total name of the abbreviation
CCC (HHCC)	Clinical Care Classification (formerly Home Health Care Classification)
EHR	Electronic health record
FinCC	Finnish Care Classification
HIT	Health information technology
ICF	International Classification of Functioning, Disability and Health
ICNP	International Classification for Nursing Practice
NANDA-I	NANDA International (formerly North American Nursing Diagnosis Association)
NIC	Nursing Interventions Classification
NMCDS	Nurse-Midwifery Clinical Data Set
NMDS	Nursing minimum data set
NOC	Nursing Outcomes Classification
PICO	Population (Participants), Intervention, Comparators, Outcomes
SNL	Standardised nursing language
VIPS	Well-being, integrity, prevention, safety (in Swedish: Välbefinnande, Integritet, Prevention, Säkerhet)

problems of the electronic health record (EHR) systems have often been connected to patient safety and quality of care (7). Further, much criticism has focused on lack of coordination between information flow and work processes. Present information systems do not support the documentation of information flow in practice, and this results in extra expenditure in hospitals (8, 9). Additionally, the increased quality of information processing after the introduction of a nursing information system, hardware and software problems, and increased documentation load have been reported (10). All this has both created anxiety and raised questions regarding the benefits of using electronic systems. However, it seems that structuring data leads to more comprehensive and multidisciplinary communication regarding patients' needs and more specific decisions about interventions (11, 12).

The American Nurses Association (2012) has recognised 12 nursing classifications to be used in nursing documentation in paper-based or electronic nursing records and care plans. There are classification systems that include nursing diagnoses and/or, interventions and/or outcomes. The NANDA-I (NANDA International, formerly North American Nursing Diagnosis Association) (13, 14) NANDA International 2012, the Nursing Interventions Classification (NIC) (15) and the Nursing Outcomes Classification (NOC) (16) are widely used classifications and have also been translated into various languages (2, 17). The International Classification of Functioning, Disability and Health (ICF) (18, 19) is the latest classification in the field and used mainly in describing nursing interventions in documentation (20). Clinical Care Classification [CCC, formerly Home Health Care Classification (HHCC)] (21–26), International

Classification for Nursing Practice (ICNP) (27) and the Omaha System (28) are internationally used nursing classifications containing several phases of the nursing process model and implemented in various types of settings where nursing care is provided (29). It has been argued that the relationships between various nursing classifications in the documentation should be evident in order to describe what kind of care the patient has received, for what needs and with what outcomes. Therefore, nursing diagnoses, nursing interventions and nursing outcomes should be linked to each other in EHR systems in order to be able to electronically track nurses' contributions to patient care and outcomes (3, 4, 30).

In Estonia, Denmark, Latvia, Norway and Sweden, the VIPS model (acronym from well-being, integrity, prevention, safety; in Swedish: Välbefinnande, Integritet, Prevention, Säkerhet) is in use both in primary and secondary care as well as in nursing homes; in Sweden, this is required by law to be used in nursing documentation (2, 20). The VIPS documentation model consists of keywords on two levels. On the primary level, the nursing process model includes the keywords nursing history, nursing status, nursing diagnosis, goal, nursing intervention, nursing outcome and nursing discharge note (31, 32). In Finland, along with the development of a national nursing documentation model, the nursing minimum data set (NMDS) was harmonised with the use of a standardised nursing classification Finnish Care Classification (FinCC), the translated and validated version of the CCC, to describe nursing diagnoses, interventions and outcomes (30, 33, 34). The discovery and sharing of new knowledge with NMDS as extracted from large databases are vital in managing the rising complexity of today's healthcare organisations (35).

Despite the use of standardised nursing language (SNL) internationally, previous studies verify that there exists a demand for HIT evaluation studies (36, 37). A vast number of literature reviews have been conducted on various topics referring to the standardisation of EHRs (17, 37–42). Häyrinen et al. (38) concluded that studies focusing on structuring and content of records are needed due to the challenge of semantic interoperability in ongoing national health record projects around the world. The review by Urquhart et al. (39) aimed to identify both beneficial and adverse effects of the use of different nursing record systems. Wang and her associates (2011) and Sweeney (2010) emphasised that nursing documentation can be improved by SNL. However, these reviews have not studied the impact of different ways of structuring nursing records, which is the aim of the current review. This paper presents the results of a systematic review of empirical studies that assess the impacts of different data structuring methods used in nursing records or care plans and an analysis of previous studies on the subject.

Aim

The aim of this study is to describe the impacts of different data structuring methods used in nursing records or care plans. The study investigates what kinds of structuring methods have been evaluated and what the effects of data structures on healthcare input, processes and outcomes in previous studies are. The following research question was stated: What are the effects of different data structuring methods in electronic nursing records? The ultimate aim is to provide an overview of potential data structuring methods in electronic nursing records.

Materials and methods

The methodology involved the cooperation of two research teams in 12 stages (Table 2). After the search problem was formulated and the analytical framework defined, the search strategy and databases were defined using Population (Participants), Intervention, Comparators, Outcomes (PICO) elements, which refers to defining the population (participants), intervention (or exposure for observational studies), comparators (main alternative interventions) and outcomes (43, 44) (see also Table 3).

A search with key words defined with the PICO method resulted in 743 studies. The search was conducted with the help of an informatician on 15 electronic databases including PubMed, Cinahl, Cochrane, ProQuest, Science Direct, a domestic database (Linda) and Web of Science. After deleting the duplicates, the final count was 680. The data were divided based on the focus on medical records and nursing records (45). The exclusion criteria for headings and abstracts are described in Fig. 1. Certain countries were excluded using the World Bank classification (46). Each abstract was read by two

Table 2 Methodology stages

Stage number	Stage name
1.	Formulation of the search problem and analytical framework
2.	Definition of the search strategy using PICO and selecting databases
3.	Testing and conducting the search strategy in each databases (?)
4.	Database retrieval and results downloaded in RefWorks
5.	Duplicate identification and elimination
6.	Update of search results from references in previous reviews
7.	Definition of exclusion and inclusion criteria
8.	Exclusion according to heading and/or abstracts (two independent reviewers + consensus round)
9.	Obtaining the full texts of the remaining articles, carrying out an inclusion round based on the full text (two independent reviewers + consensus round) and adding empirical references from previous reviews
10.	Information collection and reporting templates generation, testing and refinement on the basis of a sample of full texts
11.	Extraction of data from the articles with help of the data collection template and downsizing to reporting templates
12.	Generation of the review paper

PICO, Population (Participants), Intervention, Comparators, Outcomes.

independent reviewers, and discrepancies were solved through discussion; and if no solution was found, the articles were brought to the research team meeting. Regarding the intervention and outcomes criteria, abstracts and headings did not always provide adequate information for exclusion, so these articles were included for full text review. The inclusion criteria for full texts were the same as the exclusion criteria for the abstract,

Table 3 Exclusion criteria for abstracts and inclusion criteria for full texts

PICO	Exclusion criteria for abstracts	Inclusion criteria for full texts
General		Article is available
		Article is published in a journal
		Article is original (not double)
		Article is empirical research
		Article has an author
Population	Not upper middle and high income countries	Article is written in Finnish, Swedish or English
	Reporting language not Finnish, Swedish or English	Article is from upper middle or high income country
	Primary users not clinicians, nursing staff, patients, healthcare management or researchers	Article is studying structuring from viewpoint of clinicians or care teams or nurses
Intervention	Not focusing on EHR or nursing record structuring or use of structures in decision support	Intervention is about EHR or nursing record structure, which is described in the article
Comparison	No specific exclusion criteria, free text as search term	
Outcome	No evaluation of outcomes of implementation/exploitation of structures	Methods and results of assessing the intervention are described

EHR, electronic health record; PICO, Population (Participants), Intervention, Comparators, Outcomes.
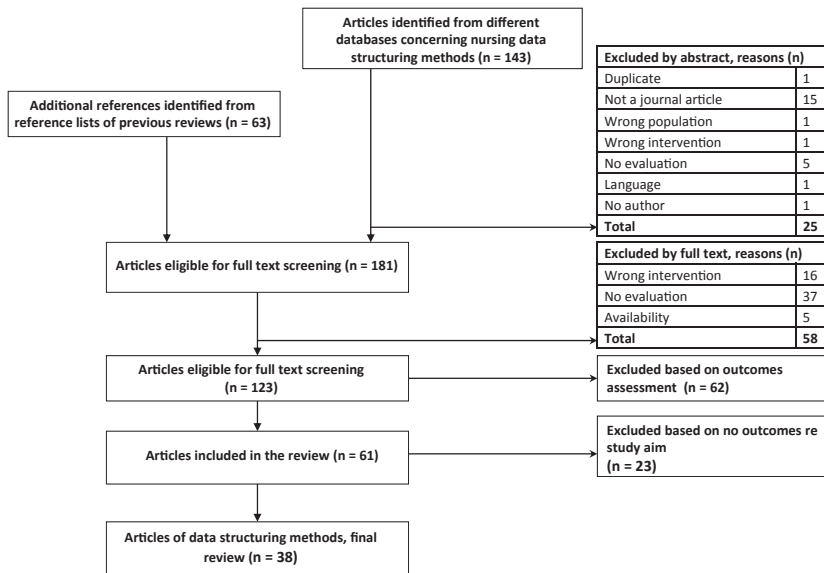
Figure 1 The search process and the final number of papers analysed.

but some generic criteria (e.g. requirements of journal publications) were added to comply with the repeatability requirement for systematic reviews. Table 3 depicts the exclusion and inclusion criteria.

The final number of papers focusing on nursing records or care plans was 143. The abstracts and/or full texts were read and assessed for quality by two independent researchers, with disagreements negotiated or solved in the team meeting if negotiation failed. Based on the exclusion criteria, 25 papers were eliminated. Additional empirical articles (n = 63) were selected from reference lists of previous reviews. Further, these papers were analysed and 62 excluded from a total of 123. The remaining full texts were read again by two independent researchers. Reviews (n = 7) were excluded from analysis; these reviews form part of a methods article (45). Studies focusing on administrative, statistical and financial issues (n = 13) were grouped together to be analysed and reported later. Based on the inclusion criteria, the number of studies to be analysed in the first stage was 61. These studies focused on evaluation of structures from the clinical nursing point of view. After final analysis, 23 studies were excluded as they did not quantify any outcomes of structuring methods (47–69) (Fig. 1).

The data extraction tool previously created for the analysis of the articles (45) was used also for the analysis of nursing articles. The analytic framework contained different aspects of interventions, that is, nursing data structures and their potential impacts on healthcare input, process and outcome factors. The key concepts for healthcare input were information and structural quality; for process factors, they were usability, technology use, acceptance and system quality. For healthcare outcomes, the key concepts were productivity, process impacts, cost efficiency, patient safety and secondary impacts. The

framework was used to generate a synthesis of results found in the studies in a meaningful way (45, 70). The analysis was made by the present authors – each paper was assessed by two authors independently. The empirical articles were classified based on their content: intervention focus and phase, structures used in documentation, care level, context, specialty, study methods and results. Descriptive statistics was used in the analyses, and the results are presented with summary tables describing the structuring methods and impacts associated with nursing data structures.

Results

Description of the data

The search revealed 61 empirical studies for further analysis. The studies were conducted in 16 countries with the majority of the studies (n = 36) being in the USA (n = 21) and Sweden (n = 15). The rest (n = 25) were conducted in 14 countries, the number in each varying between one to four studies. The studies were published between the years 1989 and 2010 in 25 journals and one proceedings issue. Twelve papers were published in Journal of Clinical Nursing; Scandinavian Journal of Caring Sciences (n = 9) and Computers, Informatics, Nursing (n = 8) also ranked high as publishers of articles selected.

The studies were conducted in secondary or tertiary care (n = 37), primary care (n = 17) and once on both care levels. In six cases, the care level could not be specified. In most cases (n = 49), the context was institutional care, that is, hospitals or departments; in four cases, ambulatory care; and in five cases, residential or home care facilities. SNL was mostly used in clinical settings (n = 39); in 19 articles, it was in the testing or piloting

Study setting *	Secondary or tertiary care (n = 37), primary care (n = 17), secondary or tertiary care, and primary care (n = 1), not specified (n = 6)
Study context *	Institutional care, hospitals, departments (n = 49), ambulatory care (n = 4),residential or home care (n = 5), institutional and ambulatory care (n = 1), institutional, ambulatory and home care (n = 1), not specified (n = 1)
Intervention phase *	Lab.testing (n = 2), testing in clinical environment (pilot) (n = 19), in practice (clinical trial, system has been in use) (n = 39), not specified (n = 1)
Original country *	USA (n = 21), Sweden (n = 15),Norway (n = 4), South-Korea (n = 3), Switzerland (n = 3), Denmark (n = 2), Iceland (n = 2), South-Africa (n = 2),Taiwan (n = 2), Austria (n = 1), Canada (n = 1), Finland (n = 1), France (n = 1), Germany (n = 1), Netherlands (n = 1), United Kingdom (n = 1)
Published in journal *	Journal of Clinical Nursing (n = 12), Scandinavian Journal of Caring Sciences (n = 9), CIN: Computers, Informatics, Nursing (n = 8), Journal of Advanced Nursing (n = 4), Journal of the American Medical Informatics Association (n = 3), Journal of Nursing Measurement (n = 3), Curationis (n = 2), International Journal of Medical Informatics (n = 2), International Journal of Nursing Terminologies and Classifications (n = 2), and 15 other journals and one proceeding book, one article published in each

*Amount of studies in brackets

Figure 2 Summary of analysed articles (n = 61).

phase in a clinical environment, and in two articles, it was in laboratory testing. The medical specialty where the studies were conducted varied widely, and in many cases, the specialty was not mentioned at all or it was unclearly stated (n = 26). However, fields such as cardiology, geriatrics, oncology, gynaecology, medical-surgical, neurology and public health were covered. Figure 2 describes the summary of the articles analysed.

The designs used in the studies varied. The design used most often was a single measurement without any control (n = 20); however, in 18 cases, randomised or control trials were used. In 14 cases, pretest and post-test measurements were used; in six cases, time series were used. In nine cases, the design was a case study. Some studies used multiple methods. The study design was most often a follow-up evaluation measuring the effects of intervention. In time series studies, the time periods varied from 4 weeks to 2 or 3 years. The follow-up measures in before–after designs were carried out from 3 months to 3 or 4 years after intervention.

Data structuring methods in the studies

The structuring methods most often used in the studies were various codes, classifications, terminologies or structured forms (n = 38). Besides these or independently, the nursing process model was used in 64% of the analysed articles (n = 61). In 23 cases, the use was not mentioned or could not be recognised. The process model most often involved seven phases (15 cases). In two cases, it had six phases; in seven cases, five phases; in 10 cases, four phases; and finally in five cases, three phases. In some articles, the phases were not accurately defined. Based on the VIPS model's keywords, VIPS model articles were categorised with seven phases in the nursing process (31, 32).

In those studies (n = 38) where different classifications, terminologies and standardisation methods were used, the classification or terminology most often used was VIPS (n = 14). Other classifications used in different studies were NIC (n = 12), NOC (n = 10), NANDA-I (n = 8), ICNP (n = 4), Omaha System (n = 2), CCC (n = 1), NMDS (n = 1) and Nurse-Midwifery Clinical Data Set (NMCDS) (n = 1). The use of the classification mentioned was international, except in one case. The data source in those studies (n = 38) was most often registry data (n = 31). Questionnaires (n = 7), focus group discussions (n = 1) and observation (n = 1) were also used in data collection. Also some studies used mixed methods or measurement instruments. The information source was patient charts (n = 31); the informants were professionals (n = 9) and patients or children (n = 3). A few studies (n = 5) had several informants (See also Tables 4–6).

The effects of data structures in previous studies

The effects of data structures on nursing records or care plans are presented with the evaluation framework assessing the healthcare input, process and outcomes factors. Table 4 describes the effects of VIPS data structures in nursing documentation. The terminology has been used in 14 studies published between 1999 and 2009. Most of the studies (n = 11) had findings related to information quality. Usability and system quality (n = 6) were quite often the result of healthcare inputs. Patient safety was mentioned in five studies. Secondary impacts of data structuring were, for example, implications for education, leadership, practice and research, and the support of information exchange between nurses facilitating care continuity and coordination (Table 4).

The effects of ICNP, Omaha System, CCC and NMDS as data structuring methods are presented in Table 5. Studies (n = 8) of these classifications have been published (1991–2009). The classification most often used was ICNP (n = 4); the others were used only once or twice. Information quality, usability and system quality were the key findings in these studies. Clinical process impact, for example facilitation of workflow and work processes, was also mentioned as a study result (Table 5).

The effects of N̲ANDA, N̲IC and N̲OC (NNN) as data structuring methods are presented in Table 6. Studies (n = 16) of these classifications have been published in 2002–2009. The NIC classification was used most often (n = 11) in the previous studies. The NOC classification was used almost as often (n = 10). The combination of all three classifications (NNN) was used in five studies. Most (n = 12) of these studies had findings of information quality. Clinical process impacts, for example increase in knowledge about how to help patients or

Table 4 Effects on healthcare inputs, processes and outcomes of VIPS data structuring methods

| Reference (n = 14), pub. year and country of origin | Data collection methods | Informants, data amount (n) | | Measured impacts: effects on healthcare inputs, on processes and on outcomes | Key conclusions (citations from the studies) |
		Nursing records (n)	Nurses (n)		
Björvell et al. (2002) Sweden (71)	Registry data	270		Information quality	Comprehensive intervention of nursing documentation based on VIPS model and including organisational support may significantly improve the quality of nursing documentation in acute care
Darmer et al. (2006) Denmark (72)	Registry data	600		Information quality	Significant improvements in the quality of nursing documentation. Context of supervision had positive impact on outcome. Keywords meaningful to nurses. Increase in information reuse. VIPS model facilitated understanding of organisation of data and analytical thinking
Ehrenberg & Ehnfors (1999) Sweden (73)	Registry data	120		Information quality, usability and system quality	Changes in record contents in study group. Number of notes on nursing history more than doubled. Occurrence of recording of nursing diagnoses, goals and discharge notes increased. Comprehensiveness of documentation of single patient problems only slightly improved in study group. Changing documentation practice involves changes in attitudes and routines. Difficulties in categorisation of some units of analysis were mainly due to the unspecific description in records. Records not corresponded to requirements of law
Ehrenberg & Birgersson (2003) Sweden (74)	Registry data	100		Information quality, usability and system quality	Deficiencies in nursing documentation of signs and symptoms of relevance for leg ulcer care. Record content did not correspond well to knowledge base that was available in the care guidelines. Clinical guidelines for leg ulcers had a low impact on nurses' documentation practice
Darmer et al. (2004) Denmark (75)	Questionnaire		117	Information quality, usability and system quality, patient safety, secondary impacts	Positive impact on nursing documentation; VIPS model increased nurses' understanding of the nursing process. Implications for education, leadership, practice and research. VIPS model reintroduced the nursing process
Hellesø (2006) Norway (76)	Registry data	66		Information quality, clinical process impacts, secondary impacts	Completion of almost all the common mandatory fields increased when nurses started using the EPR. Use of document-specific templates in EPR enables the nurses to increase the level of detail and the focus of their messages to the nurses in home health care. Use of appropriate templates developed for communication of individualised patient information between nurses facilitates the interorganisational continuity of care for patients who need posthospital nursing care
Törnvall et al. (2009) Sweden (77)	Registry data Questionnaire	194	209	Information quality, clinical process impacts, patient safety, secondary impacts	Recording wound care in a standardised fashion; advanced nursing documentation meeting legal demands gave a more comprehensive view of the patient, as a human being rather than a sufferer from a wound. Discrepancy between the nurses' stated knowledge and their performance of documentation
Bergh et al. (2007) Sweden (78)	Registry data	265		Information quality, secondary impacts	Documentation of pedagogical activities in patient records is sporadic and inadequate and does not follow the steps prescribed by the nursing process. Need for nurses and nursing students to be educated in order to develop their documentation skills in relation to pedagogical matters

Table 4 (Continued)

Reference (n = 14), pub. year and country of origin	Data collection methods	Informants, data amount (n)		Measured impacts: effects on healthcare inputs, on processes and on outcomes	Key conclusions (citations from the studies)
		Nursing records (n)	Nurses (n)		
Gunningberg et al. (2009) Sweden (79)	Registry data	130		Information quality, technology use	Significant improvements in documentation of pressure ulcer grade, size and risk assessment, nursing diagnosis, nursing goals and nursing interventions. Comprehensiveness still lacking, restricting ability to get an overview of the pressure ulcer care process and preformulated templates only partly used to guide recording
Nilsson & Willman (2000) Sweden (80)	Registry data	515		Information quality, patient safety	Statistically significant improvement in documentation after intervention. It is recommended that the audit tool Cat-ch-ing be used and that methods for examination of the content of the documentation be developed
Rykkje (2009) Norway (81)	Registry data	120		Information quality, technology availability, patient safety	More systematic and standardised documentation when using VIPS model. Documentation of the nursing process in VIPS model, especially nursing care plans, was inadequate. Nurses need further education in VIPS to learn how to use it fully. EPR needs enhanced adaptation to fulfil nursing documentation requirements
Björvell et al. (2003) Sweden (82)	Questionnaire		377	Usability and system quality, clinical process impacts, patient safety	Documentation per se was considered of value to nurses in their daily professional work and for increasing of patient safety. VIPS model was perceived to be beneficial as a tool for documentation in RNs' daily work
Björvell et al. (2003) Sweden (83)	Focus group discussions		20	Usability and system quality, clinical process impacts	Structured way of documenting nursing care made them think more and differently about their work with patients. Structured model for documentation with headings for specific nursing content may initiate a change of role for the RNs from a medical technical focus to a more nursing expertise orientation
Törnvall et al. (2004) Sweden (84)	Registry data Questionnaire	41	154	Usability and system quality, technology use	Nurses found several advantages of structured documentation. Need for support and education of nurses, to strengthen their nursing identity and the value of a wider use of documentation

clients, how to select the proper nursing interventions and how to document patient care, were mentioned in nine studies. Usability and system quality was a finding in seven studies. Effects on outcomes such as productivity, time-savings, cost efficiency and quality of service were mentioned once each (Table 6).

Summary of the impacts of nursing data structures

The impacts were classified as positive or unexpected and as affecting healthcare inputs, process or outcomes.

The positive impacts of data structures on healthcare inputs were significant: significantly better described interventions and defined nursing care outcomes than reported in earlier studies, comprehensive nursing process documentation, fulfilment of legal demands and use and availability of technology. The unexpected impacts were parallel use of paper-based and electronic records, staff's support and educational needs, inadequate nursing process documentation and lack of resources.

The positive impacts of nursing data structures on the effects on processes were audit support, support to practise, continuity of care, care collaboration and information reuse. On the other hand, the unexpected impacts involved lack of resources, for example time to benefit from computerised records and negative attitudes due to lack of managerial support.

The positive impacts of data structures on the effects on outcomes were improved patient safety, increased outcome assessment and secondary impacts, for example research initiatives, management support and education programmes. The unexpected impacts were linked to an unclear or missing outcome description.

Table 5 Effects on healthcare inputs, processes and outcomes of ICNP, Omaha System, CCC and NMCDS data structuring methods

Reference (n = 8), pub. year and country of origin	Terminology	Data collection methods	Informants, data amount (n)		Measured impacts: effects on healthcare inputs, on processes, and on outcomes	Key conclusions (citations from the reviews)
			Nursing records (n)	Nurses (n)		
Greener (1991) USA (85)	NMCDS	Registry data	709		Information quality usability and system quality	No significant differences in client past histories, but differences in processes of midwifery management. NMCDS allowed detailed data of outcomes of midwifery management. NMCDS is a uniform, standardised and valid tool for data collection about midwifery clinical practice
Örlygsdóttir (2007) Iceland (86)	Omaha System and NMDS	Registry data	74		Information quality, usability and system quality	The nursing care profile, including all nursing care NMDS elements (nursing diagnoses, interventions and outcomes), available to answer research questions, nurses documented Omaha problems, interventions and outcomes comprehensively
Cho & Park (2006) Seoul, Korea (87)	Mapping NDD vs. ICNP	Registry data	2262		Information quality usability and system quality, clinical process impacts	ICNP-based NDD could cover more than 75% of nursing expressions in real EMRs. Such an approach allows more aggregated level data to be derived from the acquisition and analysis of low-level nursing data
Cho & Park (2003) Seoul, Korea (88)	Mapping narrative nursing notes vs. ICNP	Registry data	120		Information quality usability and system quality, clinical process impacts, technology availability, productivity, time saved, secondary impacts	Computerisation of narrative nursing notes is feasible when using a concept-based nursing terminology such as the ICNP. The ICNP browser is also designed so that users can access it and it can be managed via the Internet. The server could therefore be used for the widespread dissemination of the ICNP and education of nurses about the ICNP
Kim & Park (2005) Seoul, Korea (89)	Mapping narrative nursing notes vs. ICNP	Registry data Questionnaire	46	27	Information quality usability and system quality, clinical process impacts, technology availability, acceptance and use, productivity, time saved, cost efficiency	Lack of time barrier to the evaluation and documentation of nursing outcomes. Nurses documented nursing outcomes well in pain control. Nurses agreed that they documented nursing assessments, actions and outcomes in education and emotional care poorly, even though they considered these areas important

Table 5 (Continued)

Reference (n = 8), pub. year and country of origin	Terminology	Data collection methods	Informants, data amount (n)		Measured impacts: effects on healthcare inputs, on processes, and on outcomes	Key conclusions (citations from the reviews)
			Nursing records (n)	Nurses (n)		
Feeg et al. (2008) USA (90)	CCC in database vs. type in text[a]	Registry data	28		Information quality usability and system quality, technology acceptance	Data-based PC application is effective in recording nursing care planning information using the nursing process and capturing patient care information with a language ready for integration with other patient electronic medical record data. Nursing students could efficiently learn how to use an electronic documentation system with a standard terminology to improve patient care plans. Students verbalised and wrote comments about its ease of use and efficiency
Hannah et al. (2009) Canada (91)	Mapping ICNP vs. C-HOBIC	Registry data	Not mentioned		Information quality, clinical process impacts, technology use	C-HOBIC assessment measurements, data and outcomes do not comprehensively cover all aspects of nursing care. The C-HOBIC assessment instruments provide nurses with a standardised way of recording what they do. Consistent use of standardised assessment instruments by nurses, with the resulting feedback about patient outcomes, fosters nursing use of EHRs
Bowles (2000) USA (92)	Omaha System	Registry data	30		Clinical process impacts	Omaha System useful for possible expansion into acute care as a way to standardise communication between hospital setting and home care

CCC, Clinical Care Classification; C-HOBIC, Program for the Canadian Health Outcomes for Better Information and Care; EHR, electronic health record; ICNP, International Classification for Nursing Practice; NMDS, Nursing Minimum Data Set; NMCDS, Nurse-Midwifery Clinical Data Set; NDD, Nursing Data Dictionary.
[a]An electronic charting simulation laboratory testing.

A summary of the positive and unexpected impacts associated with different nursing data structures are presented in Table 7.

Discussion

Discussion of the results

The aim of this review was to describe the impacts of different data structuring methods used in nursing records or care plans. The analytic framework (45) was used to generate a synthesis of the results found in previous studies. To strengthen the quality of this systematic review, the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) guidelines have been used (109). Search strategy and databases were defined using PICO elements, which also helped to formulate the exact research question (43, 44). The assessment of the studies included was partly based on predetermined exclusion and inclusion criteria.

Table 6 Effects on healthcare inputs, processes and outcomes of NNN data structuring methods

Reference (n = 16), publication year and country of origin	Terminology	Data collection methods	Informants, data amount (n)			Measured impacts: effects on healthcare inputs, on processes, and on outcomes	Key conclusions (citations from the reviews)
			Nursing records(n)	Nurses (n)	Patients (n)		
Smith et al. (2005) USA (93)	NIC NOC	Registry data Questionnaire Observation	141	46	82 nurses for 2-hour time periods	Information quality	Significant decrease in attitude scores postcomputerisation, no significant change in time spent charting and significant improvement in the quality of nursing documentation. Additional education required
Burkhart & Androwich (2004) USA (94)	Mapping NIC vs. free text	Registry data	170			Information quality, usability and system quality	NIC might be a superior method of documenting spiritual care compared to narrative reports. If using NIC, the documentation could clearly and concisely describe the nursing care because the NIC is based on an intervention concept and is standardised
Thoroddsen (2005) Iceland (95)	NIC	Questionnaire		198		Information quality, usability and system quality	NIC fulfils criteria of describing nursing and what it is nurses do. Potential feasibility of using NIC to document nursing care in a NIS
Larrabee et al. (2001) USA (96)	NANDANIC	Registry data	270			Information quality, usability and system quality, technology availability	Improvements in documentation not seen in first 6 months, but after re-education there were significant improvements. Data validity is a prerequisite to using patient record data to investigate the influence of nursing care quality on patient outcomes. Evaluation of documentation completeness before and after implementation is important
Klehr et al. (2009) USA (97)	NANDANIC NOC	Registry data	Not mentioned			Information quality, usability and system quality, clinical process impacts, technology availability, acceptance and use, productivity, cost efficiency	Collaboration with nurses and IT-personnel (including 2 nurse informaticists) made implementation of the project a success and so did administrative support. New workflow and documenting at first time-consuming. Education and paying attention to end-users important
Lunney et al. (2004) USA (98)	NANDANIC NOC[a]	The instrument to measure nurses' ability[b] Health measurement[c]		12 school nurses	220 school children	Information quality, usability and system quality, clinical process impacts, technology availability, acceptance and use	Nurses' ability to help children with their health may increase significantly with the use of standard terms in electronic health records: children's health outcomes were the same or improved. Documentation patterns of nurses were inconsistent in each group. Too difficult for nurses to use both paper-based and computer-based records; so computers were not used often enough to expect changes in thinking and actions

Table 6 (Continued)

Reference (n = 16), publication year and country of origin	Terminology	Data collection methods	Informants, data amount (n)			Measured impacts: effects on healthcare inputs, on processes, and on outcomes	Key conclusions (citations from the reviews)
			Nursing records(n)	Nurses (n)	Patients (n)		
Daly et al. (2002) USA (99)	NANDA and NIC vs. free text	Registry data	20			Information quality, clinical process impacts	Computer care plans yielded more nursing interventions and activities, care plans more thorough than hand-written care plans. Handwritten plans not as comprehensive as computer care plans, but it took less time to write them. Neither has impact on patient outcomes
Müller-Staub (2009) Switzerland (100)	NANDANIC NOC	Registry data	444			Information quality, clinical process impacts, patient safety	High-quality nursing diagnosis documentation and aetiology-specific nursing interventions were related to significant improvements in patient outcomes documentation
Müller-Staub et al. (2008) Switzerland (101)	NANDANIC NOC	Registry data	225			Information quality, clinical process impacts, technology use	Statistically significant quality improvement in nursing documentation; NNN provides a knowledge base and standardised language for clinical nurses to state nursing diagnoses, select nursing interventions and plan and attain favourable patient outcomes
Müller-Staub et al. (2007) Switzerland (102)	NANDANIC NOC	Registry data	72			Information quality, clinical process impacts, patient safety	Significant improvement in formulating nursing diagnostic labels, in identifying signs/symptoms and correct aetiologies. Significant increase in naming and planning concrete, clearly named nursing interventions, showing what intervention will be done, how, how often and who does the intervention
Thoroddsen & Ehnfors (2007) Iceland (103)	NANDANIC and FHP[d]	Registry data	704			Information quality, secondary impacts	Statistically significant improvements. Increased documentation of nursing diagnoses and interventions in structured and standardised format. No data on measurable outcomes was found
Figoski & Downey (2006) USA (104)	NIC	Registry data	Not mentioned			Information quality, clinical process impacts, secondary impacts, productivity, time saved	Significant improvement in documentation. Nurses understand how to quickly and accurately document, and then use that documentation to place a value on the visit
Keenan et al. (2003) USA (105)	NOC	Registry data	319			Information quality, clinical process impacts, secondary impacts, technology acceptance, quality of service	Validity of the NOC was also reinforced. NOC measures clinically adequate for measuring outcomes in NP settings

Table 6 (Continued)

Reference (n = 16), publication year and country of origin	Terminology	Data collection methods	Informants, data amount (n)			Measured impacts: effects on healthcare inputs, on processes, and on outcomes	Key conclusions (citations from the reviews)
			Nursing records(n)	Nurses (n)	Patients (n)		
Maas et al. (2003) USA (106)	NOC	Registry data	2333			Usability and system quality, clinical process impacts	Easy-to-use, thorough teaching and educating of nurses and regular auditing of terminology use is important. Nurses rate most outcomes with a high degree of agreement and provide evidence of the validity of the majority of outcomes
Keenan et al. (2003) USA (107)	NOC	Registry data	258			Usability and system quality	NOC can be used in home care practice for many NOC measures. Still, efforts are needed to strengthen the reliability of those NOCs for which inter-rater reliability was low
Moorhead et al. (2003) USA (108)	NOC	Scale measurement, to measure change in patient status after nursing interventions			354	Usability and system quality	NOC outcomes able to capture change in patient status for the participants in this research in both positive and negative directions based on the patient's response to nursing interventions

NIC, Nursing Interventions Classification; NOC, Nursing Outcomes Classification.

[a]One group of nurses used SNAP Health Center (SNAP 98)41 software with vendor-developed standard terms (Group A); the other group used SNAP 98 software with both the vendor-developed standard terms and NNN (Group B). The SNAP program is designed for nurses to record visits to the school health office and includes all data for the child's health record.

[b]The instrument to measure nurses' ability was Barrett's Power as Knowing Participation in Change Tool, Version Two (PKPCT, V-II).

[c]The instruments used to measure children's health outcomes were the Child Health Self-Concept Scale, the Schoolagers' Coping Strategies Inventory, and How Often Do You. Health self-concept (HSC) was measured by the Child Health Self-Concept Scale. Coping was measured using the Schoolagers' Coping Strategies Inventory (SCSI). Health behaviours were measured by the How Often Do You (HODY) instrument.

[d]Predefined semi-structured nursing assessments according to the functional health patterns (FHP).

Table 7 Summary of impacts associated with different nursing data structures

Key conclusion categories			
Impact category	Quality of impact	Resulting impacts	References
Effects on healthcare inputs	Positive impacts	Described interventions and defined outcomes	(71–73, 76, 79, 80, 84, 87, 89, 91, 93–96, 100–105, 107)
		Comprehensive nursing process documentation	(75, 81–83, 85, 86, 99)
		Fulfilled legal demands	(77)
		Technology acceptance and availability	(88, 90, 93)
	Unexpected impacts	Parallel use of paper-based and electronic records	(98, 99)
		Inadequate nursing process	(73, 74, 77–79, 81, 85, 86)
		Lack of resources, for example managerial support and education	(73, 78, 81, 84, 89, 96)
Effects on processes	Positive impacts	Audit supports	(96, 106)
		Support to practise	(79, 82–84, 90, 91, 95, 98, 99, 101, 102, 104, 106, 108)
		Continuity of care	(76, 92)
		Care collaboration	(97)
		Information reuse	(72, 88)
	Unexpected impacts	Lack of resources, for example time	(89, 93, 97)
		Negative attitudes because of lack of support	(73)
Effects on outcomes	Positive impacts	Patient safety	(75, 77, 80–82, 100, 102, 104)
		Outcome assessment	(98, 100, 105, 107)
		Secondary impacts, for example research, management, education	(75, 88)
	Unexpected impacts	Care outcomes unclear or missing	(103)

The nursing process model recognised by the WHO has been widely used for documentation over the decades and still serves as a basic structure to record patient care in various settings. The model has been useful from the planning, delivering, monitoring and assessing perspectives in the paper-based and the later electronic formats. Over the years, the model has involved between four to six phases: assessment, diagnosis, goal setting, planning, intervention and outcome assessment (37, 110, 111). In this review, the nursing process model was used in 39 out of 61 studies. The process comprised three to seven phases. There was also some concern that the process was not adequately used in documentation despite the many decades it has been available to implement (73, 74, 77–79, 81, 85, 86).

The development of nursing language to be used in documentation has evolved through research since the 1980s (3, 4). This review also provides evidence that the analysed studies also focused on SNL developments. However, despite advances in terminology developments, the adoption of SNL still remains sporadic also on the international front (2, 39). Nursing classifications have been developed to describe the nursing process, to document nursing care and to facilitate aggregation of data for comparisons at the local, regional, national and international levels (2, 4, 112). This review revealed that the development of SNL is seldom local or even national; most often, SNL involved international aspects.

In many countries, cross-mapping has led to the building up of a reference terminology or SNL unification (6). In English-speaking countries, SNOMED CT (113) has been used for cross-mapping purposes. From nursing classifications, at least NANDA-I, CCC (formerly HHCC) and ICNP have been cross-mapped with SNOMED (114, 115). ICNP has also been regarded as a reference terminology, and some nursing classifications have been cross-mapped with it, for example CCC, NANDA-I, Omaha System and NIC (116, 117). Translation and cultural validations are required for the worldwide use of terminologies. It is an extra endeavour for nurses to be able to use SNL in non-English-speaking countries as most of these classifications originate from the USA (2, 95).

The results highlight that SNL supports the delivery of daily care in various ways. Nursing interventions are more accurately described and outcomes of care defined (71–73, 76, 79, 80, 84, 87, 89, 91, 93–95, 100–105, 107). This study supports, albeit slightly, recently discussed technology aspects such as usability. The results indicate that nurses accept computerised tools and appreciate the availability of electronic data (72, 88, 90, 93).

However, there still exist negative attitudes towards electronic documentation and the need for support and education (73, 81, 84, 89). These findings were mostly classified as unexpected impacts of nursing data structures, and they were discovered in connection with education. Nurses were also confused when they had to use parallel systems, paper and electronic records (98, 99). As Kelley et al. (41) concluded, understanding the communication patterns on paper before converting to electronic documentation would be ideal in order to address potential obstacles for efficient information exchange following implementation of electronic nursing documentation.

Historically, there has been a long-standing discussion in nursing practice whether a standard format, for example use of a checklist, would be useful for documentation instead of free text notes. Obviously, a checklist would make the collection of information easier, but it does not promote a system that stimulates thought, creativity and response to individual patient and staff needs. In this review, nursing data structures had positive impacts on comprehensive nursing process documentation (75, 81–83, 85, 86, 99). There have also been critical comments concerning the use of classifications, emphasising that strictly defined hierarchical classifications often serve organisational and administrative needs more than patients and their needs. Nevertheless, nursing classification systems are used directly by nurses during the course of care to record diagnoses, interventions and outcomes (4, 112, 118). Beyond the many benefits, the use of a nursing classification provides for patient care, the most important today is data reuse (5, 119). This was also the positive impact of some studies (e.g. 72, 75, 88).

The use of resources, for example time in electronic documentation, has been of interest in previous studies (e.g. 120, 121). In this review, handwritten care plans were not as comprehensive as computerised care plans, but they required less time to prepare (99). Also at times opposite opinions were presented (89, 97), or no evidence of time efficiency (90, 93) was shown. When nurses, after education, understood how rigorous the documentation system was, they started to value both their own and multiprofessional documentation (104). The use of SNL had positive impacts also on internurse communication (97), continuity of care (76, 92), legal demands (77) and increase in nurses' knowledge (77). These impacts have also been found in previous studies (11, 12). Further, auditing the documentation model applied for practice had a positive impact on the use of SNL. An auditing tool has been developed, especially to assess the VIPS model in documentation (72, 80, 81).

The findings also revealed secondary impacts of the use of SNL based on the analytic framework. These impacts focused on research activities, supportive leadership and continuous education (75, 88). Education was regarded as the key component in the successful use of SNL in various studies (73, 77, 78, 81, 84).

Limitations of the study

This review followed a protocol including 12 stages in order to strengthen the validity and reliability of the study. However, some critical decisions need to be discussed. Frequently, and also in this review, search terms pose a problem as the terms used in indexing literature vary between databases. Further, the search terms used for information retrieval in the databases were problematic because nursing documentation as the umbrella concept was difficult to operationalise using keywords. Thus, some bias in search methodology may exist, and some important and relevant articles may have been missed. The bias in the original search is proven by the relatively large number of new papers when screening the reference lists of review papers. To confirm the review process and the validity of the findings, the reviewers read the articles several times. Each study was read and assessed by two reviewers individually, and in case there was some disagreement, the team was consulted. The team also focused on describing the search process accurately so that this review can be updated.

Previous reviews have also criticised the quality of the studies (e.g. Urquhart et al. 39). In this review, the study designs varied widely, and there were many descriptive studies with a single measurement. However, more rigorous methods such as randomised trials and pretest and post-test measures were also used.

The time frame of the papers analysed (1989–2010) also caused some confusion in the descriptions of the structures used in the studies. The review focused on studies where both paper-based documentation and electronic documentation were involved. There was also some uncertainty concerning the use of the nursing process model. Although it has been used for decades, it was not clearly stated how many phases the study comprises. Surprisingly, 23 studies had to be excluded as they did not assess nursing data structures at all.

The framework used for both data extraction and analysis proved to be flexible. However, it was not always clear whether the study focused on healthcare inputs, process or outcome factors. Thus, the analysis was very demanding, and while the reviewers worked independently, there was much discussion between the reviewer pairs. The team also discussed the findings thoroughly when analysing and summarising the results and categorising them as positive and unexpected impacts. The decision was made based on the studies assessed and how the original aims and objectives were described in those studies.

The settings and contexts where the studies were conducted varied widely, and based on the analysis, a

comprehensive sample of healthcare settings was represented in the studies. The studies also described the status of SNL use in documentation internationally. In all, 16 countries were included in the analysis. However, some countries had only one study included. In most of the interventions, SNL was in use in nursing practice; however, a great number of studies reported about testing classifications in the clinical environment. Thus, what has happened after the piloting remains unclear.

Conclusion

Nurses use classification systems to record nursing diagnoses, interventions and outcomes. The value of SNL is proven by its support to daily workflow, delivery of nursing care and especially to data reuse. It facilitates fluent and uniform data exchange in and between clinical settings which in turn facilitates the continuity of care and thus contributes to patient safety. The use of SNL provides also high-quality care in multiprofessional teams. Attitudes of nurses towards SNL are mainly positive, but nurses need more education and managerial support in order to be able to benefit from SNL.

Significance

This systematic review provides evidence that the movement from paper-based and narrative nursing documentation to the use of SNL in nursing records has been an ongoing process for decades. This review provides useful information about the knowledge of the needs for nursing practice and management as well as nursing informatics. Acquisition and dissemination of knowledge of the use, effects and benefits of SNL is very much needed when its implementation is under planning or adoption already in process.

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Author contributions

Kaija Saranto was responsible for the study design and drafting of manuscript and the final version of it; Ulla-Mari Kinnunen contributed to all versions of the manuscript and was responsible for the data analysis together with Kaija Saranto, Eija Kivekäs, Anna-Mari Lappalainen, Pia Liljamo and Elina Rajalahti. Hannele Hyppönen was responsible for the data collection and administrative support.

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