

Evaluating Semantic Interoperability: A Preliminary Study on Finnish Nursing Documentation and the LEP Nursing Intervention Classification

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Abstract. There is an international need to share health data across countries through ecosystems such as the European Health Data Space to improve access and promote both primary and secondary use of health data. The aim of this study was to explore the implications of coding nursing interventions with multiple classification systems on nursing documentation. Electronic health records originally captured via the Finnish Care Classification System (FinCC) were coded with the LEP Nursing 3 intervention classification to gain an understanding of the implications of applying different nursing classification systems. A total of 2807 annotations were made to 2594 nursing data entries, most of which (85.6%) were related to monitoring. There were inconsistencies in the documented entries on the FinCC component level and structured headings and subcategories were seldom used. Also, single entries often included multiple interventions under the same heading. In conclusion, implementation of health data exchange platforms using different health data standards poses challenges. Even if the standards are harmonised, their clinical use may deviate from the intended design. Coding LEP Nursing interventions in Finnish electronic health records related to movement, treatment, and safety might be feasible based on data documented via FinCC. Further research is recommended to determine the applicability of LEP to Finnish health records across all areas of nursing care.

Keywords. Nursing data, standardised terminologies, semantic interoperability, electronic health records

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1. Introduction

European countries use different standardised terminologies to document nursing care. Examples of these are the Finnish Care Classification System (FinCC) [1], the Portuguese Nursing domain ontology NursingOntos [2], and LEP Nursing 3 (LEP = Leistungserfassung in der Pflege, “documentation of nursing activities”; i.e., nursing workload measurement), which is widely used in Germany, Switzerland, and Austria [3]. These classification systems have been developed over long periods of time, are tightly integrated into the national healthcare systems, and optimised to meet local requirements. While the LEP Nursing 3 classification focuses specifically on nursing interventions [3], FinCC provides a more comprehensive framework for nursing documentation including nursing diagnoses, nursing interventions, and nursing outcomes [1].

However, different national standards pose a big challenge for cross-national data sharing. For example, the European Health Data Space (EHDS) is an EU-wide health ecosystem aiming to increase access to health data across borders and support primary and secondary use of data [4]. Such systems require common digital health standards and interoperability frameworks to ensure seamless data exchange [5]. One way to enable cross-national semantic interoperability of nursing data is to map it to a common standard, such as the international multilingual terminology SNOMED CT. Examples of recently mapped classifications to SNOMED CT include the International Classification of Nursing Practice (ICNP) [6], LEP Nursing 3 and NursingOntos [2, 7].

It is important to assess how feasible it is in practice to map nursing data to advance data interoperability beyond theory. The aim of this pilot study was to code a subset of the LEP Nursing 3 intervention classification in Finnish nursing documentation, which had originally been captured via FinCC. It is part of a project that aims to apply multiple classification systems to the same nursing data to compare the information after mapping the codes to SNOMED CT.

2. Methods

This retrospective electronic health record (EHR) review coded nursing documentation captured with the FinCC system in the EHRs, with the LEP Nursing 3 intervention classification. The data consisted of EHRs of randomly selected patients who had been admitted to the cardiac services of one Finnish Wellbeing Services County after suffering from a cardiac infarction between 2019 and 2023. The data included all information from the EHRs, excluding radiology images, and data from psychiatric or operating departments and intensive care units. The nursing documentation consisted of semi-structured entries (including data captured with the FinCC) and of structured clinical data entries according to other coding systems, e.g. Logical Observation Identifiers Names and Codes. FinCC provides 17 main components for entries (e.g. pain management, skin integrity or medication), which can be complemented with unstructured text, and 263 main categories and 117 subcategories for documentation nursing interventions [1].

The LEP Nursing 3 classification comprises around 600 case-specific (e.g., “Provide support with breastfeeding”) and around 140 non-case-specific nursing interventions (e.g., “conducting a learning situation”) [3]. The interventions are grouped according to 27 service groups and 116 service subgroups. For example, the intervention “moving a patient to bed” is contained in the service subgroup “mobilisation”, which is part of the service group “movement”.

Two researchers independently annotated content related to nursing interventions in the data of 23 randomly selected patients via the Brat rapid annotation tool. The researchers annotated a subset of the data and reached an agreement on the annotation guidelines. To reduce the complexity of the annotation task in this pilot study, the annotation was performed on the level of service subgroups of three LEP Nursing 3 service groups, which may limit the comprehensiveness of semantic mapping. The service groups *movement*, *treatment*, and *safety* were selected due to their relevance to surgical nursing care. These three service groups comprise 17 service subgroups (see Table 2) and 266 nursing care interventions.

The annotated data was exported from Brat to a csv file and analysed via LibreOffice (Version 6.4.7.2). Python was used for data extraction and descriptive statistics. To complement the quantitative analysis, the researchers discussed their observations from the annotation phase. The Ethics Committee of the University of Turku reviewed this project (9/2020/Kuha) and the wellbeing service county (T95/2020-1) provided consent. Data were processed in a secure and certified computing environment.

3. Results

3.1. Characteristics of the data

The dataset covered a total of 425 care days (on average 18.5 care days per patient), containing a total of 55482 strings (e.g. words, numbers). There were 2594 entries in total (1148 semi-structured, 1446 structured). Semi-structured entries could hold several interventions under the same heading (Table 1, line 1). Structured entries always contained a structured component, such as *diastolic pressure* or *peripheral intravenous cannula*, to which a numerical or text value was added, along with optional free text (Table 1, line 2). For some patients, the same intervention was recorded in both semi-structured and structured entries (Table 1, line 3 and 4).

Table 1. Examples of semi-structured entries and structured entries, along with their corresponding annotations.

Structured entry	Semi-structured entry	Annotated LEP service subgroup
	<i>At the beginning of the procedure, nausea occurred, and blood pressure dropped to 67/46</i>	Monitoring
<i>Diastolic pressure: 78, right arm, sitting</i>		Monitoring
<i>Peripheral intravenous cannula: inserted</i>	<i>An IV line has been established</i>	Peripheral conducting
<i>Wound dressing: changed</i>	<i>Changed dressings around the drain site that had leaked through.</i>	Wound management

3.2. LEP applicability on Finnish EHR data

The semi-structured entries only contained FinCC component headings followed by free text. There were no structured main- or subcategories describing nursing interventions in the sample. Consequently, all annotations were made to free text or structured entries. There was variability in content documented under one component as exemplified by this entry under the heading *coping* containing multiple interventions “*Feeling chilly, otherwise well-being is okay. Urination is proceeding well; residuals will be measured. The first dose of Cefuroxime has been administered. IV drip is running. Patient has eaten.*”

Out of 2807 annotations in total, most fell into the monitoring subgroup (n=2403, 85.6%) (see Table 2). This subgroup included all patient monitoring-related values, including vital sign measurements, pain assessments, calculating fluid intake and other patient health indicators. Blood pressure, heart rate and saturation formed a significant proportion of the monitoring data. There were no instances of four LEP service subgroups in the data: *transfer to another bed*, *surgical interventions*, *dialysis interventions* and *risk reduction*. This is partly due to limitations in the dataset, such as the absence of operating room data. Additionally, some subgroups were intervention specific, for example, the dialysis subgroup, which did not get any annotations because the dataset did not have any dialysis patients.

Table 2. Number of annotations per service subgroup (service subgroups without annotations omitted).

LEP service groups and subgroups		Annotations (%)
Movement		
Mobilisation		27 (1.0%)
Positioning		13 (0.5%)
Transfer to another bed		0 (0.0%)
Treatment		
Wound management		94 (3.3%)
Peripheral conduiting		58 (2.1%)
Catheter/probe		2 (0.1%)
Device / auxiliary aid management		59 (2.1%)
Provision of services with other healthcare professionals		125 (4.4%)
Physical and other interventions		16 (0.6%)
Surgical intervention		0 (0.0%)
Dialysis intervention		0 (0.0%)
Safety		
Monitoring		2403 (85.6%)
Hygiene		10 (0.4%)
Risk reduction		0 (0.0%)

4. Discussion

Our study revealed that structured FinCC categories were almost absent in the documentation of nursing interventions in this dataset. Rather, nursing interventions were described in free text or implicitly encoded in structural data, e.g. measurements of vital signs reflecting monitoring interventions. Overall, only little information in the electronic health records pertained to FinCC entries; most were free text. This poses a significant challenge for semantic interoperability since only a little information would be retained after mapping the FinCC entries to SNOMED CT.

The study also revealed inconsistencies with the choice of the FinCC headings. For example, the *coping* component intended to describe the patients' and their families' capability to cope with changes related to their health condition [1], was one of the most inconsistently used. It often served as a general component for various types of nursing intervention entries. This highlights the need for further research on the structure of nursing documentation in relation to national standards.

The same intervention was sometimes documented twice, once in the semi-structured entry and once in the structured entry (see Table 1 lines 3 and 4 for examples). This forms a challenge for data transfer, as information is duplicated when it exists in two different locations. Furthermore, in the sample, semi-structured nursing data was documented only via FinCC components and free text, with no structured main- or subcategories for the nursing interventions. To move forward with applying other coding

schemes to this data, it is vital to explore methods to incorporate and reliably code semi-structured data to preserve data quality and avoid semantic loss. Advanced natural language processing methods could be one way to maintain data integrity, rich nuances, and contextual information from the source data.

A notable bias in the documentation was observed, as 86% of all annotations were related to monitoring. The dataset consists mainly of surgical patients, where monitoring plays a significant role, which could partly explain this. In comparison, only 1.5% of the annotations related to positioning or mobilisation. Positioning-related interventions are often embedded within other entries, which could explain the lack of these entries in the current documentation (e.g. Trendelenburg is documented under Circulation [1]).

Coding LEP Nursing interventions in Finnish electronic health records documented using the FinCC might be feasible, but further research is needed to determine its suitability across all nursing care areas beyond the three selected service groups. Assessing the practical semantic interoperability of FinCC and LEP Nursing 3 would require extensive coding of nursing interventions with FinCC. However, this study revealed that coding nursing interventions using structured elements of FinCC does not adequately represent current documentation practice. As this case study only used data from one wellbeing services county further research needs to determine the transferability of the findings to other settings.

5. Conclusions

The research findings support the understanding that differing nursing documentation standards pose challenges to the implementation of health data exchange platforms such as the EHDS. Moreover, the findings suggest that the use of harmonised standards, such as the FinCC, may not comply with their intended design.

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