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Using standardized nursing data for knowledge generation – Ward level analysis of point of care nursing documentation

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ABSTRACT

Background: Standardized nursing terminology is a prerequisite for describing nursing care processes and generating knowledge for decision-making and management. The structure of the Finnish Care Classification (FinCC) facilitates documentation of nationally agreed core nursing data: nursing diagnoses, interventions, and outcomes.

Purpose: To analyze the use of FinCC to assess patient care needs (nursing diagnoses), care implementations (interventions) and evaluation of the outcomes of nursing care in electronic health records.

Methods and materials: The descriptive study applied purposeful sampling of nursing data from nursing data repositories in three surgical wards in tertiary and secondary care hospitals. The aggregated, anonymous ward level data from a six-month period was analyzed to show distributions within frequencies and means of component, main and subcategory level use of FinCC in the three hospitals.

Results: Each of the three levels of the FinCC (component, main and subcategory) were used for recording nursing care. In all hospitals, the three most used diagnosis components covered about one third of the use of all the 17 components. The five most used intervention components cover about one third of the components. The most often used components for diagnoses and interventions were Coordination of care and follow-up care, Pain Management, Activities of daily living and independence and Medication. The prevalence of different components and the main and subcategory level usage for both diagnoses and interventions varied between the hospitals.

Conclusion: Standardized point-of-care nursing data makes patients' daily nursing care transparent. Structured, standardized, and point-of-care nursing data can be utilized to generate new knowledge of nursing care processes and nursing care practice at ward level.

1. Introduction

The benefits of standardized terminology to generate knowledge are extensive and well recognized; health data can be linked with different kinds of patient socio-demographics and care-related data, such as length of stay, nursing hours required, admission category type, outcome measures and nursing intensity [1–5]. Standardized terminology is a prerequisite for characterizing nursing care, including patient diagnoses, signs, and symptoms, types of interventions provided, and changes in patient status [5,6]. A need has been identified to develop nursing terminology to guarantee uniformity, comparability, and ability to disseminate nursing data [5–10], and to generate valid and unified data that can be re-used [11,12].

Standardized data supports evidence-based decision-making and facilitates the assessment of nursing care and outcomes as well as value-based healthcare and knowledge generation [1,4,5,13,14]. With the help of unified nursing concepts, it has been possible to analyze the documented state of care given; what nursing diagnoses and

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interventions have been used [4,15] and how, for example, patients' pain management has been identified, implemented, and evaluated [16]. Transparent and unified documentation supports patient care quality and continuity, and patient safety, and protects health care professionals from legal liability [16]. Thus, it brings visibility to every specialty, such as surgery-specific documentation [17].

Nursing documentation has evolved through the introduction of electronic health records (EHR). The nursing process framework was the key component when developing the structure to describe nursing diagnoses, interventions, and outcomes already in paper records [14,18,19]. In many countries, the use of the original World Health Organization's (WHO) model [20] varies based on the number of phases [13]. Nevertheless, nursing diagnoses, plan of care, nursing interventions, and outcomes are the core of documentation in daily nursing care [13]. A huge amount of data is generated by healthcare professionals and imported into databases during different phases of patient care processes. The point-of-care data produced also supports various administrative processes, such as information management, financial management, human resource management, and education [3,21,22]. Thus, continuous evaluation, auditing of the nursing records and managerial support is important to achieve high quality nursing data for knowledge generation [23,24].

The standardized nursing terminology, the Finnish Care Classification (FinCC) (Fig. 1), originally based on the Clinical Care Classification (CCC) [25], was developed in Finland for over 20 years, and further developed and widely used in Finnish healthcare organizations [26,27]. Like the CCC, the FinCC has a three-level hierarchy: the Finnish Classification of Nursing Diagnoses (FiCND), the Finnish Classification of Nursing Interventions (FiCNI), and the Finnish Classification of Nursing Outcomes (FiCNO). For concrete patient care documentation, main and subcategories are used. The latest version 4.0 of the user guide, translated into English and Swedish, was published 2019. The structure of the FinCC facilitates the documentation of nationally agreed core nursing data: nursing diagnoses, nursing interventions, nursing outcomes, nursing intensity, and a nursing summary. The FinCC has been delivered and approved for the Finnish National Code Server organized by the National Institute of Health and Welfare, where it is freely available to all vendors [26,28–30].

According to EHR patient-specific data, nursing interventions were documented on average four times more than nursing diagnoses. Besides using FinCC in clinical documentation, both the table of vital signs [4,31] and narrative texts are used to supplement nursing documentation [3]. By cross-mapping the FinCC with the nursing intensity system, evidence appears that the numbers of nursing diagnoses and interventions used correlate with the intensity of patient care. The higher the number of nursing diagnoses and interventions documented, the higher is the nursing intensity level and the need for nursing care [4].

High-quality documentation requires usable EHRs, education and support [5,32]. The correct and reliable use of FinCC in nursing documentation requires training, and collaboration between healthcare organizations and nursing schools [28,33]. However, despite educational initiatives and widespread use of FinCC, Finnish nurses' competencies in terminology-based documentation remains at medium level, although competencies in documentation of the nationally agreed core nursing data are good [34,35]. The latest national survey of Finnish nurses' informatics competencies shows that the work environment has been a contributing factor to terminology-based documentation [36].

The purpose of this study is to analyze how FinCC has been used to assess the needs for patient care (nursing diagnoses), the implementation of care (interventions) and how the outcomes of nursing care have been assessed in EHR. The research questions were:

(1) How are the Finnish Classification of Nursing Diagnoses (FiCND), the Finnish Classification of Nursing Interventions (FiCNI), and the Finnish Classification of Nursing Outcomes (FiCNO) used by nurses?
(2) How does the use of components, main and subcategories of FinCC differ between hospitals?

Further, we discuss what conclusions concerning the point-of-care use of FinCC can be made based on aggregated nursing data.

2. Material and methods

2.1. Setting

In Finland, healthcare services are delivered mostly by public health care providers. The country is divided into healthcare districts (N = 21)

Three-level hierarchy	Components (N=17)	FiCND Main-/ Sub categories (n)	FiCNI Main-/Sub categories (n)
Finnish Classification of Nursing Diagnoses (FiCND) • Component • Main category • Subcategory Finnish Classification of Nursing Interventions (FiCNI) • Component • Main category • Subcategory Finnish Classification of Nursing Outcomes (FiCNO) • Situation: Improved, Stabilized, Deteriorated	Metabolic	8/4	11/0
	Sensory and neurological functions	2/17	18/0
	Life cycle	9/0	10/0
	Elimination	7/16	27/4
	Respiratory	7/7	12/5
	Coordination of care and follow-up care	28/0	37/0
	Pain Management	15/0	8/23
	Skin integrity	23/0	30/75
	Medication	8/0	21/0
	Fluid balance	5/0	2/8
	Mental capacity	5/18	12/1
	Activities of daily living and independence	10/7	11/1
	Nutrition	8/7	9/0
	Coping	5/14	6/0
	Health behavior	9/1	11/0
	Safety	7/0	21/2
	Circulation	3/5	9/1
		159/96	**255/120**

Fig. 1. Structure of the Finnish Care Classification (FinCC) 4.0.

containing university hospitals (tertiary care), hospitals (secondary care), and health centers providing primary care. The countrywide EHR coverage is 100 % [37]. The nursing record is part of the EHR, supporting the standardized nursing documentation at the point of care [35]. FinCC is implemented in nursing records in different sized hospitals in 16 healthcare districts. The focus of interest in this study is the point-of-care ward level data from hospital data repositories.

2.2. Sampling

Purposeful sampling was used, and hospitals in healthcare districts which had used FinCC for nursing documentation for at least five years as a part of EHR were eligible for the study. The research request for this descriptive study was sent in November 2021 to three hospitals which were able to provide aggregated, anonymous data electronically of the wards treating surgical patients. Based on hospitals' descriptions of specialties, we anticipated that the ward profiles were similar enough to enable conclusions for surgical patients' care (Table 1). The research permissions were received from the hospitals according to each research authorization practice.

2.3. Data collection

The requested anonymous, aggregated, ward level data was retrieved by the hospital administration from the data repositories in the three hospitals, and received in Microsoft Excel (version 2108) format through encrypted email. The data from January to July 2021 consisted of nursing diagnoses (FiCND component, main and subcategory level), nursing interventions (FiCNI component, main and subcategory level), and nursing outcomes (situation), the frequency of each use, and the number of patients whose nursing care was recorded with FinCC at the ward level. The hospitals also provided background data: number of hospital beds per ward, surgical ward profiles, duration of FinCC use, training in FinCC use, possibilities of healthcare professionals to use aggregated nursing data reports for development and management. The perceptions of standardized documentation were gathered with an open-ended question.

2.4. Data analyses

The data was analyzed using descriptive statistics and presented in frequency and percentage tables to ascertain whether the recording of patient care content differs between hospitals. Two hospitals used FinCC version 4.0 and one hospital version 3.0. The component *Pain management* is new in FinCC 4.0. To harmonize the use of components for this analysis, the frequencies of the *Pain management* component were calculated from *the Sensory and neurological functions* component included in version 3.0, and the frequencies of the *Activity and Daily Living*-components were combined into *Activities of daily living and independence*. The data were first classified alphabetically (in Finnish) per all 17 components (Fig. 1). The components were classified based on their frequency of FiCND and FiCNI usage and the mean of recordings of diagnoses and interventions per number of patients was calculated. Overall, the number of patients means how many diagnoses and interventions per component, and main and subcategories were allocated to patients in the wards. Finally, the three most often used components were classified based on their main and subcategory use. Due to the use of ward level aggregated data, no statistical analysis was performed. The background information was used to describe the current situation in hospitals regarding the status of using standardized terminology in nursing documentation. The narrative descriptions of the perceptions of the standardized documentation were analyzed through content analyses.

Table 1
Hospital and surgical ward profiles of FinCC usage.

Surgical ward profile	Hospital A	Hospital B	Hospital C
Surgical specialties	Orthopedic-, thorax-, gastro-intestinal-, urology-, tooth maxillofacial surgeries	Orthopedic-, traumatology surgeries	Orthopedic-, urology-, tooth maxillofacial surgery surgeries
Patient beds/ward	40	45	34
FinCC usage (years)	>10	>15	>5
FinCC version in use	4.0	4.0	3.0
FinCC levels in use	Three-hierarchy level	Three-hierarchy level	Three-hierarchy level
Nursing data used for secondary purposes	No	Multiple purposes	To some extent
Professionals' perceptions of FinCC	Some positive perceptions, but unable to use	Take advantage and use	Some positive perceptions, but unable to use
Training available for the personnel	In-house training	Mentoring support	Mentoring support

3. Results

The FinCC was used in each participating hospital at component, main and subcategory level. The use of FinCC varied between the hospitals in terms of length and version usage, as well as the use of nursing data for secondary purposes, such as reports and statistics. Professionals' perceptions of FinCC use were positive in one hospital and neutral in the other two. Two hospitals had established a mentoring system to support the use of FinCC (Table 1).

Use of FinCC to record nursing care varied between the hospitals. The number of needs assessed (FiCND) for patients was highest in hospital A, resulting in 13 diagnoses per patient on average. The highest number of interventions (FICNI) for patients was in hospital C, resulting in nine interventions for patients on average. In terms of outcomes assessment, the difference between the hospitals was small (Table 2).

The prevalence of component usage for both diagnoses and interventions varied between the hospitals (Table 3). The order of the components to describe the use in each hospital is based on the FinCC 4.0 structure (Finnish language). Of the 17 components, the *Safety* component was never used for diagnosing in hospitals A and C. In all three hospitals, the most often used components for diagnoses and interventions were *Coordination of care and follow-up care, Pain Management, Activities of daily living and independence* and *Medication*.

The frequency of FiCND and FiCNI component level usage was assessed in relation to the number of patients in the three hospitals. The mean of patient records of *Pain management* varied between 4 and 14 for diagnoses, and for interventions from 1 to 10. In the component *Skin*

Table 2
FiCND, FiCNI and FiCNO use over six months in the three hospitals.

FinCC usage/patient	Hospital A	Hospital B	Hospital C
Patients (n)	3565	5668	4030
FiCND (n)	46,313	21,075	17,427
Diagnoses/patient (mean)	13	4	4
Patients (n)	11,173	19,056	7933
FiCNI (n)	76,547	144,886	70,598
Interventions/patient (mean)	7	8	9
Patients (n)	799	1970	1323
FiCNO (n)	1553	2311	2145
Outcomes /patient (mean)	2	1	2

Note: FiCND, Finnish Classification of Nursing Diagnoses; FiCNI, Finnish Classification of Nursing Interventions; FiCNO, Finnish Classification of Nursing Outcomes.

Table 3
Distribution of FiCND and FiCNI used at the component level in the three hospitals.

Components*	Hospital A		Hospital B		Hospital C	
	FiCND n (%)	FiCNI n (%)	FiCND n (%)	FiCNI n (%)	FiCND n (%)	FiCNI n (%)
Metabolic	3 (0)	248 (0)	119 (1)	680 (0)	5 (0)	20 (0)
Sensory and neurological functions	421(1)	80 (0)	544 (3)	1894 (1)	32 (0)	73 (0)
Life cycle	60 (0)	3 (0)	4 (0)	0 (0)	0 (0)	1 (0)
Elimination	4409 (10)	8192 (11)	450 (2)	24 128 (17)	155 (1)	441 (1)
Respiratory	773 (2)	471 (1)	105 (0)	1432 (1)	3 (0)	33 (1)
Coordination of care and follow-up care	26,546 (57)	27044 (35)	2124 (10)	13833 (10)	12137 (70)	23135 (33)
Pain management	10,711 (23)	1352 (2)	5251 (25)	20028 (14)	4731 (27)	152 (0)
Skin integrity	1293 (3)	3495 (5)	4472 (21)	14690 (10)	0 (0)	601 (1)
Medication	6 (0)	15 738 (21)	148 (1)	10275 (7)	22 (0)	15 177 (21)
Fluid balance	63 (0)	528 (1)	30 (0)	6063 (4)	0 (0)	312 (0)
Mental capacity	2 (0)	130 (0)	99 (0)	1040 (1)	2 (0)	3 (0)
Activities of daily living and independence	34 (0)	12984 (17)	3006 (14)	29151 (20)	337 (2)	30594(43)
Nutrition	46 (0)	5676 (7)	119 (1)	9041 (6)	3 (0)	2 (0)
Coping	246 (1)	245 (0)	4409 (21)	9964 (7)	0 (0)	6 (0)
Health behavior	32 (0)	23 (0)	15 (0)	46 (0)	0 (0)	1 (0)
Safety	0 (0)	24 (0)	55 (0)	508 (0)	0 (0)	5 (0)
Circulation	1668(4)	314 (0)	125 (1)	2113 (1)	0 (0)	2 (0)
TOTAL	**46313(100)**	**76547(100)**	**21075(100)**	**144,886 (100)**	**17427(100)**	**70558(100)**

*In Finnish alphabetical order.

integrity, the variation of diagnoses was between 0 and 28 records, and for interventions with the same component the variation was between two and eight. The difference in FiCND (fr = 28) and FiCNI (fr = 4) use was highest for *Skin integrity* component in hospital A (Table 4).

The most often used components for nursing diagnoses were *Coordination of care and follow-up care* in hospitals A and C as well as *Pain management* in hospital B. The most used nursing diagnoses of main or subcategories in hospitals A and C were *Knowledge deficit regarding interventions* and in hospital B *Surgical wound.* Similarly, the most often used components to describe interventions for nursing care were *Activities of daily living and independence* in hospitals B and C as well as *Coordination of care and follow-up care* in hospital A. The most often used main or subcategory for interventions was *Observation post-intervention* in hospital A, *Monitoring sleep and waking states* in hospital B, and *Administration of medication* in hospital C (Table 5).

4. Discussion

4.1. Discussion of the results

This descriptive study analyzes ward level data recorded with the FinCC [26–28] in three hospitals. The surgical wards which had used FinCC for at least five years in EHRs provided aggregated data from hospital data repositories. This study shows that structured, standardized point-of-care nursing data can be utilized to generate new knowledge for nursing care practice at ward level. Each of the three levels of FinCC (component, main category, and subcategory) are used for recording patient care. However, the 17 components of FinCC are only partially used for assessing the needs for patient care (FiCND), or to describe the implementation of care (FiCNI), indicating inequality in use between the hospitals. Overall, the results show that nursing diagnoses of surgical patients clearly focus on patients' pain, survival, mobility, and coordination of care. Nursing needs are consistently met through interventions of medication, mobility assistance, and coordination of care. The three most often used components cover between 67 and 99 % of the FiCND and 51 and 97 % of the FiCNI components used for recording nursing care. This may reflect differences in surgical procedures. However, the duration of use of FinCC reflects the broad use of the component level, as the hospital which had used FinCC for longest has used the greatest number of components.

Besides variation in the duration of using FinCC, and its different versions, all three hospitals had variation in experience and training available for personnel. The benefits of terminology can be reached with supporting actions, such as education, mentoring and leadership by chief nursing officers [23,34,36]. The hospital which had used FinCC for 15 years had utilized nursing data for multiple purposes. Perceptions regarding the use of FinCC were positive in this hospital. However, access to nursing data and limited possibilities of data re-use might affect the perceptions in other hospitals. This study applies only aggregated ward level data, free text was not the focus of this study. Overall, the use of standardized terminology [2–10,12–16], patient-specific narrative descriptions [3,14] provide highly valued supplementary information [15,16].

The overall usage of FinCC to describe nursing processes [13,20] is unclear, as component-level FiCNO data was not available (Table 2). However, the FinCC recordings support earlier studies highlighting the lack of outcome assessment [13]. Obviously, the surgical wards have differences in recording patient care, as the total number of diagnoses varied considerably. This may be because that as well as nursing records, data of signs and symptoms is also recorded in the form of vital signs [4,31].

In terms of frequencies, the use of FiCND at component level varied from 10 to 17 between the hospitals (Table 3). The most used component in the surgical wards was clearly *Coordination of care and follow-up care,* covering 57 % of diagnoses in hospital A, and *Activities of daily living and independence,* covering 43 % in hospital C. The least used FiCND component was *Safety* in hospital A and *Life cycle* in hospital B. In hospital C, the FiCND components *Lifecycle, Skin integrity, Fluid balance, Coping, Health Behavior, Safety and Circulation* were not used at all or extremely little for FiCNI. Moreover, as for the FiCNI, hospital B did not use the component *Life cycle,* and *Life cycle, Mental capacity, Nutrition, Coping, Health behavior, Safety, and Circulation* were used extremely little in hospital C. Although FinCC has been part of the content of national nursing competencies in nursing schools for over 10 years [33], nurses' informatics competencies including terminology-based documentation vary according to the work environment [36] or e.g., the EHR system in use [34,35]. To guarantee unified use of classification, a nursing audit tool has been developed to evaluate nursing documentation quality. The audit process is a means to increase hospital professionals' competence in documentation [2].

The differences in the use of FiCND and FiCNI might evidence variations between surgical wards' documentation practices [8,13], but also between patient numbers. Overall, the highest means of patient records distributed differently from those of the most used components for

Table 4
The frequencies of using components for FiCND and FiCNI in hospitals.

Hospital A						**Hospital B**						**Hospital C**					
FiCND component fr	Pat.[b] fr	Mean ND/ P[c]	FiCNI[d] components fr	Pat. fr	Mean NI/ P[e]	FiCND component fr	Pat. fr	Mean ND/ P	FiCNI components fr	Pat. fr	Mean NI/P	FiCND component fr	Pat. fr	Mean ND/ P	FiCNI components fr	Pat. fr	Mean NI/P
Coordination of care 26,546	2103	13	Coordination of care 27,044	1 976	14	Pain management 5251	1436	4	ADL/ independence 29,151	2132	14	Coordination of care 12,137	1839	7	ADL/ independence 30,594	3512	9
Pain management 10,711	789	14	Medication 15,738	1 712	9	Skin integrity 4472	1199	4	Elimination 24,128	2053	12	Pain management 4731	1889	3	Coordination of care 23,135	1870	12
Elimination 4409	406	11	ADL/ independence 12,984	1 909	7	Coping 4409	1107	4	Pain management 20,028	1965	10	ADL/ independence 337	240	1	Medication 15,177	1769	9
Circulation 1668	99	17	Elimination 8192	1521	5	ADL/ independence 3006	815	4	Skin integrity 14,690	1910	8	Elimination 155	46	3	Skin integrity 601	389	2
Skin integrity 1293	47	28	Nutrition 5676	1400	4	Coordination of care 2124	604	4	Coordination of care 13,833	2142	6	Sensory/ neurology 32	7	5	Elimination 441	115	4
Respiratory 773	41	19	Skin integrity 3495	947	4	Sensory/ neurology 544	141	4	Medication 10,275	1728	6	Medication 22	4	6	Fluid balance 312	107	3
Sensory/ neurology 421	34	12	Pain management 1352	713	2	Elimination 450	141	3	Coping 9964	1748	6	Metabolic 5	2		Pain management 152	118	1
Coping 246	14	18	Fluid balance 528	244	2	Medication 148	40	4	Nutrition 9041	1779	5	Respiratory 3	1	3	Sensory/ neurology 73	24	3
Fluid balance 63	3	21	Respiratory 471	162	3	Circulation 125	43	3	Fluid balance 6063	1557	4	Nutrition 3	1	3	Respiratory 33	3	11
Life cycle 60	5	12	Circulation 314	177	2	Nutrition 119	33	4	Sensory/ neurology 1894	307	6	Mental capacity 2	1	2	Metabolic 20	12	2
Nutrition 46	6	8	Metabolic 248	105	2	Metabolic 119	24	5	Circulation 2113	761	3	Life cycle 0	0	0	Coping 6	3	2
ADL/ independence 34	9	4	Coping 245	157	2	Respiratory 105	35	3	Respiratory 1432	383	4	Skin integrity 0	0	0	Safety 5	3	2
Health behavior 32	2	16	Mental capacity 130	78	2	Mental capacity 99	22	5	Mental capacity 1040	197	5	Fluid balance 0	0	0	Mental capacity 3	2	2
Medication 6	4	2	Sensory/ neurology 80	40	2	Safety 55	12	5	Metabolic 680	152	4	Coping 0	0	0	Nutrition 2	2	1
Metabolic 3	2	2	Safety 24	13	2	Fluid balance 30	7	4	Safety 508	210	2	Health behavior 0	0	0	Circulation 2	2	1
Mental capacity 2	1	2	Health behavior 23	16	1	Health behavior 15	7	2	Health behavior 46	32	1	Safety 0	0	0	Life cycle 1	1	1
Safety 0	0	0	Life cycle 3	3	1	Life cycle 4	2	2	Life cycle 0	0	0	Circulation 0	0	0	Health behavior 1	1	1
FiCND total 46 313	3565	13	FiCNI total 76 547	11,173	7	FiCND total 21 075	5668	4	FiCNI total 144 886	19,056	8	FiCND total 17 427	4030	4	FiCNI total 70 558	7933	9

[a] Finnish Classification of Nursing Diagnoses, [b] Patient (frequency), [c] Mean of used main and subcategories of FiCND per patient, [d] Finnish Classification of Nursing Interventions, [e] Mean of used main and subcategories of FiCNI per patient.

Table 5
The three most often used components and their main or subcategories of FiCND and FiCNI in three hospitals.

Hospital	FiCND Component use (freq.)	Main*or subcategory ** use freq. (%)		FiCNI Component use (freq.)	Main* or subcategory** use freq. (%)	
A	**Coordination of care and follow-up care** (26 546)	Knowledge deficit regarding interventions*	25,686 (97)	**Coordination of care and follow-up care** (27 044)	Observation post-intervention*	18145 (67)
		Need for specialist services*	304 (1)		Planning and coordination of follow-up care*	3975 (15)
		Knowledge deficit regarding health behaviour*	204 (1)		Instruction in mobility *	2937 (11)
	Pain management (10 711)	Abdominal pain*	9066 (85)	**Medication** (15 738)	Oral administration of medication*	13304 (85)
		Acute pain*	745 (7)		Administration of medication by injection*	829 (5)
		Pain related to an intervention*	392 (4)		Epidural administration of medication*	789 (5)
	Elimination (4409)	Problem in urinating*	2297 (52)	**Activities of daily living and independence** (12 984)	Monitoring sleep and waking states*	7934 (61)
		Haematuria**	1050 (24)		Assisting in bathing/ showering*	4628 (36)
		Problem in passing stools*	592 (13)		Responsibility for exercises*	159 (1)
B	**Pain management** (5251)	Pain related to an intervention*	3174 (60)	**Activities of daily living and independence** (29 151)	Monitoring sleep and waking states*	12 517 (43)
		Traumatic pain*	1239 (24)		Responsibility for exercises*	7311 (25)
		Back pain*	357 (7)		Assisting in bathing/ showering*	5427 (19)
	Skin integrity (4472)	Surgical wound*	3620 (81)	**Elimination** (24 128)	Monitoring frequency of micturition*	9759 (40)
		Infected wound*	380 (8)		Monitoring urine quality*	6067 (25)
		Acute wound*	68 (2)		Monitoring the volume and type of stools*	1921 (8)
	Coping (4409)	Deteriorated coping cabilities*	3460 (78)	**Pain management** (20028)	Assessment of the type of pain*	11153(57)
		Needs support to cope*	872 (20)		Assessment of the intensity of pain a rest*	6862(34)
		Forgetfulness**	50 (1)		Non-pharmacological management of pain*	641(3)
C	**Coordination of care and follow-up care** (12 137)	Knowledge deficit regarding interventions*	12102 (98)	**Activities of daily living and independence** (30 594)	Monitoring sleep and waking states*	16 545 (54) 14000 (46)
		Need for follow-up care*	21 (0)		Encouraging independency* Instruction related to daily living*	22 (0)
		Need for specialist services*	10 (0)			
	Pain management (4731)	Acute pain*	4292 (91)	**Coordination of care and follow-up care** (23 135)	Observation after intervention, proceduring or sampling*	13647 (59)
		Pain related to an intervention*	437 (9)		Coordination of specialist services*	4237 (18)
		Traumatic pain*	2 (0)		Planning of follow-up care*	2890 (12)
	Activities of daily living and independence (337)	Change in activity*	306 (91)	**Medication** (15 172)	Administration of medication*	14997 (99)
		Knowledge deficit regarding support in independence*	21 (6)		Instruction in medication*	127 (1)
		Limited mobility**	5 (1)		Epidural administration of medication**	34 (0)

recording nursing procedures (Table 4). However, in hospitals B and C the distribution of the use of the components of FiCND and FiCNI was somehow similar providing evidence of patient-centered nursing care that also considers the patient's non-essential surgical patient needs [2]. In hospital A, the most used FiCND components are *Coordination of care and follow-up care*, *Pain Management*, and *Elimination*. The three most recorded components per patient are *Skin Integrity, Fluid Balance*, and *Respiratory*. When looking at the allocation of nursing diagnoses to patients, a small number of patients (n = 47) were saturated with multiple FiCND *Skin Integrity* component (n = 28) records. Overall, in terms of FiCNI the most used three components were almost the same as the components with the highest means per patient. It is not possible to deduce unequivocally from this data the reason for these differences. Thus, there is a demand for patient specific EHR, statistical data to provide knowledge of nursing care documented [8]. However, in terms of the means of FICNI recordings per patient, the frequency is slightly higher as the use of standardized nursing terminology increases descriptions of nursing interventions supporting daily care, patient safety and information reuse [4,8].

The FiCND main and subcategories of the most used components are not widely utilized. Instead, it seems that only one, or sometimes two main or subcategories are used (Table 5). However, the most common main or subcategories, such as *Knowledge deficit regarding interventions*, *Surgical wound, Abdominal pain, Acute pain, Deteriorated coping abilities* and *Change in activity* describe surgical patient's care needs [2,17]. The main and subcategories of the FiCNI are used more broadly. In hospital B, the main categories of the component *Pain management*; *Assessment of the type of pain* and *Assessment of the intensity of the pain at rest* are well recorded to improve and manage pain care [14,16]. In hospital C, the main and subcategories of the component *Activities of daily living and independence*, such as *Monitoring sleep and waking states*, *Encouraging independence,* and *Instructions related to daily living* as well as *Observation after intervention, Coordination of specialist services,* and *Planning of follow-up care* of the component *Coordination of care and follow-up,* reflect the central types of elements of surgical nursing interventions [17]. However, of the FiCNI, *Skin integrity* is not among the most used components even though wound care is an essential part of surgical patient care. [9]. Similarly, concerning the component *Medication* and its main and subcategories, the use between hospitals varied considerably, which might indicate different ways of using the EHR. The popularity of the main and subcategories is also affected by the widespread use of the table of vital signs, collecting measures such as blood pressure, temperature, pulse, respiratory rate, oxygen, and saturation [4,31].

4.2. Strengths and limitations

FinCC is the only nursing terminology that has been translated and validated for use in EHRs in Finland. Since the first translation [27] from the original CCC [25], the Finnish versions have gone through several validation processes. During the past 20 years FinCC has been modified from the original CCC due mainly to cultural issues. [28,29]. A unified national nursing terminology is both beneficial and challenging, as nursing practices vary between service providers. Terminology translations are long and demanding validation processes, and the maximum benefits from the work are assessed thoroughly before decisions. In the case of FinCC, the possibility to use the same three-level hierarchy structure for diagnoses, interventions, and outcomes is an important option in decision making. FinCC is implemented in a variety of hospitals and specialties because of the structure of the terminology.

In previous studies [4,8], patient-level FinCC data is used to analyze patient care processes. This study is the first time FinCC point-of-care ward level data has been analyzed this extensively. The aggregated ward level data provides only possibilities to use means to analyze average use of the FinCC structure in patient care. Each participating hospital was able to aggregate requested data from their data repositories anonymously. However, it would be more accurate to have patient-level data to analyze the similarities and differences in patient care processes. Structured health data can also be connected to social demographics and care-related data such as signs, symptoms, frequencies, types of interventions given and patients' status and outcomes [12]. Thus, the pitfall for data analyses is the lack of frequencies per patient due to privacy and data security regulations. Moreover, despite the unified structures of EHR for national data transfer, the local data repositories are not equal, and we were unable to obtain data of components used for FiCNO recordings from each hospital.

The research permit for this study was applied to all the organizations participating in the research. The organizations are coded for analysis and are not mentioned by name. The research followed the practices recognized by the scientific community: honesty, general diligence, and accuracy in the research, recording and presentation of results, and evaluation of research and its results [38]. The participating organizations cannot be identified in the research publications. The research material has been handled confidentially by the members of the research team.

5. Conclusion

All the three-hierarchy levels of the FinCC are used for recording patient care. FinCC-based documentation describes the key elements of surgical nursing processes in hospitals. Standardized point-of-care nursing data makes patients' daily nursing care transparent. A large amount of structured and standardized FinCC data can easily be generated through EHR databases and re-used for the development of nursing practice. Structured nursing data supports the knowledge generation for nursing management, education, and research.

6. Authors' contributions

MM and KS conceptualized and designed the study. MM and UMK collected the data, MM, UMK, PL and KS analyzed the data. MM, UMK, PL, OA, AK, and KS drafted the first version of the manuscript. All the authors commented on the manuscript drafts and gave their approval for the final version to be published. MM was the guarantor of the study.

7. Summary table

What was already known on the topic

1. Nursing terminologies have been used for nursing documentation for decades.
2. Clinical Care Classification and Finnish Care Classification are coded terminologies and data can be used for secondary purposes.
3. Nurses' competencies to use EHR are very good.
4. Secondary use of nursing documentation data by management is not yet common.

What this study added to our knowledge

1. The use of standardized nursing terminology e.g., FinCC, provides data for secondary purposes.
2. Re-use of point-of-care nursing data provides new insights into nursing practice.
3. Unified use of terminology needs continuous education and mentoring systems.
4. Implementation and maintenance of the terminology needs managerial support.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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