

Inpatient falls and pressure ulcers as nursing quality indicators in national benchmarking – a retrospective observational registry study

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Abstract

Background: Collecting data of quality of care and using these data in research and in developing clinical practice has become more systematic worldwide. Globally, one of the goals is to advance benchmarking nursing-sensitive quality of care between healthcare organizations. Inpatient falls and hospital-acquired pressure ulcers are widely used as nursing-sensitive quality indicators in benchmarking, as they are related to additional healthcare costs and the decrease in patients' quality of life. The aim of this study was to explore the prevalence of inpatient falls and hospital-acquired pressure ulcers among adult patients in Finnish acute and psychiatric care based on national nursing-sensitive benchmarking data.

Methods: The retrospective observational registry study was conducted in Finnish adult inpatient units in acute and psychiatric care between 2021 and 2022. The benchmarking data of inpatient falls covered 10 hospitals and hospital-acquired pressure ulcer data covered 11 hospitals. Frequencies and percentages were used to describe the results.

Results: The data of inpatient falls covered a total of 2 518 152 patient days (per month min 70 581; max 122 628) and the data included 4526 falls. Of them, the number of falls with an injury was 1866 (41%), totalling 0.74 falls with an injury per 1000 patient days. In the hospital-acquired pressure ulcer data, there were 48 155 patients. Of them, 88% ($n=42\ 402$) had their skin condition visually assessed from head-to-toe. A total of 3214 (7.6%) patients had pressure ulcers, of which 1917 (4.5%) were hospital-acquired pressure ulcers. The prevalence of hospital-acquired pressure ulcers in Stages 2–4 was 1.4% ($n=579$). The highest inpatient fall rate was in psychogeriatric units, whereas the highest hospital-acquired pressure ulcer rate was in intensive care units.

Conclusion: The low prevalence rates of inpatient falls and hospital-acquired pressure ulcers indicate that the quality of nursing care in Finland is on a good level when compared to international research findings. However, there is still room for improvement, especially in units with a high number of adverse events. Results provide information about nursing care quality to further develop clinical practice. The experiences and principles obtained in benchmarking nursing quality can be utilized in creating an official national quality register for nursing-sensitive quality indicators.

Keywords: inpatient falls; hospital-acquired pressure ulcers; national benchmarking; nursing-sensitive quality; observational registry study

Introduction

Measuring and evaluating the quality of care has a long history, beginning during the time of Florence Nightingale in the late 19th century. In the last few decades, investing in the quality of care has become more systematic [1]. This involves collecting

data of quality of care using internationally used benchmarking indicators. These data are used to improve the quality of nursing care and for research purposes. Today, one of the goals is to advance benchmarking nursing-sensitive quality of care between healthcare organizations [2]. Nursing-sensitive quality

indicators can be related to the structures or processes of nursing, as well as the outcomes from the patients, personnel, or organization's perspectives [3]. In Finland, all five university hospitals initiated a network called 'The Consortium for the National Benchmarking of Nursing-Sensitive Outcomes' (later Consortium, www.hoiverke.fi/en/) in 2016. Since then, 10 other healthcare organizations have joined the Consortium, covering 65% of the current wellbeing service counties in Finland. The Consortium collects and benchmarks the following nursing-sensitive quality indicators: hospital-acquired pressure ulcers (HAPUs), inpatient falls, malnutrition risk, patient satisfaction with nursing, and nurses' work satisfaction and engagement. The data are collected in various nursing environments including inpatient wards and outpatient clinics. In this study, we focus on adults' inpatient falls and HAPUs as nursing-sensitive quality indicators.

In healthcare, benchmarking is a valuable managerial tool for enhancing the quality of care [4] while simultaneously allocating both the direct and indirect costs to care paths [5]. External benchmarking involves the comparison of healthcare organizations, while internal benchmarking focuses on improving an organization's processes over time [6]. The reason for the organization-initiated benchmarking in Finland was due to the lack of a national quality register of nursing-sensitive indicators, such as the National Database of Nursing Quality Indicators (NDNQI) in the USA [7]. The Consortium aims at constantly improving the quality of patient care and illustrating the nursing contribution to patient care outcomes and patient safety. In addition, the goal is to identify deficiencies in nursing care quality and address them in nursing research, education, and development. Alongside benchmarking, research is one way to determine the trends and potential factors affecting the nursing care quality. This article focuses on the national benchmarking data of inpatient falls and HAPUs, as they are globally recognized as significant nursing-sensitive quality indicators due to their prevalence, related additional healthcare costs, and decreased patients' quality of life [8, 9]. In this study, data were compiled using the same criteria which are widely used in international research as well as NDNQI nursing-sensitive indicators.

One-tenth of the recorded inpatient falls cause serious injuries [9, 10], such as hip fractures and head injuries [10, 11]. Inpatient falls are one of the most common causes of adverse events in hospitals and high costs to the healthcare organizations [9]. Globally, the pooled fall rate in acute care varies from 1 to 9 per 1000 patient days and injury fall rates, 0.4–2 per 1000 patient days [10, 12–15]. Fall rates can vary based on factors, such as the unit types, patients' characteristics, and diseases [10, 12–15]. Most inpatient falls occur in care units, such as internal medicine, rehabilitation, and neurology [12, 15]. Moreover, the inpatient fall rate is high in psychiatry, especially in psychogeriatrics units [14, 16]. Correspondingly, the number of inpatient falls is the lowest in surgical units [12, 15].

Pressure ulcers (PU), which are painful for the patient and costly for society, are often preventable. Globally, the PU prevalence in healthcare settings ranges from 0% to 72.5% [17]. The prevalence of HAPUs varies, depending on the care environment; for instance, in a large international study, the prevalence of intensive care unit-acquired PUs was 16.2% [18]. To give another example, in acute hospitals in the USA, the HAPU prevalence was 3.2% [19] and in Finland, 10% [20]. In a study by Li *et al.* [21], the globally pooled HAPU rate was 5.1% for Stages 2–4.

The aim of this study was to explore the prevalence of inpatient falls and HAPUs among adult patients in Finnish acute

and psychiatric care based on the national nursing-sensitive benchmarking data. The research questions were: (i) What is the rate of inpatient falls and inpatient falls with an injury in adult acute and psychiatric care in the 2021–22 benchmarking data examined in different nursing contexts, and (ii) What is the prevalence of HAPUs and HAPU stages 2–4 in adult acute and psychiatric care in the 2021–22 benchmarking data examined in different nursing contexts? The study was expected to provide information about nursing care quality for the development of clinical practice. In addition, it was projected to reveal the value of benchmarking data to support development of nursing-sensitive quality registers.

Methods

Design

This retrospective observational registry study was conducted in Finnish adult inpatient units in acute and psychiatric care between 2021 and 2022. The study adhered to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) checklist.

Data collection in national benchmarking

Each hospital of the Consortium had an assigned coordinator, who was responsible for the practical arrangements for the collection of benchmarking data within his/her organization. The coordinator was also responsible for submitting the organization's summary data for benchmarking according to a set timetable. The inpatient falls data were generated either from the organization's data lake (based on nursing documentation) or by manual recordings. The prevalence of HAPUs was carried out by clinical nurses on 1 day a month in each organization. The inpatient falls data were produced quarterly at a monthly level in an excel-based summary matrix. The HAPU data were collected by monthly prevalences and summarized by quartiles.

The content for the benchmarking data of inpatient falls has been agreed by the Consortium: the number of patient days in that month and the number of inpatient falls by the level of injury (Levels 1–5). The categorization of the level of injuries is based on the NDNQI classification [22]. Similarly, the data of HAPUs have been defined to include: the count of all patients assigned to the unit and number of those patients, whose skin condition was assessed on the prevalence day, number of observed PUs by stages, unstageable PUs, deep tissue PUs, mucosal membrane PUs, non-visible PUs, total number of HAPUs and HAPU stages 2–4. The skin condition was assessed by nurse who visually checked the skin from head-to-toe [17]. The stages of PUs are based on the Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline [17]. In both benchmarking data sets, the following information is also included: three-digit organization identifier, unit type (e.g. Neurology inpatient unit), month (e.g. 3), and year (e.g. 2022). The classification of unit types based on the classification used by NDNQI but have revised to serve the structure of Finnish healthcare services.

Research data

With adequate permissions, the benchmarking data from 2021 to 2022 were used in this study. The benchmarking data of inpatient falls covered 10 hospitals (university hospitals, $n=5$; central hospitals, $n=5$). In these hospitals, an average of 198

units produced data regarding inpatient falls on a daily basis. The data included 22 different unit types (Table 1). Most of the 2-year data encompassing inpatient falls were collected from the university hospitals (university hospitals 90%, $n=4378$ units; central hospitals 10%, $n=504$ units).

The HAPU benchmarking data covered 11 hospitals (university hospitals, $n=5$; central hospitals, $n=6$). In these hospitals, an average of 121 units produced the prevalence data of PUs per month. The data included 22 different unit types (Table 1). Most of the 2-year data covering the monthly HAPU prevalence data were collected from the university hospitals (university hospitals 77%, $n=2227$ units; central hospitals 23%, $n=670$ units).

In both data sets (inpatient falls, HAPUs), the number of hospitals and units which produced benchmarking data varied substantially the eight-quartile period in 2021–22 (Table 2).

Data analysis

Frequencies and percentages were used in the analysis. The inpatient fall rates were expressed as the number of falls and

the number of falls with an injury per 1000 patient days. For the HAPU rates, the number of patients with a HAPU per the number of patients whose skin condition was assessed was calculated. The tests were conducted using IBM SPSS Statistics for Windows, Version 25.0 (Armonk, NY: IBM Corp) and Microsoft Excel.

Ethical considerations

The study was conducted following the Declaration of Helsinki and the ethical principles of the Finnish humanities [23, 24]. Originally, the data were collected for quality assurance and benchmarking purposes, and the study approvals were obtained from all member organizations of the Consortium to use the registry data for research. The confidentiality of the participants was maintained as no identifying information was collected. Following the Finnish and European Union data protection regulations, the Consortium does not collect any information about patients' demographics or health-related information. Collecting such information would require an official national quality register.

Table 1. Inpatient falls and HAPUs in Finnish adult acute and psychiatric care in 2021–22

Type of unit	Inpatient falls data ^a				PU data ^b			
	Patient days, <i>n</i>	Falls, <i>n</i>	Falls with injury, <i>n</i> (%)	Falls with injury per 1000 pd ^c	Patients, <i>n</i> (%)	Assessment of skin status, <i>n</i> (%)	Patients with HAPU (all stages), <i>n</i> (%)	Patients with HAPU (Stages 2–4), <i>n</i> (%)
Surgical units	690 605	911	382 (41.9)	0.55	16 989	14 556 (85.7)	602 (4.1)	170 (1.17)
Cardio-thoracic	94 476	155	72 (46.5)	0.76	2482	2313 (93.2)	118 (5.1)	38 (1.6)
Gastroenterologic and urologic	179 657	170	57 (33.5)	0.32	2746	2547 (92.8)	101 (4.0)	23 (0.9)
Ear, nose, throat, oral, and maxillofacial	33 388	47	19 (40.4)	0.57	471	400 (84.9)	7 (1.8)	2 (0.5)
Orthopaedic	153 086	156	61 (39.1)	0.40	3619	2861 (79.1)	79 (2.8)	27 (0.9)
Plastic	32 982	47	25 (53.2)	0.76	949	725 (76.4)	23 (3.2)	13 (1.8)
Trauma	80 148	159	85 (53.5)	1.06	2176	1693 (77.8)	56 (3.3)	24 (1.4)
Other surgical unit ^d	116 868	177	63 (35.6)	0.54	4546	4017 (88.4)	218 (5.4)	43 (1.1)
Medical units	1 075 782	2826	1115 (39.5)	1.04	22 974	20 871 (90.8)	947 (4.5)	260 (1.3)
Rehabilitation	77 078	162	43 (26.5)	0.56	1245	1151 (92.4)	47 (4.1)	12 (1.0)
Cardiac	122 005	305	139 (45.6)	1.14	2840	2559 (90.1)	24 (0.9)	6 (0.2)
Infectious disease	63 873	108	60 (55.6)	0.94	1346	1311 (97.4)	52 (4.0)	21 (1.6)
Neurology	209 931	507	212 (41.8)	1.01	2406	2006 (83.4)	69 (3.4)	25 (1.3)
Oncology	123 567	340	131 (38.5)	1.06	2552	2284 (89.5)	51 (2.2)	15 (0.7)
Respiratory	112 814	198	99 (50.0)	0.88	2914	2530 (86.8)	125 (4.9)	28 (1.1)
Other medical unit ^e	366 514	1206	431 (35.7)	1.18	9671	9030 (93.4)	579 (6.4)	153 (1.7)
Psychiatric units	526 361	684	301 (44.0)	0.57	2011	1633 (81.2)	19 (1.2)	3 (0.2)
Acute psychiatry	341 005	182	93 (51.1)	0.27	341	222 (65.1)	10 (4.5)	0 (0.0)
Psychiatric examination and rehabilitation	106 347	82	52 (63.4)	0.49	182	63 (34.6)	0 (0.0)	0 (0.0)
Psychogeriatric	79 009	420	156 (37.1)	1.97	1488	1348 (90.6)	9 (0.7)	3 (0.2)
Critical care units	66 060	57	23 (40.4)	0.35	3542	3279 (92.6)	327 (10.0)	143 (4.4)
Intensive care	22 413	26	11 (42.3)	0.49	1934	1792 (92.7)	271 (15.1)	126 (7.0)
Step-down	43 647	31	12 (38.7)	0.27	1608	1487 (92.5)	56 (3.8)	17 (1.1)
Gynaecologic and childbirth units	159 344	48	26 (54.2)	0.16	2639	2063 (78.2)	22 (1.1)	3 (0.1)
Labour and delivery	28 362	6	2 (33.3)	0.07	326	310 (95.1)	0 (0.0)	0 (0.0)
Mother/baby	76 989	7	6 (85.7)	0.08	441	289 (65.5)	0 (0.0)	0 (0.0)
Obstetrics and gynaecology	53 993	35	18 (51.4)	0.33	1872	1464 (78.2)	22 (1.5)	3 (0.2)
Total	2 518 152	4526	1866 (41.2)	0.74	48 155	42 402 (88.1)	1917 (4.5)	579 (1.4)

^aContinuous data.

^bPrevalence data.

^cpd, patient days.

^dFor example, rheumatism, kidney diseases, and skin diseases.

^eFor example, eye surgery and transplantation surgery.

Table 2. Number of units producing data of inpatient falls and HAPUs in study organizations during eight quarters in 2021 and 2022

Inpatient falls									
Organizations	Q1 2021, units (n)	Q2 2021, units (n)	Q3 2021, units (n)	Q4 2021, units (n)	Q1 2022, units (n)	Q2 2022, units (n)	Q3 2022, units (n)	Q4 2022, units (n)	Total, units (n)
Hospital A	NA ^a	NA ^a	NA ^a	NA ^a	9	6	9	9	33
Hospital B	229	222	240	246	227	232	201	196	1793
Hospital C	NA ^a	NA ^a	NA ^a	18	13	15	NA ^a	NA ^a	46
Hospital D	NA ^a	NA ^a	NA ^a	NA ^a	18	15	9	NA ^a	42
Hospital E	NA ^a	111	75	143	144	144	138	153	908
Hospital F	NA ^a	90	97	96	NA ^a	3	2	2	290
Hospital G	69	69	71	72	72	69	65	69	556
Hospital H	24	24	24	24	24	24	24	24	192
Hospital I	24	24	24	24	24	24	23	24	191
Hospital J	129	126	113	37	111	105	105	105	831
Total, units (n)	475	666	644	660	642	637	576	582	4882
HAPUs									
Organizations	Q1 2021, units (n)	Q2 2021, units (n)	Q3 2021, units (n)	Q4 2021, units (n)	Q1 2022, units (n)	Q2 2022, units (n)	Q3 2022, units (n)	Q4 2022, units (n)	Total, units (n)
Hospital B	116	122	102	101	109	72	80	89	791
Hospital C	NA ^a	2	4	13	18	12	9	15	73
Hospital D	NA ^a	NA ^a	NA ^a	10	NA ^a	NA ^a	NA ^a	NA ^a	10
Hospital K	NA ^a	18	21	21	19	10	17	16	122
Hospital E	NA ^a	33	93	107	86	83	80	87	569
Hospital F	NA ^a	54	55	47	31	18	16	24	245
Hospital G	61	53	61	61	57	41	58	51	443
Hospital H	32	33	31	32	22	27	27	30	234
Hospital I	24	24	23	24	24	21	20	20	180
Hospital J	23	22	25	22	24	19	21	20	176
Hospital L	NA ^a	4	9	8	9	8	7	9	54
Total, units (n)	256	365	424	446	399	311	335	361	2897

^aNA, not available.

Results

Inpatient falls

The data of inpatient falls covered a total of 2 518 152 patient days (range per month 70 581–122 628). Overall, the data included 4526 inpatient falls, totalling 1.80 falls per 1000 patient days. There were 1866 (41%) inpatient falls with an injury, totalling 0.74 falls per 1000 patient days. Most inpatient falls with an injury occurred in psychogeriatric units (1.97 falls per 1000 patient days), other medical units (1.18), cardiac units (1.14), trauma units (1.06), and intensive care units (0.49). The lowest number of inpatient falls with an injury was reported in labour and delivery units (0.07) and mother/baby units (0.08) (Table 1).

Pressure ulcers

During the 2-year prevalence days, the number of patients was 48 155 and 88% ($n=42\ 402$) of these patients were assessed for their skin condition. The total number of patients with a PU was 3214 (7.6%) and 1917 (4.5%) with a HAPU. The prevalence of HAPUs in Stages 2–4 was 1.4% ($n=579$) (Table 1). The highest rates of HAPUs (Stages 2–4) occurred in critical care (4.4%) and in medical care (1.3%) context (Table 1). The majority of the HAPUs (Stage 2–4) occurred in intensive care units (7.0%), plastic surgery units (1.8%), and other medical units (1.7%). The lowest number of HAPUs was reported in acute psychiatry units (0.0%), psychiatric examination and rehabilitation units (0.0%),

labour and delivery units (0.0%), and mother/baby units (0.0%) (Table 1).

Discussion

Statement of principal findings

The aim of this study was to explore the prevalence of inpatient falls and HAPUs among adult patients in Finnish acute and psychiatric care based on the national nursing-sensitive benchmarking data. Overall, the data included 4526 inpatient falls, totalling 1.80 falls per 1000 patient days. There were 1866 (41%) inpatient falls with an injury, totalling 0.74 falls per 1000 patient days. The total number of patients with a PU was 3214 (7.6%) and 1917 (4.5%) with a HAPU. The prevalence of HAPUs in Stages 2–4 was 1.4% ($n=579$).

The study was expected to provide information about nursing care quality for the development of clinical practice and to reveal the value of benchmarking data to support development of nursing-sensitive quality registers. The study revealed that benchmarking data collection was not completely systematic and established. Therefore, the benchmarking data did not give an overall picture of the nursing care quality in Finnish acute care and psychiatry care. The study process indicates that there is still work to be done on the systematic and extensive data collection and the quality of the data. In addition, the future development needs for the benchmarking data are: (i) an official national body (or an outside vendor) to receive and analyse the data and to report benchmarking

results, (ii) more detailed guidelines/protocols for data collection, (iii) education for clinical nurses regarding the data collection, and (iv) commitment of all nursing professionals in different roles for the nursing documentation and the data collection.

Interpretation within the context of the wider literature

In this study, 41% of inpatient falls caused an injury, while in previous studies the rates have been from 20% to 50% [10, 14, 25]. The data indicated that there were 0.74 inpatient falls with an injury per 1000 patient days. In previous studies, the rates of falls with an injury have been 0.4–2 per 1000 patient days in acute care [10, 12–14]. In the present study, most inpatient falls occurred in psychogeriatric units. In the study by Turner *et al.* [14], higher numbers were also found in psychogeriatric patients compared to adult psychiatry. High age and medication are among the risk factors associated with inpatient falls [11], which can also explain the high fall rate in psychogeriatric units in our study. Also in the present study, the lowest number of inpatient falls resulting in an injury was reported in the gynaecologic and childbirth context, where patients are mainly healthy and relatively young.

In this study, the prevalence of HAPUs in Stages 2–4 was 1.4%, indicating a lower prevalence compared to a previous study with a prevalence of 5.1% [21]. In this study, the highest prevalence rates of HAPUs were in Intensive care units, as was in a previous study by VanGilder *et al.* [19]. This is explained by the fact that the high assessed risk of PUs and prolonged length of stay in intensive care units are associated with the prevalence of HAPUs [18]. By using the benchmarking data, units with a high number of inpatient falls and HAPUs are identified. For these units, it is particularly important to implement systematic practices or protocols to prevent inpatient falls and HAPUs.

To provide valid data on inpatient falls and HAPUs, there is a need to develop a national nursing-sensitive quality register and agreed indicators for national and international benchmarking purposes [7, 11]. Currently, the benchmarking results are analysed based on approved assignments between the organizations within the Consortium. During the data collection of this study in 2021 and 2022, the benchmarking Consortium included 13 organizations, covering 56% of the wellbeing services counties in Finland ($n=23$). Presently, the coverage is 65%. Of the forementioned 13 organizations, 10 produced data on inpatient falls and 11 on HAPUs. This can be explained by the fact that within the Consortium, there were organizations just starting the nursing-sensitive benchmarking data production. Additionally, the number of different unit types that produces the benchmarking data monthly varied widely. In the monthly inpatient falls data, the maximum number of units per unit type was 32 (acute psychiatric unit) and the minimum number of units per unit type was 1 (intensive care units). The corresponding numbers in the HAPU data were 19 (other medical unit) and 1 (e.g. acute psychiatric unit and mother/baby unit).

The results of this study revealed the prevalence of inpatient falls and HAPUs in different nursing environments. It is essential to collect valid benchmarking data; however, it is also important to use the results of this gathered data to develop patient safety and the quality of clinical nursing care in

organizations. Inpatient falls and HAPUs as nursing-sensitive indicators in systematically measuring and evaluating the quality of care provide crucial information for national benchmarking, as the inpatient falls and HAPUs contribute to additional healthcare costs and the decrease in patients' quality of life [8, 9]. This information can be used to benchmark healthcare organizations and to develop service outcomes and patient care safety and quality in organizations. In addition, the information can be used in nursing research, as well as nurses' education and orientation in hospitals.

Strengths and limitations

The strength of this study is a large registry data from several acute and psychiatric care organizations. It also included nursing environments that have a high prevalence of inpatient falls with an injury [12, 14–16] and a prevalence of HAPUs [18]. The study results provide globally relevant information on the prevalence of inpatient falls and HAPUs.

The benchmarking data on inpatient falls were mostly generated from the organizations' data lakes based on nursing documentation. It is known that inpatient falls are underreported [26, 27], which might influence the reliability of the results in this study. In general, all nursing professionals need to be motivated and committed to producing reliable and extensive data documentation to avoid unwanted variations in benchmarking data.

Implications for policy, practice, and research

Systematic practices or protocols to prevent inpatient falls and HAPUs are needed, especially in units with a high number of inpatient falls and HAPUs. It is important for nurse directors and managers to ensure that the results of benchmarking data are presented and discussed with the nursing staff in their units to promote the culture of nursing care quality and continual improvement. For the culture of nursing care quality, nurses and nurse students need to receive education about systematic practices or protocols to prevent inpatient falls and HAPUs.

The collection of nursing-sensitive quality benchmarking data makes the quality of nursing care visible. Moreover, the transparency of the data in the units contributes to the development of nursing care quality. In the light of comparative data on nursing-sensitive indicators, the quality of nursing care in different settings can be measured. Reliable measurement requires the procedures to be further developed, as well as the education of nursing professionals in documenting the benchmarking data.

Conclusion

The low prevalence rates of the inpatients falls and HAPUs indicate that the quality of nursing care in Finland is at a good level when compared to international research findings. The type of unit in which a patient was treated was associated with inpatients falls and HAPUs; thus, the results of this study are supported by previous studies. There is a need for the prevention of inpatient falls, especially in psychogeriatric and rehabilitation units, and HAPUs, especially in intensive care units to ensure the safety and quality of patient care.

The benchmarking data can be used in research and to evaluate and develop nursing care and patient safety in

healthcare organizations. However, it is recommended to further develop the procedures and nursing professionals' education to ensure the reliability of benchmarking data. The experiences and principles obtained in benchmarking nursing quality within the Consortium can be utilized in setting up an official national quality register for nursing-sensitive quality indicators.

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Author contributions

Terhi Lemetti (Conception and design of the study, Data acquisition, Drafting the manuscript), Anniina Heikkilä (Conception and design of the study, Data acquisition, Analysis of data Drafting the manuscript), Asta Heikkilä (Conception and design of the study, Data acquisition Drafting the manuscript), Kristiina Junttila (Conception and design of the study, Data acquisition Drafting the manuscript), Marja Kaunonen (Conception and design of the study, Data acquisition Drafting the manuscript), Tiina Kortteisto (Conception and design of the study, Data acquisition Drafting the manuscript), Anu Nurmekele (Conception and design of the study, Data acquisition Drafting the manuscript), Susanne Salmela (Conception and design of the study, Data acquisition Drafting the manuscript), Pia-Maria Tantt (Conception and design of the study, Data acquisition Drafting the manuscript), and Tarja Tervo-Heikkinen (Conception and design of the study, Data acquisition Drafting the manuscript)

Supplementary data

Supplementary data is available at *IJQHC* online.

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Ethics

The study was conducted in accordance with the Declaration of Helsinki and the ethical principles of the Finnish humanities [23, 24]. Originally, the data were collected for quality assurance and benchmarking purposes, and the study approvals were obtained from all member organizations of the Consortium to use the registry data for research. The confidentiality of the participants was maintained as no identifying information was collected. According to Finnish legislation, no ethical statement was required because no identifying information was collected [28].

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