

# Exploring the Documentation of Delirium in Patients After Cardiac Surgery

## A Retrospective Patient Record Study

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Delirium is a common disorder for patients after cardiac surgery. Its manifestation and care can be examined through EHRs. The aim of this retrospective, comparative, and descriptive patient record study was to describe the documentation of delirium symptoms in the EHRs of patients who have undergone cardiac surgery and to explore how the documentation evolved between two periods (2005-2009 and 2015-2020). Randomly selected care episodes were annotated with a template, including delirium symptoms, treatment methods, and adverse events. The patients were then manually classified into two groups: nondelirious ( $n = 257$ ) and possibly delirious ( $n = 172$ ). The data were analyzed quantitatively and descriptively. According to the data, the documentation of symptoms such as disorientation, memory problems, motoric behavior, and disorganized thinking improved between periods. Yet, the key symptoms of delirium, inattention, and awareness were seldom documented. The professionals did not systematically document the possibility of delirium. Particularly, the way nurses recorded structural information did not facilitate an overall understanding of a patient's condition with respect to delirium. Information about delirium or proposed care was seldom documented in the discharge summaries. Advanced machine learning techniques can aug-

ment instruments that facilitate early detection, care planning, and transferring information to follow-up care.

**KEY WORDS:** Cardiac surgery, Delirium, Documentation, EHRs, Nursing

Delirium is a common phenomenon among hospitalized patients worldwide. Elderly patients who have undergone cardiac surgery are especially at risk of delirium, with the incidence of delirium being between 20% and 52%.<sup>1-3</sup> In European Union member states, over 138 000 coronary artery bypass procedures were conducted in 2020.<sup>4</sup> Delirium is an acute, temporary state of mind associated with a prolonged hospital stay, risk of institutionalization, lower cognitive ability, human suffering, safety risks, and increased burden of care for personnel.<sup>1,3,5,6</sup>

Delirium is a complex phenomenon, and the use of free-text documentation leads to difficulties in identifying this condition.<sup>7</sup> However, early signs of delirium may be detected in the documentation of care in EHRs by algorithms trained for this purpose.<sup>8</sup> This goal, however, necessitates defining what information can be extracted from EHRs related to this task. This information can then be used to train a machine learning model that can help professionals better identify patients exhibiting early signals of the risk of developing delirium. Therefore, the primary aim of this study was to describe the documentation of delirium symptoms, treatments, and adverse events in the EHRs of patients who have undergone cardiac surgery and to explore how the documentation evolved between two periods (2005-2009 and 2015-2020) in one hospital district in Finland. The secondary aim was to provide reliable annotated data for the development of decision-making aids, which can be integrated into EHR systems to improve the early detection and care of delirium.

### BACKGROUND

Delirium is defined through diagnostic criteria described in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*<sup>9</sup> and the *International Classification of Diseases, Tenth Revision*.<sup>10</sup> The definition includes disturbances in attention and awareness,

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This study is a part of a larger research project called "Knowledge-based Management in Perioperative Nursing," which is partially funded by The Finnish Foundation for nurse education and state funding for university-level health research in Finland (TYH2014211, TYH2019304). Second, the corresponding author (S.P.) has had funding from Department of Perioperative, Intensive Care and Pain Medicine, Helsinki University Hospital (HUS/600/2017, HUS/45/2018) and Nursing Research Center, Helsinki University Hospital (HUS/692/2019).

The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.cinjournal.com).

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DOI: 10.1097/CIN.0000000000001039

disturbances in cognition, acute onset, fluctuation, and associated symptoms such as disturbances in the sleep-wake cycle and emotions. Along with these symptoms, delirium manifests itself as a hyperactive, hypoactive, or mixed-motor subtype.<sup>9,10</sup>

The presence of some core diagnostic symptoms (eg, inattention, disorganized thinking, altered level of consciousness, and fluctuation) that do not meet the criteria for delirium has been defined as subsyndromal delirium.<sup>11</sup> It is a frequent and clinically important condition lasting from hours to days. It either can present as an independent stage or occur before full delirium becomes evident or subsides.<sup>12,13</sup> The term *confusion* is seen as consciousness being clouded with a reduced capacity to think, understand, respond, and remember. Confusion together with nonspecific symptoms such as anxiety, general malaise, or reduced pain tolerance can represent an early warning of the onset of delirium.<sup>14</sup> In this study, we use the term *possibly delirious* to cover the manifestations from confusion to subsyndromal delirium and full delirium because it is usually not possible to reliably determine the exact condition by only reading EHRs.

A computerized clinical decision support system (CDSS) integrated into an EHR system may help healthcare personnel in clinical decision-making by improving the accuracy of diagnoses and preventing delays in decision-making and patient care. Thereby, a CDSS may promote evidence-based practice in healthcare.<sup>15</sup> Furthermore, EHRs are used to support communication between professionals. According to the declaration by the World Health Organization and national legislation, EHRs should include information about planning, organizing, implementing, and assessing patient care.<sup>16,17</sup>

Best practice guidelines (BPGs) for delirium prevention and treatment have been published for intensive care<sup>13</sup> and postoperative care.<sup>18</sup> According to these BPGs and the quality standards for delirium, the key point in delirium care is to routinely evaluate the patient's state using a valid and reliable scale to detect early signs of delirium.<sup>13,19</sup>

Precise documentation of the nursing process (eg, assessing delirium risk factors and symptoms, recognizing the patient's state, planning future care, and evaluating present care) is the basis of patient-centered quality healthcare.<sup>19</sup> The documentation must be accurate, clear, and understandable so that all healthcare professionals involved in the patient's care can obtain the information they need. Adverse events, complications, and ineffective care must also be documented.<sup>20</sup> Yet, the documentation of delirium and its anticipatory symptoms in EHRs has been inconsistent. Nurses have used free text and unstructured language in delirium documentation, and the documentation does not clearly indicate whether the patient's state has been assessed, delirium was prevented, care needs were met and evaluated, and care-related information was communicated forward in the care process.<sup>7,21</sup>

## METHODS

### Design and Sample

The study design was a retrospective, comparative, and descriptive patient record study. The data consisted of the care episodes of patients who had undergone cardiac surgery during the years 2005 to 2009 (dataset 1) and 2015 to 2020 (dataset 2), as extracted from EHRs. The selected cardiac surgery procedures included the coronary artery bypass and the aortic, tricuspid, or mitral valve open-wound or transcatheter procedure. Patients who underwent open-wound surgery were treated immediately after the procedure in an ICU, after which they were first transferred to a high-dependency unit and next to a surgical ward. In contrast, patients with a transcatheter procedure were transferred directly to a high-dependency unit and a surgical ward. For this study, a random sample of 280 care episodes was selected separately from both periods. The randomization was performed by a computer. All care episodes that did not contain any postoperative nursing notes were removed from the random sample. A flow diagram of the care episode selection process is presented in Supplemental Figure 1, <http://links.lww.com/CIN/A267>.

The documentation of the care episodes included physicians' operative reports, progress notes, and discharge summaries at the ICU, the high-dependency unit, and the surgical ward. The nursing notes included both nurses' and physiotherapists' care notes and were written as free text under structured headings. Nurses' documentation from the ICU was not included because the notes had been recorded in a different EHR system. All patients continued to be cared for in the high-dependency unit and surgical ward, from which nurses' notes were included. The physiotherapists' notes mainly consisted of evaluation and guidance of motoric behavior and mobilization.

For dataset 1, the study was approved by the Ethics Committee of the Hospital District (17.2.2009 § 67), and a study permission was obtained from the administration of the Hospital District (2/2009). For dataset 2, an ethical statement was received from the University of Turku Ethics Committee (Health Care Division, 9/2020), and a study permission was obtained from the administration of the Hospital District (J14/2020). The study permissions included the right to perform text-mining research on the data. This study was performed in accordance with the Declaration of Helsinki. The pseudonymized data were stored on a secure server, and data access was limited to the researchers.

### Data Collection and Analysis

The data were semantically annotated using an annotation template, which was created through an iterative process based on diagnosis criteria (*Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, International Classification of Diseases, Tenth Revision*), two validated assessment scales, the

Confusion Assessment Method,<sup>22</sup> and the Nursing Delirium Screening Scale,<sup>23</sup> as well as clinical knowledge. Furthermore, the annotation classes were grouped into main categories that partly followed the Nursing Delirium Screening Scale headings (disorientation, psychomotor excitement, inappropriate communication, hallucinations, and psychomotor retardation). In this way, observing which core symptoms were present in the care episodes was easier. The annotation classes and their main categories are listed in Table 2. In addition, the documentation related to delirium treatments and adverse events was also annotated. The annotations were used in the manual classification of patients into possibly delirious or nondelirious.

To annotate means that one “adds a short explanation or opinion to a text.”<sup>24</sup> In this study, an annotation unit was one or more words, or even a whole sentence, because the delirium documentation had no standard terms in our language and the manifestation of the delirium varied between patients. During a pilot annotation, the fluctuation and intensity of symptoms were difficult to annotate because they were not expressed clearly in the EHRs. Thus, the fluctuations and intensities were excluded from the annotation scheme. The care episodes were annotated up to 30 postoperative days or until discharge. The purpose was not to make a diagnosis of delirium.

Dataset 1 was annotated in pairs with the BRAT rapid annotation instrument<sup>25</sup> by clinical nurses with expertise in delirium (SP, L-MP, ES) and with the assistance of domain experts in information and language technology (JH, TV, PH). Dataset 2 was annotated with a spreadsheet program by the primary investigator (SP) and evaluated by two coauthors (L-MP, ES) to ensure correctness and consistency in the annotations.

After the semantic annotation, the care episodes were reevaluated and manually classified into two groups: patients possibly suffering from delirium and patients likely not suffering from delirium. The care episodes were reviewed several times, and a consensus between three coauthors (SP, L-MP, ES) was reached. A patient was classified as possibly delirious if he/she was noted as confused or delirious, two or more core symptoms were present on a single day, the patient was behaving inappropriately or hallucinating, and/or a treatment of delirium was mentioned. How severe the symptoms were or how long the delirium episode lasted was not relevant. Short-term confusion associated with immediate awakening (ie, emergence delirium) was not treated as delirium. In addition, all ambiguous care episodes were excluded from the analysis, as seen in Supplemental Figure 1, <http://links.lww.com/CIN/A267>.

The annotations were analyzed descriptively and quantitatively. The summative analysis consisted of the average number of annotation units in the care episodes organized

by the annotation classes, datasets, and patient groups. The demographic information of the patients and procedures were statistically compared through the Pearson  $\chi^2$  test with a significance level of .05 using IBM SPSS Statistics version 27 (IBM Inc, Armonk, NY, USA).

## RESULTS

Altogether, 172 (dataset 1, n = 91; dataset 2, n = 81) patients were classified as possibly delirious, and 257 (dataset 1, n = 84; dataset 2, n = 173) were classified as nondelirious. Two care episodes with an *International Classification of Diseases, Tenth Revision* delirium diagnosis code (F05) were found in the datasets. In dataset 2, seven patients were classified as ambiguous due to the lack of sufficient information in the EHR. These patients had symptoms of sleepiness and hypoactive motoric behavior but not any mentions about attention, awareness, or orientation.

The demographics of the patients in the possibly delirious and nondelirious groups in the two periods are shown in Table 1. According to the statistical analysis, sex and age do not differ significantly between the two datasets. However, there is a statistically significant difference in the procedure type, likely because new mini-invasive procedures were adopted between the two periods.

In total, the datasets contain 10 295 annotation units, which include treatment methods and adverse events in addition to symptoms. The number of annotations across the care episodes varies between 0 and 392. The total number of annotation units regarding delirium symptoms is 3,385 for dataset 1 and 4,666 for dataset 2. To compare the occurrence of documented delirium symptoms, the average number of annotation units per care episode was calculated as presented in Table 2.

The top 10 symptoms of the possibly delirious patients in the two datasets are presented in Table 3 along with their average numbers of annotation units per care episode. Both hypoactive and hyperactive motoric manifestations were the most documented symptoms in this patient group. Between datasets 1 and 2, the proportion and importance of the explicit mentions of confusion and the manifestations of memory problems decreased, and the manifestations of disorganized thinking and disorientation increased. Notably, the main symptoms of delirium, inattention, and awareness were documented fewer times than the aforementioned symptoms.

Physicians', physiotherapists', and nurses' documentation relating to delirium differed from each other. The physicians' and physiotherapists' documentation consisted of notes with coherent bodies of text that included the assessment of the patient and the documentation of the executed care. In contrast, nurses' notes related to delirium were found under various structured, predetermined headings such as daily activities, survival, activity monitoring, and the assessment of the

**Table 1.** The Demographics of the Possibly Delirious and Nondelirious Patients in Two Datasets

Possibly Delirious	Dataset 1	Dataset 2	$\chi^2, P$	Nondelirious	Dataset 1	Dataset 2	$\chi^2, P$
Counts, n	91	81	—	Counts, n	84	173	—
Sex, n (%)			.136	Sex, n (%)			.757
Male	58 (63.7)	61 (75.3)		Male	62 (73.8)	132 (76.3)	
Female	33 (36.3)	20 (24.7)		Female	22 (26.2)	41 (23.7)	
Age category, n (%)			.265	Age category, n (%)			.675
Younger than 40 y	0 (0.0)	1 (1.2)		Younger than 40 y	3 (3.6)	4 (2.3)	
40-59 y	15 (16.5)	7 (8.6)		40-59 y	24 (28.6)	42 (24.3)	
60-79 y	62 (68.1)	62 (76.5)		60-79 y	52 (61.9)	111 (64.2)	
Older than 80 y	14 (15.4)	11 (13.6)		Older than 80 y	5 (6.0)	16 (9.2)	
Main procedure, n (%)			.047	Main procedure, n (%)			.006
Coronary bypass	53 (58.2)	36 (44.4)		Coronary bypass	61 (72.6)	91 (52.6)	
Valve <sup>a</sup>	23 (25.3)	23 (28.4)		Valve <sup>a</sup>	16 (19.1)	58 (33.5)	
Combination	15 (16.5)	16 (19.8)		Combination	6 (7.1)	13 (7.5)	
Mini-invasive <sup>b</sup>	—	5 (6.2)		Mini-invasive <sup>b</sup>	—	10 (5.8)	
Another <sup>c</sup>	0 (0.0)	1 (1.2)		Another <sup>c</sup>	0 (0.0)	1 (0.6)	
Missing	0 (0.0)	0 (0.0)		Missing	1 (1.2)	0 (0.0)	
Additional diagnosis, n (%)			—	Additional diagnosis, n (%)			—
Primary operation	79 (86.8)	72 (88.9)		Primary operation	74 (88.1)	164 (94.8)	
Reoperation <sup>d</sup>	12 (13.2)	9 (11.1)		Reoperation <sup>d</sup>	9 (10.7)	9 (5.2)	
Missing	0 (0.0)	0 (0.0)		Missing	1 (1.1)	0 (0.0)	

<sup>a</sup>Aortic, mitral, or tricuspid valve operation.

<sup>b</sup>Transcatheter procedure of aortic or mitral valve implantation.

<sup>c</sup>Procedure with cardiac tumor resection.

<sup>d</sup>Diagnosis with T-code (complication) or Z-code (earlier heart or transplant operation).

mental state. Delirium-related notes were also found under physiological assessments, such as breathing, blood circulation, pain management, and tissue density, as seen in the example below (a single time of a day, ID 211):

*Daily activities: The patient just slept a little. She didn't want a sleeping pill.*

*Survival: The patient's circadian rhythm is messed up. The patient has turned restlessly in bed and took off the mask several times.*

*Tissue density: The bandages have been renewed because apparently the patient removed them herself.*

*Daily activities: [The patient] is very stiff in her movements. She needs guidance repeatedly.*

The descriptions of delirium symptoms and the emphasis of the descriptions were different between the nurses' and physicians' documentation, as seen in the examples below (a single day, ID 261):

*[The patient] tried to get over the side of the bed. [The patient was] motorically very restless. [The patient] tells confusing events about being in the hospital. [The patient] can't really figure out where she has been and where she is now. (nurse's notes)*

*[The patient] has been confused.... There has been postoperative restlessness. (physician's progress note)*

Earlier delirium diagnoses were not considered in care planning. For example, the diagnosis of delirium F05.9 recorded to a patient's previous care episode was only mentioned by the physician in the following way:

*[The patient] has had short term memory loss in year [xx]. (ID 204)*

When a specialist (eg, a neurologist) was consulted, the documentation of the patient's delirium and treatments was precise, as seen in the following example (ID 52):

*After the procedure, the patient has been confused because of which she has had to be held in magnetic restraints for a while for her own safety. The patient was disorientated from time to time, so she moved around when cared for by the nurse. (physician's progress note)*

*The indwelling catheter was removed with physician's permission due to patient's delirium. The physician hopes that the nurse stays with the patient and mobilizes the patient with, e.g., walkers. (nurse's notes)*

The documented needs of nursing activities (such as medication treatment, daily activity assistance, repositioning treatment devices, and wound dressings) were remarkably more common for possibly delirious patients, as seen in the following examples:

*The nurse explained and recounted past days to the patient and told what happened on previous days. (nurse's note, ID 69)*

**Table 2.** The Average Number of Annotations per Care Episode for Each Annotation Class in the Possibly Delirious and Nondelirious Groups in Two Datasets

Main Category	Annotation Class	Dataset 1		Dataset 2	
		Annotations per Care Episode		Annotations per Care Episode	
		Possibly Delirious (n = 91)	Nondelirious (n = 84)	Possibly Delirious (n = 81)	Nondelirious (n = 173)
Confusion	Word confusion	2.33	0.01	2.90	0.01
Disoriented thinking	Memory problems	1.81	0.08	1.59	0.09
	Disorientation	1.37	0.06	3.72	0.02
Psychomotor excitement	Hyperactive behavior	4.99	0.25	7.52	0.16
	Inappropriate behavior	0.71	0.01	0.72	0.46
	Aggression, anger	0.51	0.01	0.46	0.12
	Hyperalert consciousness	0.05	0	0.04	0.03
	Inattention and awareness	0.52	0.02	2.05	0.07
Inappropriate communication	Slower speech	0.51	0.05	0.67	0.07
	Speech quality problems	1.09	0.04	1.99	0.05
	Disorganized thinking/speech	1.56	0.06	4.14	0.09
Hallucinations	Delusions, illusions	0.93	0.01	0.91	0.03
Psychomotor retardation	Sleepiness or unconsciousness	4.58	1.33	4.25	0.99
	Hypoactive behavior	1.27	0.07	2.38	0.21
	Hypoactive motoric	5.80	1.45	2.09	0.94
Another symptom	Sleep-wake rhythm	1.96	0.83	4.56	1.54
	Emotional disturbance	1.96	0.75	2.73	0.98
	Another problem <sup>a</sup>	0.34	0.02	1.64	0.86

<sup>a</sup>Disturbances in breathing, swallowing, dizziness, or incontinence.

...after long conversations, [the patient] does breathing exercises a few times. (nurse's note, ID 94)

Nurse got the patient to stand with the help of two other nurses. (nurse's note, ID 104)

[The patient] has been cared in bed. The resting position does not last. [The patient] cannot move herself at all. (nurse's note, ID 204)

It was also observed that safety concerns, such as the patient's own safety and the safety of other patients, were primarily addressed with the use of restraints, for example:

The right hand must be kept loosely tied because the hand immediately reaches for the nasogastric tube and other issues. (nurse's note, ID 180)

## DISCUSSION

In this study, approximately 40% of the patients were classified as possibly delirious, less than in recent studies by Mailhot et al<sup>26</sup> (2022) and Sanson et al<sup>27</sup> (2018) who studied subsyndromal and full delirium rates among patients after cardiac surgery. In their studies, the proportions of delirious and subsyndromal

**Table 3.** The Top 10 Symptoms in the Possibly Delirious Patients' Care Episodes in Two Datasets

Dataset 1	Annotations per Care Episode	Dataset 2	Annotations per Care Episode
Hypoactive motoric	5.80	Hyperactive behavior	7.52
Hyperactive behavior	4.99	Sleep-wake rhythm	4.56
Sleepiness or unconsciousness	4.58	Sleepiness or unconsciousness	4.25
Confusion	2.33	Disorganized thinking/speech	4.14
Sleep-wake rhythm	1.96	Disoriented behavior	3.72
Memory problems	1.81	Confusion	2.90
Disorganized thinking/speech	1.56	Emotional disturbance	2.73
Disoriented behavior	1.37	Hypoactive behavior	2.38
Hypoactive behavior	1.27	Hypoactive motoric	2.09
Speech quality problems	1.09	Inattention and awareness	2.05

delirious patients were between 60% and 70%.<sup>26,27</sup> A greater proportion of patients was possibly delirious in dataset 1 than in dataset 2. The reason might be that the word confusion was commonly used without any detailed explanations in dataset 1, as Laurila et al<sup>28</sup> (2004) also presented in their study.

The documentation of symptoms such as disorientation, memory problems, motoric behavior, and disorganized thinking improved between the periods. Still, in both datasets, inattention and awareness were documented less frequently than the previously mentioned symptoms. This should be particularly considered for patients with recent operations for whom the hypoactive delirium subtype often remains underrecognized. These patients commonly have problems related to maintaining a sleep-wake cycle (such as daytime tiredness and difficulties in sleeping at night) as well as hypoactive motoric behavior.<sup>27</sup> If these symptoms appear, it is particularly important to explore and document the patient's attention and awareness in order to recognize delirium.

In both datasets, a complete picture of the patients' delirium, executed care, or BPG follow-ups was hard to extract from the documentation, which complicated the annotation and examination of the EHRs. The nursing process, including the assessment, diagnosis, planning, implementation, and evaluation phases, did not clearly appear in the EHRs. The nurses' documentation style did not support getting an overall picture of a patient's delirium. The symptoms of delirium were documented under several headings, and the notes were more like descriptions of symptoms in free text than structured, coherent documentation. Note that no evidence of the use of a delirium assessment scale was found.

In both datasets, it was rare for patients to be diagnosed with delirium. Among the 172 possibly delirious patients, there were altogether four episodes with the diagnosis of delirium. This is consistent with the findings of McCoy et al<sup>21</sup> (2017) that there is often a failure to code delirium, even when it is recognized. In the present data, it might be the normal procedure for the physicians at the ward (a surgeon) not to make psychiatric diagnoses. Instead, they may be required to make a psychiatric or neurological consultation. Another reason for the underdiagnosis of delirium might be a gap in knowledge about delirium in somatic care. In cardiac surgery patient care, the Adult Cardiac Surgery Database or a similar database could be used to help professionals with the identification of postoperative delirium.<sup>29</sup>

In the examined EHRs, the professionals did not systematically document the possibility of delirium. In the physicians' progress notes and discharge summaries, the manifestation of the patient's delirium was not documented with the same emphasis as in the nurses' daily notes. Therefore, the information about the patient's delirium is not necessarily transferred to follow-up care. The patients themselves would also benefit from the information because they may be left with strong long-term memories of the delirium period.<sup>30</sup>

In this study, the possibly delirious patients needed more nursing actions, such as help in daily activities and in the care of cannulas and treatment devices, which is consistent with the literature.<sup>31,32</sup> Multiprofessional interventions and educational programs can improve the identification of delirium, patient care, and delirium documentation, and national and organizational guidelines and monitoring of care processes are needed.<sup>33,34</sup> In addition, recent guidelines can be used multiprofessionally.<sup>13,18,35</sup> Even now, our country lacks national BPGs regarding delirium care, but some organizations and departments may have their own.

### Strengths and Limitations

The data were annotated and evaluated in a coherent manner that strengthens the dependability and confirmability of this study. The annotation template was constructed based on previous theories and discussed with all annotators. With the template, a similar annotation could be performed with new data.

The study had some limitations regarding the method and the data. The retrospective approach used in this study had challenges. The recorded words might not have meant what the annotators interpreted in the retrospective analysis. Orally reported symptoms and documented symptoms might not necessarily be the same, or a symptom may be orally reported together with interventions but not documented in writing. However, this does not adhere to the legislation, BPGs, or quality standards.<sup>17,35</sup>

The annotation process was challenging because the notes related to delirium-associated symptoms were located under different headings depending on the registrar or unit. The texts also consisted of intermittent sentences with spelling mistakes, phrases, medical jargon, and variations. There were no standardized terms to describe delirium symptoms. The annotation quality was improved by reading the data several times and by double-checking the annotations in pairs.

Whether the fluctuation and intensity, together with words such as *orientated* and *alert*, should have been annotated can be questioned. This annotation is supported by Puelle et al<sup>36</sup> (2015), who mentioned that the phrase "alert and oriented" was one of the trigger words associated with the fluctuation of delirium.

The interpretation of the data depends on the evaluators and their classification of patients into the possibly delirious and nondelirious groups. In the data, the documentation was inconsistent. Consequently, this study lacks a formal "gold standard," such as the use of a validated delirium assessment scale or expert evaluation to confirm that delirium is present. There might also have been delirium-related symptoms or interventions that were not documented in the EHRs. Furthermore, the interventions used to treat delirium are usually the same as those included in quality care, making the interpretation

of the treatment methods difficult. This may have affected the reliability of the study and the group comparisons.

The data did not include nurses' notes from the ICU. Thus, there was a gap in the documentation for those patients who visited the ICU. We are of an opinion that the gap was manageable, because physicians wrote daily progress notes on these patients, based on which the patients' conditions could be reviewed. On the other hand, in other units, physicians rarely wrote daily notes and nurses' notes in that context formed a crucial source of information. Thus, we do not see that there is a systematic bias toward patients who did not stay in the ICU.

This manual annotation work was needed because documentation in Finland is generally done using free text. The data were collected from one hospital district, but one can argue that it represents the situation of the entire country. However, in other countries, the same information might be presented structurally or otherwise uniformly. Therefore, the results cannot be broadly generalized because the system in use may guide, limit, or otherwise influence the information content of the documentation.

This study reflects the need to develop a CDSS to better understand the phenomenon of delirium and nursing reality. Using a CDSS for free-text evaluation would allow all cases, from confusion to complete delirium, to be discovered in patient care processes and adverse events.<sup>21,37</sup> In the future, it would be reasonable to discuss how terminologies, ontologies, and annotated datasets like these would contribute to making the analysis easier, more reliable, and possibly automatized. It would be essential that such systems could guide the user in the documentation process.

## CONCLUSIONS

Although the documentation of some delirium symptoms improved between the examined periods, more attention should be paid to documenting a patient's inattention and lack of awareness. The professionals did not systematically document the possibility of delirium. Hence, patients with delirium possibly did not receive the care they needed. Nurses should strengthen their position as recognizers of delirium and determinedly improve their documentation manners. Moreover, information about an existing delirium or a suggested care plan were seldom reported to the follow-up care. Further conclusions could not be made from the data because of the demarcation to local data.

The nurses' documentation of delirium in the EHRs was especially informal and based on free text. This suggests that advanced machine learning techniques are needed to develop instruments that can detect early signs of delirium from EHRs. As a result of this study, annotated textual data are ready for further use. Future research should assess how an algorithm could best be trained to detect delirium from

the perspectives of precision and sensitivity, as well as how it can be integrated into a clinical setting to support professionals' decision-making, patient care, and communication.

## Practical Implications

This study discovered a gap in the documentation of patients' delirium, and several directions for further research were identified. In the future, documentation concerning patients' delirium should be more systematic, and more attention should be paid to the documentation of the core symptoms of delirium—inattention and lack of awareness. The systematic use of a delirium assessment scale can be useful with these core symptoms.

Moreover, the results of this study can be used in the development of a CDSS, which may help healthcare personnel in the early detection of delirium and in clinical decision-making to improve patient care and evidence-based practice. Furthermore, a CDSS can be developed to better support interprofessional and holistic care as well as to provide education regarding delirium as a phenomenon and its documentation.

## Acknowledgments

We would like to thank MSc Timo Viljanen and MSc Pauliina Anttila for their help in Dataset I annotation.

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