European Journal of Obstetrics and Gynecology 314 (2025) 114721

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.journals.elsevier.com/european-journal-of-obstetrics-and-gynecology-and-reproductive-biology

Full length article

Asphyxia due to substandard obstetric care in Finland: An 11-year patient insurance registry study of compensated patient claims

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ARTICLE INFO

Keywords:
Asphyxia
Obstetric care
Substandard care
Patient safety
Register-based study

ABSTRACT

Background: Asphyxia is a major cause of neonatal mortality, often linked to inadequate perinatal care, especially misinterpretation of cardiotocography. In Finland, the Patient Insurance Centre manages medical claims, offering a no-fault compensation model. Utilizing these claims could enhance obstetric safety and newborn health.
Aim: The aim of this study was to analyze the compensated patient claims and identify the substandard care leading to asphyxia.
Methods: A nationwide retrospective registry-based study was conducted. Data included all compensated patient insurance claims for neonatal asphyxia (N = 77) reported to the PIC between 2012 and 2022 Claims involving compensated fetal or neonatal asphyxia were analyzed. Data from the PIC electronic database, including obstetric and neonatal characteristics, severity of asphyxia, interventions, and long-term outcomes, were reviewed, and the substandard care was categorized and analyzed.
Results: Neonatal outcomes were categorized as follows: no permanent injury (n = 26), permanent injury (n = 28), and death (n = 23). All neonates met the criteria for asphyxia, and most required extensive intensive care. Permanent injuries included cerebral palsy, other physical disabilities, and epilepsy. All deaths resulted from severe asphyxia. Substandard care was most often attributed to inadequate monitoring of fetal well-being (n = 69), particularly in using and interpreting cardiotocographs and responding to pathological fetal heart rate changes. Other issues included delayed delivery (n = 64) and inadequate management of the birth (n = 28).
Conclusions: These findings highlight substandard care as a key contributor to asphyxia and emphasize the need for improved clinical practice. Enhancing training, protocols, and quality care standards is crucial to prevent adverse neonatal outcomes.

Introduction

Asphyxia is a leading cause of early neonatal mortality worldwide [1]. Approximately 3 to 4 infants per 1000 births are diagnosed with severe asphyxia with permanent injuries, such as cerebral palsy (CP) [2,3]. Perinatal asphyxia due to adverse events during birth is defined as the presence of metabolic acidemia, low Apgar scores, hypoxic-ischemic encephalopathy, or multiple organ failure [4]. From 2000 to 2019, intrapartum-related events (i.e. asphyxia) were responsible for 23.9 % of all neonatal deaths worldwide, making them the second leading cause of death. Intrapartum-related events were the third largest cause of under-5 mortality, accounting for 11.9 % of all deaths [5]. From 2000 to 2010, asphyxia caused 8 % of neonatal deaths in Europe [6].

Previous studies have shown that inadequate care during labour, most commonly related to the use and interpretation of cardiotocography (CTG), is associated with adverse events and poor birth outcomes, such as metabolic acidemia, asphyxia, and shoulder dystocia [7–10]. In Finland, fetal well-being is assessed using intermittent or continuous CTG in all hospital births. If concern arises from the CTG, fetal blood samples are taken per the obstetrician's evaluation [11]. The practice of

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https://doi.org/10.1016/j.ejogrb.2025.114721
Received 14 May 2025; Received in revised form 11 September 2025; Accepted 12 September 2025
Available online 15 September 2025

fetal blood sampling is still common in most Finnish hospitals. Newborn wellbeing is assessed using umbilical blood samples, which are routinely taken after each birth and analysed for pH and base excess.

In Finland, the Patient Insurance Centre (PIC) manages all claims related to medical treatment and healthcare. The system is based on a no-fault compensation model similar to other Nordic countries [12–14]. Previous studies have shown that asphyxia is a major reason for both seeking and receiving compensation for a patient claim. Inadequate care and human error were found to be leading causes resulting in compensation [12,13]. The PIC operates and makes decisions following legislation. Patient insurance claims are filed when an error or deviation in care occurs, and the patient seeks clarification and possible compensation. Although studies on PIC data have been conducted in other medical specialties, such as dentistry and surgery [15,16], the use of patient insurance claims to report obstetric safety in Finland is underutilised. This approach has the potential to improve obstetric safety and maternal and newborn health. In a preceding study on all obstetric patient insurance claims 849 claims (0.15 % of 564,056 births), 35.5 % (n = 302) involved neonatal injury, with asphyxia reported in 48.3 % (n = 146). Asphyxia-related claims had one of the highest compensation rates, with 52.8 % receiving compensation [17].

A detailed description of substandard care that leads to adverse neonatal outcomes such as asphyxia is needed to identify areas for improvement and to ensure high-quality obstetric care [17]. This study aimed to analyze insurance claims of patients who received compensation for asphyxia and to identify the substandard care leading to asphyxia.

Methods

This is a secondary analysis of data from a nationwide registry study of obstetric claims reported to PIC between 2012 and 2022 [17]. The data flow is described in Fig. 1. Asphyxia was diagnosed by a pediatrician/neonatologist based on the Apgar score, umbilical blood pH/base excess, and/or neonatal conditions. The degree of asphyxia was classified according to the diagnosis based on the International Classification of Diseases (ICD-10) [18].

All claims were compensated based on substandard care. According to the Finnish Patient Insurance Act, substandard care is considered an adverse event that occurs to the patient as a result of treatment or lack of treatment, provided that an experienced healthcare professional would have examined, treated, or otherwise managed the patient differently, and thus probably prevented harm [19].

Relevant documents (e.g., medical reports and PIC decision letters) for each claim were retrieved and reviewed. All claims were initially screened by two researchers (the first and second authors), followed by a detailed review conducted by one researcher (the first author). The first author collected the data from the PIC electronic database, which included obstetric and neonatal characteristics. Along with the diagnosis of asphyxia, the severity of the neonatal condition was determined by reviewing diagnoses of hypoxic-ischemic encephalopathy (HIE), and umbilical cord blood samples, where available. Additionally, the need and nature of neonatal care were assessed. Permanent injuries were classified based on assessment by pediatricians and neurologists during the neonatal period and later in life, up to 12 years. Deaths were classified according to their timing and cause.

The types of substandard care were retrieved from the data from PIC decision letters and expert statements, including perinatologists and neonatologists. Substandard care was categorized inductively by two researchers (the first and second authors) Claims that included multiple areas of substandard care were reported in each subcategory. Descriptive analysis was conducted using Microsoft Excel, and the results were presented as frequencies and percentages.

According to the guidelines of the Finnish National Advisory Board on Research Integrity, the use of existing anonymous (registry) data does not require approval from the National Committee of Research Ethics. The Finnish PIC granted permission to use the data in June 2024.

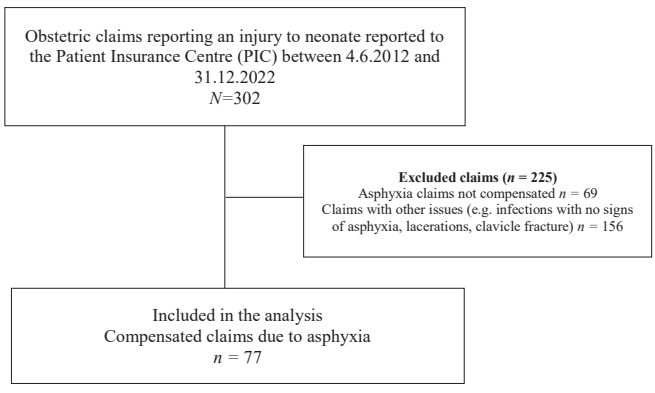

Fig. 1. Flowchart on data collection and reported variables of the study.

Results

Obstetric details of the claims are shown in Table 1..

Neonatal outcomes

The outcomes of asphyxia were categorized into three groups based on the permanence of injury: no permanent injury (n = 26), permanent injuries (n = 28), and death (n = 23) (Table 2).

All neonates without permanent injuries received immediate resuscitation (n = 26). The majority were intubated (n = 22) and treated in the neonatal intensive care unit (n = 23). Treatments included respiratory support, mainly high-flow oxygen therapy and nasal CPAP. 42.3 % of the neonates (n = 11) underwent cooling therapy. Severe metabolic

Table 1
Obstetric background information on claims (N = 77).

	n **(%)**
Parity	
Primipara	50 (64.9)
Multipara	27 (35.1)
Multiparas with previous spontaneous delivery	23 (29.9)
Pregnancy	
Singleton	67 (87.0)
Twin	10 (13.0)
Preterm (gestational age < 37 weeks at birth)	13 (16.9)
Presentation	
cephalic	71 (92.2)
breech	6 (7.8)
Onset of labor	
spontaneous	31 (40.2)
induced	29 (37.7)
High-risk patients on hospital admission	8 (10.4)
Mode of delivery	
vaginal	34 (44.2)
unassisted	15 (19.5)
vacuum assisted	14 (18.2)
breech	5 (6.5)
caesarean section	43 (55.8)

Table 2
Neonatal outcomes (N = 77).

	No permanent injury (n = 26)	Permanent injury (n = 28)	Death (n = 23)	All neonates (N = 77)
Umbilical artery (UA) acidosis				
Severe acidemia pH < 7.00 BE < -12.0 mmol/L or BDef > 12.0 mmol/L	12 (46.2)	13 (46.4)	11 (47.8)	39 (50.6)
Moderate acidemia pH 7.09 to 7.00 BE −11.9 to 10.0 mmol/L or BDef 11.9 to 10.0 mmol/L	3 (11.5)	2 (7.1)	1 (4.3)	7 (9.1)
No acidemia	3 (11.5)	8 (28.6)	0	11 (14.3)
No UA sample	1 (3.8)	4 (14.3)	6 (26.1)	11 (14.3)
5-min Apgar score < 7	24 (92.3)	27 (96.4)	23 (100)	74 (96.)
Immediate resuscitation Intubation for resuscitation	26 (100)12 (46.2)	28 (100)22 (78.6)	22 (95.7) 21 (91.3)	76 (98.7) 55 (71.4)
Intensive care Cooling therapy	23 (88.5)11 (14.3)	28 (100)22 (78.6)	16 (69.6) 14 (60.1)	67 (87.0) 47 (61.0)
Moderate or severe hypoxic-ischemic encephalopathy	7 (26.9)	23 (82.1)	11 (47.8)	41 (52.3)
Diagnosed asphyxia Mild / intermediate SevereUnspecified	18 (69.2)0	24 (85.7)2 (7.1)	16 (69.6)0	58 (75.3) 2 (2.6)

acidemia was present in more than half, with umbilical artery (UA) pH < 7.00 in most of these neonates (n = 18, 69.2 %) (Table 2).

All neonates with permanent injuries (n = 28) received immediate resuscitation and intensive care, including respiratory support (n = 28, 100 %), such as ventilator treatment, nasal CPAP, and high-flow oxygen. 84.6 % underwent cooling therapy (n = 22). Less than half of the neonates had severe acidemia, with UA pH < 7.00 (42.9 %). The most common permanent neonatal injury was CP (n = 16, 57.1 %), with most cases being dyskinetic CP, ranging from mild hemiplegia to quadriplegia requiring ongoing continuous assistance. Other physical injuries (n = 6) ranged from complete disability to impairment of one extremity. Seven children were diagnosed with intellectual disabilities. Many claims (n = 14, 50 %) involved multiple diagnoses, with epilepsy as the primary additional diagnosis (n = 10), and eight children had more than two diagnoses (Table 2).

In neonatal death claims, all but one neonate received immediate resuscitation (n = 22, 95.7 %). Six neonates (26.1 %) did not respond to resuscitation. The time to death in the neonatal intensive care unit ranged from a few hours to eight days. Asphyxia was identified as the primary cause of death in all neonates. Additional diagnoses included placental abruption (n = 2, 8.7 %) and uterine rupture (n = 3, 13.0 %) (Table 2).

Substandard care

Substandard care contributing to asphyxia occurred during birth (n = 70) and pregnancy (n = 7). Substandard care was classified into three main categories: 1) inadequate monitoring of fetal well-being, 2) delayed delivery, and 3) inadequate management of the birth. (Table 3).

Inadequate monitoring of fetal well-being was the most common form of substandard care (n = 69, 89.6 %). The primary issue was failure to respond to abnormal fetal heart rate (FHR) patterns (n = 40, 63.5 %). Responses to FHR changes were often delayed for hours, and in some cases, no action was taken. There were seven claims involving incorrect interpretation of FHR tracing, primarily due to misreading the maternal heart rate as the fetal heart rate. Technical issues in FHR tracing, such as poor-quality recording of either the heart rate or the contractions, and failure to monitor maternal heart rate, were identified in 18 claims. Additionally, in 19 claims, fetal blood samples or follow-up samples were not obtained despite clear indications. Hyperstimulation of the uterus was implicated in six claims, involving drug-induced hyperstimulation and inadequate monitoring of contractions, and thus not detecting the too frequent contractions.

Delayed delivery (n = 64, 83.1 %) was a significant area of substandard care. This included 13 claims involving delays in unassisted midwife-led births, where an obstetrician should have been informed and a vacuum-assisted delivery would have been the appropriate course of treatment. In obstetrician-led births, delays in vacuum-assisted deliveries (n = 10) involved both delayed decisions to use vacuum extraction and prolonged duration. In some cases, vacuum extraction exceeded the recommended number of pulls (six) and the recommended duration (20 min), with some procedures lasting up to an hour. In breech deliveries (n = 4), delays were attributed to the decision to continue vaginal delivery rather than performing a cesarean, despite clear contraindications for vaginal delivery.

The most common delay in delivery (n = 36, 56 %) occurred with cesarean sections. Delays were observed in both the decision-making process and the actual performance of the procedure. The delay

Table 3
Areas of substandard care.

	n **(%)**
Inadequate monitoring of fetal well-being	69 (89.6)
Failure to respond to pathological changes in FHR (fetal heart rate) tracing	40 (51.9)
Failure to ensure fetal well-being with fetal blood sample despite indications	19 (24.7)
Insufficient or low quality of the FHR tracing	18 (23.4)
Incorrect interpretation of the FHR tracing	7 (9.1)
Uterine hyperstimulation	6 (7.8)
Delayed delivery	64 (83.1)
Delay of caesarean delivery	36 (46.8)
Delay of unassisted vaginal birth	13 (16.9)
Delay of vacuum assisted delivery	10 (13.0)
Delay in breech delivery	4 (5.2)
Inadequate management of the birth	28 (36.4)
Lack of consulting an obstetrician	12 (15.6)
Others (failure to follow instructions, problems with anesthesia)	12 (15.6)
Delay in consulting an obstetrician	4 (5.2)

ranged from 30 min to several hours and, in some cases, days. A delay in performance was identified as a form of substandard care when a nonemergency procedure was conducted despite clear indications for immediate emergency surgery.

Inadequate management of childbirth was found in 28 claims (36.4 %). The most common error was failing to consult an obstetrician (n = 12) during midwife-led deliveries. This most often happened in cases with issues related to the CTG or the duration of active pushing, where no obstetrician was informed of the problems. Similarly, there were four cases involving significant delays in consulting an obstetrician, either by a midwife or a junior doctor. Other errors included issues with the anesthesia given to the patient, such as a delay in administering cesarean anesthesia or an excessive dose of local anesthetic during labour. Failure to follow established care guidelines was also noted, for example, not performing an episiotomy to speed up the birth.

All the claims involved more than one area of substandard care. The most common combination was inadequate fetal monitoring and delayed delivery (n = 29, 37.7 %). In every case, substandard care was identified as a series of events with multiple failures in managing the birth.

Discussion

This study described the neonatal outcomes of asphyxia and the substandard care that contributed to it, based on patient insurance claims that received compensation. Neonatal outcomes included temporary injuries, permanent injuries, and death, all of which could have potentially been avoided or minimized if healthcare professionals had acted differently under the circumstances. The most common examples of substandard care were inadequate monitoring of fetal well-being and delayed delivery.

The results showed that every neonate in this study met the basic definition of asphyxia: the inability to initiate or sustain spontaneous breathing [1]. Acidemia in the UA blood samples was observed in the vast majority of cases, further defining the degree of asphyxia. Severe acidemia was seen across all groups and was not linked to the permanence of the neonate's injury. This aligns with previous research indicating that HIE and low UA pH levels do not always lead to long-term adverse outcomes [20]. The impact of asphyxia is significant, at both the personal level for affected families and the societal level. Claims reporting no permanent injury to the neonate received compensation for temporary pain and suffering caused by extensive intensive care and its effects on the child. CP or other permanent disabilities resulting from perinatal asphyxia not only diminish a child's quality of life but also lead to significant financial loss [21]. The prevention and treatment of perinatal asphyxia are essential to prevent CP. Although the incidence of asphyxia is low and compensation claims are few, preventing even one case is invaluable. Learning from these claims is vital for improving care and outcomes.

The findings of this study align with previous research, where substandard care was identified as a contributing factor to poor neonatal outcomes and perinatal asphyxia [7–10]. Substandard care was characterized by professionals' failure to take appropriate action during pregnancy and childbirth that could have prevented poor outcomes. Intrapartum examples include using non–best practice interventions, withholding recommended measures, performing interventions poorly, and providing insufficient information or informed consent [22]. The areas of substandard care recognized in this study are consistent with the findings of the Each Baby Counts program, where the most common contributing factors were CTG use, risk recognition, communication, human factors, and training [23].

The most common form of substandard care was inadequate monitoring of fetal well-being, especially deficiencies in using CTG to monitor FHR [13,24]. Usually, an insufficient response to mild pathological changes set off a chain of events. This often started with a failure to address the issue promptly and further evaluate fetal well-being, leading to delayed delivery. Similar issues related to inadequate CTG monitoring were reported by Kortekaas et al. (2018) in cases of death from asphyxia [25]. This study highlights the need to improve CTG interpretation, which is complicated by its inherent subjectivity. Previous research has shown high variability in interobserver agreement for the same trace [26–28]. Notably, significant differences were observed between midwives and obstetricians, with midwives demonstrating good interobserver agreement, possibly due to their routine of reviewing records with colleagues [26,29].

Education on interpreting fetal monitoring is vital for every midwife and obstetrician, as this is the key area linked to substandard care and negligence during intrapartum care [30–32]. Previous studies indicate that CTG training improves birth outcomes, with lower rates of HIE and low UA pH after organized CTG training [33,34]. In Finland, there is no nationwide structured CTG training program for obstetricians and midwives. By law, hospitals and wellbeing service counties must provide continuing education to ensure up-to-date knowledge and enhance patient safety [35]. However, there are no specific requirements regarding the content of the training, such as focusing on CTG knowledge and interpretation, and hospitals are not obligated to provide their own programs. Paid courses on CTG are available through various organizations, but not all professionals can attend them, and some may never.

The data in this study were self-reported claims that do not represent all cases of perinatal asphyxia in Finland, causing a limitation. Information regarding the children's condition that influenced the PIC decision may have been incomplete in the most recent claims, as not all developmental issues are evident in early childhood. A relatively small sample size is another limitation; however, for descriptive purposes the sample size is suitable. A strength of this study is its use of unique nationwide data on obstetric claims submitted to the PIC, a system implemented in only a few countries globally. This is the first study to describe characteristics of substandard care leading to asphyxia based on compensated obstetric claims in Finland, demonstrating the importance of these findings. Another strength is the objective and constructive assessment of substandard care, avoiding a focus on attributing blame.

Conclusion

The findings of this study indicate that substandard care is a significant factor in cases of perinatal asphyxia and adverse neonatal outcomes, underscoring opportunities for improvement in clinical practice. Addressing these gaps in care could prevent negative outcomes for neonates and their families. This highlights the necessity for enhanced training, improved protocols, and a stronger focus on maintaining high-quality care standards in perinatal care.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the author(s) used Grammarly in order to improve the language and refine the writing style. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

CRediT authorship contribution statement

Maija Männistö: Writing – original draft, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jaana Lojander:** Writing – review & editing, Validation, Methodology, Investigation, Conceptualization. **Maiju Welling:** Writing – review & editing, Conceptualization. **Anna Axelin:** Writing – review & editing, Conceptualization. **Marja Härkänen:** Writing – review & editing, Conceptualization. **Reeta Lamminpää:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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.

Acknowledgments

We would like to thank the Patient Insurance Centre for allowing us to use their data.

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