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Original Paper

MATERNAL AND NEONATAL OUTCOMES OF VAGINAL DELIVERIES ARE COMPARABLE ACROSS HOSPITAL LEVELS IN LATVIA

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*Vaginal deliveries account for approximately 70% of all births in Latvia and represent a clinically homogeneous population suitable for assessing the quality and safety of inpatient obstetric care. This population-based cross-sectional observational study evaluated quality indicators of vaginal delivery care across different hospital levels in Latvia using retrospectively collected data from seven hospitals' performance in 2022. Medical records of 296 women with term singleton pregnancies ending in spontaneous vaginal delivery were involved. Coverage of key antenatal care indicators, including ultrasound screening, essential laboratory testing and newborn screenings, was high and largely comparable across hospital levels. Intrapartum and neonatal outcomes were generally comparable, with low complication rates and high coverage of Apgar scoring, newborn screening, and vaccination. Early breastfeeding within the first hour occurred in 94.9% of cases, and exclusive breastfeeding at discharge in 81.7%; however, breastfeeding practices differed significantly between hospital levels (*p *= 0.01). Anticoagulant use was uncommon overall (5.8%) but varied significantly across hospital levels (*p *= 0.01), reflecting the possibility of differences in clinical management and documentation practices. Overall, the results demonstrate that when vaginal delivery proceeds physiologically, hospitals of all levels in Latvia are able to provide safe and high-quality maternal and neonatal care, with largely comparable clinical outcomes. At the same time, observed variation in selected process indicators — particularly breastfeeding practices and anticoagulant use — suggests a need for improved harmonisation of clinical protocols and documentation standards. These findings support further refinement of quality criteria and justify extending similar quality assessments to more complex obstetric populations, including Caesarean deliveries.*

Keywords: *obstetric care quality, healthcare service evaluation, hospital care levels, quality indicators, Donabedian framework, process indicators, documentation practices.*

INTRODUCTION

Maternal and perinatal health remains a global public health priority, with the reduction of preventable maternal and newborn morbidity and mortality identified as a key objective by the World Health Organisation (Trends in maternal mortality 2000 to 2023, n.d.). In high-income countries, where access to skilled birth attendance and essential obstetric services is largely ensured, the focus of maternity care has increasingly shifted from service coverage toward the quality, safety, and experience of care (Afulani *et al*., 2019), (Bull, 2022). This shift reflects growing recognition that good results in obstetric care depend not only on the availability of medical interventions, but even more on how

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care is organised, delivered, and documented, providing the possibility of analyses. While maternal and perinatal mortality and morbidity remain essential outcome indicators (OECD and European Commission, 2024), they provide limited insight into routine care processes, particularly in settings with relatively low event rates. The evaluation of healthcare quality is commonly guided by the Donabedian framework, which introduced the concept of quality assessment through dimensions of structure, process, and outcomes (Donabedian, 1988). Contemporary quality frameworks therefore promote process indicators, documentation practices, and management factors, alongside clinical outcomes, as critical components of safe, effective, and family-oriented maternity care (Sandall *et al*., 2016; Oladapo *et al*., 2018; Reddy *et al*., 2022; Sriram *et al*., 2024).

In Latvia, the number of births has declined substantially over the past decade (SKPC, datubāze, n.d.), while maternal and perinatal mortality indicators remain among the higher reported rates within the European Union (SKPC, datubāze, n.d.). Comprehensive assessment of maternity care quality at the individual patient level is limited by fragmented health information systems, with relevant data distributed across multiple institutional and clinical sources. In this context, systematic review of hospital medical records represents a pragmatic approach for evaluating care processes, documentation quality, and adherence to clinical recommendations across different levels of inpatient care (Donabedian, 1988). Vaginal deliveries are the majority of births in Latvia, accounting for approximately 70% of all deliveries, and represent a clinically homogeneous population when restricted to term singleton pregnancies. Focusing on physiological vaginal births provides an appropriate baseline for assessing the quality and consistency of routine obstetric care, allowing identification of variations in care processes that may not be evident in outcome measures alone. Such analysis also creates a reference point for future evaluation of more complex obstetric populations, including operative and high-risk deliveries. The aim of this study was to assess quality indicators and clinical outcomes of vaginal delivery care across different hospital levels in Latvia, with particular attention to antenatal care, intrapartum management, neonatal outcomes, and selected process indicators.

MATERIALS AND METHODS

Study population and settings. A population-based cross-sectional study was conducted using retrospectively collected data. The analysis covered the period from 1 January to 31 December 2022. Hospital groups were defined according to the national classification of healthcare institution levels (levels II–V). This study was carried out in seven inpatient obstetric facilities in Latvia representing different levels of maternity care: Pauls Stradiņš Clinical University Hospital, Rīga Maternity Hospital, Liepāja Regional Hospital, Daugavpils Regional Hospital, Ogre Regional Hospital, Jēkabpils Regional Hospital, and Sigulda Hospital.

The study population consisted of women aged 18 years and older who were hospitalised during the study period with term (≥ 37 gestational weeks) singleton pregnancies ending in spontaneous vaginal delivery. Women with preterm birth, multiple pregnancy, or operative delivery (including caesarean section, vacuum extraction, or forceps delivery) were excluded.

Medical records were identified and selected with the assistance of the National Health Service using a stratified random sampling approach proportional to the volume of deliveries at each hospital level. The total source population comprised 11,349 eligible vaginal deliveries. Based on a predefined statistical sample size calculation, a minimum sample of 141 records was required; to achieve 80% of power. Data were extracted from delivery records using a structured data collection instrument developed on the basis of current clinical guidelines and relevant literature. Extracted variables covered maternal demographic characteristics, antenatal care indicators, intrapartum management, postpartum outcomes, and neonatal outcomes.

Statistical analysis. Descriptive statistics was performed for all study variables. Categorical variables were summarised using frequencies and percentages. Continuous variables were summarised using means and standard deviations or medians and interquartile ranges, according to their distribution. Differences across hospital levels were evaluated using Chi-square or Fisher's exact tests for categorical variables and independent samples *t*-tests, one-way ANOVA, Mann–Whitney *U*, or Kruskal–Wallis tests for continuous variables, depending on data distribution. Statistical significance was defined as $p < 0.05$. All analyses were performed using IBM SPSS Statistics, version 29.0.

RESULTS

Study population (Table 1). To increase study power and robustness, 301 medical records were initially selected. After data validation, a total of 296 women met the criteria and were included in the analysis. The median maternal age was 30.0 years (IQR 26.0–34.0), and the median pre-pregnancy body mass index was 22.7 kg/m² (IQR 22.5–25.5). The median gestational weight gain was 12.2 kg (IQR 8.3–15.95). Most women had one or two previous pregnancies (26.4% and 29.1%, respectively), and a similar pattern was observed for previous deliveries, with one (36.5%) or

Table 1. Description of the study population

Variable	Median (IQR)	n (valid)
Age (years)	30.0 (26.0–34.0)	296
Body mass index (kg/m²)	22.7 (20.5–25.5)	279
Weight gain during pregnancy (kg)	12.2 (8.3–15.95)	277
Gestational age (days)	280 (274–284)	295
Days to delivery	0 (0–0.75)	296
Duration of labour (min)	350 (250–536)	291
Blood loss ≤ 24 h (ml)	300 (250–320)	292
Neonatal birth weight (g)	3570 (3297–3860)	296

Table 2. Pregnancy care, neonatal care, and delivery characteristics according to hospital

Level (2–5)

Parameter	Category	Level 5 (n, %)	Level 4 (n, %)	Level 3 (n, %)	Level 2 (n, %)	p value
Pregnancy care						
Anticoagulant use	Yes	13 (11.3)	3 (3.6)	1 (1.5)	0 (0.0)	0.01
	No	102 (88.7)	81 (96.4)	66 (98.5)	27 (100.0)	
If Rh negative – IgG received	Yes	10 (16.4)	8 (61.5)	2 (25.0)	1 (50.0)	< 0.001
	No	3 (4.9)	4 (30.8)	5 (62.5)	1 (50.0)	
	Not reported	48 (78.7)	1 (7.7)	1 (12.5)	0 (0.0)	
Ultrasound – 1st trimester	Yes	110 (97.3)	73 (91.2)	62 (92.5)	24 (88.9)	0.21
	No	3 (2.7)	7 (8.8)	5 (7.5)	3 (11.1)	
Ultrasound – 2nd trimester	Yes	110 (97.3)	64 (100.0)	57 (95.0)	25 (92.6)	0.06
	No	3 (2.7)	0 (0.0)	3 (5.0)	2 (7.4)	
Test (GTT) documentation	Numeric	68 (74.7)	44 (52.4)	38 (56.7)	15 (55.6)	0.002
	Written	0 (0.0)	7 (8.3)	8 (11.9)	5 (18.5)	
	Not described	23 (25.3)	33 (39.3)	21 (31.3)	7 (25.9)	
Neonatal care						
Newborn genetic screening	Yes	115 (100.0)	83 (96.5)	67 (98.5)	26 (96.3)	0.23
	No	0 (0.0)	3 (3.5)	1 (1.5)	1 (3.7)	
Feeding	Breast only	92 (80.0)	61 (71.8)	61 (89.7)	27 (100.0)	0.01
	Mixed	22 (19.1)	21 (24.7)	6 (8.8)	0 (0.0)	
	Formula	1 (0.9)	3 (3.5)	1 (1.5)	0 (0.0)	
Hearing test	Successful	114 (99.1)	84 (97.7)	65 (95.6)	24 (88.9)	0.07
	Failed	1 (0.9)	0 (0.0)	0 (0.0)	1 (3.7)	
	Not done	0 (0.0)	2 (2.3)	3 (4.4)	2 (7.4)	
Delivery characteristics						
Labour duration (min)	Median (IQR)	400 (290–550)	300 (194–430)	370 (279–558)	308 (201–551.5)	0.004
Days to delivery	0 days	12 (40.0)	29 (64.4)	29 (82.9)	5 (71.4)	0.03
	1 day	16 (53.3)	10 (22.2)	5 (14.3)	2 (28.6)	
	2 days	2 (6.7)	5 (11.1)	1 (2.9)	0 (0.0)	

Rh – rhesus factor; IgG – Immunoglobulin G; GTT – glucose tolerance test

two (33.8%) deliveries being most common. Participants were recruited from hospitals representing four levels of obstetric care: level V (n = 115, 38.9%), level IV (n = 86, 29.1%), level III (n = 86, 29.1%), and level II (n = 27, 9.1%) (Table 2).

Antenatal care. Coverage of key antenatal care indicators was high across all hospital levels. First-trimester ultrasound screening was performed in 93.7% of cases and second-trimester screening in 97.0%, with no statistically significant differences between hospital levels. A glucose tolerance test (GTT) was completed in 72.2% of women; however, the quality of documentation differed significantly between hospital levels ($p = 0.002$). Numerical reporting of test results was most frequent in higher-level hospitals, while lower-level hospitals more often documented results descriptively or lacked numerical values. Anticoagulant administration during pregnancy was uncommon overall (5.8%) but varied significantly across hospital levels ($p = 0.01$). Its use was most frequently documented in level V hospitals and was absent in level II hospitals. Group B streptococcus screening was performed in 89.2% of women, while antibiotic administration for positive results was documented in 12.5%, without statistically significant differences between hospital levels. Rh factor testing was nearly universal (99.7%). Among Rh-negative women, immunoglobulin prophylaxis was administered in 25.0% of cases, not administered despite indication in 15.5%, and documentation regarding indication was missing in 59.5%. The proportion of women receiving immunoglobulin prophylaxis differed significantly across hospital levels ($p < 0.001$), with lower coverage observed in higher-level institutions.

Intrapartum characteristics. The median gestational age at delivery was 280 days (IQR 274–284). Most women (75%) delivered on the day of hospital admission, although the interval from admission to delivery differed significantly between hospital levels ($p = 0.03$). Same-day delivery was most frequent in level III hospitals, while a one-day interval was more commonly observed in level V hospitals. The median duration of labour was 350 minutes (IQR 250–536), with statistically significant differences across hospital levels ($p = 0.004$). Longer median labour durations were observed in higher-level hospitals compared with lower-level institutions. Median postpartum blood loss was 300 ml (IQR 250–320) and did not differ significantly between hospital levels.

Spontaneous onset of labour occurred in 60.1% of cases. Labour induction was most commonly performed using amniotomy (17.7%) or combined methods (13.7%), with prolonged pregnancy (28.6%) and gestational diabetes (12.1%) being the most frequently documented indications. Documentation of induction indication was missing in a substantial proportion of cases. Oxytocin augmentation was used in 21.6% of deliveries, episiotomy was performed in 10.8%, and uterotonic agents were administered in 82.4% of cases, without clinically meaningful differences between hospital levels. Major postpartum interventions, including uterine curettage, tamponade, and blood transfusion, were rare (% of cases). Epidural analgesia was used in 26.4% of deliveries, while 73.6% of women did not receive epidural analgesia. Documentation of alternative pain relief methods was limited: among cases with available data, nitrous oxide was used in 64.3% (n = 9) and other non-epidural methods in 35.7% (n = 5); however, in this parameter the information on alternative analgesia was missing in 282 cases.

Information on the presence of a support person during labour was available for 133 (44.3%) women. A support person was present in 67.7% of cases (n = 90), while 32.3% delivered without a support person (n = 43); data were missing for 163 cases (55.7%).

Blood transfusion was required in one case (0.3%), while 99.7% of women did not require transfusion. Perineal integrity was preserved in 70.9% of deliveries (n = 210). First-degree perineal tears occurred in 17.2% (n = 51), second-degree tears in 11.5% (n = 34), and third-degree tears in 0.3% (n = 1); no fourth-degree tears were recorded.

Neonatal outcomes (Table 3). The median neonatal birthweight was 3570 g (IQR 3297–3860). Apgar scores at 1 and 5 minutes were recorded for nearly all newborns, with no significant differences across hospital levels. Umbilical cord blood gas analysis was performed in 23.3% of cases.

Breastfeeding was initiated within the first hour in 94.9% of cases. Exclusive breastfeeding at discharge was achieved in 81.7% of newborns; however, feeding practices differed significantly across hospital levels (p = 0.01). Exclusive breastfeeding was most frequently documented in lower-level hospitals, while mixed or artificial feeding was more common in higher-level institutions. Formula feeding overall was rare (1.4%).

Coverage of neonatal screening and preventive interventions was high across all hospital levels. Bilirubin testing was performed in 43.2% of newborns, Tuberculosis vaccination in 92.6%, hearing screening in 97.0%, and genetic

Table 3. Neonatal outcomes in the study cohort

Variable	Category	n (%)	Valid n
Neonatal health problems	No	182 (61.5)	214
	Yes	32 (10.8)	
Apgar score at 1 minute recorded	Yes	294 (99.3)	296
	No	2 (0.7)	
Apgar score at 5 minutes recorded	Yes	293 (99.0)	296
	No	3 (1.0)	
Cord blood gas analysis performed	No	227 (76.7)	296
	Yes	69 (23.3)	
Breastfeeding at 1 hour postpartum	No	11 (3.7)	294
	Yes	279 (94.9)	
	Skin-to-skin only	4 (1.4)	
Feeding type at discharge	Breastfeeding only	241 (81.7)	295
	Mixed feeding	49 (16.6)	
	Formula feeding	4 (1.4)	
	Other / unspecified	1 (0.3)	
Bilirubin measurement performed	No	168 (56.8)	296
	Yes	128 (43.2)	
Tuberculosis vaccination	Not given	5 (1.7)	296
	Contraindicated	17 (5.7)	
	Given	274 (92.6)	
Newborn hearing screening	Not done	7 (2.4)	296
	Failed	2 (0.7)	
	Successful	287 (97.0)	
Newborn genetic screening	No	5 (1.7)	296
	Yes	291 (98.3)	
Discharge status	Discharged in good condition	285 (96.3)	296
	Transferred / other	11 (3.7)	

screening in 98.3%, with no statistically significant differences between hospital levels. Most newborns (96.3%) were discharged home.

Postpartum outcomes. Postpartum complications occurring beyond 24 hours were infrequent. No complications were documented in 97.6% of women, while bleeding (1.7%) and infection (0.7%) were rare. Most women were discharged on postpartum day three (70.8%), with no significant variation between hospital levels.

DISCUSSION

This retrospective assessment of term singleton spontaneous vaginal deliveries provides a baseline picture of routine obstetric care quality across Latvian hospital levels. The principal finding is that maternal and neonatal short-term outcomes were broadly comparable across levels, with high coverage of essential antenatal screening (first- and second-trimester ultrasound), good intrapartum and postpartum outcomes (rare severe complications and major interventions), and high uptake of neonatal screening and preventive measures. In this context, observed differences between hospital levels were more prominent in selected process indicators and documentation practices than in clinical outcomes, similarly to other studies in the field (e.g., Shahbazi Sighaldeh *et al*., 2025) .

Several indicators highlighted documentation and process variability. The most notable example was glucose tolerance testing: although testing coverage was substantial, documentation quality differed between hospital levels, including a meaningful proportion of records lacking numerical results. In routine clinical practice, incomplete recording of test values reduces transparency of decision-making and may compromise continuity of care (Sandall *et al*., 2016), while at the system level, it limits the usability of routinely collected data for monitoring and quality improvement.

Variation was also observed in anticoagulant use. Overall use was low (5.8%), which is consistent with a cohort dominated by low-risk pregnancies ending in uncomplicated vaginal birth (Jacobson *et al*., 2020) . However, differences across hospital levels may reflect a combination of factors: heterogeneity in patient risk profiles (including referral patterns), differences in the application of thromboprophylaxis algorithms, and/or differences in recording practices. Because the number of anticoagulant users was small, interpretation should remain cautious; nonetheless, anticoagulant prescribing and its documentation represent a relevant process-of-care indicator. Similar considerations apply to Rh immunoglobulin prophylaxis, where substantial missingness regarding indication limits inferences and underlines that documentation completeness itself is an important quality attribute within the Donabedian process domain (Donabedian, 1988).

Intrapartum results were consistent with physiological birth, including low rates of major interventions and very rare transfusion requirement. Differences in labour duration and time from admission to delivery across hospital levels may reflect organisational workflows and case mix rather than quality deficits per se. Higher-level hospitals may more often receive patients with greater clinical complexity or a higher likelihood of intrapartum risk escalation, even within a cohort that ultimately delivers vaginally. These organisational indicators may therefore function as signals for targeted process evaluation (e.g., admission timing, patient flow, induction management pathways), rather than direct proxies of safety (Kruk *et al*., 2018). Maternal complications, including perineal tears, blood loss, and the use of labour augmentation, were comparable across hospital levels, indicating a broadly similar clinical approach to intrapartum management.

Early postpartum and neonatal findings were reassuring overall, including high Apgar score recording and high coverage of neonatal screening and vaccination. Importantly, breastfeeding indicators differed between hospital levels, despite the cohort's generally favourable neonatal condition. Early initiation was high, and exclusive breastfeeding at discharge was also high overall, but inter-level differences suggest that breastfeeding success at discharge is sensitive to organisational and environmental factors. Evidence indicates that structured breastfeeding-support, including Baby-Friendly Hospital Initiative–type interventions, increase early initiation and exclusive breastfeeding (Habte *et al*., 2025). Variation in exclusive breastfeeding rates may plausibly relate to staffing patterns, workload, routines around mother–infant separation, rooming-in practices, and the availability of targeted lactation support, as well as differences in maternal and neonatal clinical complexity that were not fully captured by the dataset. Despite those possible biases, the study population largely represents a low-risk obstetric cohort across all hospital levels. These findings support treating breastfeeding-related indicators as meaningful process outcomes for quality monitoring in early postpartum care (Habte *et al*., 2025).

Two domains were particularly affected by missing documentation: non-epidural pain relief methods and support person participation. Epidural use was clearly recorded (26.4%), but information on alternative analgesia approaches was absent in the vast majority of records. Similarly, support person data were missing in over half of the cohort. Incomplete recording limits both clinical interpretability and research utility and weakens the ability to evaluate, whether we are stepping towards woman and family centered practices of inpatient obstetric care (Bull, 2022, Sriram *et al*., 2024). These gaps should be interpreted primarily as a limitation of retrospective record-based evaluation and, simultaneously, as a potential target for quality improvement in documentation standards. Given the increasing emphasis on experience-of-care in maternity quality frameworks, improving the completeness of routine recording for supportive care and analgesia options would strengthen both clinical governance and system monitoring (Kruk *et al*., 2018).

LIMITATIONS AND STRENGTHS OF THE STUDY

The most prominent limitation of the study is its cross-sectional nature: we do not have the possibility of assessing the changes that occur in the organisation of hospital documentation and vaginal care quality over time. Another possible limitation is that regardless of our attempt to cover all possible vaginal care indicators, some of them might have been missed in this study. While the study was based on existing international guidelines for such an assessment, some additional indicators may be important to increase the quality of care specifically in the Latvian population. A substantial proportion of missing data was observed for several parameters across hospital levels, potentially introducing information bias and reducing the robustness of comparative analyses. At the same time, this finding itself is informative, highlighting variability in clinical documentation and pointing to gaps in the systematic capture of key maternal and neonatal indicators, particularly in the context of healthcare quality assessment.

A consistent strength of the study is the high coverage of core antenatal and neonatal measures, suggesting relatively uniform implementation of national recommendations for mandatory screening and newborn preventive care.

CONCLUSIONS

In this retrospective study of term singleton spontaneous vaginal deliveries, maternal and neonatal short-term outcomes were broadly comparable across Latvian hospital levels, with high coverage of core antenatal screening and neonatal preventive care. Inter-level differences were more evident in selected process indicators and documentation practices, particularly breastfeeding outcomes at discharge and anticoagulant use. These findings support the capacity of all hospital levels in Latvia to provide safe care for physiological vaginal births and underline the importance of process-based indicators and documentation completeness for quality monitoring. Extending similar analyses to operative deliveries, especially Caesarean sections, is warranted to evaluate quality across the full spectrum of obstetric care.

ETHICS

The study protocol was reviewed and approved by the Clinical Research Ethics Committee of the Pauls Stradiņš Clinical University Hospital (approval No. 080424-3L, 8 April 2024). All data were anonymised before analysis. Individual patient identifiers were removed, and researchers had access only to fully anonymised datasets.

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VAGINĀLU DZEMDĪBU KVALITĀTES INDIKATORI UN TO SALĪDZINĀJUMS PA STACIONĀRU LĪMEŅIEM LATVIJĀ

Aptuveni 70% no visām dzemdībām Latvijā ir vaginālas un veido klīniski homogēnu pacientu grupu, kas ir piemērota iniciālai stacionārās dzemdniecības aprūpes kvalitātes un drošības izvērtēšanai. Šajā populācijā balstītajā šķērsgriezuma novērošanas pētījumā tika analizēti vaginālu dzemdību aprūpes kvalitātes rādītāji dažādu līmeņu slimnīcās Latvijā, izmantojot retrospektīvi iegūtus datus no septiņām ārstniecības iestādēm par to darbību 2022. gadā. Analīzē tika iekļautas 296 sievietes ar viena augļa grūtniecību, kas beigusies ar spontānām vaginālām dzemdībām laikā. Galveno prenatālās aprūpes kvalitātes rādītāju, tostarp ultrasonogrāfiskā skrīninga, būtisko laboratorisko izmeklējumu un jaundzimušo skrīningu, pārklājums bija augsts un lielākoties līdzvērtīgs starp slimnīcu līmeņiem. Dzemdību gaitas un neonatālie iznākumi kopumā bija līdzīgi, ar zemu komplikāciju biežumu, pārliecinošu jaundzimušo skrīninga un vakcinācijas aptveri. Zīdīšana pirmajā dzīves stundā tika uzsākta 94,9% gadījumu, bet ekskluzīva zīdīšana izrakstīšanas brīdī tika sasniegta 81,7% gadījumu; tomēr zīdīšanas prakse būtiski atšķīrās starp slimnīcu līmeņiem (p = 0,01). Antikoagulantu lietošana kopumā bija reta (5,8 %), taču arī uzrādīja statistiski nozīmīgas atšķirības starp slimnīcu līmeņiem (p = 0,01), iespējams, atspoguļojot atšķirības klīniskajā vadībā un dokumentācijas praksē. Iegūtie rezultāti liecina, ka gadījumos, kad vaginālas dzemdības norit fizioloģiski, visu līmeņu slimnīcas spēj nodrošināt drošu un augstas kvalitātes mātes un jaundzimušā aprūpi. Konstatētās atšķirības atsevišķos procesa rādītājos norāda uz nepieciešamību turpmāk saskaņot kvalitātes kritērijus un pamato līdzīgas analīzes nepieciešamību sarežģītākām dzemdniecības pacientu grupām, tostarp ķeizargrieziena gadījumiem.