Original Article

Trends in Caesarean Section Rates and Puerperal Purulent–Septic Infections in Kazakhstan: A Five-Year Retrospective Study (2020–2024)

Gulnoza Aldabekova[1], Zaituna Khamidullina[1], Svetlana Abdrashidova[1], Aiman Mussina[1], Gulnara Kamalbekova[1] Samal Kassymbek[1], Gulsim Kokisheva[1]

ABSTRACT

Background

The postpartum period involves extensive physiological adjustments, but remains a vulnerable stage for maternal morbidity, particularly from infections. Despite antibiotic prophylaxis, puerperal purulent–septic infections (PSI) persist as clinically significant complications, especially following cesarean section (CS), the most common major obstetric surgery worldwide. Understanding trends in CS and PSI is essential for improving maternal outcomes.

Aim

To evaluate trends in deliveries, CS rates, and the incidence, clinical characteristics, and complications of PSI in a tertiary maternity hospital in Kazakhstan from 2020 to 2024.

Methods

A retrospective observational study included 36,317 deliveries over five years. Data on delivery mode, CS type (elective vs. emergency), PSI incidence and type, re-hospitalisation, and associated obstetric complications were extracted from electronic medical records. Descriptive statistics and trend analysis were performed.

Results

CS rates increased from 23.6% in 2020 to 27.2% in 2024, with emergency procedures predominating. PSI incidence remained low overall but rose from 0.01% in 2022 to 0.20% in 2023–2024. Endometritis was the most frequent infection, followed by wound dehiscence, which increased notably in the final two years. No postpartum sepsis occurred. PSI cases were more common in young, primiparous women and those undergoing emergency CS. Frequent associated conditions included labour abnormalities, fetal hypoxia, chorioamnionitis, obstetric trauma, and premature rupture of membranes.

Conclusion

Although overall PSI incidence was low, the rising CS rate and wound-related complications underscore the need for strengthened perioperative prevention strategies, targeted risk assessment, and vigilant postoperative monitoring to optimize postpartum outcomes in Kazakhstan.

INTRODUCTION

The postpartum period—commonly defined as the first six weeks after childbirth—is a time of profound physical change as a woman's body gradually returns to its pre-pregnancy state. During this phase, the uterus shrinks back to its normal size, tissues begin to heal from perineal tears or surgical incisions, lactation is established, and cardiovascular and metabolic systems slowly stabilize [1].

Although these processes are natural and expected, the postpartum period is also a vulnerable time. Women may face a higher risk of complications, including infections, bleeding, thromboembolic events, and emotional or psychological challenges. National data from Slovenia suggest that approximately 10% of women require medical assessment within the first six weeks after delivery, highlighting the importance of careful monitoring and timely postpartum care [2].

Typical postpartum issues include challenges with breastfeeding, abnormal uterine bleeding, pain from perineal or surgical wounds, gastrointestinal and urinary complaints, headaches, and hypertension-related disorders. Among these, infections represent a major contributor to postpartum illness and are a common cause of emergency medical visits [1] Despite advances in obstetric practice and

1. Astana Medical University (Non-Commercial JSC), Astana 010000, Republic of Kazakhstan.

Correspondence

Gulnara Kamalbekova, PhD - Professor, Department of Public Health and Epidemiology, Astana Medical University (Non-Commercial JSC), Astana 010000, Republic of Kazakhstan; E-mail: kgm.08@mail.ru

Bangladesh Journal of Medical Science Vol. 25 No. 02 April'26

DOI: https://doi.org/10.3329/bjms.v25i2.88748

broad access to antibiotics, postpartum infections remain a significant source of maternal morbidity—and in some regions, maternal mortality. Although the impact is more substantial in low-resource settings, these infections continue to present concerns in high-income countries as well. Without timely identification and management, they can progress to sepsis or septic shock [3]. A postpartum fever higher than 38 °C should therefore prompt a comprehensive clinical assessment to identify the infectious focus and initiate appropriate antibiotic therapy. The most frequent infections during the postpartum period are endometritis (infection of the uterine lining), mastitis (infection of the breast), and wound infections involving cesarean-section sites or perineal tears/episiotomies [4].

Endometritis is the most common postpartum infection, occurring in roughly 2% of women following vaginal birth and in 10–15% of those who deliver by cesarean section.

Endometritis is a polymicrobial infection involving bacteria from the normal vaginal flora, including Group B streptococci, aerobic Gram-negative bacteria such as *Escherichia coli* (E. coli), *Klebsiella pneumoniae*, and *Proteus*species, as well as anaerobic organisms. It typically presents with fever, foul-smelling lochia, lower abdominal discomfort, and uterine tenderness. Management involves broad-spectrum antibiotics along with antipyretics [1].

Mastitis, an infection of breast tissue in lactating women, often arises due to trauma to the areola, incomplete emptying of the breast, or breast pump use. Patients usually experience sudden-onset fever, chills, and a firm, painful, erythematous breast. The most frequent causative organisms are skin flora, especially *Staphylococcus* species. First-line treatment includes antistaphylococcalpenicillins, and continued breastfeeding is recommended. Untreated mastitis can progress to a breast abscess, which occurs in about 0.1% of lactating women and generally requires incision and drainage in addition to antibiotic therapy [2].

Surgical site infections (SSIs) after childbirth encompass cesarean wound infections and, less frequently, deep pelvic infections. These infections generally arise from skin or genital tract bacteria and manifest with localized signs such as redness, swelling, pain, purulent discharge, or systemic symptoms like fever [1]. Rare but severe postpartum infections—such as necrotizing fasciitis, septic pelvic thrombophlebitis, or intra-abdominal abscesses—can occur and are associated with high morbidity and mortality [1].

Cesarean delivery and other invasive procedures during vaginal birth (e.g., manual removal of retained placenta or placental fragments) significantly increase the risk of surgical site infections by introducing bacteria into sterile tissues [5,6]. As the most common major obstetric surgery worldwide, cesarean section carries a substantially higher risk of infection compared to vaginal delivery [7]. Without prophylactic antibiotics, up to 20–25% of women develop postpartum infections after cesarean delivery, with endometritis rates reaching 30–35% [8,9]. Even with prophylaxis, the risk of postpartum infection remains roughly five times higher than after vaginal birth.

Acknowledging this elevated risk, the World Health Organization (WHO) released guidelines in 2021 recommending routine prophylactic antibiotics for all cesarean births. A single pre-incision dose of a first-generation cephalosporin—or clindamycin for women allergic to penicillin—is standard practice to reduce surgical site infections [9]. Additionally, a multicenter study by Tita et al. (2016) showed that the addition of a 500 mg intravenous dose of azithromycin significantly lowered the risk of surgical site infections [10].

AIM

To evaluate the trends in deliveries, caesarean section rates, and the incidence, clinical characteristics, and complications of puerperal purulent–septic infections (PSI) among postpartum women from 2020 to 2024 in Kazakhstan.

METHODS

A retrospective observational study was conducted over a five-year period (2020–2024) at a tertiary maternity hospital. The study involved systematic collection of delivery and postpartum infection data to describe trends, infection types, and associated maternal factors.

Samples

- **Population:** All women who delivered at the study hospital between January 2020 and December 2024.
- **Sample size:** 36,317 deliveries across five years.
- **Inclusion criteria:** Women with complete medical records for delivery and postpartum follow-up.

- **Exclusion criteria:** Women with incomplete medical records or transferred cases without follow-up data.

Data Collection

- Delivery data (total births, mode of delivery, preterm births).
- Caesarean section data (emergency vs. elective).
- Postpartum infection data (PSI incidence, type, re-hospitalisation).
- Clinical characteristics of infected patients (age, parity, delivery type).
- Pregnancy and intrapartum complications associated with PSI.

Data were extracted from hospital electronic medical records and infection control reports.

Data Analysis

- Annual distribution of deliveries and caesarean section rates.
- Incidence of PSI calculated as the proportion of cases per total deliveries per year.
- Classification of PSI by type: endometritis, wound dehiscence, mastitis, sepsis.
- Description of healthcare-associated infections (HAIs) and their structure.
- Analysis of clinical characteristics of patients with PSI, including age, parity, delivery type, and re-hospitalisation.
- Evaluation of pregnancy and intrapartum complications among patients with PSI.

Statistical Analysis

Descriptive statistics: frequencies, percentages, means ± standard deviation.

Trends over time assessed using simple linear trends (e.g., caesarean section rates).

Comparisons of categorical variables (e.g., infection type across years) using chi-square tests.

No inferential testing was explicitly reported; primary focus on descriptive epidemiology.

Ethical clearence

This study was conducted in accordance with ethical standards. Ethical approval was obtained from the appropriate institutional review board, and informed consent was secured from all participants prior to data collection.

RESULTS

General Characteristics of Deliveries (2020–2024)

During the five-year observation period, a total of **36,317 deliveries** were recorded. Annual birth numbers ranged from 5,288 to 8,555. The proportion of preterm deliveries remained relatively stable (4–6%). The caesarean section rate showed a gradual increase from **23.6% in 2020** to **27.2% in 2024**. Emergency caesarean sections consistently accounted for more than half of all operative deliveries.

Table 1. Delivery characteristics and caesarean section rates (2020–2024)

Year	Total deliveries	Caesareansection, n (%)	Emergency CS	Elective CS	Pretermbirths (%)
2020	8555	2023 (23.6%)	1068	955	4.2%
2021	5288	1299 (24.6%)	723	576	6.1%
2022	7257	1937 (26.7%)	1130	807	6.1%
2023	7365	1989 (27.0%)	1134	855	6.3%
2024	7552	2052 (27.2%)	1150	902	4.4%

Table 1 summarises the annual distribution of deliveries and caesarean section rates from 2020 to 2024. A consistent upward trend in caesarean delivery is evident, with emergency procedures prevailing over elective ones each year. Preterm birth rates remained largely unchanged throughout the study period.

Incidence of Puerperal Purulent–Septic Infections

The overall incidence of purulent–septic infections (PSI) among postpartum women remained low. The lowest rate was recorded in 2022 (0.01%), whereas the highest incidence occurred in 2023–2024 (0.20%). No cases of postpartum sepsis were registered.

Table 2. Incidence of puerperal purulent–septic infections (2020–2024)

Year	Deliveries	PSI, n (%)	Endometritis	Wounddehiscence	Mastitis	Sepsis
2020	8555	5 (0.05%)	3	–	1	0
2021	5288	4 (0.07%)	3	–	1	0
2022	7257	1 (0.01%)	1	–	0	0
2023	7365	13 (0.20%)	9	1	0	0
2024	7552	17 (0.20%)	10	7	0	0

Table 2 presents the incidence of puerperal infections across the study period. Endometritis was the predominant clinical form of infection. A notable increase in wound-related complications—including uterine suture dehiscence—was observed during the last two years. No cases of postpartum sepsis were reported.

Structure of Healthcare-Associated Infections (HAIs)

Postpartum endometritis constituted the leading form of healthcare-associated infections (HAIs), accounting for 58–73% of cases. Postoperative wound infections represented the second most frequent category.

Table 3. Structure of healthcare-associated infections (2022–2024)

Infectiontype	2022	2023	2024
Postpartumendometritis	48 (58%)	85 (73%)	60 (71%)
Postoperativewoundinfections	14 (25%)	12 (16%)	12 (20%)
Perinealwoundinfections	2 (2%)	6 (5%)	3 (4%)
Peritonitis	5 (6%)	5 (4%)	2 (2%)
Sepsis	10 (12%)	3 (3%)	4 (5%)
Other	4 (5%)	5 (4%)	4 (5%)

Table 3 details the distribution of HAIs recorded from 2022 to 2024. Postpartum endometritis consistently dominated the infection structure. Surgical-site infections appeared as the second most common category, while peritonitis, perineal wound infections, and other less frequent conditions accounted for a small proportion of cases.

Clinical Characteristics of Patients With Puerperal Infections (2024)

In 2024, **17 cases** of puerperal infections were identified. Endometritis accounted for 60% of the cases, whereas suture dehiscence represented 40%. Re-hospitalisation was required in 29% of women.

Table 4. Clinical characteristics of patients with puerperal infections (2024)

Parameter	Value
Total PSI cases	17
Operativedelivery	11 (65%)
— Emergency CS	9 (53%)
— Elective CS	2 (12%)
Vaginaldelivery	6 (35%)
Endometritis	10 (60%)
Suturedehiscence	7 (40%)
Re-hospitalisation	5 (29%)
Age<25 years	6 (35%)
Primiparity	11 (64%)
Meanage	29.2 ± 6.0 years

Table 4 outlines the clinical profile of patients with puerperal infections in 2024. Most cases occurred among women who underwent operative delivery, particularly emergency caesarean section. Young primiparous women comprised the majority of affected patients. Endometritis and suture dehiscence were the most frequent clinical forms.

Pregnancy and Intrapartum Complications Among Patients With PSI

The most frequently documented associated conditions included labour abnormalities, fetal hypoxic states, infectious complications such as chorioamnionitis, obstetric trauma, and prelabour rupture of membranes.

Table 5. Pregnancy and intrapartum complications among patients with PSI (2024)

Complicationgroup	Representativeconditions	Cases
Infectious	Chorioamnionitis	3
Labourabnormalities	Uterineinertia, failedinduction	4
Fetalcomplications	Fetalhypoxia, nuchalcord	4
Obstetrictrauma/haemorrhage	Perinealtears, bleeding	3
PROM	Prelabourruptureofmembranes	2

Table 5 presents the associated pregnancy and intrapartum complications among patients with puerperal infections. The most common coexisting factors included abnormalities of labour progression and fetal distress. Infectious complications such as chorioamnionitis, as well as obstetric trauma and membrane rupture, also contributed to the overall clinical profile.

DISCUSSION

The findings of this five-year retrospective analysis highlight important trends in postpartum care, caesarean section (CS) practices, and the epidemiology of puerperal purulent–septic infections (PSI). Although

the overall incidence of PSI in this cohort remained low, the observed rise in infections—particularly wound dehiscence and endometritis—in 2023 and 2024 warrants clinical attention. These results mirror international evidence showing that postpartum infectious morbidity persists despite widespread use of antibiotic prophylaxis and advances in intrapartum care (Acosta & Knight, 2013; Knowles et al., 2015).

Rising caesarean section rates, increasing from 23.6% to 27.2% during the study period, align with global trends reported across Europe and other high-income regions. Boerma et al. (2018) documented significant worldwide increases in CS rates, and Betrán et al. (2021) emphasized that many regions exceed recommended thresholds. Higher CS frequency is clinically relevant because it is one of the strongest predictors of postpartum infection. Numerous studies confirm the elevated risk of postoperative endometritis, wound infection, and sepsis following CS compared with vaginal birth (Olsen et al., 2010; Tita et al., 2009; Ziogou&Kokolakis, 2022). The dominance of emergency CS among infected patients in this study echoes findings by Leth et al. (2011), who demonstrated that emergency procedures carry a particularly high risk due to prolonged labour, ruptured membranes, intrapartum fever, and urgent surgical conditions.

The **predominance of endometritis** observed in our cohort is consistent with earlier reports describing it as the most common postpartum infection (Lučovnik, 2015; Boggess & Watts, 2020). Endometritis typically arises from polymicrobial flora, including Group B streptococci, anaerobes, and Gram-negative rods. Similar microbiological patterns have been reported by Gibbs et al. (1992) and by Andrews et al. (2003), who emphasized that prophylactic antibiotics reduce—but do not eliminate—its occurrence. That the infection burden was strongly associated with operative deliveries further supports evidence from Blackwell et al. (2012) and Smaill&Grivell (2014), who identified surgical intervention as a principal driver of postpartum infectious morbidity.

An encouraging finding is the **absence of postpartum sepsis cases** during the entire study period. Sepsis remains a leading cause of maternal mortality worldwide, particularly in low- and middle-income countries (Say et al., 2014; Bonet et al., 2017). The low rate observed here likely reflects effective hospital protocols, timely recognition of early infection signs, and robust access to antimicrobial therapy. Nevertheless, Acosta et al. (2014) stressed that sepsis may be underdiagnosed, especially when presentations are atypical or early warning indicators are subtle. Continued vigilance remains essential.

The **increase in wound-related complications**—notably uterine suture dehiscence—in 2023–2024 is clinically noteworthy. Similar upward trends have been reported elsewhere, often linked to rising CS rates, technical surgical factors, and maternal comorbidities (Wloch et al., 2016; Owens &Stoessel, 2008). While our study did not evaluate surgeon-specific or procedural factors, the pattern warrants further investigation, particularly because wound infections are among the most preventable postpartum morbidities.

Patient-level characteristics also played a significant role. The predominance of young, primiparous women among PSI cases aligns with observations by Schellekens et al. (2021), who found that primiparity is associated with increased obstetric intervention, prolonged labour, and a higher likelihood of intrapartum complications—all factors that predispose to infection. Moreover, labour abnormalities and fetal distress—frequently recorded in our dataset—have been strongly associated with infectious morbidity due to prolonged exposure to vaginal flora, increased examination frequency, and the heightened likelihood of operative delivery (Newton et al., 2020).

Finally, the clinical significance of **chorioamnionitis**, PROM, and obstetric trauma among infected patients in this cohort reflects long-established risk patterns. Chorioamnionitis substantially increases the risk of postpartum endometritis and sepsis (Tita& Andrews, 2010), while PROM has been repeatedly shown to facilitate ascending genital tract infection (Hannah et al., 1996; Mercer, 2003). These data underscore the multifactorial nature of PSI and the importance of individualized risk assessment.

CONCLUSION

This five-year analysis demonstrates a low but fluctuating incidence of puerperal purulent–septic infections, with notable increases during 2023–2024. Endometritis remained the leading postpartum infection, followed by wound-related complications, particularly in women undergoing emergency caesarean section. Despite high surgical activity and rising CS rates, no cases of postpartum sepsis were recorded, indicating effective infection prevention and management measures.

The results highlight several key clinical implications:

1. Continued surveillance is essential as rising CS rates may counteract improvements in infection control.
2. Emergency CS remains a high-risk procedure, requiring optimized perioperative protocols and careful patient selection.
3. Risk factors such as chorioamnionitis, labour abnormalities, PROM, and obstetric trauma substantially contribute to postpartum infection and should be proactively identified.
4. Strengthening postoperative wound management and adherence to antibiotic prophylaxis guidelines may reduce the recent increase in wound dehiscence.

Future research should explore modifiable surgical and intrapartum factors, evaluate long-term maternal outcomes, and incorporate microbiological confirmation to improve diagnostic accuracy. Overall, integrated obstetric, surgical, and infection-control strategies remain crucial for ensuring safe postpartum recovery.

Authors' Contributions

All authors contributed equally to the conception, design, and writing of this manuscript.

Conflict of Interest

The authors declare no conflicts of interest related to this study. This manuscript is original, has not been published previously, and is not under consideration for publication elsewhere.

Funding

This study did not receive any external funding or financial support from third parties.

REFERENCES

1. Lučovnik M. Puerperij - poporodnoobdobje. In: Pajntar M,Novak Antolič Ž, Lučovnik M, editors. Nosečnost in vodenjeporoda. Ljubljana: Društvomedicinskirazgledi; 2015.
2. BojcŠmid E, Mudrovčič S, TrojnerBregar A. Ponovnisprejemotročnice v porodnišnico. In: Grosek Š, Lučovnik M, Smrkolj Š, editors. Oskrbaploda med porodom in novorojenčka v porodnišnici. Ljubljana: Društvo za pomočprezgodajrojenimotrokom; 2022.
3. Acosta CD, Knight M. Sepsis and maternal mortality. *CurrOpinObstetGynecol*2013;**25**:109–16.
4. Knowles SJ, O'Sullivan NP, Meenan AM, Hanniffy R, Robson M. Maternal sepsis incidence, aetiology and outcome for mother and fetus: a prospective study. *BJOG* 2015;**122**:663–71.
5. Tita AT, Rouse DJ, Blackwell S, Saade GR, Spong CY, Andrews WW. Emerging concepts in antibiotic prophylaxis for cesarean delivery: a systematic review. *ObstetGynecol*2009;**113**:675–82.
6. Mohamed-Ahmed O, Hinshaw K, Knight M. Operative vaginal delivery and post-partum infection. *Best Pract Res Clin ObstetGynaecol* 2019; **56**:93–106.
7. Olsen MA, Butler AM, Willes DM, Cross GA, Deukota P, Fraser VJ. Risk factors for endomyometritis after low transverse cesarean delivery. *Infect Control Hosp Epidemiol*2010;**31**:69–77.
8. Ziogou A, Kokolakis I. Post caesarian section surgical site infections: review of current literature. *Hell J ObstetGynecol*2022;**22**:1–8.
9. World Health Organization. WHO recommendation on prophylactic antibiotics for women undergoing caesarean section. Geneva: *World Health Organization*; 2021.
10. Tita ATN, Szychowski JM, Boggess K, Saade G, Longo S, Clark E, et al. Adjunctive azithromycin prophylaxis for cesarean delivery. *N Engl J Med* 2016;**375**:1231–41.
11. Boerma T, Ronsmans C, Melesse DY, et al. Global epidemiology of use of and disparities in caesarean sections. *Lancet*. 2018;**392**:1341–48.
12. Betrán AP, Temmerman M, Kingdon C, et al. Interventions to reduce unnecessary caesarean sections. *Lancet*. 2021;**398**:1287–98.
13. Leth RA, Møller JK, Thomsen RW, Uldbjerg N, Nørgaard M. Risk of selected postpartum infections after emergency vs. elective cesarean section. *Acta ObstetGynecol Scand*. 2011;**90**(9):1090–1096.
14. Boggess KA, Watts DH. Infectious diseases in pregnancy. In: Gabbe SG, Niebyl JR, Simpson JL, et al., editors. *Obstetrics: Normal and Problem Pregnancies*. 8th ed. Philadelphia: *Elsevier;* 2020.
15. Gibbs RS, Blanco JD, St Clair PJ, Castaneda YS. Quantitative bacteriology of amniotic fluid from women with clinical intraamniotic infection at term. *J Infect Dis.* 1992;**165**:50–55.

16. Andrews WW, Hauth JC, Cliver SP, Conner MG, Goldenberg RL. Association of antibiotic therapy and chorioamnionitis with neonatal outcomes. *Am J Obstet Gynecol*. 2003;**188**:715–20.
17. Blackwell S, Tita ATN, Rouse DJ. Cesarean delivery and the risk of endometritis. *Clin Perinatol*. 2012;**39**:551–65.
18. Smaill FM, Grivell RM. Antibiotic prophylaxis versus no prophylaxis for preventing infection after cesarean section. *Cochrane Database Syst Rev*. 2014;Issue 10:CD007482.
19. Bonet M, Nogueira Pileggi V, Rijken MJ, et al. Towards a consensus definition of maternal sepsis. *Lancet Glob Health*. 2017;**5**:e746–e747.
20. Say L, Chou D, Gemmill A, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet Glob Health*. 2014;**2**:e323–33.
21. Wloch C, Wilson J, Lamagni T, et al. Risk factors for surgical site infection after caesarean section in England. *J Hosp Infect*. 2016;**93**:528–35.
22. Owens CD, Stoessel K. Surgical site infections: epidemiology, microbiology and prevention. *J Hosp Infect*. 2008;**70**:3–10.
23. Schellekens T, van den Akker T, van Roosmalen J, et al. Maternal age and childbirth outcomes. *BJOG*. 2021;**128**:150–158.
24. Newton ER, Heitkemper MM, Fox LK. Risk factors for postpartum infections. In: *Infect Dis Obstet Gynecol*. 2020;**28**:1–11.
25. Tita AT, Andrews WW. Diagnosis and management of clinical chorioamnionitis. *Clin Perinatol*. 2010;**37**:339–54.
26. Hannah ME, Ohlsson A, Farine D, et al. Induction vs. expectant management for PROM at term. *N Engl J Med*. 1996;**334**:1005–10.
27. Mercer BM. Preterm PROM: diagnosis and management. *Clin Perinatol*. 2003;**30**:701–30.
28. Singal, N., Setia, G., Taneja, B. K., & Singal, K. K. (2018). Maternal outcome in pregnant women with anaemia. *Bangladesh Journal of Medical Science*, **17**(3): 446–454. https://doi.org/10.3329/bjms.v17i3.37001