



Research Article

TRENDS IN CAESAREAN SECTION RATES AND STILLBIRTHS AT A SENEGALESE REFERRAL MATERNITY HOSPITAL, 2020-2025

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Abstract

Caesarean section is essential when medically indicated, but rising use should be interpreted according to the obstetric profile of individual facilities. We assessed concurrent trends in caesarean section use and stillbirths at a referral maternity hospital in suburban Dakar, Senegal. This retrospective analytical study included deliveries recorded at Centre Hospitalier National de Pikine from 1 January 2020 to 31 December 2025. Caesarean section rates were calculated among deliveries with a documented mode of birth. To avoid mismatch between pregnancies and fetuses, the primary stillbirth analysis was restricted to singleton pregnancies with documented fetal status. Trends were assessed using logistic regression, and associated factors were estimated using adjusted odds ratios (aORs) with 95% confidence intervals (CIs). Among 22,682 deliveries, 9,662 caesarean sections were recorded (42.8%). The rate increased from 37.5% in 2020 to 47.7% in 2025 (P for trend <0.001). Among 20,898 eligible singleton births, 1,134 stillbirths occurred (54.3 per 1,000). The rate declined from 58.7 per 1,000 in 2020 to 41.7 per 1,000 in 2025, with a peak of 80.0 per 1,000 in 2022 (P for trend <0.001). Caesarean delivery was associated with obstetric referral, non-cephalic presentation, placental abruption, placenta praevia, severe pre-eclampsia, and fetal growth restriction. Stillbirth was associated with fewer than four antenatal visits (aOR 2.97; 95% CI 2.56-3.43), obstetric referral (aOR 2.03; 95% CI 1.76-2.34), placental abruption (aOR 9.85; 95% CI 7.98-12.15), and prematurity (aOR 4.02; 95% CI 3.43-4.70). Caesarean section use increased while hospital stillbirths declined overall, but these concurrent trends do not establish causality. Standardised audits of caesarean indications, stillbirths, and referral pathways are warranted.

Keywords: Caesarean section, Stillbirth, Temporal trend, Obstetric referral; Senegal, Sub-Saharan Africa.

INTRODUCTION

Caesarean section is a major obstetric intervention that can prevent maternal and perinatal mortality and morbidity when performed at the right time for an appropriate indication. Its use is, however, increasing in every region of the world. In 2018, approximately 21.1% of births worldwide occurred by caesarean section, compared with an average of nearly 5% in sub-Saharan Africa, and the global proportion is projected to reach 28.5% by 2030 [1]. The World Health Organization (WHO) does not recommend a target rate for individual hospitals because referral patterns and level of care strongly determine their obstetric case mix. Instead, it recommends assessing the appropriateness and outcomes of caesarean delivery in relation to case mix, particularly using the Robson classification [2-4]. High rates in referral maternity hospitals may therefore reflect a concentration of complications, delayed referrals, or changes in clinical practice and do not, by themselves, demonstrate overuse. In low- and middle-income countries, inadequate access and potentially excessive use can coexist. Maternal and perinatal deaths following caesarean section remain disproportionately high, especially when surgery is performed as an emergency or in resource-constrained settings [5,6]. In Senegal, geographical and socioeconomic disparities persist despite the national policy of free caesarean delivery. In urban Dakar, the population-level rate was estimated at 13.3% in 2019, with substantial variation according to socioeconomic status and type of facility [7]. Stillbirth is also a sensitive indicator of maternal health, antenatal care quality, referral-system performance, and intrapartum care.

In 2019, the global rate was estimated at 13.9 per 1,000 births, while the burden remained concentrated in sub-Saharan Africa [8]. Potentially modifiable factors identified in the region include insufficient antenatal care, direct obstetric complications, prematurity, emergency referral, and quality of care [9]. This study aimed primarily to describe annual trends in caesarean section rates and hospital stillbirths between 2020 and 2025. Secondary objectives were to identify characteristics associated with caesarean delivery and factors associated with stillbirth among singleton pregnancies.

MATERIALS AND METHODS

Study design, period, and setting

This retrospective, descriptive, and analytical observational study covered the period from 1 January 2020 to 31 December 2025. It was conducted at Centre Hospitalier National de Pikine (CHNP), a referral maternity hospital in the Dakar region that receives both self-referred patients and transfers from peripheral health facilities. The report was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [10].

Study population

All deliveries recorded in the FileMaker database during the study period were included. The caesarean section analysis included records with a documented mode of delivery. The primary stillbirth analysis was restricted to singleton pregnancies with documented fetal status.

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Variables and operational definitions

Caesarean section was defined as a mode of delivery recorded as caesarean. Hospital stillbirths included both fresh and macerated stillbirths as recorded in the database. Because gestational age was missing in a substantial proportion of records, the international threshold of 28 weeks could not be applied uniformly. The indicator should therefore be interpreted as the rate of stillbirths recorded at the maternity hospital rather than a strictly standardised population estimate. Maternal age was grouped as younger than 20 years, 20-34 years, and 35 years or older; parity as nulliparity, parity 1-4, and grand multiparity (at least five previous births); and antenatal care as fewer than four visits or at least four visits. Other variables included obstetric referral, pregnancy type, fetal presentation, and recorded diagnoses: placental abruption, placenta praevia, severe pre-eclampsia, prematurity, fetal growth restriction, and macrosomia.

Statistical analysis

Categorical variables were summarised as counts and percentages. Annual caesarean section rates were calculated per 100 deliveries with known mode of delivery. Annual stillbirth rates were calculated per 1,000 singleton births with known fetal status. Logistic regression, with year treated as a continuous variable, was used to test linear trends. Two separate multivariable models estimated factors associated with caesarean delivery and stillbirth. Results are presented as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). Statistical significance was set at 5%. Analyses were performed using Python 3.12, pandas, NumPy, and SciPy.

Ethical considerations

The study used secondary hospital data. Analyses were conducted using a working dataset from which direct identifiers had been removed, and results are presented only in aggregate form.

RESULTS

Annual trends

The database contained 22,682 deliveries. Mode of delivery was available for 22,566 records (99.5%). Overall, 9,662 caesarean sections were recorded, corresponding to a rate of 42.8%. The annual rate increased from 37.5% in 2020 to 47.7% in 2025. The linear increase was significant (crude OR per year 1.07; $P < 0.001$). The stillbirth analysis included 20,898 singleton births with documented fetal status. It identified 1,134 stillbirths, comprising 558 fresh and 576 macerated stillbirths, for an overall rate of 54.3 per 1,000. The rate declined from 58.7 per 1,000 in 2020 to 41.7 per 1,000 in 2025, despite a peak of 80.0 per 1,000 in 2022. The overall linear trend was downward (crude OR per year 0.92; $P < 0.001$).

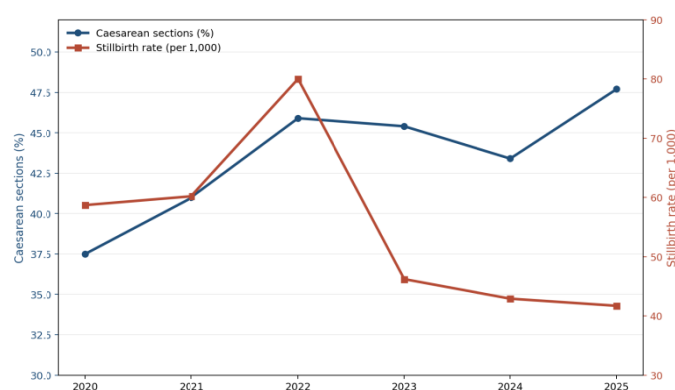


Figure 1. Trends in caesarean section and hospital stillbirth rates, 2020-2025

Factors associated with caesarean delivery

The multivariable model included 21,115 complete records. After adjustment, the odds of caesarean delivery increased by 6% per year.

Table 1. Annual trends in deliveries, caesarean sections, and hospital stillbirths

Year	Deliveries	Caesarean sections, n (%)	Eligible singleton births	Stillbirths, n (per 1,000)	Fresh / macerated
2020	5,047	1,888 (37.5)	4,749	279 (58.7)	157 / 122
2021	4,537	1,853 (41.0)	4,236	255 (60.2)	116 / 139
2022	2,365	1,075 (45.9)	2,174	174 (80.0)	84 / 90
2023	3,856	1,737 (45.4)	3,504	162 (46.2)	79 / 83
2024	3,662	1,583 (43.4)	3,311	142 (42.9)	60 / 82
2025	3,215	1,526 (47.7)	2,924	122 (41.7)	62 / 60
Total	22,682	9,662 (42.8)	20,898	1,134 (54.3)	558 / 576

Note: Caesarean section denominators include deliveries with a documented mode of birth. Stillbirth denominators include singleton births with documented fetal status.

Table 2. Factors associated with caesarean delivery in the multivariable logistic model

Variable	Adjusted OR (95% CI)	P value
Year (one-year increase)	1.06 (1.04-1.08)	<0.001
Age <20 years	0.68 (0.61-0.76)	<0.001
Age ≥35 years	1.53 (1.42-1.66)	<0.001
Nulliparity	1.14 (1.07-1.22)	<0.001
Grand multiparity (≥5)	0.59 (0.52-0.67)	<0.001
Fewer than 4 antenatal visits	0.87 (0.81-0.94)	<0.001
Obstetric referral	1.25 (1.18-1.33)	<0.001
Non-cephalic presentation	2.19 (1.98-2.42)	<0.001
Placental abruption	11.51 (8.62-15.38)	<0.001
Placenta praevia	8.88 (5.66-13.94)	<0.001
Severe pre-eclampsia	3.95 (3.49-4.47)	<0.001
Prematurity	0.97 (0.89-1.06)	0.471
Fetal growth restriction	3.61 (2.85-4.58)	<0.001
Macrosomia	2.10 (1.85-2.38)	<0.001
Multiple pregnancy	0.91 (0.79-1.04)	0.167

The strongest associations were observed for placental abruption, placenta praevia, severe pre-eclampsia, fetal growth restriction, non-cephalic presentation, and macrosomia. Obstetric referral and maternal age of at least 35 years also remained associated with caesarean delivery.

Factors associated with stillbirth

The stillbirth model included 19,858 complete singleton pregnancies. The annual decline persisted after adjustment (aOR 0.91; 95% CI 0.87-0.95). Factors strongly associated with stillbirth were placental abruption, prematurity, fewer than four antenatal visits, and obstetric referral. Grand multiparity and non-cephalic presentation were also associated with increased odds.

Table 3. Factors associated with stillbirth among singleton pregnancies

Variable	Adjusted OR (95% CI)	P value
Year (one-year increase)	0.91 (0.87-0.95)	<0.001
Age <20 years	0.69 (0.53-0.90)	0.006
Age ≥35 years	0.98 (0.81-1.18)	0.846
Nulliparity	1.08 (0.92-1.27)	0.361
Grand multiparity (≥5)	1.55 (1.21-1.99)	<0.001
Fewer than 4 antenatal visits	2.97 (2.56-3.43)	<0.001
Obstetric referral	2.03 (1.76-2.34)	<0.001
Non-cephalic presentation	1.62 (1.31-1.99)	<0.001
Placental abruption	9.85 (7.98-12.15)	<0.001
Placenta praevia	0.71 (0.40-1.27)	0.250
Severe pre-eclampsia	1.03 (0.84-1.26)	0.771
Prematurity	4.02 (3.43-4.70)	<0.001
Fetal growth restriction	0.33 (0.20-0.56)	<0.001
Macrosomia	0.74 (0.50-1.10)	0.139

DISCUSSION

Principal findings

This study identified two concurrent trends: a marked increase in caesarean section use and an overall decline in hospital stillbirths, interrupted by a pronounced peak in 2022. Between 2020 and 2025, the caesarean section rate increased by approximately 10 percentage points, while the recorded stillbirth rate among singleton pregnancies declined by approximately 17 per 1,000. Adjusted analyses confirmed these trends independently of several available characteristics. This pattern must not be interpreted as demonstrating that the increase in caesarean sections caused the decrease in stillbirths. The data were aggregated over time, the indication and timing of surgery were insufficiently detailed, and a caesarean section may have been performed after fetal death. Both indicators may also have been influenced by changes in case mix, recording, referral, and organisation of care.

Trends in caesarean delivery

The overall rate of 42.8% was substantially higher than the population average reported for sub-Saharan Africa, but direct comparison would be inappropriate. CHNP is a referral maternity hospital that manages complications and transferred patients. WHO specifically emphasises that no universal hospital target rate can be recommended and that interpretation must account for patient profile [2]. Population-level estimates and rates across all facility types in Dakar were considerably lower but characterised by inequalities in access [7]. The observed associations with non-cephalic presentation, placenta praevia, placental abruption, severe pre-eclampsia, fetal

growth restriction, and macrosomia are clinically consistent with common indications. The association with referral suggests a more severe case mix among transferred patients. Earlier Senegalese studies had already demonstrated the importance of unmet need for major obstetric interventions and referral in access to obstetric surgery [11,12]. To distinguish justified increases from potentially avoidable use, the next step should be an audit based on the Robson classification. This approach assigns all women to 10 mutually exclusive groups and identifies those contributing most to the overall rate [3,4].

Stillbirth and associated factors

The hospital stillbirth rate of 54.3 per 1,000 remained high compared with global estimates, which is consistent with CHNP's referral status. Studies conducted in tertiary hospitals in sub-Saharan Africa have reported variable rates. In Ghana, Dah et al. reported 31.3 stillbirths per 1,000 births in a tertiary facility, while regional series show substantial heterogeneity according to referral level and data quality [13]. Placental abruption was the factor most strongly associated with stillbirth, consistent with its potential to cause acute hypoxia and intrapartum death. Prematurity, insufficient antenatal care, grand multiparity, non-cephalic presentation, and obstetric referral were also associated with the adverse outcome. These findings are consistent with the systematic review by Mukherjee et al., which identified limited antenatal contacts, direct obstetric complications, prematurity, grand multiparity, and emergency referral as important factors in sub-Saharan Africa [9].

Strengths and limitations

The strengths of this study include the large cohort, six-year observation period, high completeness of mode of delivery and fetal-status data, and separate analysis of the two indicators. Restricting the stillbirth analysis to singleton pregnancies avoided denominator bias related to multiple pregnancies. Several limitations should be acknowledged. First, the retrospective design was susceptible to data-entry errors, coding variation, and unmeasured confounding. Second, gestational age was insufficiently documented to apply a uniform international stillbirth definition; the reported rate is therefore a hospital indicator. Third, fresh or macerated status alone cannot establish the timing of death with certainty. Fourth, important variables, including uterine scar, decision-to-delivery interval, socioeconomic status, quality of antenatal care, and detailed cause of death, were missing or incomplete. Finally, findings from this single-centre analysis cannot be generalised to the Senegalese population.

IMPLICATIONS FOR PRACTICE AND RESEARCH

- Implement a quarterly dashboard combining caesarean section rates, Robson groups, indications, urgency, and perinatal outcomes.
- Conduct a systematic audit of every stillbirth, including timing and cause classification, preventability assessment, and referral-delay analysis.
- Strengthen effective antenatal care, particularly for grand multiparous women and women at risk of prematurity or placental disease.
- Standardise mandatory register variables, including reliable gestational age, fetal status at admission, decision and delivery times, uterine scar, primary indication, and neonatal outcome.

Conclusion

Between 2020 and 2025, the caesarean section rate increased at CHNP, while hospital stillbirths among singleton pregnancies declined overall after a peak in 2022. Obstetric referral and several major complications were associated with both outcomes; insufficient antenatal care, placental abruption, and prematurity were strongly associated with stillbirth. These findings support joint, standardised, and repeated audits of caesarean sections, fetal deaths, and referral pathways. They do not establish a causal effect of increased caesarean delivery on reduced stillbirths.

Declarations

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Competing interests: The author declares no competing interests.

Author contributions: Mouhamet Sene conceived the study, analysed and interpreted the data, drafted the manuscript, and approved the final version.

Data availability: The hospital data are not publicly available because they are confidential. An anonymised dataset may be made available upon reasonable request and subject to institutional authorisation.

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