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Perinatal outcomes of cesarean deliveries in Sierra Leone: A prospective multicenter observational study

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Abstract

Objective: To analyze the indications for cesarean deliveries and factors associated with adverse perinatal outcomes in Sierra Leone.

Methods: Between October 2016 and May 2017, patients undergoing cesarean delivery performed by medical doctors and associate clinicians in nine hospitals were included in a prospective observational study. Data were collected perioperatively, at discharge, and during home visits after 30 days.

Results: In total, 1274 cesarean deliveries were included of which 1099 (86.3%) were performed as emergency surgery. Of the 1376 babies, 261 (19.0%) were perinatal deaths (53 antepartum stillbirths, 155 intrapartum stillbirths, and 53 early neonatal deaths). Indications with the highest perinatal mortality were uterine rupture (45 of 55 [81.8%]), abruptio placentae (61 of 85 [71.8%]), and antepartum hemorrhage (8 of 15 [53.3%]). In the group with cesarean deliveries performed for obstructed and prolonged labor, a partograph was filled out for 212 of 425 (49.9%). However, when completed, babies had 1.81-fold reduced odds for perinatal death (95% confidence interval 1.03–3.18, *P*-value 0.041).

Conclusion: Cesarean deliveries in Sierra Leone are associated with an exceptionally high perinatal mortality rate of 190 per 1000 births. Late presentation in the facilities and lack of adequate fetal monitoring may be contributing factors.

KEYWORDS

Cesarean delivery; Fetal monitoring; Partograph; Perinatal death; Perinatal mortality; Stillbirth

1 | INTRODUCTION

Every year, an estimated 2.6 million stillbirths occur worldwide.[1] In addition, there are 2.5 million deaths during the first 28 days of life (neonatal period),[2] with 73% occurring in the first week (early neonatal period).[1] The resulting 4.4 million perinatal deaths (stillbirths and early neonatal deaths)[3] exceed the 3.0 million annual deaths caused by HIV, tuberculosis, and malaria combined.[4]

Globally, stillbirth and neonatal death rates have declined by 20% and 37%, respectively, over the last 20 years[1]; however, this reduction has been slower than the decline in maternal mortality[5] and under-5 mortality.[6] Despite the devastating psychosocial and economic consequences, this silent epidemic remains an unfinished endeavor on the global health agenda.[7]

Antepartum stillbirths (before labor) are typically caused by fetal growth restriction, congenital malformations, non-communicable diseases, and (treatable) maternal infections while intrapartum stillbirths (during labor) are associated with obstetric emergencies and suboptimal access to quality emergency obstetric care.[8] Consequently, the intrapartum proportion of stillbirths varies from less than 10% in high-income countries to 51% in sub-Saharan Africa and 59% in Southeast Asia.[8]

A skilled surgical team can save the life of both the mother and child with a timely cesarean delivery if performed for the correct indication. An estimated 29.7 million cesarean deliveries are performed annually, making it the most commonly performed surgical procedure worldwide.[9] National cesarean delivery rates range from 0.6% in South Sudan to 58.1% in the Dominican Republic.[9] Paradoxically, while cesarean delivery rates are approaching epidemic proportions in some areas, certain groups in low-income countries still have no access to this potentially lifesaving procedure.[10]

Sierra Leone has one of the world's poorest perinatal health indicators, with a national cesarean delivery rate of 2.9%[11] and an overall perinatal mortality rate of 39 per 1000 pregnancies.[12] A prospective multicenter study assessing outcomes after cesarean deliveries performed by medical doctors and associate clinicians in Sierra Leone revealed a five times higher perinatal mortality rate (190 per 1000 births [n = 261/1376]).[13] This finding urged us to explore the causes of this alarmingly high perinatal mortality. The aim of the present study was to analyze the indications for these cesarean deliveries and associated factors resulting in perinatal death in Sierra Leone.

2 | MATERIALS AND METHODS

The present study was part of a prospective observational multicenter study of women who underwent cesarean delivery in nine hospitals in Sierra Leone between October 1, 2016, and May 5, 2017. Both associate clinicians and medical doctors performed cesarean deliveries (Table 1).[13] Associate clinicians had completed 2-year surgical training and the medical doctors were either specialists or non-specialists. The participating hospitals performed 3465 (47.1%) of all 7357 cesarean deliveries carried out in Sierra Leone in 2016[11] and consisted of four district hospitals, one regional hospital, the national maternity referral center, and three private non-profit hospitals.

In the study hospitals, the management of labor and deliveries were typically supervised by a team of midwives and/or nurses. If the team identified the need for a surgical intervention, a surgical provider was called for consultation. The surgical provider made the final decision whether to do a cesarean delivery and determined the main indication according to locally applied definitions (Table S1).

Informed written consent was obtained by getting a signature or thumbprint from each woman either before or as soon as possible after surgery. The study was approved by the Sierra Leone Ethics and Scientific

TABLE 1 Study hospitals by category, delivery statistics, and study inclusions.

			Annual deliveries[a]		Cesareans included in study	
No.	Hospital name and type	Category	Cesarean	Total	Eligible[b]	Included (%)
1	Kabala Governmental Hospital	District	158	1133	115	78 (67.8)
2	Kambia Governmental Hospital	District	157	672	113	100 (88.5)
3	Magburaka Governmental Hospital	District	277	1096	205	195 (95.1)
4	Port Loko Governmental Hospital	District	150	546	85	60 (70.6)
5	Kenema Governmental Hospital	Regional	407	1806	151	120 (79.5)
6	PCM Hospital, Freetown	Tertiary	1848	5718	824	503 (61.0)
7	Lion Heart Medical Center	Pnp	82	572	42	39 (92.9)
8	Magbenteh Community Hospital	Pnp	208	684	98	88 (89.8)
9	Serabu Catholic Hospital	Pnp	178	625	95	91 (95.8)
	Study Total		3456	12 852	1728	1274 (73.7)
	National Total (37 hospitals)		7357	31 614		

Abbreviation: Pnp, private non-profit.

[a]Annual cesarean deliveries and total deliveries by facility in 2016, with permission from Holmer et al. 2019.[11]

[b]Eligible cesarean deliveries are those performed by medical doctors or associate clinicians during the study period.

Review Committee, the Regional Committees for Medical and Health Research Ethics in central Norway (ethical clearance no. 2016/1163) and registered in the international clinical trial register (ISRCTN: 16157971).

In each hospital, trained anesthesia team members enrolled patients in the study and collected in-hospital data. At 1- to 3-week intervals, the primary investigator reviewed the collected data during hospital visits and entered it, on location, in a Microsoft Excel 2016 database (Microsoft Corp., Redmond, WA, USA). Demographic, maternal, labor, and fetal characteristics were collected perioperatively and during admission. Follow-up home visits after 30 days were performed by four trained research nurses, who collected data on education and marital status, and validated the data collected during admission.

In this manuscript perinatal mortality, defined as the combination of stillbirths and early neonatal deaths, was analyzed. Early neonatal death was defined as death within the first 7 days of life. Stillbirths were classified as antepartum when the fetus showed 'macerated' skin, suggesting death before the start of the delivery, and as intrapartum when the fetus lacked such changes.[14] The perinatal mortality rate was defined as the number of perinatal deaths divided by the total number of births per 1000 births.[3]

Perinatal outcomes were presented by indication for cesarean delivery. Univariable and multivariable logistic regression models were used to identify factors associated with perinatal death. Statistically significant variables in the univariable analysis were included in the multivariable analysis. For all logistic regression analysis, the largest subgroup was selected as the reference group. The χ^2 test was used to test the overall effect of each factor for both uni- and multivariable analysis. Missing data are presented in tables but were not included in the analysis. *P* values of <0.05 were considered statistically significant. Statistical analyses were performed with STATA 15.1 (StataCorp LLC, College Station, TX, USA).

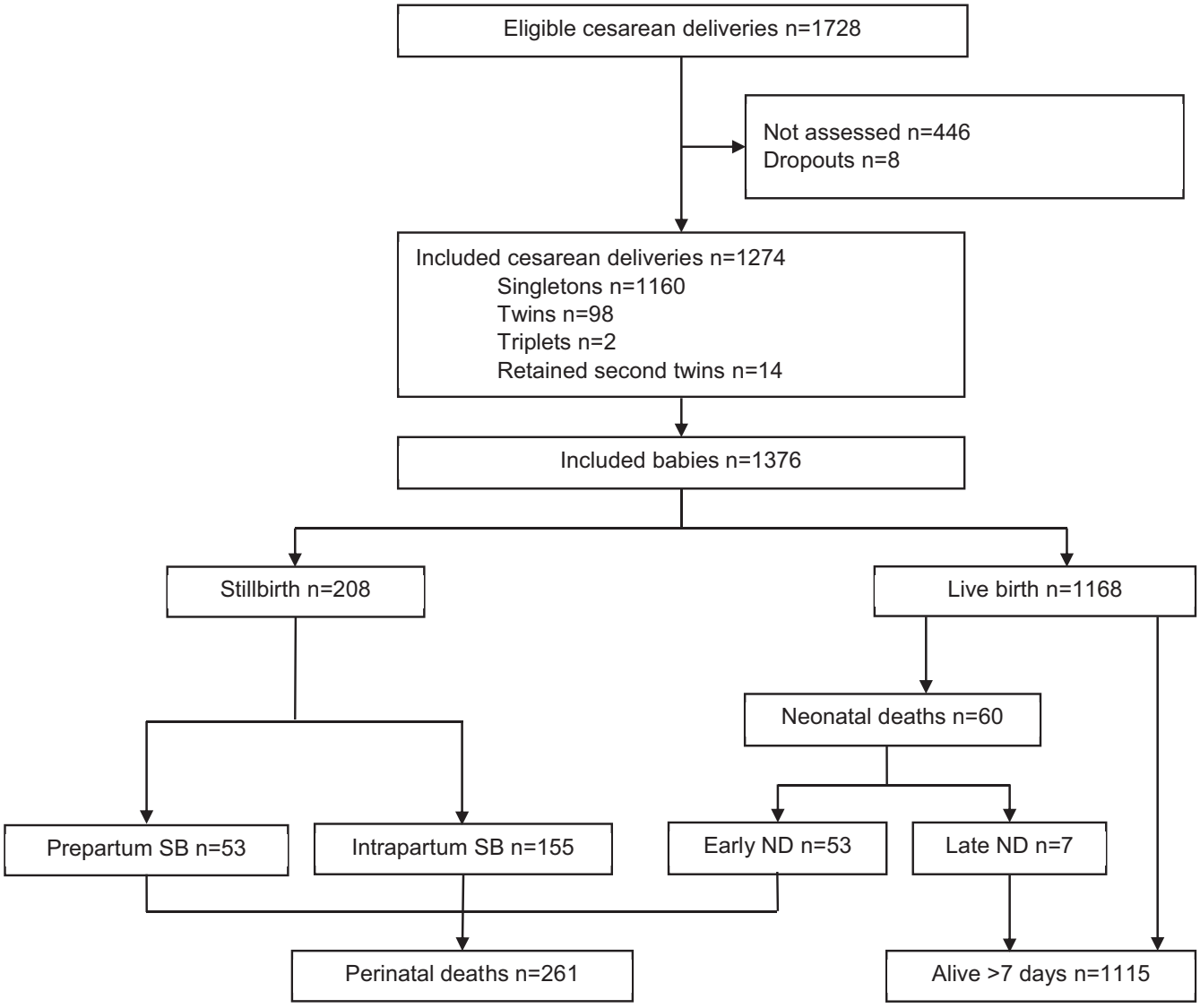


FIGURE 1 Study flowchart of stillbirths, livebirths, and neonatal deaths following 1274 cesarean deliveries in Sierra Leone. Abbreviations: ND, neonatal death; SB, stillbirth.

3 | RESULTS

During the study period, 1728 cesarean deliveries were performed in the study hospitals (Fig. 1), of which 1282 (74.2%) were assessed for inclusion. Seven women dropped out because of incomplete essential data and one patient withdrew from the study. Of the 1274 included cesarean deliveries, 234 (18.4%) were performed by a specialist obstetrician, 597 (46.9%) by a non-specialist medical doctor, and 443 (34.8%) by an associate clinician. In total 1376 babies were delivered, of which 1259 (91.5%) were followed up with home visits. Of all babies, 208 (15.1%) were stillborn (155 intrapartum and 53 prepartum). Of the 1168 live births, 53 (4.5%) died in the first week and seven died between the second and fourth week of life. The overall perinatal mortality rate in this cohort was 190 per 1000 births (95% confidence interval [CI] 169–210).

Of the 1274 cesarean deliveries, 1099 (86.3%) were performed as emergency surgery (Table S2). The three most frequent indications for surgery were prolonged and obstructed labor (481 [37.8%]), previous cesarean delivery (164 [12.9%]), and abruptio placentae (85 [6.4%]) (Table 2). Only 89 (7.0%) of the cesarean deliveries were performed

TABLE 2 Perinatal outcomes by indication for cesarean delivery.

	Cesarean	Perinatal deaths					Alive[b]	
Indication[a]	n	ASB	ISB	END	Tot	%	n	%
Prolonged or obstructed labor	481	7	20	23	50	10.1	445	89.9
Previous cesarean delivery	164	3	5	1	9	5.4	159	94.6
Abruptio placentae	81	9	44	8	61	71.8	24	28.2
Eclampsia or pre-eclampsia	69	4	9	3	16	21.6	58	78.4
Breech	65	4	3	3	10	14.1	61	85.9
Fetal distress	62	1	4	6	11	16.9	54	83.1
Uterine rupture	55	9	35	1	45	81.8	10	18.2
Placenta previa	55	1	8	4	13	22.4	45	77.6
Twin pregnancy	52	0	4	0	4	3.8	102	96.2
Transverse lie	35	5	4	1	10	26.3	28	73.7
Failure of induction	30	1	1	1	3	9.4	29	90.6
Other	20	2	0	0	2	10.0	18	90.0
Antepartum hemorrhage	14	1	7	0	8	53.3	7	46.7
Retained second twin	14	1	4	0	5	35.7	9	64.3
Umbilical cord prolapse	13	1	5	0	6	40.0	9	60.0
Preterm rupture of membranes	11	1	0	0	1	9.1	10	90.9
Face presentation	10	0	0	2	2	20.0	8	80.0
Post-term	10	0	0	0	0	0.0	10	100.0
Hand prolapse	7	2	0	0	2	28.6	5	71.4
Malpresentation	6	0	0	0	0	0.0	6	100.0
Poor obstetric history	6	0	0	0	0	0.0	6	100.0
Previous VVF surgery	4	0	1	0	1	25.0	3	75.0
Pregnancy-induced hypertension	3	0	0	0	0	0.0	3	100.0
Trauma	2	1	0	0	1	50.0	1	50.0
HIV-positive mother	2	0	0	0	0	0.0	3	100.0
Oligohydramnios	2	0	0	0	0	0.0	2	100.0
Polyhydramnios	1	0	1	0	1	100.0	0	0.0
Total	1274	53	155	53	261	19.0	1115	81.0

Abbreviations: END, early neonatal death; HIV, human immunodeficiency virus; ISB, intrapartum stillbirth; ASB, antepartum stillbirth; VVF, vesicovaginal fistula.
[a]Indication for cesarean delivery sorted by contribution to the total number of cesarean deliveries.
[b]Alive after 7 days.

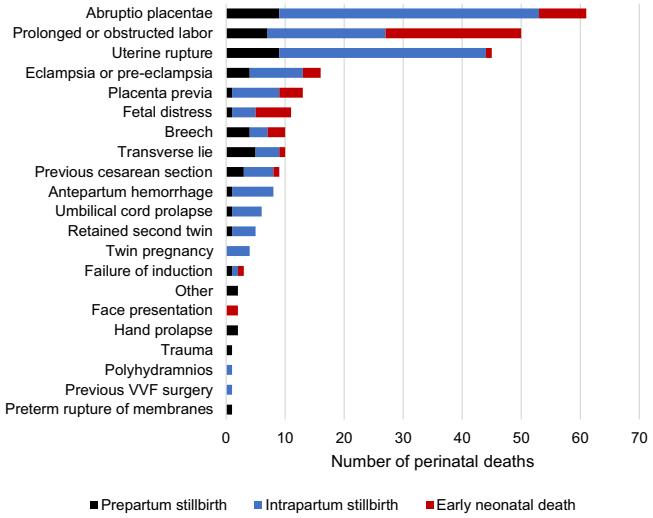


FIGURE 2 Perinatal deaths (antepartum stillbirths [n = 53], intrapartum stillbirths [n = 155], and early neonatal deaths [n = 53]) after cesarean delivery. Indications for cesarean delivery are ordered by the total contribution to perinatal deaths. Total number of babies was 1376. Abbreviation: VVF, vesicovaginal fistula.

for fetal indication (62 for fetal distress, 13 for umbilical cord prolapse, 11 for premature rupture of membranes, two for oligohydramnios, and one for polyhydramnios).

The three indications that contributed most to the number of perinatal deaths were abruptio placentae (61 [23.4%]), prolonged and obstructed labor (50 [19.2%]), and uterine rupture (45 [17.2%]) (Fig. 2). Cesarean delivery was performed for fetal indications in 19 (7.3%) of the perinatal deaths. Cesarean deliveries performed for uterine rupture had the highest perinatal mortality (45 of 55 [81.8%]), followed by abruptio placentae (61 of 85 [71.8%]) and antepartum hemorrhage (8 of 15 [53.3%]).

Table 3 describes the multivariable analysis of 13 risk factors that were significant on univariable analysis (Table S3). Babies of mothers with secondary or tertiary education had 2.15- and 4.87-fold lower adjusted odds (95% CI 1.25–3.69, $P = 0.006$ and 1.38–17.14, $P = 0.014$, respectively) of perinatal death, compared with babies of mothers with no education. Babies of mothers who had attended prenatal clinic only two times or less had 2.30-fold higher adjusted odds (95% CI 1.21–4.38, $P = 0.011$ of perinatal death compared with those of mothers who visited prenatal clinic more often.

In the present cohort of babies delivered by cesarean delivery, twin pregnancy (adjusted odds ratio [aOR] 0.33, 95% CI 0.15–0.71, $P = 0.005$ and mothers with a previous cesarean delivery (aOR 0.38, 95% CI 0.16–0.87, $P = 0.022$ had a lower perinatal mortality compared with singleton pregnancy and mothers with no previous cesarean delivery. Babies of mothers who were referred from another primary healthcare unit or hospital had 1.71-fold higher adjusted odds of perinatal death (95% CI 1.09–2.67, $P = 0.020$.

Babies with fetal weight below 1500 g had 5.37-fold increased adjusted odds (95% CI 1.52–19.05 for perinatal death compared with those with a weight between 2500 and 3499 g. A partograph was used for 343 of 1147 (29.9%) of the cesarean deliveries and for 212 of 425 (49.9%) in the group with obstructed labor. However, when a partograph was used in the group with obstructed labor, babies had 1.81-fold reduced odds for perinatal death (95% CI 1.03–3.18, $P = 0.041$.

Of the 53 neonates who died, 38 (71.7%) died during the first day of life (Fig. 3). For neonates with an APGAR score of 0–3 after 5 minutes, 11 of 16 (68.8%) died within the first week compared with 11 of 47 (23.4%) for APGAR 4–6 and 22 of 918 (2.4%) for APGAR 7–10 (Table S4). that received chest compressions or bag mask ventilation had 10.25- and 18.50-fold higher odds (95% CI 3.63–29.00 and 7.52–45.51, $P < 0.001$ for early neonatal death compared with the stimulation-only group.

4 | DISCUSSION

The present prospective multicenter observational study of perinatal outcomes after cesarean delivery assessed the indications for cesarean delivery and factors associated with perinatal death in Sierra Leone. Eighty-six percent of cesarean deliveries were performed for emergencies, and the highest perinatal mortality rates were observed in women who had a cesarean delivery for uterine rupture, abruptio placentae, or antepartum hemorrhage. An increased perinatal mortality was also seen in women with a low education level, two or less antenatal visits, and who were referred from another health facility. A partograph was filled out in 30% of all cesarean deliveries and in 50% of the cesarean deliveries for obstructed and prolonged labor.

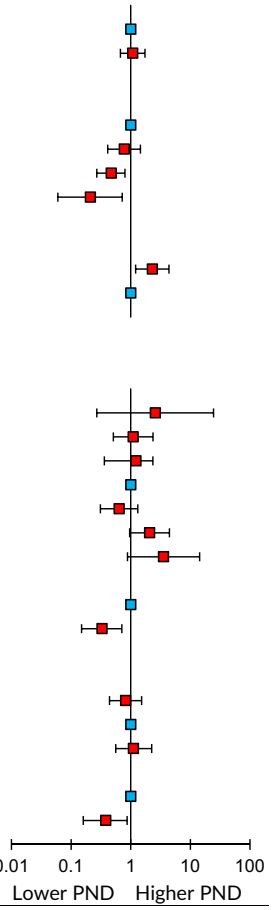
The strength of the present study is its prospective design with home visits after 1 month, allowing us to validate data gathered during admission. The nine study hospitals cover different categories with a wide geographic distribution and account for almost half of all cesarean deliveries performed in the country.[11] The inclusion period was purposefully done in the dry season, to be able to maximize the follow-up rate, as many roads are impassable during the rainy season.

An important limitation of the present study is that only women who delivered by cesarean were included, hence a comparison of outcomes between cesarean and vaginal deliveries cannot be presented. In the present study, where reliable information on fetal heartbeat before the cesarean delivery was insufficient, the distinction between antepartum and intrapartum stillbirths was based on skin maceration. Although this surrogate marker has its limitations with 18%–30% misclassification,[15] it can be useful in low-resource settings, where fetal monitoring is not routinely available.[14] Finally, only 1274 (73.7%) of 1728 eligible cesareans were included as 446 (25.8%) were not assessed and 8 (0.5%) dropped out, which could have introduced a substantial selection bias. The reasons for not assessing patients were either that trained data collection staff or materials were unavailable, or due to busy clinical work being prioritized over data collection.

The perinatal mortality rate of 190 per 1000 births in the present study is exceptionally high and much higher than previously published rates after cesarean delivery from other sub-Saharan African countries such as the Democratic Republic of the Congo (71 per 1000 births)[16] and

TABLE 3 Multivariable regression of factors associated with perinatal death after cesarean delivery.[a]

	PND n (%)	Alive [b] n (%)	Adjusted OR (95% CI)	*P* value	Forest plot
Demographic characteristics					
Estimated travel time				0.755	
≤ 2 h	149 (15.4)	816 (84.6)	(reference)		
> 2 h	107 (26.8)	292 (73.2)	1.08 (0.67–1.73)		
Missing	5 (41.7)	7 (58.3)		0.755	
Education mother				0.008	
None	121 (24.2)	378 (75.8)	(reference)		
Primary	35 (21.3)	129 (78.7)	0.78 (0.41–1.45)	0.429	
Secondary	59 (12.6)	409 (87.4)	0.47 (0.27–0.80)	0.006	
Higher education	7 (5.5)	121 (94.5)	0.21 (0.06–0.72)	0.014	
Missing	39 (33.3)	78 (66.7)			
Number of prenatal clinic visits				0.011	
0–2	54 (37.0)	92 (63.0)	2.30 (1.21–4.38)	0.011	
≥3	203 (16.8)	1005 (83.2)	(reference)		
Missing	4 (18.2)	18 (81.8)			
Maternal characteristics					
Age group				0.061	
< 15 y	2 (18.2)	9 (81.8)	2.58 (0.27–24.48)	0.408	
15–19 y	34 (14.2)	205 (85.8)	1.10 (0.51–2.36)	0.808	
20–24 y	58 (17.6)	272 (82.4)	1.22 (0.63–2.35)	0.561	
25–29 y	65 (17.1)	315 (82.9)	(reference)		
30–34 y	42 (17.4)	200 (82.6)	0.64 (0.31–1.31)	0.218	
35–39 y	51 (34.5)	97 (65.5)	2.07 (0.96–4.45)	0.063	
≥ 40 y	9 (34.6)	17 (65.4)	3.54 (0.88–14.29)	0.076	
Single/multiple pregnancy				0.005	
Single pregnancy	235 (20.3)	925 (79.7)	(reference)		
Twin pregnancy	26 (12.4)	184 (87.6)	0.33 (0.15–0.71)	0.005	
Triplet pregnancy	0 (0.0)	6 (100.0)	NA		
Parity				0.765	
Nullipara (para 0)	57 (12.9)	384 (87.1)	0.82 (0.44–1.52)	0.532	
Multipara (para 1–4)	142 (18.5)	626 (81.5)	(reference)		
Grand multipara (para ≥5)	62 (37.1)	105 (62.9)	1.12 (0.56–2.25)	0.749	
Previous cesarean				0.022	
No previous cesarean	237 (21.1)	885 (78.9)	(reference)		
One or more previous cesarean	24 (9.4)	230 (90.6)	0.38 (0.16–0.87)	0.022	



(Continues)

Malawi (112 per 1000 births),[17] and is almost double the regional average.[18] Most of the cesarean deliveries in the present study were emergencies and often performed after referral from another health facility.

The high number of uterine ruptures among women without a prior uterine scar indicates insufficiencies in the system for care in pregnancy and childbirth. Given the limited access to cesarean deliveries in Sierra Leone, many women with pregnancy complications present to a hospital after an unsuccessful attempt to deliver at home or in another health facility. During this process, they have often received various medications and travelled long distances.[19]

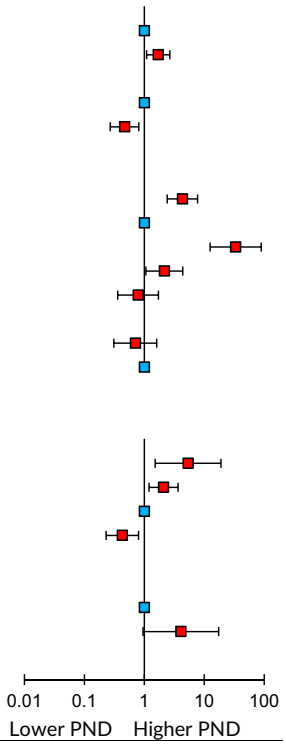
Only 7.3% of cesarean deliveries were done for fetal indications, which is a lower rate than has been described in other low- and middle-income countries.[20] Together with low utilization of the partograph, this implies a very limited degree of intrapartum fetal monitoring. WHO encourages fetal monitoring during every labor, using a partograph in combination with an analog fetoscope or Doppler. The partograph is an important tool for assessment of labor progression, for decision making during labor, and thus for justification and documentation to proceed with a cesarean delivery.[21] Acknowledging the gap between international guidelines and the available resources that are required for adequate fetal and labor progress monitoring using the partograph [22] emphasizes the need for greater investment in monitoring as a first step towards improving perinatal outcomes.[23]

When fetal monitoring confirms that a fetus has died in utero, cesarean deliveries should be avoided to keep a woman from obtaining an 'avoidable scar' that will likely increase the risks in a consecutive pregnancy.[24] However, cesarean deliveries are justified among women with intrauterine fetal death for maternal indications where the life of the mother is threatened by conditions such as uterine rupture and abruptio placentae. For confirmed intrauterine fetal death, alternative management including augmentation, instrumental delivery, and craniotomy should be considered first.[25]

Fetal monitoring is a critical tool for assessing fetal status and making the decision to perform a cesarean.[22] Given this, the justification for cesarean delivery in some subgroups in our study should be questioned. For example, in the fetal indications group, there was a high proportion of stillbirths (13 of 94 [13.8%]) (Table S5), and it was not clear whether the fetal heartbeat was checked prior to cesarean delivery. Additionally, certain indications such as premature rupture of membranes and oligo- and polyhydramnios might not be sufficient to justify cesarean delivery in isolation.

TABLE 3 (Continued)

	PND n (%)	Alive [b] n (%)	Adjusted OR (95% CI)	*P* value	Forest plot
Labor characteristics					
Referred from another facility				0.020	
Not referred	94 (12.6)	654 (87.4)	(reference)		
Referred	167 (26.6)	461 (73.4)	1.71 (1.09–2.67)	0.020	
Use of partograph				0.007	
Partograph not used	195 (22.4)	676 (77.6)	(reference)		
Partograph used	38 (10.3)	330 (89.7)	0.47 (0.27–0.81)	0.007	
Missing	28 (20.4)	109 (79.6)			
Indication group				<0.001	
Antepartum hemorrhage [c]	82 (51.9)	76 (48.1)	4.32 (2.41–7.73)	<0.001	
Obstructed and prolonged labor [d]	86 (11.0)	693 (89.0)	(reference)		
Uterine rupture	45 (81.8)	10 (18.2)	33.3 (12.5–89.34)	<0.001	
Fetal indication [e]	19 (20.2)	75 (79.8)	2.16 (1.06–4.38)	0.034	
Other [ff]	29 (10.0)	261 (90.0)	0.79 (0.36–1.72)	0.550	
Urgency				0.411	
Planned	12 (6.6)	183 (93.4)	0.71 (0.31–1.61)	0.411	
Emergency	249 (21.0)	932 (79.0)	(reference)		
Fetal characteristics					
Fetal weight				<0.001	
< 1500 g	17 (58.6)	12 (41.4)	5.37 (1.52–19.05)	0.009	
1500–2499 g	41 (20.6)	158 (79.4)	2.09 (1.20–3.65)	0.009	
2500–3499 g	106 (14.4)	631 (85.6)	1.00 (reference)		
≥ 3500 g	33 (10.3)	288 (89.7)	0.43 (0.23–0.80)	0.008	
Missing	64 (71.1)	26 (28.9)			
Congenital malformation				0.058	
No malformation	247 (18.4)	1094 (81.6)	(reference)		
Malformation	9 (50.0)	9 (50.0)	4.07 (0.95–17.37)	0.058	
Missing	5 (29.4)	12 (70.6)			



Abbreviations: CI, confidence interval; NA, not applicable; OR, odds ratio; PND, perinatal death.

[a]Multivariable analysis of demographic, maternal, labor, and fetal factors for perinatal deaths. Factors with an overall $P \leq 0.05$ in the univariable analysis (Table S3) were included in the multivariable analysis. Forest plot shows the odds ratio (red squares) with 95% confidence intervals and reference subgroups (blue squares).

[b]Alive after 7 days.

[c]Including: abruptio placentae and placenta previa.

[d]Including: malpresentation, retained second twin, and failure of induction.

[e]Including: cord prolapse, fetal distress, oligohydramnios and polyhydramnios, premature rupture of membranes, and post-term.

[f]Including: poor obstetric history, elderly primigravida, and previous cesarean delivery as the main indications.

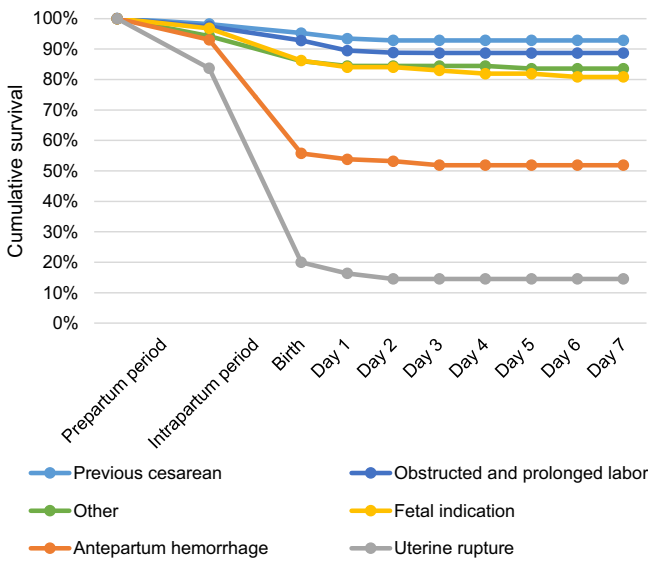


FIGURE 3 Perinatal survival during the antepartum period, intrapartum period, and first 7 days of life by indication group.

Furthermore, for 14 of 150 (9.3%) cesarean deliveries performed for antepartum hemorrhage, no etiology was reported. These issues highlight the need for appropriate clinical management during labor to ensure that cesarean deliveries are not performed unless medically indicated.

The invisible epidemic of stillbirths and neonatal deaths has enormous social, psychologic, and economic consequences for mothers and their families. Women continue to suffer from grief and guilt as a result of losing their babies. Some cope with early anticipation of the next pregnancy, which, especially after a cesarean delivery, may result in additional risks if a subsequent pregnancy occurs within the first year after surgery.

5 | CONCLUSION

The perinatal mortality among babies delivered by cesarean delivery in the present study is five times higher than previously described. The high proportion of cesarean deliveries performed as emergencies,

the low use of fetal monitoring and the partograph, and the high number of uterine ruptures illustrate the delay that many women experience before reaching and receiving the required quality obstetric care. This provides a window of opportunity in reducing perinatal deaths by strengthening prenatal care, promoting institutional delivery, and ensuring that high-quality obstetric and surgical care is available in hospitals. In this light, there is a need for comprehensive and coordinated action among government, professional associations, academia, development partners, civil society, and families to improve the quality of obstetric care in order to decrease perinatal mortality in Sierra Leone.

AUTHOR CONTRIBUTIONS

AJvD, AL, LH, AW, and HAB conceived the study and wrote the protocol. AJvD, JW, HAB, and MJR developed the data analysis plan with input from MMK, FF, AL, and LH. AJvD and MMK coordinated the data collection, supervised by HAB and AL. AJvD and JW analyzed the data and wrote the first draft of the manuscript. All authors participated in the revision of the manuscript and approved the final version.

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CONFLICTS OF INTEREST

AJvD and HAB are unpaid board members of CapaCare, the non-governmental organization that organizes surgical training for medical doctors and community health officers in Sierra Leone in collaboration with the Ministry of Health and Sanitation.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Routine locally applied definitions of the 20 most frequent indications for cesarean delivery, ordered by rate of occurrence in the present study.

Table S2. Urgency and surgical provider by indication of cesarean delivery.

Table S3. Univariable regression of factors associated with perinatal death after cesarean delivery.[a]

Table S4. Univariable regression of early neonatal death.

Table S5. Stillbirths delivered by caesarean for fetal indication.