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## Original Research Article

# Medication-induced labor with prostaglandins in viable fetuses: a 31-month retrospective study in the gynecology and obstetrics department of Amath Dansokho hospital/Kédougou/Senegal

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## ABSTRACT

**Background:** To analyze the indications, methods, and outcomes of labor induction with prostaglandins at the Gynecology and Obstetrics Department of Amath Dansokho Regional Hospital in Kédougou, Senegal.

**Methods:** We conducted a retrospective cohort study including 2,750 deliveries from January 1, 2023, to July 31, 2025. All pregnant women  $\geq 28$  weeks receiving prostaglandin-induced labor were included (n=501). Exclusion criteria were intrauterine fetal death, abnormal fetal heart rate on admission, prophylactic cesarean, and incomplete records. Data on sociodemographic, obstetric history, induction indications, induction method, and maternal and neonatal outcomes were analyzed using SPSS 27. Patients were classified as “Exposed” (induced) and “Unexposed” (spontaneous labor).

**Results:** Labor induction frequency was 18.2%. Main indications were post-term pregnancy (29.4%), hypertensive disorders (28.9%), and preventive induction (19.3%). Misoprostol (91.6%) was the primary induction agent, administered vaginally at 25  $\mu\text{g}$  per dose. Induction success was 97.6%. Vaginal delivery occurred in 85% of induced patients, and cesarean section risk was significantly lower compared to spontaneous labor (14.8% vs. 25.9%; RR=0.57,  $p<0.001$ ). Uterine rupture occurred in 0.6% of cases. Neonatal outcomes, including Apgar score  $<7$  at 5 minutes, neonatal resuscitation, transfer, and stillbirth, did not differ significantly between groups.

**Conclusions:** Labor induction with prostaglandins is a safe and effective strategy in a resource-limited and geographically isolated setting, reducing cesarean section rates without compromising neonatal outcomes. Preventive induction and structured monitoring protocols are practical approaches to improve maternal and neonatal safety in low-resource contexts. These findings support the use of context-specific guidelines and further research on optimal induction protocols in similar settings.

**Keywords:** Labor induction, Prostaglandins, Misoprostol, Cesarean section, Maternal outcomes, Neonatal outcomes, Low-resource setting, Senegal

## INTRODUCTION

Induction of labor is a common practice in modern obstetrics. It is defined as a medical procedure that artificially induces uterine contractions in order to initiate the labor.<sup>1</sup> This procedure, which is becoming increasingly

common worldwide, may be indicated in various maternal or fetal situations where continuing the pregnancy poses a greater risk than delivery.<sup>2</sup> Over time, the indications for induction have diversified in these contexts. In France, the use of artificial labor induction rose from 19.7% in 2010 to 22.7% in 2016.<sup>3</sup> Drug-induced labor induction,

particularly using prostaglandins, has become one of the preferred methods due to its effectiveness and ease of use.<sup>4</sup>

Furthermore, worldwide, cesarean section rates continue to rise and are no longer just a problem in industrialized countries, but also in developing countries.<sup>5</sup> The availability, accessibility, quality, and use of health services during pregnancy and childbirth remain major challenges in these countries. Maintaining an acceptable cesarean section rate while reducing maternal and perinatal mortality and morbidity is a public health imperative.

The objective of our study is to analyze the different practices of artificial induction of labor, their indications, and their results, in order to improve the quality of obstetric care and maternal-fetal efficiency and safety in the Gynecology and Obstetrics Department of the Amath Dansokho Hospital in Kédougou.

## METHODS

### *Design, population, and setting*

The study was carried out in the Department of Gynecology and Obstetrics at Amath Dansokho Regional Hospital Center in Kédougou, Senegal. Located 800 km from Dakar, the hospital is a Level II Public Health Establishment that opened on May 31, 2021. It is the referral maternity unit for the Kédougou region, covering three districts: Kédougou, Salémata, and Saraya. Emergency obstetric, neonatal, and gynecological care is provided 24 hours a day by a team including a gynecologist, a senior anesthesia technician, midwives, and nurses. Gynecology visits, pre- and post-natal check-ups, family planning, and ultrasound scans are carried out on a daily basis. Scheduled surgery is performed using a wide range of approaches (abdominal, vaginal, and endoscopic).

This is a descriptive and analytical retrospective cohort study covering a 31-month period from January 1, 2023, to July 31, 2025, involving a total of 2,750 patients seen during the period. All pregnancies with a gestational age  $\geq$  28 weeks were included in the study. Regarding the method of induction, only patients who received prostaglandins were included. In 2023, misoprostol (PGE1 analogue) was the only molecule used; dinoprostone gel (PGE2) was introduced in 2024. We excluded patients admitted for intrauterine fetal death or fetal heart rate abnormalities on admission, prophylactic cesarean section, emergency cesarean section before labor, and incomplete records data were also excluded.

The variables studied were: sociodemographic data, obstetric history, indications for induction, type of molecule, and outcome of labor. The criteria for assessing maternal prognosis were mode of delivery, occurrence of uterine rupture, and/or postpartum hemorrhage. The criteria for assessing fetal/neonatal prognosis were an

Apgar score of less than 7 at 5 minutes, transfer of the newborn, and intrapartum fetal death or early neonatal death.

### *Operational definition*

*Preventive induction of labor:* we considered preventive induction of labor to be the artificial induction of uterine contractions in a pregnant woman at term or close to term, without immediate pathological indication, with the aim of anticipating delivery and reducing the risk of complications associated with returning home before birth. This is an “organizational” or contextual indication that is geographical in nature. In the Kédougou region, a significant proportion of patients live in remote rural areas, sometimes several hours away from the hospital by road, or in isolated areas that are difficult to access (isolation due to geographical, climatic, or transport conditions, such as during the rainy season or in mountainous areas). This practice is mainly aimed at avoiding certain complications such as mechanical dystocia and uterine rupture, which can lead to high maternal and neonatal morbidity and mortality due to geographical remoteness, lack of transportation, and limited access to emergency obstetric care.

### *Data analysis*

The patients were divided into two groups, which we will refer to as “Exposed” and “Unexposed.” The exposed group consisted of patients who underwent artificial labor induction. Those who underwent spontaneous labor induction were classified as “Unexposed” and constituted the reference/comparison group. The data were entered into our E-périnatal computer database. They were then extracted to Microsoft Excel 2020 and analyzed using Statistical Package for Social Sciences (SPSS) software, version 27. Continuous quantitative variables were described by their position and dispersion parameters: mean, median, mode, and standard deviation. Qualitative variables were described by proportions relative to their total share. The obstetric and neonatal outcomes were compared using the Chi-square test between the two groups (Exposed/Unexposed) at a significance level of  $p=0.05$ .

## RESULTS

During the study period, 2,750 patients were included, 501 underwent artificial induction of labor with prostaglandins, representing a frequency of 18.2%. The mean age of the patients was 24.44 years. The extremes were 10 and 47 years. Nearly one in two patients was multiparous (47%,  $n=1,292$ ). A proportion of 59.1% of patients were admitted via medical evacuation, with the remaining patients coming from their homes. The characteristics of patients who underwent induction are summarized in Table I. Induction was performed mainly on normal uterus (91.6%), on fetuses in cephalic presentation (95.8%), of normal weight (75.8%), and on

singleton pregnancies (97%). However, the sample included 8.4% of single scarred uterus, 4.2% of breech presentations, and 3% of multiple pregnancies. It was mainly performed in multiparous women (57.9%) and involved 26.9% of nulliparous women. Patients with full-term pregnancies accounted for two-thirds of these patients. Post-term pregnancy and hypertension associated with pregnancy were the two main indications for induction (29.4% and 28.9%, respectively). Nearly one in five patients (19.3%) underwent preventive induction, as shown in figure 1.

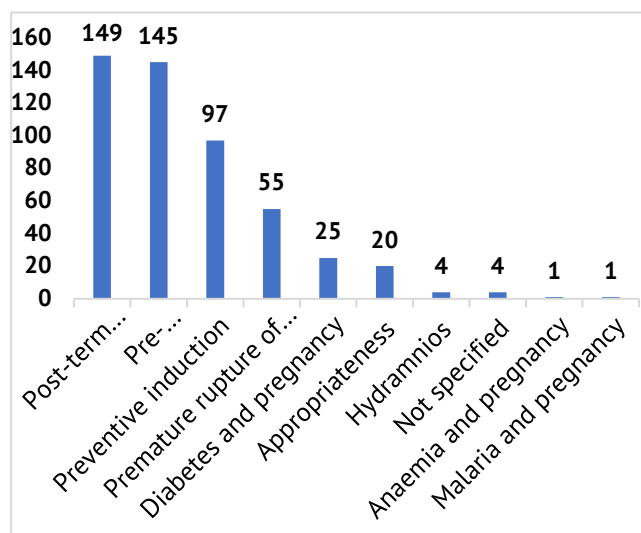


Figure 1: Distribution of patients according to the reason for induction.

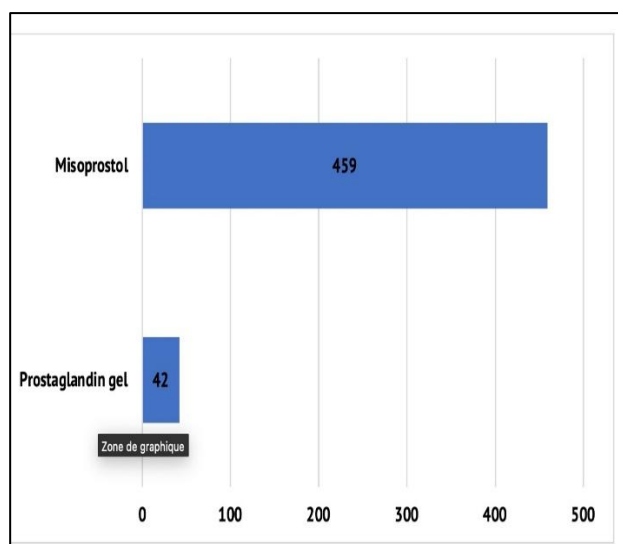


Figure 2: Illustrates the distribution of patients according to the method used to induce labor.

Bishop's score was unfavorable in approximately 82% of cases. The main method used to induce labor was medical, using misoprostol (n=459-91.6%). Figure 2 illustrates the distribution of patients according to the method used to induce labor.

Table 1: Obstetric characteristics of patients undergoing induction.

	Number (n=501)	Percentage (%)
<b>Uterus</b>		
Scared uterus	42	8.4
Normal	459	91.6
<b>Parity</b>		
Nulliparous	135	26.9
Primiparous	76	15.2
Multiparous	290	57.9
<b>Type of pregnancy</b>		
Single fetus	486	97
Multiple	15	3
<b>Type of presentation</b>		
Cephalic	480	95.8
Breech	21	4.2
<b>Fetal weight</b>		
< 2500 g	110	22
2500-3999 g	380	75.8
>4000 g	11	2.2
<b>Terme of pregnancy</b>		
Term	331	66
Pre term	87	17.4
Post term	83	16.6

The main dosage used for misoprostol was 25 µg per dose in 99.5% of cases (472 patients). Misoprostol was mainly administered vaginally in 92.8%. Nearly 60% of patients received two doses of misoprostol for labor induction. They were spaced 6 hours apart in 94.7% of cases. Figure 3 shows the distribution of the number of doses.

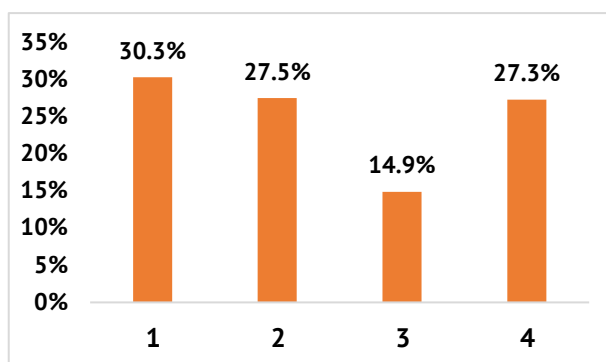


Figure 3: Distribution of the number of doses of misoprostol.

Induction was successful in 97.6% of cases; we observed 12 cases of induction failure. Statistical analysis showed that 85% of women who underwent induction of labor achieved vaginal delivery. Induction of labor was associated with a significantly reduced risk of cesarean section compared with spontaneous labor (14.8% vs. 25.9%; relative risk (RR)=0.5; P< 0.001). No statistically significant differences were found between the two groups regarding maternal complications, including uterine

rupture and postpartum hemorrhage. Similarly, neonatal outcomes according to an Apgar score <7 at 5 minutes, neonatal resuscitation, neonatal transfer, and stillbirth did

not differ significantly between induced and spontaneous labor (Table 2).

**Table 2: Significant difference between induced and spontaneous labor.**

	Spontaneous labour	Induction of labour	RR IC	P value
	Number (%)	Number (%)		
<b>Mode of delivery</b>				
Vaginal	1662 (74.1)	427 (85.2)	1	0.001
C-section	582 (25.9)	74 (14.8)	0.57 (0.457-0.712)	
<b>Uterine rupture</b>	8 (0.4)	3 (0.6)	1.68 (0.448-6.329)	0.436
<b>Postpartum haemorrhage</b>	32 (1.4)	11 (2.2)	1.543 (0.783-3.039)	0.207
<b>Apgar score &lt; 7 at 5 minutes</b>	79 (3.5)	17 (3.4)		0.717
<b>New born resuscitation</b>	426 (90)	90 (18.9)	0.948 (0.772-1.165)	0.612
<b>Neonatal admission</b>	270 (12)	58 (11.6)	0.964 (0.738-1.259)	0.89
<b>Fresh stillbirth</b>	26 (1.2)	8 (1.6)	1.381 (0.662-3.030)	0.419

\*RR: Risk Ratio; CI: confidence interval

## DISCUSSION

In our series, the overall frequency of labor induction was 18.2%. Induction was performed mainly on normal uterus (91.6%), on fetuses in cephalic presentation (95.8%), of normal weight (75.8%), and on singleton pregnancies (97%). Post-term pregnancy was the leading indication, representing 29.4% of cases, while hypertensive disorders of pregnancy accounted for 28.9% of indications. Preventive or organizational inductions represented nearly 20% of cases, reflecting the geographical isolation and limited access to emergency obstetric services in Kédougou. The main method used to induce labor was medical, using misoprostol (n=459–91.6%) and dinoprostol gel. The main dosage used for misoprostol was 25 µg per dose in 99.5% of cases (472 patients). Misoprostol was mainly administered vaginally in 92.8%. Vaginal delivery was achieved in 85% of induced patients, and induction significantly reduced the risk of cesarean section compared with spontaneous labor (14.8% vs. 25.9%; RR=0.57; p<0.001). Uterine rupture occurred in 0.6% of cases. Neonatal outcomes, including Apgar scores <7 at 5 minutes, did not differ significantly between induced and spontaneous labor groups.

From January 1, 2023 to June 30, 2025 a total of 2,750 deliveries were included, among which 501 cases involved artificial induction of labor, corresponding to a frequency of 18.2%. The prevalence of labor induction shows considerable variability across regions and even between healthcare facilities. Despite this heterogeneity, induction rates are generally higher in high-income countries compared with low- and middle-income settings. In several European countries, a substantial proportion of inductions are performed for non-medical or convenience-related reasons. In France, while the rate of medically indicated inductions has remained relatively stable, inductions for convenience have increased over time.<sup>5</sup> In contrast, lower induction frequencies have been reported in sub-Saharan Africa. A study conducted in 2021 at

Philippe Maguilen Senghor Health Center in Dakar reported an induction rate of 3.6%, while Dolo et al in Mali reported a frequency of 1.84%.<sup>6,7</sup> The frequency of artificial induction of labor observed in our facility is comparable to rates reported in Western countries, notably the 21% rate documented in France in 2019.<sup>5</sup> This finding may be explained by the high prevalence of specific indications in our setting, including prolonged and post-term pregnancies, as well as preventive inductions. The particular context of Kédougou likely contributes to this pattern.

Antenatal care is often suboptimal, and many pregnancies are followed without early ultrasound assessment, leading to diagnostic uncertainty regarding gestational age and, consequently, to either pathological conditions or misclassification of term. In addition, our hospital serves as the regional referral center for three districts, operating with a single surgical team and one operating theater. In such a resource-constrained environment, the availability, accessibility, quality, and utilization of maternal health services during pregnancy and childbirth remain major challenges.

Within this context, reducing both maternal mortality and cesarean section rates represents a critical public health priority. Evidence from Grobman et al demonstrated that systematic induction of labor at term in a low-risk population was associated with a significant reduction in cesarean delivery rates and a non-significant decrease in neonatal morbidity. The demonstrated efficacy and safety of artificial labor induction support its promotion as an alternative to cesarean section, particularly given that maternal mortality associated with cesarean delivery remains approximately three times higher than that associated with vaginal birth, despite the steady decline in cesarean-related maternal mortality over the past five decades.<sup>8</sup> As in other studies, drug-induced labor was predominant in our series, based mainly on the vaginal administration of misoprostol (92.8%).<sup>7,9,10</sup>

The priority use of misoprostol for labor induction in our facility can be explained, on the one hand, by the adoption of a local management protocol recommending this drug as an induction agent and, on the other hand, by its practical advantages: stability, storage at room temperature, and very low cost. Furthermore, the high cost of prostaglandin E2 (PGE2) also reinforces its use. The American College of Obstetricians and Gynecologists places misoprostol on the same level as dinoprostone as first-line molecules for cervical ripening (Grade A recommendation). Similarly, the World Health Organization considers misoprostol to be an essential drug for cervical ripening.<sup>11</sup> In our facility, the protocol used follows the 2017 FIGO recommendations.<sup>12</sup>

The vaginal route is by far the most commonly used (92.3%). Several studies evaluating misoprostol according to different routes of administration and dosages have been conducted.<sup>13,14</sup> These studies agree on the use of a vaginal dosage of 25 µg of misoprostol every 3 to 6 hours in cases of unfavorable cervix, rather than resorting to a higher dose (NP1). The 25-µg dosage is associated with a significant reduction in the risk of adverse effects compared to the 50-µg dose: RR=0.5 (0.4-0.7) for hyperstimulation and RR=0.6 (0.5-0.8) for hyperkinesia or hypertonia, without altering the fetal heart rate. Furthermore, the latest recommendations from the FIGO 2023 no longer recommend the use of oral or sublingual misoprostol for labor induction in living children, as it is associated with increased tachysystole and fetal distress. Dinoprostone was used in only 42 patients, or 8.3%. The product was introduced into our practices in 2024. Furthermore, the affordability of this product in rural areas does not encourage its widespread use compared to misoprostol, especially since the results are comparable between misoprostol 25g vaginal and dinoprostone in terms of contractility abnormalities, neonatal status, uterine rupture, and side effects.<sup>15</sup>

Induction was mainly performed on singleton pregnancies in cephalic presentation. Since the study by Hanna et al in 2000, the mode of vaginal delivery in cases of breech presentation remains a widely debated topic.<sup>16</sup> In these circumstances, labor induction in cases of breech presentation remains very rare. In our study, 4.2% of cases of induction were performed for medical reasons in cases of breech presentation. These practices are reported in a few Anglo-Saxon studies, which already considered it a safe and reasonable option in 2001.<sup>17</sup> In the same vein, the new CNGOF (2020) clinical practice guidelines for breech presentation specify that full-term breech presentation is not a contraindication to induction when the criteria for vaginal delivery are met (Grade C) and prostaglandins can be used. A recent systematic review evaluating the safety of misoprostol use in twin pregnancies concluded that labor induction in this population does not appear to increase the risk of major maternal or neonatal complications.<sup>18</sup> In our series, induction was predominantly performed in women with an unscarred uterus (91.6%), while 8.4% had a single uterine scar.

Several authors have reported the use of prostaglandins in women with a scarred uterus without demonstrating a significant increase in the risk of uterine rupture compared with women with an unscarred uterus.<sup>19,20</sup> However, the 2023 recommendations of the FIGO no longer support the use of misoprostol for labor induction in women with a scarred uterus (previous cesarean section) beyond 28 weeks of gestation. In light of these updated guidelines, specific precautionary measures are implemented in our department. High-risk patients undergo continuous fetal heart rate monitoring during labor, and clinical teams are specifically trained to ensure early recognition of signs suggestive of uterine rupture. Additionally, a color-coded emergency cesarean section protocol has been established to optimize response time. For this indications, dinoprostone gel remains the first-line agent in our facility. In cases of dynamic dystocia, oxytocin is administered via infusion pump in accordance with the recommendations of the CNGOF, with an initial infusion rate of 6 mL/h.<sup>21</sup>

In our series, post-term pregnancy was the leading reason for inducing labor (29.4%). These results are very similar to those reported by Blanc-Petitjean et al (28.7%).<sup>5</sup> In Mali, we found similar proportions, with rates of 35.8% and 21.5% respectively in the series by Dolo et al and Coulibaly et al.<sup>7-9</sup> In this situation, labor induction represents a valuable strategy for reducing cesarean section rate in this patient group. Some authors suggest that elective induction at 41 weeks or earlier under certain specific conditions could reduce the risk of cesarean section as well as complications such as the presence of meconium-stained amniotic fluid.<sup>22</sup> Indeed, Winer's (2011) study on the modalities of induction in prolonged pregnancies highlighted the benefits of using prostaglandins (E1,E2) for cervical ripening and to promote the onset of labor. This does not increase the rate of cesarean sections or perinatal mortality. However, the use of these molecules, particularly misoprostol, requires an environment with access to appropriate monitoring equipment to monitor fetal heart rate and uterine tone.<sup>23</sup>

Hypertensive disorders of pregnancy accounted for 28.9% of the indications for labor induction in our series. This proportion is higher than those reported by Wade et al (12.6%), Ezechi et al in Nigeria (19.8%), and Dolo et al (17.2%).<sup>6,7,10</sup> The definitive management of preeclampsia remains delivery, as continuation of pregnancy may worsen maternal and fetal outcomes. The decision regarding the mode of delivery, including the potential indication for labor induction, depends on both gestational age and the severity of clinical manifestations. The relatively high incidence of hypertensive disorders and preeclampsia observed in Kédougou may be attributed to multiple contextual factors, including delayed or inadequate antenatal care, limited access to healthcare services, sociocultural barriers, insufficient early screening, and delays in referral or evacuation. These structural challenges are compounded by individual obstetric and nutritional risk factors, which may further contribute to the burden of disease in this setting.

Preventive induction accounted for nearly 20% of indications in our series. This organizational or contextual indication reflects the specific geographical and socio-demographic characteristics of the Kédougou region, an isolated and mountainous area intersected by rivers and waterways, with a low population density of approximately 11 inhabitants per km<sup>2</sup>. In this setting, preventive induction aims to reduce the risk of severe obstetric complications such as mechanical dystocia or uterine rupture which may result in substantial maternal and neonatal morbidity and mortality due to geographical remoteness, limited transportation options, and restricted access to comprehensive emergency obstetric care. In France, this indication is regulated by the 2008 recommendations of the Haute Autorité de Santé (HAS), which outline the conditions for artificial induction of labor from 37 weeks of gestation.<sup>24</sup> In our context, in the absence of financing and construction of guest house for pregnant women in the city for patients living in isolated and/or enclaved areas; awareness strategies combined with scheduled induction of labor appear to constitute a pragmatic and relevant alternative.

During the study period, 85% of women who underwent induction achieved vaginal delivery. Moreover, induced patients had a significantly lower risk of cesarean section compared with women who experienced spontaneous labor (14.8% vs. 25.9%; RR=0.57; p<0.001). In Senegal, Ndiaye et al reported a cesarean section rate of 12.1%; however, their study included cases of intrauterine fetal death, which may partly explain the observed difference. Wade et al, in a study evaluating artificial induction of labor in viable pregnancies using misoprostol, reported a cesarean section rate of 23.6%.<sup>6,25</sup> The relatively low cesarean rate observed in our series may be attributable to the substantial proportion of preventive inductions. Indeed, these women did not present obstetric risk factors at the time of induction, in contrast to other studies where induction was predominantly performed for medical indications. Supporting this interpretation, an audit conducted in a Danish university hospital evaluating oral misoprostol 25 µg for induction in low-risk pregnancies reported a cesarean section rate comparable to ours (14.9%).<sup>26</sup>

The frequency of uterine rupture in our series was 0.6%, which is comparable to the 0.4% reported by Ndiaye and close to the rates documented by Rageth in Switzerland (0.7%) and Dekker in Australia (0.68-1.77%) (6,27,28). In the American literature, reported rates range from 0.6% to 2.5%, depending on the induction method used. These findings confirm that although the risk of uterine rupture is real, it remains low and acceptable when strict monitoring is ensured, with a scarred uterus being a major predisposing factor.<sup>28,29</sup> In our study, three cases of uterine rupture were observed following induction. In two cases, the diagnosis was made intraoperatively during cesarean section and immediately postpartum. Neonatal outcomes were favorable in two of the three cases. Regarding neonatal outcomes, induction of labor did not appear to

increase the risk of asphyxia. The proportion of newborns with an Apgar score <7 at 5 minutes was similar between the induction and spontaneous labor groups (3.4% vs. 3.5%). These results contrast with those of Wade et al, who reported a two- to threefold higher risk of neonatal asphyxia following induction.<sup>6</sup> This discrepancy may be explained, in part, by the patient profile in our series—particularly the high proportion of preventive inductions—but also, and more importantly, by the specific precautions implemented during labor and delivery to optimize maternal and fetal safety.

On the hospital level, the high success rate of labor induction (85% vaginal deliveries) and the significant reduction in cesarean section risk demonstrate that induction is a safe and effective strategy for both at-risk and low-risk patients. The use of prostaglandins with continuous fetal heart rate and uterine monitoring shows that structured protocols can minimize maternal and neonatal complications, even in resource-limited settings, while standardized procedures for high-risk patients, including those with previous cesarean sections, enhance obstetric safety and quality of care. From a public health perspective, scheduled induction particularly for post-term pregnancies or in geographically isolated areas can reduce maternal and neonatal morbidity, limit preventable deaths, and help maintain cesarean section rates at an acceptable level. Planned inductions and patient education also help overcome challenges related to poor access to healthcare due to distance, transportation difficulties, and limited infrastructure. Finally, this study contributes valuable local data on the indications, safety, and effectiveness of labor induction, providing evidence to inform context-specific guidelines. It also highlights the need for further research to optimize induction protocols, compare different prostaglandin agents, and assess long-term maternal and neonatal outcomes in similar low-resource and rural settings.

### **Strengths and limitations**

Our study highlights that drug-induced labor plays an important role in obstetric practice in Kédougou, with misoprostol being the most commonly used drug due to its availability, low cost, and effectiveness. The main indications were post-term pregnancy, hypertensive disorders and, in particular, “preventive” induction related to the local context. However, certain limitations remain: this is a retrospective study, and the frequency of preventive induction could bias the prognosis for patients.

### **CONCLUSION**

Labor induction with prostaglandins in this setting proved to be a safe and effective strategy for reducing cesarean section rates and improving maternal and neonatal outcomes, especially in a resource-limited and geographically isolated region. Planned inductions and patient education also help overcome challenges related to

poor access to healthcare due to distance, transportation difficulties, and limited infrastructure.

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