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# Analysis of preterm birth in a tertiary maternity hospital in Niger: A Retrospective cohort study

## *Analyse de l'accouchement prématuré dans une maternité de niveau 3 au Niger. Une étude de cohorte retrospective*

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**Résumé**

*Contexte & objectif.* L'accouchement prématuré (AP, une cause majeure de morbi-mortalité néonatales est peu documenté dans nos contrées. L'étude visait à déterminer la prévalence de l'AP et à identifier les facteurs associés à l'AP et à la mortalité néonatale intra-hospitalière. *Méthodes*. C'etait une étude de cohorte retrospective incluant tous les accouchements enregistrés entre le 1er janvier et le 31 décembre 2021 dans une maternité tertiaire du Niger. L'AP était défini par un accouchement avant 37SA. Une analyse de régression logistique multivariée a été utilisée pour identifier les facteurs associés à l'AP. La survie neonatale et les facteurs associés à la mortalité néonatale intra-hospitalière chez les prématurés nés vivants, ont été analysées resptivement, par la methode de survie de Kaplan-Meier et de la régression de Cox. *Résultats*. Parmi 7 718 accouchements, 1 155 étaient prématurés (14,97%). Les facteurs associés à l'AP étaient : âge maternel ⩾35 ans (ORa 1,24), intervalle inter-gestationnel <12 mois (ORa 2,80), moin s de 4 CPN (ORa 3,17), absence de CPN (ORa 3,76), hypertension gravidique (ORa 5,78), rupture prématurée des membranes (ORa 5,40), antécédent d'AP (ORa 4,06), paludisme (ORa 8,51) et infection urinaire (ORa 3,45). La mortalité néonatale intra-hospitalière était de 10,82%. La durée moyenne de survie était

**Summary**

*Context and objective*. Preterm birth (PTB), a major contributor to neonatal morbidity and mortality, remains poorly documented. The present study aimed to determine the prevalence of PTB and identify factors associated with PTB and in-hospital neonatal mortality in a tertiary maternity hospital in Niger.

*Methods*. We conducted a retrospective cohort study including all deliveries recorded between January 1 and December 31, 2021, in a tertiary maternity hospital in Niger. PTB was defined as delivery before 37 weeks of gestation. Multivariable logistic regression was used to identify factors associated with PTB. Neonatal survival time and factors associated with in-hospital neonatal mortality among live-born preterm neonates were assessed using Kaplan-Meier survival analysis and Cox proportional hazards regression. *Results*. Among 7,718 deliveries, 1,155 were preterm (14.97%). Factors independently associated with PTB included maternal age ⩾35 years (AOR 1.24), inter-gestational interval <12 months (AOR 2.80), fewer than four antenatal care visits (AOR 3.17), absence of antenatal care (AOR 3.76), pregnancy-induced hypertension (AOR 5.78), premature rupture of membranes (AOR 5.40), history of PTB (AOR 4.06), malaria (AOR 8.51), and urinary tract infection (AOR 3.45). In-hospital neonatal mortality among live-born preterm neonates was 10.82%. The mean survival time was 6.34 (95%CI: 6.21-6.83) and low birth weight, low Apgar score, and lower gestational age were independently associated

de 6.34 jours (IC 95%: 6.21-6.83). En analyse multivariée, un faible poids de naissance, un faible score d'Apgar et la grande prématurité étaient indépendamment associés à une augmentation de la mortalité.

*Conclusion.* L'AP reste fréquent au Niger et fortement associé à des complications maternelles évitables. Le renforcement des soins prénatals pourrait améliorer le pronostic néonatal.

**Mots-clés** : Accouchement prématuré, Morbidité maternelle, Mortalité périnatale, mortalité néonatale

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with increased mortality in multivariable Cox model. *Conclusion***.** PTB remains highly prevalent in Niger and is strongly associated with preventable maternal conditions. Strengthening antenatal care and management of obstetric complications could improve neonatal outcomes.

**Keywords:** Preterm delivery, Maternal morbidity, Perinatal mortality, Neonatal mortality

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## Introduction

The term "preterm birth" is used to describe any birth that occurs before 37 weeks of gestation (1). The classification of preterm birth is based on the gestational age at the time of delivery, with very preterm birth defined as less than 28 weeks, moderate preterm birth as between 28 and 32 weeks, and late preterm birth as between 32 and 36 weeks. Preterm birth can be either spontaneous or induced. In the event of an emergency, a medical practitioner may perform an obstetric intervention for the purpose of maternal or fetal rescue (1). In 2020, 13.4 million infants (representing over one in ten births) were born prematurely (2). It is estimated that approximately 900,000 children die each year due to complications associated with prematurity (3). On a worldwide basis, preterm birth represents the primary cause of mortality among children under the age of five years old. In low-income countries, the mortality rate for very premature babies is more than 90%, with over half of infants born at 32 weeks dying within the first few days of life.

This is in contrast to the mortality rate of less than 10% seen in high-income countries (2). As the WHO has stated, these deaths are attributed to a lack of feasible and cost-effective care, including protection from heat, breastfeeding support, basic infection control, and respiratory support (2, 4). For those who survive, the main morbidities are lifelong disabilities, including impairments to learning, vision, and hearing (2,4). In addition, the issue of delivery methods for these vulnerable fetuses is also raised by preterm birth. The decision to undergo a caesarean section is dependent on additional factors, particularly when there is a maternal or fetal indication to terminate the pregnancy, while the conditions for induced labor are not met (4). Preterm birth is a global issue, with an estimated prevalence of 9.9% in 2020. In Europe, the prevalence range is between 5% and 8%. In 2020, approximately 65% of all global preterm births occurred in South Asia and sub-Saharan Africa (2). In Africa, the prevalence of preterm birth exhibited considerable variation across different countries, with a mean of 10.1% (2, 5, 6). For illustrative purposes, the preterm birth

rate was 9.9% in Nigeria, 12.9% in Ethiopia, and 12.4% in the Democratic Republic of the Congo (2). In a single center study, the preterm birth rate was recorded at 2.7% in Mali (6).

In Niger, the prevalence of preterm birth was 20.5% in 2018 (7). A variety of factors are associated with preterm birth, including socioeconomic conditions, premature rupture of membranes, a history of preterm birth, and multiple pregnancies (4). In order to reduce this high rate of preterm birth as well as maternal, neonatal and child mortality, Niger has made significant efforts in the field of health, with an emphasis on reproductive health. The government has introduced a policy of universal coverage for caesarean sections and all other modes of delivery, as well as antenatal care and curative care for children aged 0 to 5 years old (7).

In light of the paucity of recent data on preterm birth in Niger and within our department, this study aims to provide a comprehensive analysis of the prevalence, socio-economic, and obstetric factors associated with preterm birth in a tertiary maternity hospital in Niger. In addition, we provide a detailed description of the clinical, therapeutic aspects, the fetal and maternal outcomes and to evaluate neonatal survival and factors associated with in-hospital neonatal mortality.

**Methods**

*Study design and setting*

We conducted a retrospective cohort study at Issaka Gazobi Maternity Hospital, a tertiary referral center in Niamey, Niger, from January 1 to December 31, 2021.

*Study population*

The study included all women who delivered during the study period. Patients were divided into: Preterm births (<37 weeks) defined as women who delivered after 22 weeks and before 37 weeks of gestation, and term births defined as women who delivered at term (≥37 weeks). The sample size was 1,155 preterm births and 6,563 term births.

*Inclusion criteria*

We included singleton pregnancies with reliable gestational age assessment, based on last menstrual period and/or early ultrasound. The study also incorporated these patients' newborns.

*Non-inclusion criteria*

The study did not include records with incomplete or unusable data.

*Variables studied*

For each patient, we studied variables relating to: socio-economic characteristics, medical and surgical history, obstetrical follow-up, clinical and therapeutic aspects, and maternal and perinatal prognosis. The study collected data on a range of variables, including socio-economic characteristics (e.g., age, weight, height, level of education, lifestyle) and obstetric characteristics (e.g., parity, number of antenatal care visits, mode of delivery, and gestational age at delivery). The study also collected newborn parameters (e.g., sex, birth weight, and Apgar score at the first and fifth minute). The number of antenatal care (ANC) visits was used to determine the classification of a pregnancy monitoring. A pregnancy was considered not followed if no ANC had taken place, poorly followed if the number of ANC was less than four, and well followed if this number was greater than or equal to four.

*Outcome measures*

The primary outcome was preterm birth. The secondary outcomes was in hospital neonatal mortality among live-born preterm neonates.

In hospital neonatal mortality was defined as death occurring during the first seven days after birth or before discharge among live-born preterm neonates.

Stillbirths were excluded from neonatal mortality analyses.

*Data collection*

Data were extracted from hospital medical records and delivery registers using a standardized data collection form. Data quality was ensured through cross-checking. Patients with incomplete or unusable obstetric or neonatal records were excluded from the study. The data quality and reliability were verified by three of the study's authors.

*Statistical analysis*

Data were analyzed using SPSS version 25 software. Quantitative variables were compared using Student’s t-test and qualitative variables using the Chi-square test. Crude odds ratios (COR) were first calculated in bivariate analysis, followed by multivariate logistic regression to identify factors associated with preterm birth. Kaplan-Meier survival analysis and the log-rank test were used to estimate neonatal survival probabilities. Factors associated with in-hospital neonatal death were identified using Cox proportional hazards regression. Variables that had a p-value < 0.02

in bivariate analysis were entered into the multivariable model and variables that had a p-value < 0.05 in multivariable Cox proportional hazards model were considered as statistically significant.

*Ethics approval*

Ethics approval was obtained from the Ethics Committee of Abdou Moumouni University of Niamey (Approval Number: 000864/2AUA/FSS/SS, Date: December 12th, 2020). The institutional review board of our hospital (Issaka Gazobi Maternity) waived the requirement for written informed consent from the patients because of the retrospective design of the study.

**Results**

A total of 7,718 deliveries were recorded, including 1,155 preterm births (14.97%).

The mean maternal age was 28.32±5.57 years (range: 15 – 48 years old) in the preterm birth group, compared to 27.49±2.73 years (range: 15 – 42 years old) in the term birth group.

Women ≥35 years were more represented in preterm birth group (22.08% vs. 14.45%, p=0.0034). The largest age group represented in preterm birth group was 30–34-year-olds (24.07%, 278 cases) compared to 33.01% in the term birth group (P=0.0034). The mean parity was 2.47±1.26 (range: 1 - 13) in the preterm birth group compared to 2.91±1.03 (range: 1 - 8) in the term birth group (P=0.063). Primiparous women were more frequent among preterm births cases (38.01% vs. 17.08%), whereas multiparous women predominated in the term birth group (42.87% vs. 16.97%, P=0.063). A short inter-gestational interval (<12 months) was more common in the preterm birth group (2%, vs 1.47%, P<0.0001). The average inter-gestational interval was 18.4±5.34 months in patient with preterm birth (range: 4 months to 36 months) compared to 23.7±2.58 months (range: 5 months to 47 months) in the term birth group.

The rate of a history of preterm birth was significantly higher among the preterm birth cases (23.98% vs. 5.01%, P = 0.0003). Additionally, a history of cesarean section was significantly higher among patients with preterm birth (40.34% vs. 10.01%, P = 0.0003).

Regarding the patients' origins, 45.2% of patients with preterm birth came from the urban areas, while 54.8% came from rural areas. These patients traveled between 20 and 214 kilometers (15 minutes to 4 hours by road) to reach the hospital. Furthermore, 73.76% (852 patients) of those with preterm births did not have access to modern transportation.

Regarding antenatal care, the average number of ANC visits was 2.9 ± 1.46 (range: 0–6) in the preterm birth group, compared to 3.82 ± 4.07 (range: 0–9) in the term birth group. A lack of antenatal care was more prevalent in the preterm birth group (29.95% vs. 12.84%), as were fewer than four ANC visits (40.08% vs. 66.70%, P < 0.0001). However, women who had at least four ANC visits were more prevalent in the preterm births group (27.97% vs. 20.47%).

Table 1 provides more information about the socioeconomic characteristics and prenatal monitoring of patients with preterm births.

**Table 1**. Socioeconomic characteristics and prenatal follow-up of patients with preterm birth.

| **Variables** | **Preterm birth (%)** | | **Term birth (%)** | | **P value** |
|---|---|---|---|---|---|
| | **N=1,155** | | **N=6,563** | | |
| **Age (year)** | | | | | |
| 15 -19 | 124 | 10.74 | 834 | 12.70 | |
| 20 -24 | 256 | 22.16 | 1743 | 26.55 | |
| 25 -29 | 242 | 20.95 | 870 | 13.26 | 0.0034 |
| 30 - 34 | 278 | 24.07 | 2167 | 33.01 | |
| 35 -39 | 182 | 15.76 | 783 | 11.93 | |
| ≥ 40 | 73 | 6.32 | 166 | 2.52 | |

| | | | | | |
|---|---|---|---|---|---|
| **Education level** | | | | | |
| Primary | 185 | 16.02 | 124 | 1.88 | |
| Secondary | 383 | 33.16 | 498 | 7.58 | 0.093 |
| Superior | 198 | 17.14 | 272 | 4.14 | |
| No schooling | 389 | 33.68 | 5669 | 86.38 | |
| **Parity** | | | | | |
| Primiparous (1) | 439 | 38.01 | 1121 | 17.08 | |
| Pauci parous (2-3) | 391 | 33.85 | 1445 | 22.01 | 0.063 |
| Multiparous (4-5) | 196 | 16.97 | 2814 | 42.87 | |
| Grand multiparous (≥ 6) | 129 | 11.17 | 1183 | 18.02 | |
| **Living children** | | | | | |
| 0 | 339 | 29.35 | 1121 | 17.08 | |
| 1-3 | 613 | 53.07 | 3614 | 55.06 | 0.716 |
| 4-5 | 145 | 12.55 | 1381 | 21.04 | |
| ≥ 6 | 58 | 5.02 | 447 | 6.81 | |
| **IGI (months)** | | | | | |
| < 12 | 23 | 02 | 97 | 1.47 | |
| 12-23 | 687 | 59.48 | 4388 | 66.85 | <0.0001 |
| ≥ 24 | 445 | 38.53 | 2078 | 31.67 | |
| **Background** | | | | | |
| Preterm birth | 277 | 23.98 | 329 | 5.01 | |
| Caesarean section | 466 | 40.34 | 657 | 10.01 | |
| Preeclampsia | 162 | 14.03 | 292 | 4.44 | |
| RPH | 145 | 12.55 | 186 | 2.84 | 0.0003 |
| PP | 13 | 1.13 | 95 | 1.44 | |
| Cervical incompetence | 10 | 0.87 | 0 | 0 | |
| IUD | 7 | 0.61 | 2 | 0.03 | |
| Obstetric fistulas | 4 | 0.35 | 0 | 0 | |
| Genital prolapse | 4 | 0.35 | 0 | 0 | |
| Other | 7 | 0.60 | 10 | 0.15 | |
| **ANC** | | | | | |
| 0 | 346 | 29.95 | 843 | 12.84 | |

| | | | | | |
|---|---|---|---|---|---|
| 1-3 | 486 | 40.08 | 4377 | 66.70 | <0.0001 |
| ≥ 4 | 323 | 27.97 | 1344 | 20.47 | |

**IGI :** Inter-gestational interval, **ANC** : Antenatal care, **RPH :** Retroplacental hematoma**, PP** : Placenta previa spectrum, **IUD** : Intra-uterin death

With regard to the clinical aspects, malaria was significantly more frequent among preterm birth cases (73.94% vs. 28.96%, P<0.0001), as well as urinary tract infection (18.44% vs. 6.15%, P=0.0003). Pregnancy-induced hypertension was strongly associated with preterm birth (58.5% vs. 41.5%, P<0.0001), as was premature rupture of membranes (57.7% vs. 2.7%, P<0.0001).

With regard to the mode of admission among patients with preterm birth, 77.92% of patients (900 cases) were referred from other maternity hospitals (Table 2).

**Table 2**. Clinical characteristics of patients with preterm birth (N=1155)

| Variables | Number of cases | Percentage (%) |
|---|---|---|
| **Admission mode** | | |
| Direct admission | 255 | 22.08 |
| Reference from others centers | 900 | 77.92 |
| **Term of pregnancy** | | |
| 22 - 27 SA | 95 | 8.23 |
| 28 - 31 SA | 249 | 21.56 |
| 32 - 36 SA | 811 | 70.21 |
| **Uterine contractions on admission** | | |
| Absent | 346 | 29.96 |
| Present | 809 | 70.04 |
| **State of cervical dilatation on admission** | | |
| Latent phase (< 4cm) | 980 | 84.85 |
| Active phase (≥ 4cm) | 175 | 15.15 |
| **Status of amniotic membranes** | | |
| Intact | 915 | 79.22 |
| Ruptured | 240 | 20.78 |
| **Type of delivery** | | |
| Induced labor | 1025 | 88.74 |
| Spontaneous delivery | 130 | 11.26 |
| **Mode of delivery** | | |
| Caesarean section | 868 | 75.15 |

| | | |
|---|---|---|
| vaginal delivery | 287 | 24.85 |
| **Indications for Caesarean section** | | |
| Uterine scar disruption | 299 | 34.89 |
| Pre-eclampsia/Eclampsia | 231 | 26.95 |
| Third-trimester hemorrhage | 163 | 19.02 |
| PROM/ Oligohydramnios/Anamnios | 85 | 9.92 |
| Maternal pathologies (sickle cell disease, heart disease, infections) | 49 | 5.72 |
| Dystocic premature delivery | 21 | 2.45 |
| Intra-uterine grow restriction/ Perpartum asphyxie | 20 | 2.30 |
| **Emergency care** | | |
| Antenatal corticosteroid therapy | 909 | 78.70 |
| Antibiotic therapy | 263 | 22.77 |
| Magnesium sulfate | 163 | 14.11 |
| Calcium inhibitor (tocolysis) | 159 | 13.77 |
| Antimalarial treatment | 43 | 3.72 |

The primary reasons for admission were prophylactic caesarean section (18.44%, 213 cases), pre-eclampsia and eclampsia (17.83%, 206 cases), second and third trimester hemorrhage (17.75%, 205 cases), threatened preterm birth (16.54%, 191 cases), and premature rupture of membranes (10.48%, 121 cases). The gestational age at admission was between 32 and 36 weeks in 811 patients (70.21%), with a median of 33.4±5.05 weeks (range: 22 to 36 weeks). Upon admission, uterine contractions were observed in 809 patients (70.04%). In 15.5% of cases, the patients were in the active phase of labor. Table 2 provides further details on the clinical characteristics of patients with preterm birth.

With regard to the therapeutic and prognostic aspects, preterm birth was induced in 88.74% of cases, mainly due to obstetric complications. The main reasons for inducing preterm birth observed were: preeclampsia/eclampsia (316 cases, 27.35%), antepartum hemorrhagia (205 cases, 17.74%), premature rupture of membranes with fetal distress (121 cases, 10.47%), intrauterine growth restriction (11 cases, 0.9%), suspicion of spontaneous uterine scar disruption (110 cases, 9.52%), prophylactic cesarean for multiple scars uterus (213 cases, 18.44%), and maternal comorbidity (49 cases, 4.24%). Antenatal corticosteroid therapy was used to accelerate fetal lung maturation in 909 patients (78.70%). Magnesium sulfate was administered in 163 patients (14.11%) for maternal and/or fetal indications. Tocolysis was performed in 159 patients (13.77%).

Cesarean section was the predominant mode of delivery in the preterm birth group (75.15%; 868 cases). Cesarean section was performed between 32 and 36 weeks of gestation in 692 patients (59.91%). The average gestational age at delivery was 33.4±5.05 weeks (range: 22 to 36 weeks).

Among preterm newborns (Table 3), the mean birth weight was 2000.85 ± 16.27 g (range: 510 g to 2880 g). Low birth weight (<1500 g) was observed in 15.15% (n=175), while the birth weight was between 2,000 g and 2,500 g in 436 newborns (37.75%).

**Table 3**. Birth parameters of preterm newborns (N=1155)

| Variables | Number of cases | Percentage (%) |
|---|---|---|
| **Birth weight (grams)** | | |
| 510 -1499 g | 175 | 15.15 |
| 1500-2000 g | 315 | 27.27 |
| 2001-2499 g | 436 | 37.75 |
| ≥ 2500g | 229 | 19.83 |
| **First-minute Apgar score (N=1,155)*** | | |
| 0 | 185 | 16.01 |
| 1-3 | 100 | 08.65 |
| 4-6 | 249 | 21.56 |
| ≥ 7 | 621 | 53.57 |
| **Neonatal morbidities** | | |
| Respiratory distress | 154 | 15.21 |
| Neonatal infections | 52 | 5.13 |
| Neonatal malaria | 11 | 1.08 |
| Convulsion | 8 | 0.79 |
| Perinatal asphyxia | 4 | 0.39 |
| Jaundice | 4 | 0.39 |
| Hemorrhage (epistaxis/purpura) | 3 | 0.29 |
| **Causes of neonatal death (N=125)** | | |
| Respiratory distress | 76 | 60.8 |
| Neonatal infection | 39 | 31.2 |
| Neonatal malaria | 5 | 4.0 |
| Hemorrhagic syndrome | 3 | 2.4 |
| Perinatal asphyxia | 2 | 1.6 |

***** Apgar score distribution among all preterm births, including stillbirths

Furthermore, neonatal resuscitation was required in 236 newborns (23.32%). The perinatal mortality rate was 26.83% (N=310) including 185 cases of stillbirths (16.01%) and 125 cases of in hospital neonatal mortality (10.82%), with the highest mortality observed among extremely preterm infants (<28 weeks), where survival was null (log-rank p< 0.001) (Fig. 1).

Among live-born preterm neonates, 60 (6.18%) died in the first follow up day, which is 48% of the observed deaths within the study period. Similarly, the proportion of death at the second, third and seven follow up days was 2.57%, 1.34% and 1.23% respectively (Fig. 1).

The cumulative proportion of survival among the live-born preterm neonates was 93.81%

(95%CI:88.67-96.43), 91.13%(95%CI:85.55-95.87), 90.00%(95%CI:84.14-94.27), 88.76%(95%CI:83.82-90.48) and 87.11%(95%CI:81.72-89.83) at the end of first, second, third, five and seven follow-up days respectively. As we have seen from Fig. 1, there was a rapid decline of survival on the first day and it be came slow in the corresponding follow-up days. The overall mean survival time was 6.34 (95% CI: 6.21-6.83).

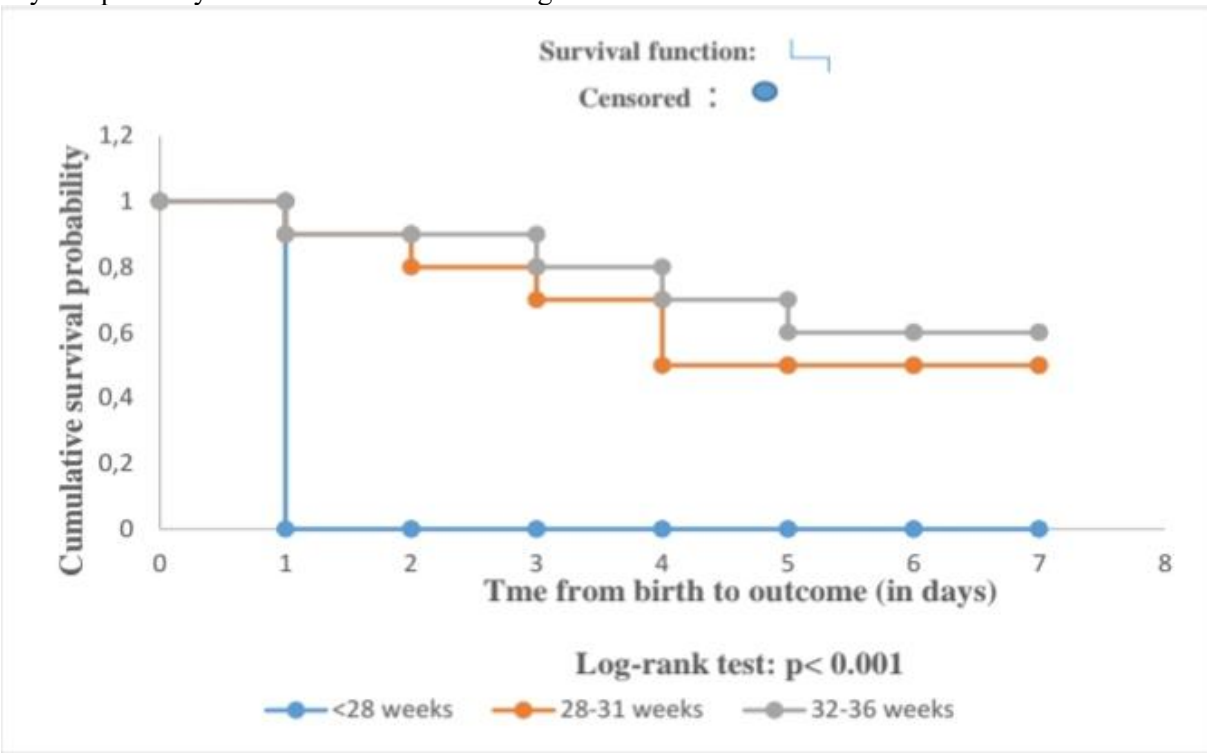


**Figure 1.** Kaplan-Meier survival curves by gestational age category among live-born preterm neonates

**Table 4.** Association between preterm birth and socioeconomic and obstetric parameters

| Variables | All births (n=7718) | Preterm births (n=1155) | Full term births (n=6563) | P-value |
|---|---|---|---|---|
| **Maternal age (years)** | | | | |
| < 20 | 958 (12.4) | 124 (13) | 834(87) | 0.0034 |
| 20-34 | 5556(72) | 776 (14) | 4780(86) | |
| ≥35 | 1204(15.6) | 255 (21.2) | 949(78.2) | |
| **Education level** | | | | |
| No formal education | 6058(78.5) | 389(6.4) | 5669(93.6) | 0.093 |

| | | | | |
|---|---|---|---|---|
| Schooling | 1660(21.5) | 766(46.1) | 894(53.9) | |
| **Inter-gestational interval** | | | | |
| < 12 months | 101(15) | 23(27.8) | 78(77.2) | <0.0001 |
| 12-23 months | 4605 (44.2) | 687(15) | 3918(85) | |
| ≥ 24 months | 3012 (40.8) | 445(14.8) | 2567(85.2) | |
| **History of preterm birth** | | | | |
| Yes | 556(7.2) | 227(40.8) | 329(59.2) | 0.0003 |
| No | 7162(92.8) | 878(12.3) | 6284(87.7) | |
| **Parity** | | | | |
| Primiparous(1) | 1560 (20.2) | 439(28.1) | 1121(71.9) | |
| Pauciparous(2-3) | 1836 (23.8) | 391(21.3) | 1445 (78.7) | |
| Multiparous(4-5) | 3010 (39) | 196(6.5) | 2814(93.5) | 0.063 |
| Grand multiparous(≥6) | 1312 (17) | 129(9.8) | 1183(90.2) | |
| **Number of prenatal visits** | | | | |
| 0 | 1188 (15.4) | 345(29) | 843(71) | |
| 1-3 | 2863 (37.1) | 486(17) | 4377(83) | <0.0001 |
| ≥4 | 3667 (47.5) | 323(9) | 1344(91) | |
| **Pregnancy induced hypertension** | | | | |
| Yes | 703 (9.1) | 411 (58.5) | 292(41.5) | |
| No | 7015 (90.9) | 744 (10.6) | 6271(89.4) | < 0.0001 |
| **PROM** | | | | |
| Yes | 416(5.4) | 240 (57.7) | 176(42.3) | |
| No | 7302(94.6) | 915(12.5) | 6387(87.5) | < 0.0001 |
| **Malaria** | | | | |
| Yes | 2755(35.7) | 854(31) | 1901(69) | |
| No | 4963(64.3) | 301(6) | 4662(94) | <0.0001 |
| **Urinary tract infection** | | | | |
| Yes | 617 (8) | 213(34.5) | 404(65.5) | 0.0003 |
| No | 7101 (92) | 942(13.3) | 6159(86.7) | |

IGI: Inter-gestational interval, ANC : Antenatal care, PROM : Premature rupture of membranes. Pregnancy induced hypertension disorder: included gestational hypertension, preeclampsia/eclampsia.

With regard to the associated factors with preterm birth (Table 5), after adjustment, preterm birth was independently associated with: maternal age ≥35 years (AOR 1.24; 95% CI : 1.11 –5.42; P=0.0034), inter-gestational interval <12 months (AOR 2.80; 95% CI : 1.18–5.62; P<0.0001), and history of preterm birth (AOR 4.06; 95% CI : 2.19–10.00; P=0.0003). The analysis also revealed that the absence of antenatal care (AOR 3.76; 95% CI : 1.82–8.83; P<0.0001), or <4 ANC (AOR 3.17; 95% CI : 1.57–7.30; P<0.0001), and pregnancy-induced hypertension (AOR 5.78; 95% CI : 3.16–10.06; P<0.0001) were all associated with an increased risk of preterm birth. Furthermore, premature rupture of the membranes (AOR 5.40; 95% CI : 3.83–9.17; P<0.0001), malaria (AOR 8.51; 95% CI : 6.09–11.96; P<0.0001), and urinary tract infection (AOR 3.45 ; 95% CI : 2.72–4.33; P=0.0003) were significant factors associated with preterm birth.

Seven cases of maternal death were recorded, representing a maternal mortality rate of 0.60%.

**Table 5.** Risk factors of preterm birth in 7,718 pregnant women in multivariate analysis

| Variables | Crude OR | 95% CI | Adjusted OR | 95% CI | P-value |
|---|---|---|---|---|---|
| Age ≥35 years | 1.68 | [1.45-1.95] | 1.24 | [1.11-5.42] | 0.0034 |
| IGI <12 months | 4.74 | [2.90-7.74] | 2.80 | [1.18-5.62] | <0.0001 |
| History of PTB | 4.95 | [4.15-5.91] | 4.06 | [2.19-10.00] | 0.0003 |
| <4 ANC visits | 2.07 | [1.79-2.39] | 3.17 | [1.57-7.30] | <0.0001 |
| No ANC | 2.97 | [2.56-3.45] | 3.76 | [1.82-8.83] | <0.0001 |
| Pregnancy-induced hypertension | 12.00 | [10.20-14.12] | 5.78 | [3.16-10.06] | <0.0001 |
| PROM | 9.50 | [7.90-11.40] | 5.40 | [3.83-9.17] | <0.0001 |
| Malaria | 6.97 | [5.90-8.20] | 8.51 | [6.09-11.96] | <0.0001 |
| Urinary tract infection | 3.45 | [2.90-4.10] | 3.45 | [2.72-4.33] | 0.0003 |

IGI : Inter-gestational interval, **ANC** : Antenatal care, PROM **:** Premature rupture of membranes. Pregnancy induced hypertension disorder : inclued gravidique hypertension, preeclampsia/eclampsia.

The multivariable Cox regression model identified several independent factors associated with in hospital neonatal mortality (Table 6).

Extreme prematurity (<28 weeks) was strongly associated with high risk of mortality (AHR 6.42; 95% CI: 4.11–9.92; p<0.001), as well as gestational age of 28–31 weeks (AHR 2.73; 95% CI: 1.76–6.34; p<0.001), compared to 32–36 weeks.

Low Apgar score showed a strong graded association with mortality. Neonates with Apgar 1–3 had markedly increased hazard of death (AHR 3.50; 95% CI: 1.53–5.78; p<0.001), followed by those with Apgar 4–6 (AHR 1.34; 95% CI: 1.10–2.67; p<0.001).

Birth weight <1500 g (AHR 4.13; 95% CI: 2.51–7.05; p<0.001) and 1500–2000 g (AHR 1.44; 95% CI: 1.18–3.32; p<0.001) were also independently associated with increased mortality.

Mode of delivery was not independently associated with mortality after adjustment (AHR 1.18; 95% CI: 0.75–3.28; p=0.28).

**Table 6**. Factors associated with neonatal mortality among live-born preterm neonates in bivariable and multivariable cox regression analysis (n = 970).

| Variables | All live-born PTN (n=970) | Deceased PTN (n=125) | Live PTN (n=845) | Crude HR | 95% CI | Adjusted HR | 95% CI | P-value |
|---|---|---|---|---|---|---|---|---|
| **Gestational age** | | | | | | | | |
| <28 weeks | 95(9.8) | 95(100) | 0(0.00) | 4.36 | [2.12–7.14] | 6.42 | [4.11–9.92] | <0.001 |
| 28-31 weeks | 196(20.2) | 8(4.0) | 188(96) | 2.18 | [1.29–3.40] | 2.73 | [1.76–6.34] | <0.001 |
| 32-36 weeks | 679(70) | 22(3.2) | 657(96.8) | 1 | | 1 | | |
| **Delivery mode** | | | | | | | | |
| Vaginal | 256(26.4) | 22(8.6) | 234(91.4) | 1 | | 1 | | |
| Caesarean section | 714(73.6) | 103(14.4) | 611(85.6) | 1.57 | [1.06–3.23] | 1.18 | [0.75–3.28] | 0.28 |
| **Apgar** | | | | | | | | |
| 1-3 | 100(10.3) | 35(35) | 65(65) | 4.34 | [1.85–8.39] | 3.50 | [1.53–5.78] | <0.001 |
| 4-6 | 314(32.4) | 66(21.0) | 248(79) | 2.40 | [1.25–5.01] | 1.34 | [1.10–2.67] | <0.001 |
| ≥7 | 556(57.3) | 24(4.3) | 532(95.7) | 1 | | 1 | | |
| **Birth weight** | | | | | | | | |
| <1500g | 98(10.1) | 85(86.7) | 13(13.3) | 5.52 | [3.52–8.18] | 4.13 | [2.51–7.05] | <0.001 |
| 1500g–2000g | 252(26) | 20(7.9) | 232(92.1) | 1.81 | [1.12–4.17] | 1.44 | [1.18–3.32] | <0.001 |
| 2001–2499g | 413(42.4) | 15(3.6) | 398(96.4) | 1.34 | [0.67–5.11] | 1.14 | [0.50–1.48] | 0.31 |
| ≥2500g | 207(21.5) | 5(2.4) | 202(97.6) | 1 | | 1 | | |

**PTN** : Preterm neonate ; **HR** : Hazard Ratio; **CI** : Confidence interval

**Discussion**

This retrospective cohort study conducted in a tertiary referral maternity hospital in Niger found a high prevalence of preterm birth (14.97%), with a substantial burden of perinatal mortality (26.83%), and in hospital neonatal mortality (10.82%) among live-born preterm neonates. Preterm birth was strongly associated with preventable maternal conditions, including infections (malaria and urinary tract infections), hypertensive disorders, inadequate antenatal care, and short interpregnancy interval. In addition, in hospital neonatal mortality among live-born preterm neonates was significantly associated with extreme prematurity, very low birth weight,

and low Apgar score. Concerning the mode of delivery, the apparent risk effect observed for cesarean delivery in univariate analysis likely reflects indication bias, as cesarean sections are more frequently performed in high-risk pregnancies.

These findings are supported by the Kaplan-Meier analysis, which demonstrated significantly lower survival probabilities among extremely preterm neonates (log-rank $p< 0.001$).

The prevalence of preterm birth observed in our study is higher than the global estimate of approximately 10% reported by the World Health Organization (2), but remains consistent with findings from sub-Saharan Africa , Asia, and South America where rates often exceed 12% due to the high burden of maternal morbidity and limited access to quality antenatal care (2,5, 6, 9-14).

The high prevalence observed in our study is likely attributable to the fact that our hospital is the only national reference maternity hospital with a neonatology department, responsible for the management of premature babies under the gestational age of 32 weeks. For the Niamey Region, which has a population of over 5 million, our service is the only center that handles preterm birth before 35 weeks, as well as all obstetric complications that may require maternal or fetal resuscitation. These facts provide a clear rationale for why 88.74% of preterm births in this study were induced. A study by Hirsch *et al*. (15) in a reference hospital in Tel Aviv, Israel, found that 47.82% of premature deliveries were induced.

This study indicates a correlation between maternal age and a high preterm birth rate. After adjustment for other variables, preterm birth is approximately 21.2% higher among patients aged 35 years and older. As reported by several authors, including Younes *et al*. (13) in Qatar and Azeez, Butali *et al.* (16) in Nigeria, age ≥35 years is strongly associated with a risk of preterm birth. While maternal age <20 years is not associated with preterm birth in our series, Tariku Laelago *et al.* (17), in a systematic review of the literature including 58 studies with 134,801 participants from 11 East African countries, reported that mother age <20 years is associated with high risk of preterm birth (AOR: 1.76, 95% CI: 1.33–2.32).

The strong association between hypertensive disorders and preterm birth observed in this study is well documented. Conditions such as preeclampsia often necessitate medically indicated preterm delivery to prevent severe maternal and fetal complications (17-19). Similarly, premature rupture of membranes was a major determinant, reflecting both infectious and inflammatory pathways leading to preterm labor.

A history of preterm birth was associated with a high risk of preterm birth in the current pregnancy. The rate of preterm birth increased from 12.3% in patients without a history of preterm birth to 40.8% in those with a history of preterm birth. Research conducted by other African, Asian, American, and European authors has yielded comparable results (10, 12, 15, 18).

Maternal infections, particularly malaria, showed a very strong association with preterm birth. This finding aligns with previous studies in malaria-endemic regions, where placental malaria contributes to intrauterine growth restriction and preterm birth (5, 6, 8, 18, 20, 21). Urinary tract infections have also been consistently associated with preterm birth due to ascending infection and inflammatory responses (6, 17, 18).

An inter-gestational interval of less than 12 months was found to be significantly associated with an elevated risk of preterm birth. The rate of preterm birth increased from 27.8% in patients with an inter-gestational interval <12 months, to 15% in those with an inter-gestational interval of between 12-23 months, and up to 14.8% when the inter-gestational interval was ≥ 24 months. The minimum inter-gestational interval from which the risk of preterm birth is negligible is not clearly defined. According to the findings of Laelago *et al.*(17), an inter-gestational interval of less than 24 months was associated with a significant risk for preterm birth, with an adjusted odds ratio of 2.03 and a 95% confidence interval of 1.57 to 2.62. In contrast, Torchin *et al.* (18) found that the risk of preterm birth increases when the inter-gestational interval is less than six months. A review of the literature reveals discordant data regarding intergestational intervals between 6 and 18 months (18).

Inadequate or absent antenatal care emerged as a major risk factor, highlighting systemic

barriers to maternal health services. Antenatal care provides an opportunity for early detection and management of complications, and its absence is a known contributor to adverse pregnancy outcomes (19, 20). Multivariate analysis, taking into account other factors, clearly shows a substantial decrease in the preterm birth rate in the group of pregnant women who attended four or more ANCs. The number of ANCs attended by women with term birth far exceeds that of mothers with preterm birth in this study.

This result suggests that close monitoring of pregnant women may have a significant impact on the pregnancy outcome for our patients. Indeed, prenatal monitoring is the period when high-risk pregnancies are detected with a view to early management (20). Our results are in line with those of Laelago *et al*. (17), Ahumada-Barrios *et al*. (10) and Torchin *et al.* (18), who also noted this observation.

Regarding in hospital neonatal mortality, our findings demonstrate a clear gradient effect with decreasing gestational age and birth weight. Extreme prematurity (<28 weeks) and very low birth weight (<1500 g) were associated with markedly increased risk of mortality. This dose–response relationship is consistent with global neonatal survival patterns, where survival improves significantly with advancing gestational age and fetal maturity (22).

Low Apgar score was also a strong predictor of mortality, reflecting neonatal asphyxia and poor immediate adaptation at birth. This is consistent with previous literature identifying Apgar score as a robust predictor of early neonatal outcomes (23).

*Strengths and limitations*

This study has several strengths. It includes a large sample size and captures all deliveries over a one-year period in a major tertiary referral center, providing valuable insight into the epidemiology of preterm birth in Niger. To our knowledge, this is one of the largest hospital-based cohorts on preterm birth in the country.

However, several limitations must be acknowledged. First, the retrospective design exposes the study to potential information bias and missing data. Second, as a single-center study conducted in a tertiary referral hospital, the findings are subject to referral bias and may not be generalizable to the general population. Third, neonatal survival was evaluated only during hospitalization and up to seven days after birth; therefore, deaths occurring after discharge were not captured. Finally, causal inferences cannot be established due to the observational nature of the study.

*Implications for practice and research*

The findings of this study have important implications for maternal and neonatal health in low-resource settings. Strengthening antenatal care services, particularly early booking and adequate follow-up, is essential to identify and manage risk factors such as infections and hypertensive disorders. Preventive strategies, including malaria prophylaxis and screening for urinary tract infections, should be reinforced.

Improving the management of preterm labor and enhancing neonatal care capacity, particularly for very preterm and low birth weight infants, could significantly reduce perinatal mortality. Investments in neonatal resuscitation training and essential newborn care are also critical.

Future research should focus on prospective cohort studies to better understand neonatal survival patterns. Multicenter studies would also improve generalizability and provide a more comprehensive understanding of preterm birth in Niger and similar settings.

**Conclusion**

The study demonstrated that preterm birth is a prevalent phenomenon in Niger. The preterm birth was essentially induced for maternal or fetal rescue. A number of associated factors have been identified as contributing to preterm births in Niger. The associated factors can be categorized as follows: socio-economic factors, obstetric complications, medical conditions, and behavioral factors. The study indicates a high rate of perinatal mortality in preterm babies. The study also demonstrates that extremely preterm and very low birth weight newborns are more vulnerable in our setting. It is vital to emphasize the modernization of hospitals' technical platforms, and improving the quality of

prenatal, intrapartum, and postnatal care. Simultaneously, efforts must be made to raise awareness of the importance of attending prenatal care services.

**Conflict of interest**

The authors declare that there are no conflicts of interest.

**Author's Contribution**

MO, HSD, AID: Contributed to the study's conception and design, along with participating in patient treatment, data collection, manuscript drafting, draft review, and manuscript finalization. AA, MCY, R.M.G., and MN: participated in patient treatment, data collection, data analysis and review of the interpretation, and draft manuscript for intellectual content. The final manuscript was read and approved by all authors.

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**References**

1. Castaigne, V., Picone, O., & Frydman, R. Premature Delivery. *EMC Gynecol Obstet.* 2005; **2** (4):354-363. Doi : 10.1016/j.emcgo.2005.09.001
2. Ohuma EO, Moller AB, Bradley E, Chakwera S, Hussain-Alkhateeb L, Lewin A, *et al.* National, regional, and global estimates of preterm birth in 2020, with trends from 2010: a systematic analysis. *Lancet.* 2023; **402** (10409):1261–1271. Doi : 10.1016/S0140-6736(23)00878-4.
3. Perin J, Mulick A, Yeung D, Villavicencio F, Lopez G, Strong K.L*., et al*. Global, regional, and national causes of under-5 mortality in 2000–19: an updated systematic analysis with implications for the Sustainable Development Goals. *Lancet Child Adolesc Health*. 2022; **6** (2): 106–15. Doi : 10.1016/S2352-4642(21)00311-4.
4. Mottet N, Riethmuller, D. Mode of delivery in spontaneous preterm birth. *J Gynecol Obstet Reprod Biol*. 2016;**45** (10):1432-1445. Doi : 10.1016/j.jgyn.2016.09.021.
5. Christian, K. N., Tamubango, K. H., Balthazar, M. B., Roger, T. M., Patrick, M. K., Yves, II, *et al*. "Preterm delivery at Lubumbashi University Clinics from 2011-2019: Frequency and Management." *J Med Res Health Sci.* 2023;**6** (2):2457–2470. Doi : https://doi.org/10.52845/JMRHS/2023-6-2-8.
6. Bocoum, A., & Youssouf, T. Preterm delivery: Epidemiological-clinical aspects, management, and maternal-fetal prognosis. *J SAGO*. 2021; **22** (2):10-19.
7. Ministere de la santé publique (Niger). Plan du développement sanitaire 2017-2021**.** Aout 2016, 137P Accessible sur : *https://www.prb.org/wp-content/uploads/2019/06/PLAN-DE-DEVELOPPEMENT-SANITAIRE_2017_2021_Niger.pdf*, *Accessed june 30th 2025.*
8. Hounkponou N.F.M., Tonato Bagman A., Ahouingnan A.Y., Gbevo S., Laourou H., Vodouhe M., *et al*. "Frequence et facteurs associees aux accouchements prematures au Centre Hospitalier Universitaire et Departemental du Borgou Alibori au Benin." *Eur. Sci. J*. 2017; **13** (24):427-435. Doi: 10.19044/esj. 2017.v13n24p427.
9. YE. C., Chen S.-B., Wang T.-T., Zhang S.-M., Qin J.-B., Chen L.-Z. Risk factors for preterm birth: a prospective cohort study. *Chin. J. Contemp. Pediatr*. 2021, **23** (12): 1242-9. Doi : 10.7499/j.issn.1008-8830.2108015.
10. Ahumada-Barrios, M. E., & Alvarado, G. F. Risk factors for premature birth in a hospital. *Rev. Lat Am Enfermagem*. 2016;**24**: e2750. DOI: http://dx.doi.org/10.1590/1518-8345.0775.2750.
11. Salama E, Salama H, Al-Obaidly S. Socioeconomic Risk Factors for Preterm Birth in the State of Qatar: A Population-Based Study. *Acta Biomed*. 2021; **92 (**3): e2021186. DOI: 10.23750/abm.v92i3.11292.
12. Younes S, Samara M, Al-Jurf R, Nasrallah G, Al-Obaidly S, Salama H, *et al*. Incidence, Risk Factors, and Outcomes of

Preterm and Early Term Births: A Population-Based Register Study. *Int J Environ Res Public Health.* 2021, **18,** 5865. https:// doi.org/10.3390/ijerph18115865.

13. Alansi BA, Mukhtar HB, Alazizi MA, Zuiran AA, Al-Atawi AM, Al-Sabah BA, *et al*. Risk Factors for Early Preterm Birth at King Salman Armed Forces Hospital in 2010. *Open Access Maced J Med Sci.* 2017, **5** (**7**):1016-1020. Doi : 10.3889/oamjms.2017.103.
14. Heroual N, Boukfoussa N, Houti L. Épidémiologie et facteurs de risque de la prématurité dans le Nord-Ouest algérien. *Pan Afr Med J*. 2024;**47**:183. Doi : 10.11604/pamj.2024.47.183.40657.
15. Hiersch L, Pasternak Y, Melamed N, Meshulam M, Shashar R, Hadar E, *et al*. The risk of preterm birth in women with three consecutive deliveries. The effect of number and type of prior preterm births. *J. Clin. Med*., 2020, **9**, 3933. Doi:10.3390/jcm9123933.
16. Butali A, Ezeaka C, Ekhaguere O, Weathers N, Ladd J, Fajolu I, *et al*. Characteristics and risk factors of preterm births in a tertiary center in Lagos, Nigeria. *Pan Afr Med J*. 2016; 24:**1.** Doi:10.11604/pamj.2016.24.1.8382.
17. Laelago T, Yohannes T, Tsige G. Determinants of preterm birth among mothers who gave birth in East Africa: systematic review and meta-analysis. *Ital J Pediatr*. 2020 ; **46**:10. https://doi.org/10.1186/s13052-020-0772-1.
18. Torchin T, Ancel P-Y. Epidemiology and risk factors of preterm birth. *J Gynéco Obstét Biol Reprod*. 2016 ; **45** (1), 1213-1230. Doi : 10.1016/j.jgyn.2016.09.013.
19. Ceccaldi PF, Duvilier C, Poujade O, Chatel P, Pernin E, Davitian C, *et al*. Surveillance de la grossesse normale. *EMC Obstét. Gynécol*. 2015, **10** (2) : 1-13. Doi : 10.1016/S0246-0335(15)62696-5.
20. Hussein H, Shamsipour M, Yunesian M, Hassanvand MS, Agordoh PD, Seidu MA, *et al*. Prenatal malaria exposure and risk of adverse birth outcomes: a prospective cohort study of pregnant women in the Northern Region of Ghana. *BMJ Open*. 2022 Aug 1;**12** (8):e058343. Doi: 10.1136/bmjopen-2021-058343.
21. Philemon M.M., Célestin K.B., Théodore M.M. Factors associated with preterm delivery at Bukavu Provincial Hospital, in the Democratic Republic of Congo. *Rev Mar Sante Publique.* 2016, **3** (4): 16-22. https://doi.org/10.34874/IMIST.PRSM/RMSP/2581.
22. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, *et al.* National, regional, and worldwide estimates of preterm birth rates. *Lancet.* 2012;**379** (9832):2162–72. Doi: 10.1016/S0140-6736 (12) 60820-4.
23. Casey BM, McIntire DD, Leveno KJ. The continuing value of the Apgar score. *N Engl J Med.* 2001**;344** (7):467–71. Doi: 10.1056/NEMJ200102153440701.

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