Vol. 13(3), pp. 159-167, July-September 2021
DOI: 10.5897/JPHE2021.1329
Article Number: 225BA6E67179
ISSN 2141-2316

http://www.academicjournals.org/JPHE

Journal of Public Health and Epidemiology

Full Length Research Paper

Preventing prematurity: The power of determining factors and challenges in a rural district hospital in Benin

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Received 17 May, 2021; Accepted 21 June, 2021

Preterm births remain a major public health issue due to its weight in neonatal mortality and the significant socio-economic costs for its care. The aim of the current study was to identify factors associated with preterm births at Allada-Toffo-Zè zone hospital in Benin. This was a case-controlling study, which took place in April 2019. A total of 222 women's files were examined, including 74 cases and 148 controlling samples. Socio-demographic data, health status during pregnancy, previous state of being and health system were collected. Conditional logistic regression was used to identify explanatory factors for prematurity via Stata 15. The prematurity rate was 9.4%. Self-medication OR = 4.99 with 95% CI = [1.71-14.5], alcohol consumption OR = 19.55 with 95% CI = [5.89-64.90], threat to premature birth OR = 3.88 with 95% CI = [1.04-14.35], the mother's occupation OR = 13.22 with a 95% CI = [1.65-105.66] were related to prematurity. Prematurity is a problem that requires corrective actions. Promoting empowerment of women which guarantees good health during pregnancy, as well as enhancing health staff skills will significantly reduce preterm births at Allada-Toffo-Zè district hospital.

Key words: Prematurity, factors, determinants, district, Allada-Toffo-Zè, Benin.

INTRODUCTION

Prematurity is defined as a gestational age birth less than 37 Weeks of Amenorrhea (WA) or 259 days. This duration is calculated from the first day of last menstruation (Abu-Saad and Fraser, 2010). According to a systematic review, the World Health Organization (WHO) identified 115.3 million births, including 12.9 9.6% million premature births, giving a global prevalence of for prematurity (Abu-Saad and Fraser, 2010). The majority of these preterm births (10.9 million) were found in Africa and Asia, that is, around 85% (Abu-Saad and Fraser, 2010; Balaka et al., 2002). According to the WHO, nearly 2.6 million newborns die within the first month of life worldwide, among newborns (Abu-Saad and Fraser, 2010; Faye and Paraiso, 2017). Developing countries

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have neonatal mortality rate estimates at 27 deaths per 1,000 live births compared to 3 neonatal deaths per 1,000 live births in developed countries. Several factors explain this high neonatal mortality rate, among which prematurity account for an important part (Garces et al., 2017). The consequences of prematurity are widely enhanced and numerous studies have shown a strong link between prematurity, neonatal and perinatal morbidity and mortality (Balaka et al., 2002). Growth disorders and disorders of psychomotor and cognitive development have also been described in premature infants. The causes of prematurity are varied and can be maternal, fetal or health origin. Several factors have been found to explain the occurrence of prematurity. It occurs most often in the context of preeclampsia, pre-partum hemorrhage, intrauterine growth retardation (IUGR), acute fetal distress (Abu-Saad and Fraser, 2010; Torchin and Ancel, 2016). Maternal age over 35 is a risk factor, as it increases maternal hypertensive pathologies as well as eclampsia, which leads to preterm fetal extractions (Abu-Saad and Fraser, 2010; Torchin and Ancel, 2016). Insufficient technical platform and limited resources make it more difficult to be taken care of (Abu-Saad and Fraser, 2010). In Benin, infant mortality rate was estimated at 68% in 2017. Prematurity has a prevalence of 10.3% (Abu-Saad and Fraser, 2010). It is the third cause of death after asphyxiation and infections (Balaka et al., 2002; Faye and Paraiso, 2017). In view of the extent and consequences of prematurity on child future, it is necessary to conduct an inquiry of this health phenomenon to identify the factors that can make it possible to effectively reduce its occurrence, as well as perinatal morbidity and mortality it induces. That is why the purpose of the current study was to identify factors related to prematurity at Allada-Toffo-Zê Zone Hospital (ATZ) (Table 1).

METHODOLOGY

Study settings

The current survey took place at Allada-Toffo-Zè health district hospital. The hospital is located in Atlantic Department and covers an area of 1526 km². The main ethnic groups encountered were: Aïzo, Fon, Xwla, Sahouè, Pédah, Peulh, Yorouba, Adja, Nago, Mina. The main religions practiced are: Animism, Christianity, and Islam (Abu-Saad and Fraser, 2010; Ministry of Public Health of Benin, 2018). The socioeconomic level is low and people live mainly on farming, fishing and hunting (Ministry of Public Health of Benin, 2018).

Type of study and target population

This was a case-controlling study that took place in April 2019 in ATZ Zone Hospital. The target population consisted of children born from August 2018 to April 2019 at the ATZ Zone Hospital, the mothers of these children, managers and skilled health personnel from Neonatal and Gynecology Department. The cases were infants born prematurely whose mothers gave birth at ATZ Hospital. The controlling samples were the children born at term in the same period as the cases of babies and whose mothers also gave birth in this hospital. The matching criteria were two: the sex of children and age group of selected mothers. The completeness technique was used for the cases. The controlling sample was selected by a reasoned choice, namely the births registered immediately after the cases; and the controlling samples (not premature) were selected taking into account matching criteria stated above. The match design consisted of a case against two controls. A total of 74 cases were registered during the study period. The controlling samples retained after matching were 148.

Study variables

Whereas prematurity was the dependent variable, the independent variables were: factors related to mother (socio-demographic characteristics, type of activity, marital status, level of education, ethnicity, municipality of residence, means of travelling, lifestyle (tobacco, alcohol, traditional medicines, self-medication); obstetrical record (pregnancy, parity, prematurity record, abortion record, maternal pregnancy factors, namely ailments during pregnancy (placental diseases, threats of premature birth, premature rupture of membranes, Antenatal Care (ANC), Sexually Transmitted Infection (STI)/Sexually Transmitted Disease (STD), diabetes, malaria, hypertension, anemia); prevention during pregnancy (Intermittent Preventive Therapy IPT, Long lasting insecticidal nets LLIN); means of delivery (cesarean section or vaginal delivery); factors related to child: gestational age, birth weight, sex, APGAR score, twinning and factors linked to the health system: qualification of the staff, technical platform, referral system versus referral.

Data collection technique and tools

Documentary analysis was used for the cases and controlling samples by using screening sheet and individual interviews conducted by the staff. The study was based on records of women with limited risk of information bias by triangulation data. Sampling bias was limited because the cases and controlling samples were selected from the same population and under the same working conditions. A pre-test was carried out in the neighboring zone hospital, Ouidah-Kpomassè-Tori Bossito, to identify and correct deficiencies in the data collection tools. Experienced investigators such as midwives and external nurses were responsible for this collection under the supervision of the authors of this work to have valid data.

Data analysis

Daily data checking were carried out to ensure completeness and quality of the data. Data analysis was performed through STATA version 15 software. Distribution of qualitative variables was collected by calculating the proportions with their confidence interval. In terms of quantitative variables, mean and standard deviation were used when the distribution was normal or the median and interquartile range (Q1; Q3) when the distribution was not normal. The bivariate analysis allowed investigating on the link between dependent variable and independent variables using Pearson's Chi-square statistical test. The associations between independent variables and dependent variable were assessed by the odds ratios (OR) of exposure or odds ratio (OR) and their 95% confidence interval. Any variable with a p-value less than 20% was included in the multivariate analysis model. Searching for possible associations between independent variables while identifying

Table 1. Factors associated to prematurity at bivariate level at ATZ Zone Hospital.

Factor	Odds ratio	[95% Conf. Interval]	P>|z|
Mother's individual factors			
Socio demographic			
Marital status			
Married /consensual union	1		
Single	4.16	[1.12 – 15.48]	**0.033***
Mother's occupation			
Civil servant	1		
Trader	4.78	[1.44 – 15.91]	**0.011***
Artisan	4.86	[1.41 – 16.76]	**0.012***
Farmer	7.58	[1.61 – 35.61]	**0.001***
Housewife	2.17	[0.58 – 8.19]	0.249
Pupil/student	6.42	[1.28 – 32.3]	**0.024***
Residential commune			
Allada	1		
Zè	0.96	[0.42 – 2.21]	0.93
Toffo	0.43	[0.19 – 0.95]	**0.039***
Other	0.64	[0.22 – 1.84]	0.409
Ethnic group			
Fon	1.97	[1.04 – 3.72]	**0.037***
Aïzo	1		
Mina	2.59	[0.79 – 8.50]	**0.117**
Obstetrical record			
Gesture			
No	1		
Yes	1.01	[0.67 – 1.53]	**0.136**
Parity			
No	1		
Yes	1.2	[0.81 – 1.76]	0.365
Stillbirths' record			
No	1		
Yes	0.43	[0.12 – 1.49]	**0.18**
Spontaneous abortion			
No	1		
Yes	0.52	[0.52 – 1.44]	0.209
Premature record			
No	1		
Yes	3.87	[0.38 – 39.5]	0.25
Lifestyle			
Tobacco			
No	1		
Yes	9.12	[2.10 -39.56]	**0**.053
Alcohol			
No	1		
Yes	9.43	[3.66 – 24.25]	**0.000***
Traditional medicine			
No	1		
Yes	1.75	[0.36 – 8.42]	0.485
Self-medication			

Table 1. Contd.

No	1		
Yes	2.16	0.99 – 4.71	**0.003***
Maternal factor of pregnancy			
Consultation reason			
No	1		
Yes	0.74	[0.39 – 1.41]	0.366
Setting date			
No	1		
Yes	0.69	[0.12 – 3.87]	0.68
Ultrasound			
Yes	1		
No	2.09	[1.00 – 4.39]	**0.05***
Pregnancy age	0.27	[0.15 – 0.51]	**0.000***
Delivery threat			
No	1		
Yes	1.69	[0.75 – 3.82]	**0.000***
Diabetes			
No	1		
Yes	0.67	[0.13 – 3.30]	0.61
HTA			
No	1		
Yes	1.89	[0.90 – 3.96]	0.093
Pre-eclampsia			
No	1		
Yes	0.87	[0.36 – 2.13]	0.766
Malaria			
No	1		
Yes	3.48	[1.03 – 11.72]	**0.044***
Anemia			
No	1		
Yes	3.06	[1.27 – 7.35]	**0.013***
Placenta praevia			
No	1		
Yes	0.91	[0.33 – 2.54]	0.860
Hydramnios			
No	1		
Yes	1.69	[0.23 – 12.23]	0.605
STIs/STDs			
No	1		
Yes	2.64	[0.43 – 16.02]	0.292
Urinary tract infection			
No	1		
Yes	1.59	[0.31 – 8.05]	0.575
Amniotic liquid			
Clear	1		
Colored	1.06	[0.54 – 2.06]	0.865
Delivery mode			
Low way	1		
Cesarean	0.46	[0.22 – 0.92]	**0.02***

Table 1. Contd.

Milda use			
Yes	1		
No	1.07	[0.57 – 2.01]	0.830
Iron grip			
Oui	1		
Non	1.01	[0.59 – 1.73]	0.960
Prise de TPI			
Yes	1		
No	1.54	[0.84 – 2.80]	0.161
Factors related to the child			
Birth weight			
Low weight	35.22	[8.51 – 145.75]	**0.000***
Normal weight	1		
Moaning			
No	1		
Yes	1.87	[0.82 – 4.28]	0.136
APGAR score			
3-6	1		
7-10	0.4	[0.18 – 0.88]	**0.022***
Revived			
No	1		
Yes	1.37	[0.68 – 2.78]	0.374
Health system factors			
Qualification of referral staff			
Gynecologist	1		
Midwife	6.14	[0.72 – 51.92]	0.096
Nurse	3.67	[0.33 – 41.33]	0.293
Admission mode			
CPN	1		
Referred	1.67	[0.66 – 4.18]	0.275
Means of transport			
Taxi	1		
Motor	0.305	[0.71 – 1.30]	0.108
Reference/Versus reference			
Yes	1		
No	0.59	[0.18 – 1.91]	0.375

confounding variables or effect modifiers on each other was carried out. A conditional logistic regression model was used for multivariate analysis. Associations were tested by the odds ratio (OR) and its 95% confidence interval. Then, "step-by-step top-down" modeling followed to eliminate the explanatory variables with a p-value greater than 5% to achieving final model.

RESULTS

Prematurity rate

The number of living births during the study period was 789 and there were 74 preterm infants. The prematurity rate at ATZ Zone Hospital was then estimated at 94 per 1000 living births (Table 2).

Sample description

The average age of the women was 26.42 (Min 13 Max: 42) years. Almost (90.91%) of them live in Allada Municipality. The most represented ethnic groups were the Fon (48.64%), the Aizo (40%). The majority of women surveyed were in a common-law relationship (88.77%). Apart from pupils, the majority of women surveyed were

Table 2. Factors associated to prematurity among parturient women at ATZ zone hospital in 2018 for final modeling.

Factor	OR	[IC à 95 %]	p-value
Self-medication			
No	1		
Yes	4.99	1.71 – 14.5	**0.002****
Alcohol			
No	1		
Yes	19 .55	5.89 – 64.90	**0.000****
Mother's occupation			
Civil servant	1		
Trader	5.30	1.21 – 23.26	**0.005****
Artisan	3.24	0.70 – 15.02	0.086
Farmer	13.22	1.65 – 105.66	**0.021****
Housewife	4.49	0.81 – 24.88	**0.044****
Pupil/Student	12.98	1.43 – 117.89	**0.01****
Threat of premature delivery			
No	1		
Yes	3.88	1.04 – 14.35	**0.012****

artisans (28.38%) and traders (28.83%). Women moved mainly (76.96%) on foot.

Identification of factors significantly related to prematurity in bivariate analysis

After bivariate analysis of 40 independent factors, 14 factors were significantly associated with prematurity, it was about Mother's individual factors: Marital status, mother's profession, town of residence, ethnicity, alcohol consumption and self-medication.

Pregnancy-related factors: Having had at least one ultrasound, undergone preterm delivery threat, age of pregnancy at childbirth, malaria and method of delivery.

Factors related to child: Low birth weight and APGAR score.

Identification of factors significantly related to prematurity in multivariate analysis

After eliminating variables having p-value less than 20%, four (4) variables were retained as factors associated to prematurity in ATZ health zone for final modelling. These were: self-medication, alcohol, mother's occupation, the threat of premature delivery.

By adjusting the factors of premature delivery threat, alcohol consumption and self-medication administration, women who were students or farmers were 13 times more likely to have a premature child than female civil servant. This risk was much higher than that of trader's women, housewives and artisans.

Parturients who have consumed alcohol during pregnancy are 20 times more likely to have a preterm delivery than those who have not consumed it, adjusted to the parturient occupation, the threat of premature delivery and self-medication.

Self-medication increases the risk of giving birth to a premature child 5 times more, when adjusted to alcohol, threat of premature delivery factors, and the occupation of the parturient.

Women who had undergone a threatened preterm birth were 4 times more likely to have a preterm birth than those who did not. (Appendix 1)

DISCUSSION

The purpose of this study was to investigate factors associated with prematurity at ATZ Zonal Hospital. The prematurity rate was 9.4% in the current study. Studies conducted in Lomé (Balaka et al., 2002) reported a similar prematurity rate estimated at 11.1% while in Ghana (Adu-Bonsaffoh et al., 2019), 19% prematurity rate was reported. This difference could be explained by

duration of their study which was one calendar year.

Factors associated with prematurity at ATZ zone hospital

The current survey did not find association between matching criterion. In France, no relationship between the mother's age and prematurity was found as evidences are inconsistent (Lorthe, 2017). However, in other settings (Tseng et al., 2019), significant and positive relationship was found where mother's age over 35 years was associated with higher prematurity risk. This difference can be explained by the differences between characteristics of the target populations. Self-medication was strongly associated with prematurity in the current study. Women who took drugs without a referral from trained health workers were 5 times more likely to give birth prematurely to their product of conception. This is explained by the fact that the women admitted to ATZ Zone Hospital come from the villages and have recourse to traditional medicines for socio-cultural considerations, and also prefer not to come to hospital in case of health problems "called minors", and buy street drugs. With very few studies focusing on self-medication to pregnancy outcome; we have not found any authors finding such link between self-medication and prematurity.

In Paris, significant association between alcohol consumption and onset of prematurity was found (Toutain et al., 2010). The findings of that research are in agreement with this study where alcohol consumption increases the risk of giving birth to premature baby by 20 times. On the other hand, there was no significant relationship between alcohol consumption and the onset of prematurity at Zinguinchor Regional Hospital (Niokhor et al., 2017). This difference could be explained by the fact that alcohol consumption is prohibited to the majority of Muslim communities in Senegal, and therefore difficult to inspect. In this survey, mother occupation influenced the occurrence of prematurity. In Brazil, significant association between mother occupation and occurrence of prematurity was reported (Oliveira et al., 2016). In Madagascar, it was found that the occupation considered hard had significant link with preterm birth (Rakotomalala et al., 2019). This study did not investigate painful side of occupations. Also, another study found significant association between occupation of mother and onset of prematurity (Saurel-Cubizolles et al., 2003). Elsewhere, the mother's occupation did not influence prematurity (Dumas et al., 2014). The difference from this study would be the type of study and sample size. Preterm delivery was 3 times more common among mothers at risk of preterm delivery (PAD) in this survey while a strong association between PAD and prematurity was found in other settings (Wagura et al., 2018). An experimental study did not find any significant association (Jagusiak, 2016). Being multiparous in this survey did not influence birth of a child prematurely while a significant relationship with multiparity was reported elsewhere (Niokhor et al., 2017). This difference could be explained by births that are spaced, although women are mostly multiparous in Benin. The literature reports that prenatal checkup and antenatal care frequency strongly influenced the outcome of the pregnancy. It was found that having low ANC frequency during pregnancy increases the risk of preterm birth (Balaka et al., 2002; Niokhor et al., 2017). The current study did not find significant association between prematurity and ANC frequency, although it was significant in bivariate analysis (p-value < 20%).

Conclusion

The prematurity rate was 9.4% at ATZ Zone Hospital in 2019. Factors associated to mother such as occupation, alcohol consumption, self-medication and those related to pregnancy such as premature delivery threat could explain this prematurity. Also, many difficulties exist in the health system for parturients adequate caring, such as the referral and counter-referral system, breakdown of blood products, and lack of qualified human resources. It is necessary to raise public awareness about the proper planning and delivery of pregnancy and educational work among the population. Interventions to enhance the capacity of health staff and promoting empowerment of women will help reduce prematurity rate and its severe consequences for child at ATZ Zone Hospital and in Benin.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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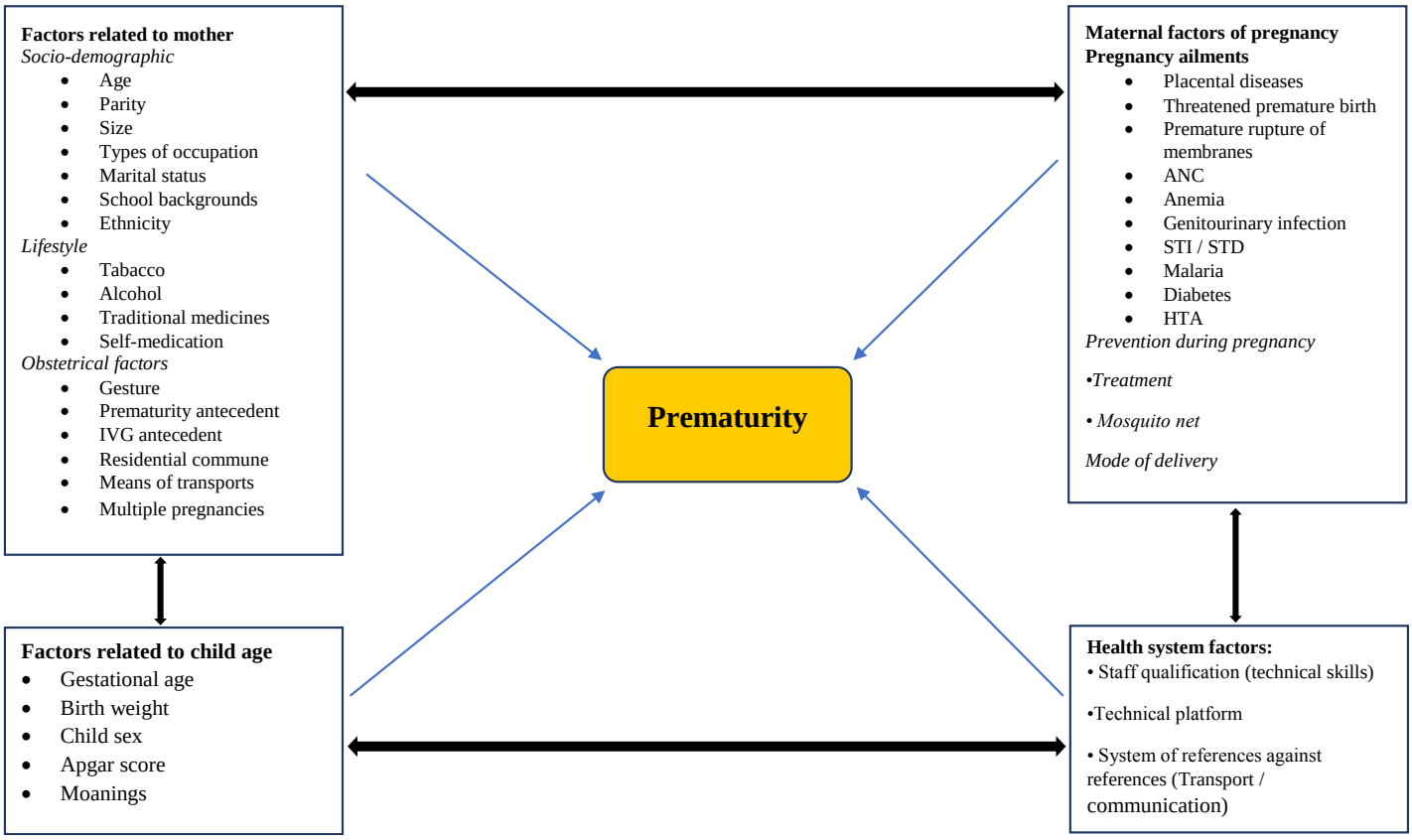
APPENDIX


Factors related to mother
Socio-demographic
Age
Parity
Size
Types of occupation
Marital status
School backgrounds
Ethnicity
Lifestyle
Tabacco
Alcohol
Traditional medicines
Self-medication
Obstetrical factors
Gesture
Prematurity antecedent
IVG antecedent
Residential commune
Means of transports
Multiple pregnancies
Maternal factors of pregnancy
Pregnancy ailments
Placental diseases
Threatened premature birth
Premature rupture of membranes
ANC
Anemia
Genitourinary infection
STI / STD
Malaria
Diabetes
HTA
Prevention during pregnancy
•Treatment
• Mosquito net
Mode of delivery
Prematurity
Factors related to child age
Gestational age
Birth weight
Child sex
Apgar score
Moanings
Health system factors:
• Staff qualification (technical skills)
•Technical platform
• System of references against references (Transport / communication)