

BMJ Open Predictors of adverse perinatal outcome among women who gave birth at Medical Center of Southwest Ethiopia: a retrospective cohort study

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To cite: Jaleta DD, Abdisa DK. Predictors of adverse perinatal outcome among women who gave birth at Medical Center of Southwest Ethiopia: a retrospective cohort study. *BMJ Open* 2022;**12**:e053881. doi:10.1136/bmjopen-2021-053881

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-053881>).

Received 27 May 2021

Accepted 10 February 2022



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ABSTRACT

Objectives The aim of this study was to determine predictors of adverse perinatal outcome among women who gave birth at Medical Center of Southwest Ethiopia.

Setting Institutional based retrospective cohort study was conducted among women who gave birth at Medical Center of Southwest Ethiopia.

Participants Medical record of 777 women was included in the study by using maternity HMIS logbook as entry point. Simple random sampling technique without replacement was employed to select individual medical record using computer generated random numbers.

Primary outcome measured Predictors of adverse perinatal outcome were examined using modified Poisson regression with a robust SE.

Results Majority, 74.1% of the participants were in the age group of 21–34 years and the median age was 26 (IQR=7) years. More than one-third, 35.9% of the mothers were primigravida and only 21.2% of them had above four antenatal cares (ANC) visit. The overall incidence of adverse perinatal outcome was 31.5% (95% CI: 28.3 to 34.9). Maternal age less than 20 years (adjusted risk ratio, aRR=1.3; 95% CI: 1.01 to 1.5), rural residence (aRR=1.27; 95% CI: 1.04 to 1.59), presence of antepartum haemorrhage in current pregnancy (aRR=1.7; 95% CI: 1.38 to 2.07), maternal anaemia (aRR=1.25; 95% CI: 1.03 to 1.53), lack of ANC visit (aRR=2.29; 95% CI: 1.35 to 3.90), induced labour (aRR=1.77; 95% CI: 1.43 to 2.19) and being positive for venereal disease research laboratory (VDRL) test in current pregnancy (aRR=2.0; 95% CI: 1.16 to 3.38) were found to be significantly associated with adverse perinatal outcome.

Conclusion The incidence of adverse perinatal outcome in the study area is high and maternal age less than 20, rural residency, maternal anaemia, antepartum haemorrhage in the current pregnancy, inadequate ANC visit, induction of labour and being positive for VDRL test were found to predict occurrence of adverse perinatal outcome. Majority of these problems can be managed by providing quality antenatal, intrapartum and post-natal care.

INTRODUCTION

Pregnancy is supposed to be source of joy for most families. However, significant number of pregnancy ends unfavourably that results

Strengths and limitations of this study

- The model used was preferable to give unbiased estimates of relative risk than logit function.
- Including large retrospective cohorts of women.
- As limitations, variables such as maternal nutritional status, smoking, indoor air pollution and maternal educational status were not included.

in either death of babies, delivery of earlier than expected date or babies with low birth weight.¹ These adverse perinatal outcomes are remained to be common pregnancy outcomes in developing countries and results in significant consequences on infants, families and communities.²

Globally, 97%–99% of the estimated 3–4 million stillbirths and 3 million neonatal deaths occur each year in low-income and middle-income countries. Over 40% of all stillbirths encountered during intrapartum period could have been prevented with improved monitoring and access to emergency obstetric care when required.^{3–4} In 2019, 47% of all under-5 deaths occurred within the 7 days of their birth, of that about one-third dying on the first day of their birth and close to three quarters dying within the first week of life.⁵

If survived; infants with adverse perinatal outcome are at greater risk for mortality and a variety of health and developmental problems. Preterm babies are at high risk of hospitalisation, death in early life and can suffer lifelong effects such as cerebral palsy, mental retardation, visual and hearing impairments and poor health and growth. In Ethiopia, about 320 000 babies are born preterm each year, of which 24 400 die at the age of less than 5 years due to direct complications of preterm birth.⁶

Similarly, a low birth weight baby (birth weight less than 2500 g) continues to be a

significant public health problem globally, with a range of both short-term and long-term consequences. Around 20 million births each year are low birth weight, which are estimated to be 15%–20% of all births. The majority of low birth weight occurs in low-income and middle-income countries. It increases the risk for non-communicable diseases later in life.⁷ In Ethiopia, 13% of the babies weigh less than 2.5 kg according to 2016 Ethiopian demographic and health survey (EDHS) report.⁸

These adverse perinatal outcome is associated mostly with maternal factors most of which can be preventable by appropriate care during pregnancy, child birth and postpartum.⁹ In Ethiopia, despite inconsistent findings on the incidence of adverse fetal outcome across the studies, no studies examined predictors of adverse perinatal outcome by incorporating early neonatal deaths as deaths during this time are related to pregnancy and intrapartum abnormalities. Hence, this study aimed to determine predictors of adverse perinatal outcome among women who gave birth at Jimma Medical Center and provided information that are crucial in order to improve maternal and child healthcare in the setting.

MATERIALS AND METHODS

Study setting, design and participants

This study was conducted in Jimma Medical Center (JMC), located in Jimma town of Southwest Ethiopia, 343 km away from the capital, Addis Ababa. The centre provides medical care for approximately 15 million people. It provides services with around 1600 staff members and has 32 intensive care unit (ICU) beds and 800 ward beds and about 9590 deliveries were conducted at this centre during study time period. A retrospective cohort study was conducted by reviewing medical record of women who gave birth at JMC from 26 June 2017 to 16 March 2020. Source populations were mothers who gave birth at 28 weeks of gestation and above at JMC during the study time period. Medical records were excluded if components of outcome variable were lacking and if the neonates had congenital anomalies.

Sample size was calculated by using STATCALC command of Epi-info V.7 for other study, which were 777. Maternity HMIS logbook was used to obtain medical record number as an entry point. Simple random sampling technique without replacement was employed using computer generated random number.

Variables

The dependent variable is adverse perinatal outcome, defined as a newborn with the occurrence of any of the following outcomes: low birth weight, small for gestational age, preterm birth, stillbirth or neonatal death before 7 days of life.

Low birth weight was defined as a birth weight of live born infant of less than 2500 g while preterm birth is a birth of infants occurring after 28 completed weeks but before 37 completed weeks of gestation. Small for

gestational age was defined as a birth weight of newborn below the 10th percentile of weight distribution at the specified gestational age of a pregnancy. Stillbirth as death of product of conception after 28 weeks of pregnancy.^{10 11}

Data collection tools and procedure

Data were collected from the medical record using structured checklist after reviewing different literature.^{11–15} Six Bachelor of Science Degree Nurses were recruited to collect data from maternal and neonatal records after receiving 2 days training. Newborn related data were extracted from neonatal ICU logbook.

Data processing and analysis

Data were entered into Epi data manager V.3.1 and exported to STATA V.13 for analysis. Descriptive statistics like frequency and percentage for categorical variables and summary statistics for continuous variables were used to characterise the study participants. Bivariate regression analysis was done to identify predictors of adverse perinatal outcomes. P-value of <0.25 was used to include independent variables into multivariable regression model. The relative risk of adverse perinatal outcome was calculated using modified Poisson regression model.¹⁶ Therefore, modified Poisson regression model with lowest Akaike's information criteria and Bayesian information criteria was used as final model using backward method.

Patient and public involvement

Patients, caregivers and lay people were not involved in the development of the research question, study design or outcome measures, nor the interpretation or writing up of the results for this study. Data from this study will be available on request. Investigators may disseminate the results of this study with local ministries of health, patients and relevant medical organisations in the communities where the study was conducted.

RESULTS

SOCIODEMOGRAPHIC AND OBSTETRIC CHARACTERISTICS OF STUDY PARTICIPANTS

Regarding to the sociodemographic characteristics of the mothers, 576 (74.1%) were in the age group of 21–34 years. Almost all of them were married 771 (99.2%) and more than half (55.3%) were urban residents (table 1). The median maternal age was 26 years with IQR of 7 years.

Almost half, 382 (49.2%) of mothers were multigravida and 97% of the mothers had at least one ANC follow-up, of which, 75.8% of women had ANC visit ranges between one and four. About one in five (20%) of mothers had anaemia in current pregnancy. Regarding medical illness, 23 (3%) mothers were HIV positive, 41 (5.3%) diagnosed malaria infection in current pregnancy and 9 (1.2%) of mothers tested positive for venereal disease research laboratory (VDRL) test for syphilis during current pregnancy.

Table 1 Sociodemographic and obstetric characteristics of pregnant women who gave birth at Jimma Medical Center, Southwest Ethiopia from June 2017 to March 2020

Variable		Frequency	Percentage (%)
Maternal age (n=777)	≤20 years	116	14.9
	21–34 years	576	74.1
	≥35 years	85	11
Residence	Urban	430	55.3
	Rural	347	44.7
Marital status	Single	6	0.8
	Married	771	99.2
Gravidity	Primigravida	279	35.9
	Multigravida (II–IV)	382	49.2
	Grand multigravida (V+)	116	14.9
History of anaemia	Yes	155	19.9
	No	622	80.1
Malaria diagnosed in current pregnancy	Yes	41	5.3
	No	736	94.7
Maternal HIV status	Reactive	23	3
	Non-reactive	754	97
VDRL test positive	Yes	9	1.2
	No	768	98.8
Number of ANC visit in current pregnancy	Zero	23	3
	1–4	589	75.8
	5+	165	21.2
On set of labour	Induced	149	19.2
	Spontaneous	507	65.2
	Direct caesarean section	121	15.6
Fetal mal-presentation at birth	Yes	160	20.6
	No	617	79.4
Platelet count	100 000+	736	94.7
	<100 000	41	5.3
Mode of delivery	Vaginal	378	48.7
	Caesarean section	399	51.3
Type of pregnancy	Single	747	96.1
	Twin	30	3.9
Sex of newborn	Male	392	50.5
	Female	385	49.5
Maternal outcome	Alive on discharge	770	99.1
	Died	7	0.9

ANC, antenatal care; VDRL, venereal disease research laboratory.

There were 3.86% multiple pregnancies. The onset of labour was spontaneous in 65.2% of women and 48.6% of mothers gave birth via spontaneous vaginal delivery (table 1).

Incidence of adverse birth outcome

The overall incidence of adverse perinatal outcome was 31.5%. Six point four (6.4%) of stillbirth and 5% of early neonatal mortality occurred during the study period. The

incidence of low birth weight, small for gestational age and preterm birth was 16.6 %, 6.4% and 7.7%., respectively.

Predictors of adverse birth outcome

Variables in multivariable model were maternal age, residence, gravidity, hypertensive disorders of pregnancy (HDP), antepartum haemorrhage, maternal haemoglobin, number of ANC visit, onset of labour, fetal

mal-presentation, maternal VDRL test, number of fetus and maternal outcome on discharge.

The study showed that adverse perinatal outcomes were 1.3 times more likely to occur among mother's aged 20 years or below 95% CI: 1.01 to 1.5 as compared with mothers aged 21–34 years. The mothers who reside in rural area were 1.27 times more likely to have adverse perinatal outcome 95% of CI: 1.04 to 1.59 than mothers living in urban. The risk of adverse perinatal outcome doubled in women who had HDP when compared with normotensive mothers, adjusted risk ratio (aRR)=2.04, 95% CI: 1.64 to 2.52. Women who had antepartum haemorrhage in current pregnancy were 1.7 times at higher risk of having adverse perinatal outcome when compared with women who had not experience antepartum haemorrhage with 95% CI: 1.38 to 2.07. Adverse prenatal outcome was 1.25 times more likely to occur among anaemic mothers 95% of CI: 1.03 to 1.53 when compared with mother who had not experienced anaemia.

This study also revealed that newborns whose mothers had not attended ANC visits were 2.29 times more likely to develop adverse perinatal outcome with 95% of CI: 1.35 to 3.90 than those who had more than four ANC visits. Adverse perinatal outcome was 1.54 times more likely to occur when the mother had one to four ANC visits 95% of CI: 1.09 to 2.17 than when the mother had more than four ANC visits. Mothers who had VDRL test positive were two times more likely to have newborn with adverse perinatal outcome with 95% of CI: 1.16 to 3.38 than those who test negative (table 2).

DISCUSSION

This study was aimed to identify predictors of adverse perinatal outcome among women who gave birth at Jimma Medical Center. From this study, almost one-third (31.5%) of the deliveries were resulted in the adverse perinatal outcome, with 95% of 28.3% to 34.9%. Which is in line with pooled prevalence reported of adverse birth outcomes in Ethiopia (26.9 %).¹⁰

Rural residency poses higher risk of adverse perinatal outcome as reported in previous studies from other parts of Ethiopia, Brazil and Gambia.^{10 17 18} The disparity in healthcare service distribution and utilisation across urban and rural residents in low-income countries may explain this difference. Similarly, mothers with age ≤ 20 years had higher risk of adverse perinatal outcome when compared with those who aged 21–34 years. This finding is in line with the study from northeastern Brazil that revealed teenager had higher risk of obstetric complications that end up of adverse perinatal outcome.^{19 20} Mothers who had no ANC follow-up or less than four ANC visits were twice at risk of having adverse fetal outcome than those who had five and above ANC visits. This is in line with the studies conducted in another part of this country²¹ and Gaza strip.²² This finding reaffirms implementing WHO ANC recommendation of minimum eight

contacts²³ throughout pregnancy can reduce adverse perinatal outcomes.

Additionally, mothers with haemoglobin level of less than 11 g/dL had 1.3 times increased risk of adverse perinatal outcome compared with their counterparts. This is in line with studies in India, Nigeria, Sudan and other parts of Ethiopia.^{21 24–28} This could be due to the fact that haemoglobin level is a proxy indicator of nutritional status which, significantly influence birth outcome due to inadequate perfusion and nutrient supplementation to the fetus.²⁹ Maternal interventions focused primarily on maternal nutrition and iron folic acid supplementation including improvement of adherence to the supplement is required in order to reduce the risk of adverse perinatal outcome.

The risk of delivering adverse perinatal outcome was two times higher among women with HDP compared with normotensive women (aRR): 2.04; 95% CI: 1.64 to 2.52. The result is consistent with the other studies.^{11 30} This can be explained by the fact that HDP may cause an inadequate vascular response to abnormal placentation in pregnancy and may represent a distinct pathogenesis, which might affect fetal growth.³¹ Developing guideline at national level to screen pregnant women in order to indentify women at high risk to develop HDP is warranted for early intervention that reduce the risk of adverse perinatal outcome.

This study indicated that adverse perinatal outcome is more likely to be related to induced labour, which was (aRR): 1.77; 95% CI: 1.43 to 2.19 as compared with women who had spontaneous onset of labour. This finding is in line with the study in Latin America.³² Despite the undisputed importance of labour induction for better perinatal and maternal consequences in women with indications, this finding might be due to much number of women who were induced (65%) had HDP and late arrival of women at the Center, since Jimma Medical Center serve as the referral centre for primary and secondary health facilities in the southwestern part of the country. Additionally, inducing labour in high-risk nulliparas of less than 39 weeks of gestational age increases the need for immediate neonatal care and admission to an ICU.^{33 34} Women who test positive for VDRL in current pregnancy had two times the risk of have adverse perinatal outcome compared with women test negative with 95% CI: 1.16 to 3.38. This is in line with established evidence.³⁵ This implies, enhancing provision of quality ANC with early identification followed by prompt treatment for infections during pregnancy is warranted.

As limitations, variable that may have potential effect on perinatal outcome such as maternal nutritional status, smoking, indoor air pollution and maternal educational status was not included. Incompleteness of data for certain variables is an inherent limitation of studies that are conducted from the review of medical records.

Table 2 Predictors of adverse perinatal outcome among women who gave birth at Jimma Medical Center, Southwest Ethiopia from June 2017 to March 2020

Variables		Adverse perinatal outcome		Unadjusted RR (95% CI)	Adjusted RR (95% CI)
		Yes	No		
Maternal age	20 year and less	56	60	1.72 (1.36 to 2.16)	1.3 (1.01 to 1.57)
	21–34 years	162	414	1	1
	35 years and above	27	58	1.13 (0.81 to 1.58)	1.02 (0.78 to 1.38)
Residence	Rural	140	325	1.7 (1.34 to 2.04)	1.27 (1.04 to 1.59)
	Urban	105	207	1	1
Gravidity	Primigravida	95	184	1.24 (0.98 to 1.56)	
	Multigravida (II–IV)	105	277	1	
	Grand multigravida (V+)	45	71	1.41 (1.07 to 1.87)	
Hypertensive disorders of pregnancy	Yes	142	117	2.76 (2.25 to 3.39)	2.04 (1.64 to 2.52)
	No	103	415	1	1
Antepartum haemorrhage	Yes	62	40	2.24 (1.84 to 2.74)	1.69 (1.38 to 2.07)
	No	183	492	1	1
Anaemic mother	Yes	73	82	1.70 (1.38 to 2.10)	1.25 (1.03 to 1.53)
	No	172	450	1	1
Maternal ANC visit	Never	15	8	3.99 (2.52 to 6.29)	2.29 (1.35 to 3.90)
	1–4 visit	203	386	6.29 (1.47 to 3.03)	1.54 (1.09 to 2.17)
	Above 4	27	138	1	1
On set of labour	Induced	97	52	2.77 (2.28 to 3.38)	1.77 (1.43 to 2.19)
	Spontaneous	119	388	1	1
	Direct caesarean section	29	92	1.02 (0.72 to 1.47)	1.06 (0.77 to 1.46)
Maternal VDRL test positive	Yes	6	3	2.14 (1.33 to 3.44)	2 (1.16 to 3.38)
	No	239	529	1	1
Number of fetus	Twin	17	13	1.85 (1.33 to 2.59)	2.06 (1.45 to 2.94)
	Single	228	519	1	1
Maternal outcome on discharge	Died	5	2	2.29 (1.42 to 3.70)	1.3 (0.88 to 1.91)
	Alive	240	530	1	1

ANC, antenatal care; RR, risk ratio; VDRL, venereal disease research laboratory.

CONCLUSION

There was high incidence of adverse perinatal outcome in the study area and maternal age of less than 20, rural residency, maternal anaemia, antepartum haemorrhage in the current pregnancy, inadequate ANC visit, induction of labour and being positive for VDRL test were found to predict occurrence of adverse perinatal outcome. Majority of these factors can be managed by providing quality antenatal, intrapartum and postnatal care for mothers.

Acknowledgements We would like to acknowledge the Jimma Medical Center administrator, health professionals and data collectors who contributed to this work.

We would like to extend our gratitude to Jimma University for all support to conduct this study.

Contributors DDJ conceived and DKA designed the study, developed data collection instruments and supervised data collection. All participated in testing and finalisation of the data collection instruments and coordinated the study progress. DDJ performed the statistical analysis and both authors wrote the manuscript and approved the final manuscript. DDJ act as guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval This study was conducted after Jimma University IRB provided ethics approval of Ref No IRB/00099/2020; date of issue 20 March 2020. All

methods were performed following principles of Helsinki declaration. Jimma University Institute of Health Science Review Board waived off the need for participant informed consent during ethical review, for the fact that, it was not possible to reach individuals to whom the reviewed charts belongs to. Rather, formal letter of cooperation was written to Jimma Medical Center administration from Jimma University. Written permission was secured from the Jimma Medical Center director office. No personal identifiers were used for analysis in order to maintain confidentiality of the information and privacy.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All data for this research article are available and can be accessed from the corresponding author at any time by request.

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