

Research Article

# Magnitude and Associated Factors of Non-Reassuring Fetal Heart Rate Among Laboring Mothers at Jigjiga Public Hospitals, Eastern Ethiopia, 2024

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## Abstract

**Background:** Non-reassuring fetal heart rate, which indicates fetal hypoxia due to inadequate oxygen supply, is the most common reason for increasing cesarean sections and operative vaginal deliveries beyond world health organization recommendations. However, there is a lack of research on this issue nationally and no studies have been conducted in the study area. **Objective:** This study aimed to assess the prevalence and factors associated with non-reassuring fetal heart rate among laboring mothers who gave birth at Jigjiga Public Hospital, Eastern Ethiopia, 2024. **Methods:** An institution-based cross-sectional study was conducted among 281 laboring mothers who gave birth at Jigjiga Public Hospital from April 15 to May 15, 2024. Study subjects were selected using a systematic random sampling technique. Data was collected through pretested, interviewer-administered, semi-structured questionnaires, then entered into EPI-DATA Version 4.6 and exported to SPSS Version 25 for analysis. Binary logistic regression analyses were performed to identify factors associated with non-reassuring fetal heart rate. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated to assess the strength of associations, with statistical significance declared at a p-value < 0.05. Model fitness was assessed using the Hosmer-Lemeshow test. **Results:** The prevalence of non-reassuring fetal heart rate was 22.4% (95% CI: 17.5-27.5). Meconium-stained amniotic fluid (AOR = 6.239, 95% CI: 2.726-12.281), bloody amniotic fluid (AOR = 6.232, 95% CI: 2.726-19.183), not having antenatal contact (AOR = 4.196, 95% CI: 1.859-9.473), obstetric complications (AOR = 9.562, 95% CI: 4.139-20.090), and rural residence (AOR = 3.32, 95% CI: 1.32-8.346) were significantly associated with Non-reassuring fetal heart rate. **Conclusions:** The overall prevalence of non-reassuring fetal heart rate was high. Significant associations were found with residing in rural areas, having obstetric complications, meconium- and blood-stained amniotic fluid, and not having anti natal care visits.

## Keywords

Non-reassuring Fetal Heart Rate, Jigjiga, Ethiopia

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## 1. Introduction

Non-reassuring fetal heart rate status (NRFHR) describes abnormal fetal heart rate patterns, including repeated decelerations, abnormal variability, and irregular tone [1]. A normal fetal heart rate (FHR) baseline ranges from 110 to 160 beats per minute. If the baseline FHR is below 110 beats per minute, it is termed bradycardia. If it exceeds 160 beats per minute, it is termed tachycardia. Variability refers to fluctuations in the FHR baseline of 2 cycles per minute or greater, with irregular amplitude and inconsistent frequency. All of these abnormalities can occur due to inadequate oxygen supply to the fetus [2, 3].

The American College of Obstetricians and Gynecologists (ACOG) and the National Institute of Child Health and Human Development (NICHD) categorize fetal heart rate status (FHR) into three tiers for management purposes. Category I includes a baseline heart rate of 110–160 beats per minute, moderate variability, and no late or variable decelerations, though early accelerations and decelerations may be present or absent. Category III is characterized by sinusoidal FHR, absent baseline FHR variability, and recurring late decelerations, bradycardia, or recurrent varied decelerations. Category II comprises indeterminate FHR that are not classified as Category I or III, or situations where no accelerations are induced after fetal stimulation [4, 5].

Non-reassuring fetal status often links with maternal conditions like cardiovascular disease, anemia, diabetes, hypertension, infection, and placental abruption, alongside fetal issues such as abnormal presentation, intrauterine growth restriction, and umbilical cord compression. It occurs in around 15% of labors. The fetus experiences three stages of deterioration due to depleted oxygen levels: transient hypoxia without metabolic acidosis, tissue hypoxia with a risk of metabolic acidosis, and hypoxia with metabolic acidosis. But the status of fetal heart rate can be monitored through certain mechanisms [5, 6].

The two most common methods of monitoring fetal heart rate are cardiotocography (CTG) and intermittent auscultation. In high-resource settings, continuous electronic fetal heart rate monitoring via CTG is prevalent. However, in developing countries like Ethiopia, where CTG is unavailable, intermittent auscultation is recommended for all laboring women. Intermittent auscultation involves assessing the fetal heart rate at predetermined intervals using either a fetal stethoscope or a handheld Doppler [4, 6, 7]. The fetal heart rate significantly changes in response to prolonged oxygen deprivation, making fetal heart rate monitoring a valuable and commonly used tool for assessing fetal oxygenation status in real time [3].

Non-reassuring fetal heart rate status, a major concern during labor, contributes significantly to global perinatal mortality rates. Globally, Around 1 million fresh stillbirths and 0.7 million early neonatal deaths occur each year as a result of an intrapartum fetal heart rate status abnormalities [8]. This

often leads to more cesarean sections and surgical deliveries than what the World Health Organization recommends (WHO) [9].

Prolonged fetal hypoxia is linked to perinatal morbidities such as cerebral palsy, encephalopathy, seizures, and neurodevelopmental delay and mortality; furthermore the existence of delayed intervention usually leads to fetal death or serious neurological consequence [6, 10] The mother also suffer extra risks like caesarian section, blood loss, long hospital stay, infection, and possible birth injuries [11].

Non-reassuring fetal heart rate status is a common reason why a newborn is admitted to the neonatal intensive care unit (NICU) and dies during the neonatal period [7]. In spite of improvement in obstetrics care and quality of health service neonatal mortality is still a big issue in Ethiopia where 30/1000 neonatal death was reported [12].

The World Health Organization (WHO) advised intrapartum fetal monitoring by qualified medical personnel; nevertheless, this strategy is challenging in nations with few resources, In developed countries maternal participation in fetal heart rate monitoring during labor is a potentially feasible, effective and sustainable approach to overcome complications related to non-reassuring fetal heart rate (NRFHR) [13].

The American College of Obstetricians and Gynecologists (ACOG) recommend that all hospitals must be capable of performing emergency caesarian section within 30 minutes of fetal compromise. But not all decisions for a cesarean delivery will require a 30 min response time [14]. According to NRFHR tracking, in order to prevent or lessen a poor newborn outcome, prompt intervention is required, such as a caesarean section or instrumental vaginal delivery intrauterine resuscitation, which includes oxytocin deprivation and amnio infusion [4]. But it can be very challenging to decide which course of action is best when there are aberrant FHR tracings. Furthermore, not much is known about this critical issue of altered fetal heart rate (FHR) [15]. In Ethiopia there is no enough resource for intrapartum fetal monitoring. This issue need great concern, Ethiopia is one of countries with high number of still birth and neonatal death due to perinatal asphyxia [16].

The prevalence of no reassuring fetal heart rate (NRFHR) in the world lies between 1.7% to 41.5%, which is responsible for over half of all stillbirths [17, 18]. In United States common indication of primary caesarean section was non-reassuring fetal heart rate status which accounts 23% [19]. Case referent study conducted in South Africa showed combined still birth rate of 17.6% per thousand deliveries due to inadequate intra partum fetal monitoring [20].

The Study conducted in Japan reported that 3.9% of children had a non-reassuring fetal heart rate pattern among which 3.3% of the NRFS scenarios were positive, 83.3% were false positives, and 13.4% did not fit into any of these

categories [21]. A prospective observational study carried out in the tertiary hospital of Xiamen University of China found that 11.5% of 44 cases out of 384 pregnant women admitted for induction of labor had non-reassuring fetal heart rate patterns; 19 of these cases underwent emergency C/S, and 25 cases underwent instrumental deliveries [22].

Non-reassuring fetal heart rate status is Global health concern. In developed countries intra partum fetal monitoring is advanced than that of developing countries, but still there is incidence of abnormal fetal heart rate. Mostly in developing countries intra partum fetal monitoring is by pinard fetoscope rather than advanced intra partum fetal monitoring technique [14, 23]. In sub-Saharan and south Asia, the practice continuous electronic fetal monitoring was less. Due to this reason in such countries the risk of death in neonatal period was six times higher than in developed countries [24].

In spite of this impact of non-reassuring fetal heart rate there are few studies conducted in Ethiopia and there is no study conducted particularly in somale regional state. Hence, this study aimed to asses the magnitude of non-reassuring fetal heart rate and associated factors among laboring mothers who gave birth at jigjiga public hospitals, Somali region, Ethiopia.

## 2. Methods and Materials

### 2.1. Study Area and Period

An institution-based cross-sectional study was conducted from April 15, 2024 to May 15, 2024 at Jigjiga public hospitals. Jigjiga is the capital city of Somali Regional State located in the eastern part of Ethiopia; it is 621 km away from Addis Ababa, the capital city of Ethiopia. The population is mainly of Somali extraction and most residents are Muslim. The town has six health institutions (One Referral hospital, one Zonal hospital, one Primary hospital and 3 Health centers). Jigjiga Sh Hassan Yabare Comprehensive Specialized Hospital is the largest and most modern hospital, providing state-of-the-art and comprehensive service under one roof in eastern Ethiopia. The hospital is built on 60,000 m<sup>2</sup> of land. It is planned to provide preventive, diagnostic, curative, therapeutic, rehabilitative, and support services to all patients the other hospital is Karamara general hospital this hospital stand as a trusted institution and most mothers prefer this hospital deliver there are around 63 midwifery and 7 specialist doctors available and obs and gyn ward my third study area is jigjiga primary hospital it has 3 major wards MCH gyn delivery and postnal wards, and there are 30 midwife and 2 specialist doctors are available at this hospital [25, 26].

### 2.2. Study Design and Period

An institutional-based cross-sectional study was conducted at Jigjiga Public Hospital from April 15 to May 15, 2024.

## 2.3. Population

### 2.3.1. Source Population

All laboring mothers who gave birth a Jigjiga public hospitals were the source population.

### 2.3.2. Study Population

All laboring mothers who gave birth a Jigjiga public hospitals during data collection perood were the study population.

## 2.4. Inclusion and Exclusion Criteria

### 2.4.1. Inclusion Criteria

All laboring mothers who gave birth at jigjiga public hospitals during study period.

### 2.4.2. Exclusion Criteria

Those mother critically ill, diagnosed as intra-uterine fetal death (IUFD) on or before admission, with gross congenital malformation (anencephaly, spinal bifida and hydrocephalus) and mothers with scheduled cesarean delivery were excluded from the study.

## 2.5. Sample Size and Sampling Procedure

### Sample size

The sample size was determined using the single population proportion formula, considering a prevalence (P) of 21.16% from a previous study (27), and a confidence level ( $Z\alpha/2$ ) of 95%, and a margin of error of 5%. The formula used to calculate the sample size was as follows:

$$n = \frac{(z\alpha/2)^2 p(1-p)}{d^2}$$

$$\frac{(1.96)^2 0.2116(1-0.2116)}{0.05^2} \approx 255$$

Where  $z = Z$  score for a 95% confidence interval, which is 1.96.

$p$  = prevalence of NRFHR which is 21.16% [27].

$d$  = margin of error, which is 5%.

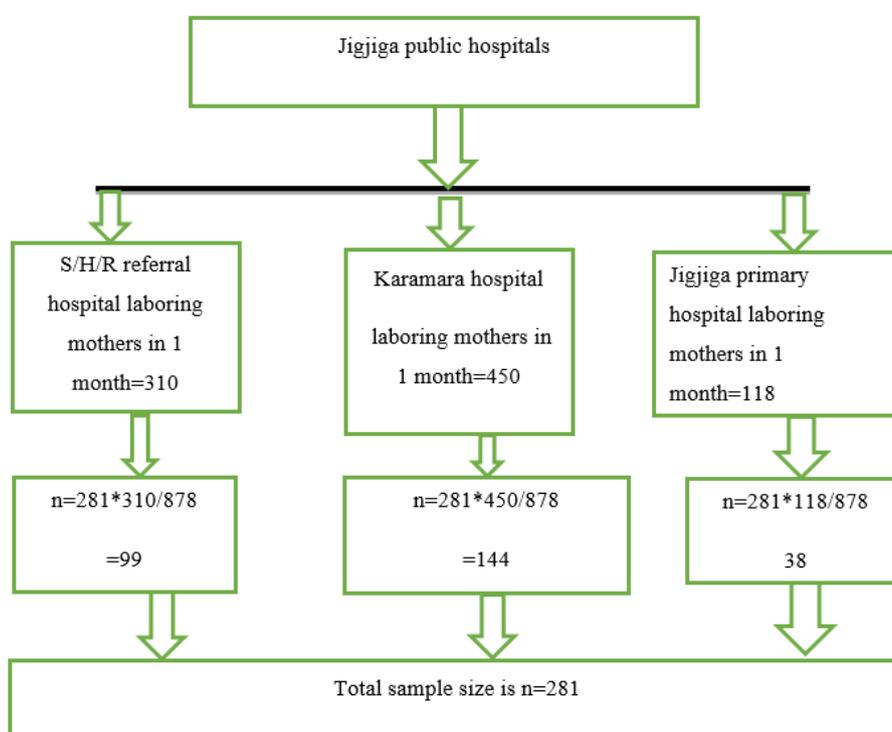
After adding a 10% non-response rate to the calculated sample size, the final sample size was determined to be 281.

For the second objective, the sample size was determined using Epi-Info StatCalc version 7 software, based on proportions of associated factors obtained from previous studies conducted at South Gondar Zone Public Hospitals in North West Ethiopia in 2022 and Finote-selam Primary Hospital in 2020. Factors such as referral from health facilities, current pregnancy complications, and augmentation of labor were found to be significantly associated with non-reassuring fetal heart rate status. Table 1. However, the sample size calculat-

ed based on these factors did not exceed that determined by proportion. Therefore, the final sample size remained at 281.

**Table 1.** Sample size determination for factors associated with non-reassuring fetal heart rate among laboring mothers who gave birth at Jigjiga public hospitals in 2024.

Sr. no	Variables	CI	Power	Prevalence among unexposed group	Prevalence among exposed group	AOR	Non response rate	Total sample size	Reference
1	Referral from health facility	95%	80	36.81	12.98	3.90	10	130	(27)
2	Augmentation of labor	95%	80	42.30	10.73	3.24	10	140	(28)
3	Current pregnancy complication	95%	80	35.41	18.36	2.44	10	257	(27)



**Figure 1.** Schematic diagram showing the sampling technique and procedures to select a sample of 281 laboring mothers who gave birth at jigjiga public hospitals, Somalia, Ethiopia.

### 2.6. Sampling Procedure

A two-stage sampling method was used to select the hospitals and study participants. Initially, all hospitals were selected, followed by a selection of study subjects. Of the existing hospitals in Jigjiga town, all were included. Those hospitals are S/H/Y referral hospital, karamar hospital and jigjiga primary hospital. Next, a proportional allocation of the sample size was used for each selected hospital according to the number of laboring mothers.

The number of participants per month was estimated based on the three-month review of postnatal care documents from

each hospital. The average number of laboring mother who gave birth per month in these hospitals was 310, 450 and 118 respectively. The required number of study participants was proportionally allocated to each hospital based on their average monthly births; that is 99, 144 and 38 for S/H/Y referral hospital, karamar hospital and jigjiga primary hospital respectively. Finally, study participants were recruited by systematic random sampling at every 3 intervals of mothers who gave birth in those public hospitals by dividing the total number reported (878) by health institutions for a final sample size of 281. The first study participant was selected by the lottery method. [Figure 1.](#)

## 2.7. Data Collection Tools

The data were collected by a pretested semi structured questionnaire developed from reviewing different literature [14, 18, 27-29]. Interviewer administered questionnaire was used for collecting primary data from the study participants during postnatal periods because it is difficult to interview the mother during labor and patient chart review was used to get information related to labor and delivery progress and the diagnosis of fetal heart rate. The questionnaire contains many factors which were related with non-reassuring fetal heart rate such as socio demographic factors, antipartum factors, intrapartum factor and other factors from the study. The questionnaire was developed in English first, then translated into Af Somali and Amharic languages by language experts, and then returned to English for the consistency of the questionnaires.

## 2.8. Data Collection Procedures

Data was collected by six BSc Midwives and three senior BSc midwife, fluent in Amharic and Afa Somali and not working in the study sites was recruited for data collection and supervision respectively. The data collectors were recruited based on their previous data collection experience and one-day intensive training regarding ethical issues, tools, sampling techniques, and procedures was given for both data collectors and supervisors by the principal investigator. Data collection was undertaken through an interview using a semi structured questionnaire and that was complemented with medical records. The diagnosis was confirmed by a senior doctor of obstetric ward, and a total of one month was taken to complete the data collection.

## 2.9. Study Variables

### *Dependent variables*

Non-reassuring fetal heart rate (Yes/No).

### *Independent variables*

*Socio demographic factors* (Age, residence, Ethnicity, Marital status, Occupation, and income).

*Antepartum factors* (ANC follow up, Gravidity, parity, bad obstetric history, maternal Rh factor, history of medical illness, current pregnancy complications, and Hct level).

*Intra-Partum Factors* (Presentation, Stage of labor on Admission, Duration of labor, Amniotic fluid status, Grade of meconium, Referred, Sex of neonate, Birth weight, Gestation age, and Onset and progress of labor) are independent variables.

### *Operational terms*

*Non-reassuring fetal heart rate (NRFHR)*: Considered when the fetal heart rate is less than 110bpm (bradycardia) or greater than 160 bpm (tachycardia) in the intrapartum period [1].

*A baseline fetal heart rate status*: normal between 110 to 160 bpm,

*Bradycardia* – a baseline value below 110 bpm lasting more than 10 min

*Tachycardia* – a baseline value above 160 bpm lasting more than 10 minutes

*Anemia*: Defined as according to (WHO, 2011) (hemoglobin levels of >11 mg/dl was considered as normal, <11mg/dl considered as anemia [30].

*MUAC*: according FMOH Ethiopia, 2022 Antenatal Care guideline  $\geq 23$  cm considered as normal while <23cm is considered as malnourished [30].

## 2.10. Data Quality Control

A pretest was conducted on 5% of the sample population two weeks prior to the main data collection among women admitted for delivery at Kebribayah Primary Hospital. Following the pretest, adjustments were made to enhance the logical structure, sequence, and clarity of the questionnaire. The principal investigator meticulously checked the collected data for completeness, consistency, and cleanliness.

To ensure consistency in data collection, the questionnaire was translated by language experts from English into Af Somali and Amharic, and then back into English. Adjustments were made to items as necessary based on this process. Subsequently, a day of intensive training was provided to both data collectors and supervisors.

## 2.11. Data Processing and Analysis

The collected data was coded, entered and cleaned by Epi-Data 4.6 and exported to statistical package for social science (SPSS) version 25 was used for analysis. Frequency, Percentages, tables and figures were used to present the result. Binary logistic regression test was used to compute Crude Odds Ratio with its 95% confidence interval to test the associations between dependent and independent variables. Then Variables with a p-value <0.25 at 95% CI in the binary logistic regression model of bivariable logistic regression was transformed into a multivariable logistic regression. Finally, Multivariable analysis with Adjusted Odds Ratio (AOR) with a 95% confidence interval (CI) was used to control possible confounders and to identify factors associated with NRFHR. In this study, a variable with a p-value < 0.05 was considered statistically significant.

## 3. Results

### 3.1. Socio-Demographic Characteristics

In this study, 281 laboring mothers with 100% response rate were participated. The mean age of the participating mothers was 28.29 (SD±6.3) years. The age of the respondents ranged from 18 to 42 years, with the majority falling within the age category of 26-35 (47%). Approximately 75.1% of the respondents lived in urban areas, and 92.2%

were married. Regarding education, 63.6% of the participants did not have formal education. Additionally, the major-

ity of the women (63%) were housewives [Table 2](#).

**Table 2.** Sociodemographic characteristics of laboring mothers who gave birth at jigjiga public hospitals eastern ethiopia, 2024 (N=281).

Variable	Category	Frequency (n)	Percentage%
Maternal age	15 – 25	96	34.2
	26 – 35	132	47
	36 – 45	53	18.9
Residence	Urban	211	75.1
	Rural	70	24.9
Marital status	Married	259	92.2
	Single	17	6
	Others*	5	1.8
Occupational status of the mother	House wife	177	63
	Marchent	45	16
	Governmental employe	42	14.9
	Others*	17	6.2
Educational status of the mother	Havingno forma leducation	179	63.6
	Having formal education	102	36.4
Religion	Muslim	230	81.9
	Orthodox	31	11
	Protestant	19	6.8
	Catholic	1	0.4

Others\*(widowed, divorced) Others\* (student, daily laborer)

### 3.2. Antepartum Characteristics

Out of all mothers, 82.9% were multigravida, and the majority, 81.5%, were multipara, and 43.1% of them had ANC contact, with 15.7%, of them had 2 contact, 14.9% of them

had 3 contact and 69.4% of the had attend 4 and above. More than two-thirds (73%) had a mid upper arm circumference (MUAC) of  $\geq 23$ . The majority of women (79.4%) had a hematocrit level of  $\geq 33\%$ . [Table 3](#).

**Table 3.** Antepartum factors of laboring mothers who gave birth at jigjiga public hospitals eastern ethiopia, 2024 (N=281).

Variable	Category	Frequency (n)	Percentage%
Parity	Primi parous	52	18.5
	Multi parous	229	81.5
Gravidity	Primi gravida	48	17.1
	Multi gravida	233	82.9

Variable	Category	Frequency (n)	Percentage%
ANC visit	Yes	121	43.1
	No	160	56.9
Frequency of ANC visit (N=121)	<4	37	30.6
	≥ 4	84	69.4
Current obstetric history	Yes	61	21.7
	No	220	78.3
Hematocrit level	Anemic	58	20.6
	Normal	223	79.4
MUAC	Malnourished	76	27
	Normal	205	73

### 3.3. Intrapartum Characteristics

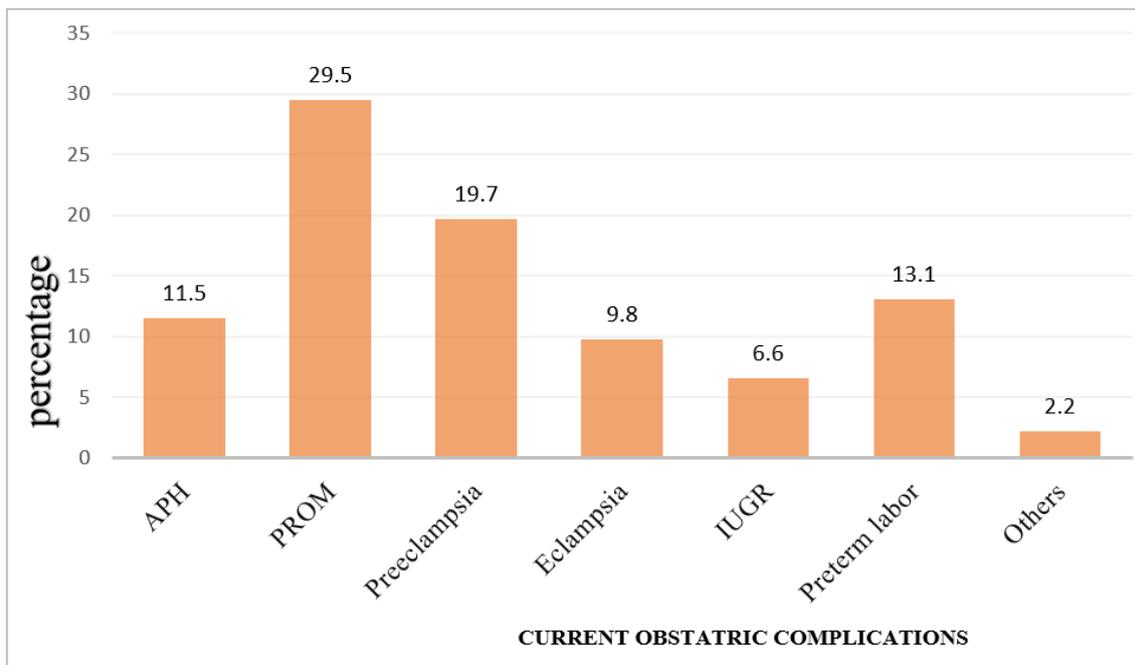
The mean gestational age of the fetus who participated in this study with standard deviation was 38.56 (SD ±2.03). Among the total of 281 delivering mothers, 88.6% experienced spontaneous onset of labor. Approximately two-thirds (69.4%) delivered vaginally, while 19.9% underwent instru-

mental delivery, and 10.7% had a cesarean section. 23.8% of mothers were referred from other health facilities. Of all deliveries, 14.3% had cord prolapse, 6.3% had preeclampsia, and 7.9% had a nuchal cord. 96.1% of newborns were singleton, while the remaining were twin pregnancies. Out of the detected FHR abnormalities 44 (69.8%) were bradycardia and 19 (30.2%), tachycardia. More than two third of NRFHR was detected at activefist stage of labor 48 (76.2%). [Table 4](#).

**Table 4.** Intrapartum factors of laboring mothers who gave birth at jigjiga public hospitals eastern ethiopia, 2024 (N=281).

Variable	Category	Frequency (n)	Percentage%
Birth weight	<2500	11	3.5
	2500-3999	170	63.7
	≥4000	91	32.4
Duration of ROM	≥12 Hr	54	19.2
	<12 Hr	227	80.2
Mode of delivery	SVD	195	69.4
	C/S	30	10.7
	Vacuum extraction	43	15.3
	Other*	13	4.6
Presentation	Cephalic	240	85.4
	Breach	32	11.4
	Others*	9	3.2
Color of amniotic fluid	Clear	188	66.9
	Blood containing	27	9.6
	Meconium	66	23.5

Others\* Mode of delivery (forceps, assisted breach extraction), Others\* Presentation (shoulder, compound).



Others\* oligohydramnios, post term pregnancy.

Figure 2. Current obstetrics complications among laboring mothers who gave birth at jigjiga public hospitals eastern Ethiopia, 2024.

### 3.4. Magnitude of Non-Reassuring Fetal Heart Rate

Out of 281 laboring mothers who delivered at jigjiga public hospitals, the prevalence of non-reassuring fetal heart rate was 22.4% (95% CI: 17.5-27.5).

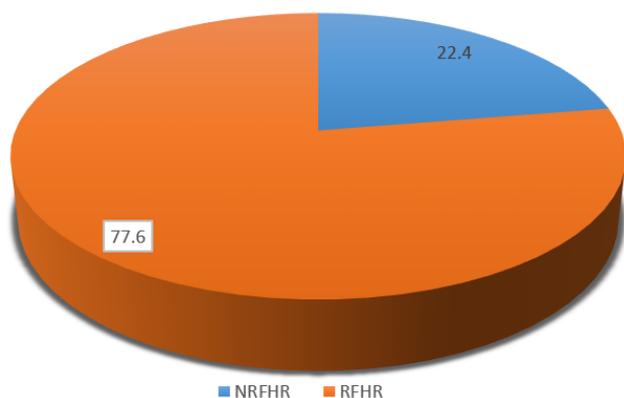


Figure 3. Magnitude of NRFHR among laboring mothers who gave birth at jigjiga public hospitals eastern Ethiopia, 2024.

### 3.5. Factors Associated with Non-Reassuring Fetal Heart Rate

In examining factors associated with NRFHR, the bivariate analysis highlighted 8 variables, such as parity, being anemic, living in rural areas, having current obstetric complication, not having ANC contact, being underweight, being referral, having bloody and MSAF were found potential candidates for further analysis ( $p \leq 0.25$ ). However, upon conducting multivariable analysis only variables, living in rural areas, not having ANC visit, having current obstetric complication and having MSAF were significantly associated with FHR abnormalities with p-value of  $< 0.05$ .

Women who had no ANC contact were 4.1 times more likely to develop NRFHR than women who attend ANC (AOR = 4.19, 95%CI: 1.859-9.473). Mothers with current obstetric complications were 9.5 times more likely to develop NRFHR as compared with those without current obstetric complications (AOR = 9.562, 95%CI: 4.139-20.090). Additionally, mothers who had MSAF and bloody were 6.2 times more likely to develop NRFHR than those who presented with clear amniotic fluid (AOR = 6.239, 95%CI: 2.726-12.281) and (AOR = 6.232, 95%CI: 2.726-19.183). Table 5.

**Table 5.** Bivariable and multivariable logistic regression for Factors associated with non-reassuring fetal heart rate among laboring mothers who gave birth at jigjiga public hospitals eastern ethiopia, 2024 (N=281).

Variables	Categories	NRFHR		P-value	COR (95%C. I)	AOR (95%C. I)	P-value
		YES	NO				
Residence	Urban	31	180		1		
	Rural	32	38	0.000	4.8 (2.7-8.9)	3.3 (1.3-8.3)	0.011
Parity	Primi parous	15	37	0.221	1.5 (0.8-3.0)	1.3 (0.5-3.2)	0.658
	Multi parous	48	181		1		
ANC visit	Yes	15	106		1		
	No	48	112	0.001	3.1 (1.61-5.7)	4.2 ((1.9 -9.5)	0.001
MUAC	<23cm	23	53	0.057	1.8 (0.9-3.3)	1.8 (0.7-4.4)	0.189
	≥23cm	40	165		1		
Obstetric complication	Yes	34	27		1		
	No	29	191	0.000	8.3 (4.4-15.7)	9.5 (4.1-20.1)	0.000
Color of amniotic fluid	Clear	22	166		1		
	Bloody	10	17	0.001	4.4 (1.8-10.9)	6.2 (2.7-19.1)	0.002
	Meconium	31	35	0.000	6.7 (3.5-12.9)	6.2 (2.7-12.3)	0.000
Hematocrit level	Anemic	17	41	0.160	1.6 (0.8-3.1)	1.3 (0.5-3.2)	0.142
	Normal	46	177		1		
Referred	Yes	25	42	0.001	2.8 (1.5-5.1)	0.7 (0.3-1.7)	0.390
	No	37	173		1		

### 4. Discussion

This study was carried out to assess the magnitude of non-reassuring fetal heart rate and associated factors among laboring mothers who gave birth at jigjiga public hospitals, eastern, Ethiopia. The finding of this study showed that the prevalence of non-reassuring fetal heart rate was 22.4% (95% CI: 17.5-27.5). this result indicates that fetus and laboring mothers faces significant fetal heart rate abnormalities which have a negative consequence on both of them, by increasing instrumental delivery, cesarean section as well as many fetal and newborn problems, making it more difficult to meet the sustainable developmental goal 3 which focus on maternal and new born health's.

The finding was in line with the study conducted at gonder (21.16%) (27), Bahir Dar (19.4%) (31), and Israel on 2018 (21.2%) [32]. However, the finding of this study is higher than the study done at Finote Selam hospital 15.1% [28],

Tanzania (9.9%) [33], and China, 11.5% [22]. Variations in the study population, the level of the health institution, the study method, the time interval, and the inclusion and exclusion criteria may account for the discrepancy in this result. The study at Finote Selam was retrospective and performed at primary hospital in which low risk mothers will deliver. The study at Tanzania didn't include mothers with abruption, cervical dilation above 7cm and preterm pregnancies. and the study in china only include term pregnancy.

On the other hand, the results are less than those of studies conducted in South Omo, Southern Ethiopia, 41.5% [18] and Thailand, 30.7% [29]. The disparity could result from different study periods, variations in the characteristics, or the use of more sensitive materials for NRFHR diagnosis in Thailand. NRFHR. for study conducted at southern omo the difference is due to different sociodemographic characteristic and it was done in district hospitals around half 40.9% the women lived in rural areas.

This study revealed that Blood stained amniotic fluid was

significantly associated with a non-reassuring fetal heart rate. The odds of non-reassuring fetal heart rate were 6.2 times more likely to be higher with blood stained amniotic fluid compared with clear this study also supported by study done in bahdar [31]. Negligence or inability to distinguish blood stained amniotic fluid from bloody show results in a non-reassuring fetal heart rate pattern, since blood stained amniotic fluid requires intervention. It indicates abnormalities in placental attachment or premature separation of the placenta, which results in utero-placental insufficiency [34].

In this study amniotic fluid status was another factor for NRFHR. Those mother whose amniotic fluid was meconium stained were 6.2 times more likely to develop NRFHRS than that had clear amniotic fluid, which is similar with other studies done in thialand in siriraj hospital [29], Finote Selam [28] and bahardar [31]. This might be due to non-reassuring fetal heart rate increased risk of meconium stained amniotic vice versa increased magnitude of NRFHR [1, 34].

The current study's findings showed a significant association between the magnitude of NRFHR and current obstetric problems, whose mothers who have current obstetric complication were 9.5 times more likely to develop NRFHR when compared to mothers who did not. This finding was further supported by a cross-sectional study conducted in both south omo and gonder shows that obstetric complication increases the prevalence of NRFHR [18, 27] respectively. The evidence indicated that the health and development of the fetus is significantly affected by the effects of maternal morbidity. Since both placental perfusion and maternal oxygenation are prerequisites for fetal oxygen supplementation, maternal medical conditions and obstetric complications considered as risk factors [6].

According to this study those mothers who didn't attend ANC follow-up increase the prevalence ratio of NRFHR by 4.2 times, when compared with mothers who attended ANC follow-up, which is supported by the study conducted at Addis Ababa and south ommo [14, 18] respectively. The possible implication is among women's who don't had ANC visit missed opportunity of early detection and management of abnormalities that might cause NRFHRS status [35].

This study also shows that, those women mothers who lived in rural area 3.3 times risk for developing NRFHR than those who lived in urban residence this result was supported by study done in Amhara region at Gondar public hospitals [27]. This might be because pregnant women living in rural areas are less likely to be aware of the need for ANC follow-up and the complications that arise from it, and the distance to the health center may also contribute to this outcome.

## 5. Conclusion

The findings of this study indicate the prevalence of non-reassuring fetal heart rate among laboring mothers who gave

birth at jigjiga public hospitals was high when compared to other African countries and this remains a maternal and perinatal concern. Residing in rural area, having obstetric complications, meconium and blood-stained amniotic fluid, and not having ANC follow up were significantly associated with NRFHR.

## Abbreviations

ACOG	American College of Obstetrics and Gynecology
BPP	Biophysical Profile
CEFM	Continuous Electronic Fetal Monitoring
CTG	Cardiotocograph
C/S	Caesarian Section
EFW	Estimated Fetal Weight
FHR	Fetal Heart Rate
FHRS	Fetal Heart Rate Status
FPO	Fetal Pulse Oximetry
FSB	Fresh Still Birth
FSE	Fetal Scalp Electrode
FSS	Fetal Scalp Sampling
GA	Gestational Age
IA	Intermittent Auscultation
MSAF	Meconium Stained Amniotic Fluid
NRFHRP	Non Reassuring Fetal Heart Rate Pattern
WHO	World Health Organization

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## Author Contributions

HA designed the study. HZA, MH, BTO, GS and MKG analyzed the data, drafted the manuscript and critically reviewed the article. All authors read and approved the final manuscript.

## Ethical Declaration

Before the beginning of the data collection, ethical clearance letter was obtained from jigjiga University Institutional Review Committee. Verbal informed consent of the study participants was gained from each study participant by explaining the purpose of the study, and confidentiality of the information was assured and privacy of the participants was maintained. Those who were not willing to participate or refuse on the middle of the study was given full right to discontinue the interview.

## Consent for Publication

Not applicable.

## Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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## Conflicts of Interest

The authors declare no conflicts of interest.

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