



# Determinants of Neonatal Near Miss among Neonates Delivered in Public Hospitals in Shashemane City Administration, Ethiopia, 2021: Facility-Based Unmatched Case-Control Study

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## ABSTRACT

**Background:** Neonatal near miss is an event that nearly died between 0-28 days but survived by chance or good quality of care. The number of neonates who survived morbidities was approximately 5 times greater than those who died. However, there is limited evidence stating the determinants of neonatal near miss in Ethiopia, particularly in Shashemane. So, this study attempted to identify determinants of Neonatal near-misses among neonates delivered in public Hospitals in Shashemane, Oromia, Ethiopia.

**Methods:** Facility-based unmatched case-control study conducted from March 22, 2021, to May 22, 2021. Structured and pretested questionnaires were used for data collection. 104 cases were selected consecutively and 208 controls were selected by systematic random sampling by 2<sup>nd</sup> k during the study period. For each near-miss case, two controls were selected. After data collection, data were checked for consistency, coded, and entered by using EPI INFO 7, and exported to a statistical package for social science for analysis by using binary logistic regression based on Odds ratio, 95% CI, and p-value of less than 0.05. Variables with p<0.25 in Bivariable analysis entered into a multivariable logistic regression model using the backward variable selection method.

**Result:** The result shows that the mother age group between 20 and 34 had 0.12 fewer odds to experience neonatal near-misses than the age group below 20. [AOR=0.12, 95% (CI=0.02-0.76)]. Neonates who were delivered by spontaneous vaginal delivery had 0.38 fewer odds of experiencing neonatal near-misses than neonates delivered by instrumental assisted delivery and Cesarean section [AOR 0.38, 95% (CI=0.22-0.68)]. Delivery followed by partograph had 0.25 fewer odds likely to develop neonatal near miss than those not followed by partograph [AOR=0.25 95% (CI, 0.11-0.54)].

**Conclusion:** Age of mother, gestational age, delivery mode, and delivery followed by partograph were determinants of the neonatal near miss. So, for women who conceive at below 20 years of old, mothers that will not give birth by spontaneous vaginal delivery should be advised of the greater risk of neonatal near misses. Health workers in the delivery ward should use partograph for every delivery in both hospitals.

**Keywords:** Neonatal near miss, Neonate, Shashemane.

## INTRODUCTION

Neonatal Near Miss (NNM) is an evolving concept and so far, there is no standard definition for NNM. However, it may be referred to newborns that had severe morbidity but survived this condition within the first 28 days of life [1-3]. The Latin American Center of Perinatology (CLAP, Montevideo, Uruguay) from the Pan America Health Organization develop a definition of the Neonatal Near Miss as "any newborn infant who exhibited pragmatic and/or

management criteria and survived the first 28 days of life" using WHO global survey conducted 2005 and WHO multi-country survey in 2014 [4]. Neonatal near miss definition and criteria may be seen as a basis for future applications of the near-miss concept in neonatal health. These tools can be used to inform policymakers on how to apply scarce resources to improving the quality of care and reducing neonatal mortality [5].

By the end of 2030 Sustainable Development Goal (SDG) global

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target is an NMR of 12 deaths per 1000 Livebirths and if the slow reduction continues newborn deaths account for 45 percent of under-five deaths globally, up from 40 percent in 1990 [6]. And following the launch of the Global strategy for women's, children, and adolescent health (2016- 2030), WHO developed a vision for quality of care in newborn health services which sees a future in which "every newborn receives quality care throughout pregnancy, childbirth and postnatal period" [7]. The Ministry of Health (MOH) of Ethiopia is working with WHO and other partners to strengthen and invest in care, particularly around the time of birth and the first week when most newborns are dying in this period and also focus on improving the quality of newborn care from pregnancy to entire postnatal period [8]. And implemented the Health Sector Development Program and Health Sector Transformation Plan (HSTP) helping reform the nation's health system in the last 20 years. The HSTP has identified quality and equity as a cornerstone of the transformation agenda focusing mainly on maternal, neonatal, and child health; nutrition, and others [9].

Since the Neonatal Near Miss is a new concept, a dearth of literature indicates determinants factors. In Ethiopia also there is a dearth of literature that identifies determinants of NNM. Despite, Neonatal health-related problems are still there is justified by the 2019 Biannual report of Shashemane Comprehensive Specialized Hospital (SCSH) from a total of 1573 Livebirth delivered in the Hospital 445 Newborns admit to NICU with at least one indication, and from admitted 29 neonates died and in Melka Oda general hospital report from 2569 Livebirth 320 newborn admit to NICU and 24 newborns died. And particular there is no study done on it in Shashemane city. So, this study attempted to identify determinants for NNM in this study area, used as part of the evidence, the basic framework for another researcher, public hospitals, and the city administration health office.

A study done by WHO in WHOMCS and WHOOGS in 2005 put great insight into the NNM approach with its limitation of the study design which is survey type and does not identify basic determinants of NNM [3]. And study in Brazil classify NNM based only on organ-dysfunction markers it doesn't account for pragmatic criteria and has the limitation of representativeness since it's done in 17 Health facilities that are selected purposely [5]. The study in three African countries does not consider the differences in sociodemographic characteristics of the study area and which survey type study design. All studies in Ethiopia take the assumptions to calculate sample size from a study done in Brazil that has different sociodemographic and other characteristics. It does not incorporate some of the variables such as Health workers that attend delivery and partograph follow during attending labor [10-12].

The Neonatal near-miss approach will be important if it intervenes appropriately in newborn health. But the available study has some limitations, such as methodological differences, use only pragmatic criteria, representativeness, weak study design, doesn't incorporate important variables, and different determinants across the setting. So, this study attempted to identify determinants of NNM in this study area by facility-based case-control study design, by considering the above-mentioned limitation of available literature, and by adding some important factors like Partograph usage and delivery attended by.

## MATERIALS AND METHODS

### Study area and study period

Shashemene city administration is found in Oromia Region, 240 km from the capital Addis Ababa to South. This study was conducted in two public hospitals in Shashemene city in Melka Oda general hospital and Shashemene Comprehensive Specialized Hospital/SCSH/ from March 22, 2021, to May 22, 2021. An Institution-based unmatched case-control study design was conducted.

### Source population

All Livebirth neonates delivered in public hospitals in Shashemane city administration were used as Source population and study population for the case were all livebirth neonates delivered and admitted at NICU in hospitals and for controls were all livebirths' neonates delivered and diagnosed as healthy babies in hospitals.

### Inclusion and exclusion criteria

**Inclusion criteria:** Cases (Neonatal Near Miss) were livebirth delivered and admitted to the NICU of public hospitals in Shashemene city.

The control were neonates delivered and admitted to the postnatal or neonatal ward

**Exclusion criteria:** Home-delivered baby, multiple pregnancies, neonates referred from other health care institutions.

### Sample size determination techniques

The sample size was calculated using Epi Info 7 software, the confidence level of 95%, power of the study, 80%, the case-control ratio 1:2. Expected percent of exposures in control 11.7%, and percent exposure among cases 25.7%. It is calculated using a study done in Hawassa. Pregnancy Induced HTN as one of the main exposure variables for neonatal near-miss that provide the maximum sample size of 312 with a 10% non-response rate [10]. By adding the non-response rate sample size will be 104 cases and 208 controls.

### Operational definition

Neonatal Near Miss/NNM is considered when the newborn faced at least one of the following proposed criteria but survived those complications [5].

**Pragmatic criteria:** Birth weight <1750 g, Gestational age <33weeks, 5th-minute Apgar score <7 Management criteria; Mechanical ventilation, Cardiopulmonary Resuscitation (CPR), Intubation, Nasal Continuous Positive Airway Pressure (NCPAP), Parenteral antibiotics, use of parenteral nutrition, Vasoactive drugs, Phototherapy during the first 28 days, Anticonvulsants, use of blood products, use of steroids for the treatment of refractory hypoglycemia, Surgical procedures, Use antenatal steroid [4].

### The neonatal period

Refers to the day of birth up to 28 days of life [8].

**APGAR scoring** The APGAR score is now used worldwide to quickly assess the health of an infant one minute and five minutes after birth. The 1-minute APGAR score measures how well the

newborn tolerated the birthing process. The 5-minute APGAR score assesses how well the newborn is adapting to the environment [13].

### Newborn death

The death within 28 days of the birth of any live-born baby regardless of weight or gestational age [14]. Neonatal death occurs in approximately 1 in 250 births, the majority of which are expected due to perinatal complications, clinically identified congenital abnormalities, or complications of prematurity.

### Data quality control and data collection tools

The questionnaire was pretested in Dodola general hospital which has almost similar characteristics with this study area before the actual data collection period on 5% of the actual sample. Primary data; socio-demographic and economic characteristics of mothers were collected through face-to-face-interview and secondary data; obstetrics and medical history of mothers and neonatal characteristics were extracted from maternal and neonate medical.

### Method of data analysis

After data collection data were checked for consistency, coded, and entered by using EPI INFO 7 and exported to SPSS version 25 for analysis. Bivariate binary logistic regression was carried out to identify determinants of Neonatal Near Miss based on OR, 95% CI, and p-value of less than 0.05. Variables with  $p < 0.25$  in Bivariate binary logistic regression analysis entered into a Multivariate binary logistic regression model using the Backward LR. During Multivariate binary logistic regression analysis model fitness will be checked by Hosmer-Lemeshow model fitness. Variance Inflation Factors (VIFs) and Tolerance are used to check Multicollinearity among independent variables. A VIF below 10 and Tolerance above 0.1 were checked and SPSS output shows the absence of Multicollinearity.

## RESULTS

### Socio-demographic characteristics

In this study, 104 cases and 208 controls were involved with a null nonresponse rate for both cases and controls, as it was a case-control study. The mean age in years and a standard deviation of neonate's mother was  $26.85 \pm 7.17$  for cases and  $27.58 \pm 4.46$  for controls. Mothers of the newborns were under the age of 20 among

cases were 28 (26.9%) and only 12 (5.8%) among controls were under the age of 20. Out of neonate's mothers, 104 (50%) in cases and 61 (58.7%) in control groups were Muslim religion.

Eighty-three (79.8%) ethnic groups among cases and 130 (62.5%) control were Oromo. The educational status of neonate mothers among cases in primary education were 51 (49%) and among control 77 (37%). Regarding the education of fathers, 76 (36.5%) of neonates' fathers had the educational status of secondary among cases and 21 (20.9%) for controls. Housewife maternal occupation for maternal among cases was 74 (71.2%) and for control were 119 (23.1%) (Table 1).

### Obstetric factors and newborn condition

Ninety-nine (95.2%) of neonate mothers received at least one ANC visit among the cases group and 205 (98.6%) in control. Regarding the Number of ANC visits during the current pregnancy, 32 (30.8%) of neonates' mothers in cases and 175 (84.1%) in control had at least 4 visits.

Out of the total number of neonates' mothers, 49 (47.1%) of cases and 81 (38.9%) of controls were primipara. The birth interval between current and previous pregnancy in multipara mothers those with less than 24 months were 38 (66.6%) among cases and control 18 (13.5%) became pregnant within less than 24 months (Table 2).

### Determinants of neonatal near miss

Neonate's mother age group aged between 20 and 34 age years old were 0.12 less likely to experience NNM when compared to those aged less than 20 years old [AOR=0.12, 95%, CI=0.02-0.76].

Neonate mothers who give birth in GA of 37-41 weeks were 0.16 less likely to experience neonatal near-misses than neonates of <37weeks of gestational age at birth [AOR=0.16, 95% CI: (0.06-0.47)]. Neonate mother who was given birth by SVD were 0.38 times fewer odds of experiencing neonatal near miss than neonates who gave birth by IAD and CS [AOR=0.38, CI, 95% (0.22-0.68)]. Delivery followed by partograph was 0.25 less likely to develop neonatal near miss than those not followed by partograph [AOR=0.25 95% CI: (0.11-0.54)] (Table 3).

Finally, the Age of the mother, gestational age between 37-41 weeks, SVD, and delivery followed by partograph were identified as determinants of the neonatal near miss.

**Table 1:** Sociodemographic characteristics of the respondents from March 22, 2021, to May 22, 2021, in Melka Oda General Hospital and SCRH in Shashemene, Ethiopia

Variables	Category	Case N (%)	Control N (%)	Total N (%)
Age of mother	<20	28 (26.9)	12 (5.8)	40 (12.8)
	20-34	53 (51)	178 (85.6)	231 (68.26)
	>34	23 (22.1)	18 (8.7)	41 (13.14)
Place of Residence	Urban	45 (43.3)	98 (47.1)	143 (45.8)
	Rural	59 (56.7)	110 (52.9)	169 (54.1)
Religion	Muslim	104 (50)	61 (58.7)	165 (52.8)
	Orthodox	60 (28.8)	20 (19.2)	80 (25.6)
	Protestant	30 (14.4)	15 (14.4)	45 (14.4)
	Catholic	13 (6.3)	7 (6.7)	20 (6.4)
	Wakefata	1 (0.5)	1 (1)	2 (0.6)

Ethnicity	Oromo	83 (79.8)	130 (62.5)	130 (41.6)
	Amhara	12 (11.5)	34 (16.3)	56 (17.9)
	Wolaita	4 (3.8)	9 (4.3)	13 (4.1)
	Tigre	0 (0)	8 (3.8)	8 (2.5)
	Gurage	1 (1)	12 (5.8)	13 (4.1)
	Silte	3 (2.88)	15 (7.2)	17 (5.4)
	Admission mode of Mother	Self-referred	60 (57.7)	121 (58.2)
Referred from another facility		44 (42.3)	87 (41.8)	131 (41.9)
Means of transport to Hospital	Ambulance	48 (46.2)	86 (41.3)	134 (42.9)
	Public transport	52 (50)	104 (50)	156 (50)
	Personnel Vehicles and by walking	4 (3.8)	18 (8.6)	22 (7.05)
The educational level of the mother	No formal education	28(26.9)	26 (12.5)	54 (17.3)
	Primary (1-8)	51 (49)	77 (37)	128 (33.6)
	Secondary (9-12)	22 (21.2)	86 (41.3)	108 (34.6)
	Collage and above	3 (2.9)	19 (9.1)	22 (7.05)
The educational level of the Parental	No formal education	14 (6.7)	21 (20.2)	35 (11.2)
	Primary (1-8)	46 (22.1)	33 (31.7)	79 (25.3)
	Secondary (9-12)	76 (36.5)	21 (20.2)	97 (31.1)
	Collage and above	72 (34.6)	29 (27.9)	101 (32.3)
Occupation of the mother	House Wife	74 (71.2)	119 (23.1)	193 (61.8)
	Merchant	21 (20.2)	41 (19.7)	62 (19.8)
	Government or NGO Employee	8 (7.7)	48 (23.1)	56 (17.9)
	Daily Laborer	1 (1)	0 (0)	1 (0.0)
Family Size	<4	69 (66.3)	119 (57.2)	188 (60.2)
	04-Jul	18 (17.1)	75 (36.1)	93 (29.8)
	≥ 7	17 (16.3)	14 (6.7)	

**Table 2:** Obstetrics and neonatal related characteristics of neonatal near miss among neonates admitted from March 22, 2021, to May 28, 2021, in Melka Oda General Hospital and SCRH in Shashemane, Ethiopia.

Variables	Category	Case N (%)	Control N (%)	Total N (%)
Parity	Primipara	49 (47.1)	81 (38.9)	130 (41.6)
	Multipara	55 (52.9)	127 (61.1)	182 (58.3)
Birth Interval for Multi	<24	38 (66.6)	18 (13.5)	56 (30.4)
	≥ 24	13 (13.5)	115 (53.3)	128 (69.5)
Gestational age at Birth	<37	34 (33.6)	17 (8.1)	51 (16.3)
	37-41	59 (56.7)	170 (81.7)	229 (73.4)
	>41	11 (10.5)	10 (4.8)	21 (6.7)
At least one ANC during the current pregnancy	Yes	99 (95.2)	205 (98.60)	304 (97.4)
	No	5 (4.8)	3 (1.4)	8 (2.5)
Number of ANC 1st visit	<4 visits	72 (69.2)	33 (15.9)	105 (33.6)
	≥ 4 visits	32 (30.8)	175 (84.1)	207 (66.3)
Maternal preexisting condition	No History	197 (94.7)	98 (94.2)	295 (94.5)
Hypertension	Has history of	9 (8.6)	6 (2.8)	15 (4.8)
Presentation	Cephalic	98 (94.2)	194 (93.3)	292 (93.5)
	Breech Transverse/Face/Brow	6 (5.7)	14 (6.7)	20 (6.4)

Delivery Mode	Instrumental assisted delivery and CS	45 (43.2)	65 (31.2)	110 (35.2)
	SVD	59 (56.7)	143 (68.8)	110 (35.2)
Delivery Attended by	Obstetrician and Gynecologist	10 (9.6)	19 (9.1)	29 (9.2)
	IESO	33 (31.7)	60 (28.8)	93 (29.8)
	Midwife	61 (58.7)	129 (62)	190 (60.8)
Sex of Neonate	Male	49 (47.1)	115 (55.3)	164 (52.5)
	Female	55 (52.9)	93 (44.7)	148 (47.4)
Follow by partograph	No	23 (22.1)	19 (9.1)	42 (13.4)
	Yes	81 (77.8)	189 (90.8)	270 (86.5)
Maternal complication Dystocia	No complication	191 (91.8)	58 (55.8)	249 (79.8)
	Cephalopelvic Disproportion	1 (0.5)	14 (13.5)	15 (4.8)
	Prolonged labor	15 (7.2)	26 (25)	41 (13.1)
	Uterine pre rupture	1 (0.5)	6 (5.8)	7 (2.2)
Neonate's weight (in mg)	<2500	30 (28.8)	25 (12)	55 (17.6)
	2500-4000	72 (69.2)	179 (86.1)	251 (80.4)
	>4000	2 (1.9)	4 (1.9)	6 (1.9)

**Table 3:** Bivariable and multivariable analysis of factors associated with neonatal near-miss among neonates delivered and admitted (n=312) from March 22, 2021, to May 22, 2021, in Melka Oda General Hospital and SCRH in Shashemene, Ethiopia.

Variables (n=312)	Category	NNM		COR (95%CI)	AOR (95%CI)
		Case N%	Control N%		
Age of mother	<20	28 (26.9)	12 (5.8)	1	1
	20-34	53 (51)	178 (85.6)	0.13 (0.06-0.26)*	0.12 (0.02-0.76)**
	>34	23 (22.1)	18 (8.7)	0.54 (0.21-1.36)	0.56 (0.081-3.87)
The educational level of the mother	No formal education	51 (49)	77 (37)	1	
	Primary (1-8)	22 (21.2)	86 (41.3)	0.38 (0.16-2.78)	0.24 (0.10-1.96)
	Secondary (9-12)	3 (2.9)	19 (9.1)	0.24 (0.16-2.46)	0.18 (0.14-2.01)
	Collage and above	28 (26.9)	26 (12.5)	1.62 (1.34-5.01)	1.09 (0.52-2.25)
Parity	Primipara	49 (47.1)	81 (38.9)	1	1
	Multipara	55 (52.9)	127 (61.1)	0.71 (0.66-2.24)	0.68 (0.40-3.17)
At least one ANC during the current pregnancy	Yes	99 (95.2)	205 (98.60)	1	1
	No	5 (4.8)	3 (1.4)	3.45 (0.80-14.73)	1.39 (0.17-11.01)
Gestational age at Birth	<37	34 (33.6)	17 (8.1)	1	1
	37-41	59 (56.7)	170 (81.7)	0.17 (0.14-0.43)*	0.16 (0.06-0.47)**
	>41	11 (10.5)	10 (4.8)	0.55 (0.04-11.5)	0.02 (0.001-0.64)
Presentation	Cephalic	98 (94.2)	194 (93.3)	1	1
	Breech Transverse/ Face/Brow	6 (5.7)	14 (6.7)	0.84 (0.34-3.78)	1.06 (0.15-7.12)
Delivery Mode	Instrumental assisted delivery and CS	45 (43.2)	65 (31.2)	1	1
	SVD	59 (56.7)	143 (68.8)	0.59 (0.36-0.96)*	0.38 (0.22-0.68)**
Follow by partograph	No	23 (22.1)	19 (9.1)	1	1
	Yes	81 (77.8)	189 (90.8)	0.35 (0.18-0.68)*	0.25 (0.11-0.54)**

**Note:** \*\*Significant at a p-value of  $\leq 0.05$ .

## DISCUSSION

The result from the multivariable shows that the age of the mother between 20-34, gestational age 37-41 weeks, SVD, and delivery followed by partograph were identified as determinants of the neonatal near miss.

The age of mothers between 20 and 34 had lower odds of experiencing Neonatal Near Miss than those mothers of age below 20 years old [15]. This result is in line with a study done in Tigray that showed that being under 18 years of age at first marriage [AOR=2.8, 95%CI: 1.18-6.83], had higher odds of experiencing NNM than those above the age of 18 [16]. This is because at early age physiological and psychological they aren't enough matured and early pregnancy in the prematurity stage is associated with a neonatal near miss. Additionally, as most of the respondents were from rural areas and uneducated, there is still early marriage in the area.

A study done in Brazil show that advanced maternal age (>35 years old) was to be a risk factor for neonatal near-miss in nulliparous (OR=1.62; 95%CI: 1.05-2.50) and multiparous women (OR=1.51; 95%CI: 1.20-1.91) when compared to women 20-29 years of age [17]. There were also in a study done in northeast Brazil Infants born to older mothers showed a nearly 2-fold risk of neonatal near miss, compared to mothers aged 20 to 34 (OR: 0.43; 95% CI: 0.23-0.83) [18]. But studies did in Brazil use different age group categories with a range of 10 years when compared with the current study.

Another variable which significantly associated with NNM was GA. GA with 37-41 weeks had 0.16 times lower odds of experiencing neonatal near miss than neonates of <37 weeks of gestational age at birth [AOR=0.16, 95% CI: (0.06-0.47)]. In line with this result, in a study in Ghana, the most predictive element of the NNM was gestational age >33 weeks, study in Brazil gestational age <33 weeks was identified in 85.7% of hospitalized newborns, and this was the factor that most contributed to the near-miss rate [19,20]. Also, a study conducted in Brazil, shows that >80% of near-miss cases were <30 weeks of gestational age this is because most complications have supposed to be related to prematurity [16]. In Ethiopia also study conducted in Ambo shows that the gestational age between 36-41 weeks was protected against neonatal near miss than neonates of  $\geq 42$  weeks of gestational age at birth [AOR=0.13, 95% CI: (0.051, 0.32)] this is because prematurity imposes the newborn with life-threatening conditions because of his immature organ [21].

Opposite to the result, in a study done in three African countries (Benin, Burkina Faso, and Morocco) most neonatal near misses occurred in babies without extreme values of gestational age (>41) [21]. This result shows the opposite of the current study it's because of methodological differences, study setting, and use large sample size than the current study.

Another variable that determined NNM was the mode of the delivery study shows that neonates with SVD had fewer odds of experiencing NNM than those delivered assisted instrumentally and CS. This result shows a similar conclusion to a study done in Ambo which reveal that neonates who were given birth by instrumental delivery had higher odds of experiencing neonatal near miss than neonates who gave birth by spontaneous vaginal delivery [AOR=4.62, 95% CI: (1.78, 11.98)] [19]. It is supposed to be a fact that instrumental delivery can cause a lot of adverse effects on neonates and mothers and the increased risk of such complications

is estimated to lead to NNM. Another study in Gamo Gofa shows that mothers who gave birth by cesarean mode of delivery were 4.89 times more likely to have NNM cases than SVD and Instrumental assisted delivery [18]. And also in other ways, evidence from Brazil stated that the neonatal near miss rate was higher among babies delivered by C/S than in those delivered through SVD. The result shows the same result as the current result.

Another variable, delivery followed by partograph had fewer odds of developing Neonatal near-miss than not followed by partograph. Even though there was no study supporting this finding, it is a fact that delivery not followed by partograph can lead to a lot of adverse effects on neonates and mothers. To avoid adverse outcomes a chart called a partograph will help you to follow the progress of labor that is prolonged and which may be obstructed. It will also alert you to signs of fetal distress. The partograph has been established as the "gold standard" labor monitoring tool universally. It has been recommended by the World Health Organization (WHO) for use in active labor [8].

In this study Occupation of mother and parental, marital status, complication during labor and delivery, parity, delivery attended health worker, and presentation was insignificantly associated with a neonatal near miss [22]. And also, ethnicity, religion, sex of neonate, and place of residence had no significant association with neonatal near-miss cases in this finding [23]. This is because, nowadays there is an improvement in the health care delivery system, advances in technology, and seeking health information irrespective of residence, Ethnicity, religion, and educational status [24].

Finally, the strength of this study was employing standardized neonatal near miss identification criteria to avoid misclassification and the incomplete questionnaires were filled to get a 100% response rate of the respondents [25]. This study didn't analyze the selection criteria for case events, the criteria only identify the neonatal near-miss event and identify the additional determinant factor (Partograph usage) that isn't addressed yet in published literature.

## CONCLUSION

Age of mother, gestational age, delivery mode, and delivery followed by partograph were determinants of the neonatal near-miss in public hospitals in Shashemene, Oromia and other researchers should do further investigation into the NNM event. So, for women who conceive at below 20 years of old, mothers that will not give birth by spontaneous vaginal delivery should be advised of the greater risk of neonatal near misses. Health workers in the delivery ward should use partograph for every delivery in both hospitals.

## LIMITATION

In this study, data corresponding to sociodemographic and economic variables was collected by interviews and might be subject to recall bias. The readers should consider the limitations of this study while interpreting the finding and the other scholars will do more to overcome those limitations.

## DATA SHARING

Data sharing not applicable at this article as no datasets were generated or analyzed by this study.

## ETHICS APPROVAL

Ethical approval for the trial was obtained from WCG IRB (#20212330) and in addition to each site IRB. Written informed consent will be obtained from all participants. Data and safety monitoring of the trial will be done by an independent Data Safety Management Board (DSMB) who have no conflict of interest in trial outcome or affiliation with sponsor.

## AUTHOR CONTRIBUTIONS AND ACKNOWLEDGEMENTS

A.E.D: Designed research, J.S.L: Performed research, analyzed data and wrote the paper, L.T.O.G; J.C.B; O.F.A.G; L.N.O; C.I; Performed research, J.T: Contributed vital new reagents or analytical tools.

## COMPETING INTERESTS

All authors have no competing interests, Henok Girma, Bikila Lenca, Lalisa Gedefa, Sintayehu Gabisa, and Bonso

Ami declare that they have no competing interests.

## DECLARATION

### Ethical consideration and consent to participate

Ethical clearance was obtained from the institutional review board of the school of public health at Madda Walabu University. It was confirmed that the study met the ethical and scientific standards outlined in national and International guidelines. The consent to participate in the study from the mother was obtained before data Collection. The privacy and confidentiality of their personal information were protected according to ethical principles for medical research involving human subjects of the World Medical Association Declaration of Helsinki.

## AUTHORS' CONTRIBUTIONS

HG wrote the draft proposal, participated in data collection, and analyzed the data. BL, LK, SG, and BA approved the proposal with major revisions, participated in data analysis, and revised subsequent drafts of the paper. All authors read and approved the final manuscript.

## FUNDING

No fund was obtained for this research.

## CONSENT FOR PUBLICATION

Not applicable

## AVAILABILITY OF DATA AND MATERIALS

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

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