

Effect of place of birth on knowledge of neonatal danger signs and associated factors among mother's in Meicha district, Northwest Ethiopia: A community-based comparative cross-sectional study.

Teferi Gebru Gebremeskel^{1*}, Adino Tesfahun Tsegaye², Alehegn Bishaw Geremew³, Teklit Grum¹, Hailay Abrha Gesesew^{4,5}, Paul R Ward⁴

¹Department of Reproductive Health, College of Health Sciences, Aksum University, Aksum, Ethiopia

²Department of Epidemiology and Biostatistics, Institute of Public Health College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

³Department of Reproductive Health, Institute of Public Health College of Medicine and Health Sciences, Gondar University of Gondar, Gondar, Ethiopia

⁴Discipline of Public Health, Flinders University, Adelaide, Australia

⁵Departments of Epidemiology, College of Health Sciences, Mekele University, Mekele, Ethiopia

Abstract

Introduction: Neonatal mortality in Ethiopia remains high accounting for 29 per 1,000 live births.

Objective: This study compares the knowledge of neonatal danger signs and associated factors of mothers who gave birth at home and health facilities in Northwest Ethiopia.

Methods: A comparative community-based cross-sectional study was conducted. A simple random sampling method was used to select the participants. A binary logistic regression analysis was used to identify correlations.

Results: A total of 650 mothers were interviewed. Of these, 50.7% (95% CI=45.7, 55.9) of the mother is aware of the signs of neonatal danger in the district. Knowledge of neonatal danger sign is higher among those who give birth in health care 60.1% than home births 41.1% mothers.

Maternal age (AOR: 3.99, 95% CI: (1.45-11.03)), age new born (AOR: 0.53, 95% CI: (0.36-0.78)), Para (AOR:1.27, 95% CI: (1.37-5.31)), postnatal care attendance (AOR=2.42, 95% CI: (1.47, 3.96)) were significantly associated with overall mother's knowledge. Whereas, residence (AOR: 3.09, 95% CI: (1.44, 6.64)) and occupational of husband (AOR: 0.23, 95% CI: (0.201, 0.67)) were significantly associated with mothers who give birth in health care. Age of new born (AOR: 0.50, 95% CI: (0.28,0.896)), parity(AOR: 0.29, 95% CI: (0.113,0.74)), antenatal care (AOR: 12.04, 95% CI: (5.9,24.65)) was closely associated with home birth mother.

Conclusion: The overall mother's knowledge of neonatal danger signs was low but was high among mothers who delivered at health institutions than those who delivered at home. This implies that we need to strengthen the awareness of neonatal danger signs among home-delivered mothers.

Keywords: Neonatal danger sign, Knowledge, Institution delivery, Home delivery.

Accepted on July 20, 2021

Introduction

Neonatal mortality is one of the world's most neglected and still a significant public health problem. It is estimated that globally, four million deaths during the first 4 weeks of life occur every year, and 75% of neonatal deaths happen in the first week of life [1,2]. Out of the whole neonatal deaths, 99% occur in Low and Middle Income Countries (LMICs), mostly in sub-Saharan Africa [1,3-5]. A majority of these newborn deaths occur at home, indicating that few families recognize signs of newborn illness, and/or a majority of the neonates are not taken to health facilities when they are sick [4]. Demographic and health survey data from 40 countries collected between 1995 and 2003 reported that more than 50 percent of neonatal deaths occur after home birth [6-8].

Different tools to facilitate the identification of these health problems and reduce neonatal mortality have been introduced into health programs in several countries [9]. Integrated Management of Newborn and Childhood Illness (IMNCI) developed by the WHO focuses on the assessment of general danger signs in the examination of neonates presenting with illness at health care centers [9]. The danger signs of severe illness included are the history of difficult feeding, convulsion, respiratory rate of over 60 breaths per minute, severe chest in-drawing, body temperature above 37.5°C, body temperature below 35.5°C, movements when only stimulated, yellow soles (a sign of jaundice), umbilical redness or draining pus, skin boils, eyes draining pus, and vomiting [10]. Over the past several decades, the global incidence of under-five mortality has steadily decreased. Death during the neonatal period

accounts for almost two-thirds of all deaths in the first year of life and 40% of deaths before the age of five [1,11,12]. Evidence shows that decreasing the proportion of deliveries conducted at home could reduce prenatal death by nearly half [1,13,14].

Africa, accounting for a prevalence rate of 39%, has scored the slowest decrement in NMR with a decline of only 19% from 1990 to 2010, compared to a 43% decline in high-income countries [10]. Ethiopia is one of the top ten countries of global neonatal mortality, with an estimated 122,000 newborn deaths per year [4]. The Ethiopian Demographic Health Survey (EDHS) surveys have shown close to 73% of delivery in Ethiopia takes place at home, indicating the potential to miss to recognize the danger signs early [15]. Recent studies identified that predictors for knowledge about neonatal danger signs were educational status, obstetric status, health institutions related factors, the consumption of Maternal and Child Health (MCH) services, and place of births [16-22]. There are inadequate studies in Ethiopia which assessed the mother's knowledge about neonatal danger signs and associated factors which affect the knowledge status, and none in the current study setting. This study estimated the maternal level of knowledge towards neonatal danger signs by comparing mothers who delivered at home and health facilities.

Methodology

A community based comparative cross-sectional study was conducted in Meicha District, North Ethiopia from March to April 2018. Meicha is located 543 Km away from the Northwest of Addis Ababa, the capital city of Ethiopia. The total population of the Meicha district was 614,022 in 2018. The local communities in the district largely depend on agriculture [23]. Mothers who lived at least 6 months in Meicha districts and gave live birth two months before the data collection were included for the interview. Mothers who were not mentally competent for an interview or had any psychiatric disorders and/or had a serious illness were excluded from the study.

The sample size was calculated using a two population proportion formula; considering mother's knowledge of neonatal dangers sign 41% [17], 95% confidence level (1.96), Power 80% design effect 1.5% and 5% possible non-response rate. The sample size was estimated to be 650 (325 home-delivered and 325 Health institutions delivered). A simple random sampling technique was employed to recruit study participants. We have recruited 25 of 53 kebeles in the district through simple random sampling (lottery method) and numerated 917 mothers who gave birth the last two months (381 at Home and 536 at Health institution), which served as a sampling frame. Then, the sample size was allocated proportionally for each selected kebeles.

The interview was conducted at the study participants' homes. The dependent variable of the study was knowledge status towards neonatal danger signs, dichotomized as good and poor knowledge. Good knowledge was assumed if a mother who mentioned three of the ten danger signs for neonate without

probing and more than three danger signs with probing [21,24]. Recently delivered mothers were assumed as a mother who delivered before 2 months of the survey irrespective of how many births gave before. Data were collected *via* an interview with a pre-tested and structured questionnaire. Three nurse diploma collectors and one BSc nurse supervisor were used to collecting and controlling the data. We delivered training for data collectors and supervisors on the study's objective, ethical procedures, and data collection techniques. The questionnaire consisted of information on socio-demographic characteristics, obstetric characteristics, and place of delivery, maternal health service exposure, health Institutions related factors, and other questions.

Data were coded, entered into Epi-Data version 3.1, and exported into SPSS version 21 software for analysis. A binary logistic regression model was used to determine factors affecting knowledge of neonatal danger signs. We have fitted three separate logistic regression models: (i) Model to determine the association between exposure variables and knowledge to neonatal danger signs among all mothers irrespective of place of delivery; (ii) Model to determine the association between exposure variables and knowledge of neonatal danger signs among mothers delivered at home; and (iii) Model to determine the association between exposure variables and knowledge to neonatal danger signs among mothers who delivered at the health facility. Multicollinearity was checked to test correlation among predictor variables and Hosmer and Lemeshow test P-value (>0.2) was conducted to check the fitness of the model. Odds ratio and P-value was determined to check the association between variables and p-value <0.05 was considered as a cut-off for statistical significance.

Ethical clearance was obtained from the Institute of Public Health, College of Medicine and Health Sciences, University of Gondar. A letter of permission was obtained from administrative bodies of the West Gojam zone Health Department, Meicha district, and selected kebeles. A letter of cooperation from kebeles administrators was also secured. Finally, written and verbal consent was obtained from every study participant included in the study during data collection time after explaining the objectives of the study and the right to withdraw from the study at any time. Written informed consent was obtained from a parent or guardian for participants under 16 years old.

Results

Socio-demographic characteristics of the participant's

A total of 637 mothers' (with a response rate of 98%) were interviewed. Out of the total participated women, 316(49.6%) of them delivered at health institutions, and 321(50.4%) at home. The mean age of the study participants was 29.59(SD +6.52) years. Among the study participants, 158(45.4%) health institutions and 190(5.5%) home-delivered mothers were able to read and write (Table 1).

Effect of place of birth on knowledge of neonatal danger signs and associated factors among mothers in Meicha district, northwest Ethiopia: A community-based comparative cross-sectional study.

Characteristics		No (%)	NDS knowledge among HID mothers		NDS knowledge among HD mothers	
		n=637	Good (%)	Poor (%)	Good (%)	Poor (%)
Age	15-19	56(8.8)	11(55.0)	9(45.0)	11(30.6)	25(69.4)
	20-24	106(16.6)	34(73.9)	12(26.1)	25(41.7)	35(58.3)
	25-29	139(21.8)	59(61.5)	37(38.5)	12(27.9)	31(72.1)
	30-34	162(25.4)	44(62.9)	26(37.1)	46(50.0)	46(50.0)
	35+	174(27.3)	43(51.2)	41(48.8)	38(42.2)	52(57.8)
Marital status	Married	597(93.7)	181(60.7)	117(39.3)	120(40.1)	179(59.9)
	Single	40(6.3)	10(55.6)	8(44.4)	12(54.9)	10(45.5)
Residence	Urban	92(85.5)	59(81.9)	13(18.1)	12(60.0)	8(40.0)
	Rural	545(14.5)	132(54.1)	112(45.9)	120(39.9)	181(60.1)
Educational status of the mother	Able to read and write	348(54.6)	74(46.8)	84(53.2)	69(36.3)	121(63.7)
	Cannot read and write	125(19.6)	29(63.0)	17(37.0)	43(54.4)	36(45.6)
	Grade (1-8)	95(14.9)	47(83.9)	9(16.1)	14(35.9)	25(64.1)
	Grade (9-12)	52(8.2)	32(82.1)	7(17.9)	6(46.2)	7(53.8)
	College and above	17(2.7)	9(52.9)	8(47.1)	0(0.0)	0(0.0)
Educational status of the husband	Able to read and write	253(39.7)	55(45.1)	60(52.2)	53(38.4)	85(61.6)
	Cannot read and write	219(34.4)	62(63.3)	31(33.3)	57(45.2)	69(54.8)
	Grade (1-8)	86(13.5)	31(64.6)	17(35.4)	10(26.3)	28(73.7)
	Grade (9-12)	45(7.1)	20(71.4)	8(28.6)	11(64.7)	6(35.3)
	College and above	34(5.3)	23(71.9)	9(28.1)	1(50.0)	1(50.0)
Occupation status of mothers	Gov't employee	13(2.0)	12(100)	0(0.0)	1(100.0)	0(0.0)
	Private employee	42(6.6)	22(81.5)	5(18.5)	3(20.0)	12(80.0)
	Housewife	265(41.6)	98(61.6)	61(38.4)	60(56.6)	46(43.4)
	Farmer	272(42.7)	37(43.0)	49(57.0)	63(33.9)	123(66.1)
	Merchant	31(4.9)	19(73.1)	7(26.9)	3(60.0)	2(40.0)
	Student	14(2.2)	3(50.0)	3(50.0)	2(25.0)	6(75.0)
Occupation status of husbands	Gov't employee	18(2.8)	14(100)	0(0.0)	1(25.0)	3(75.0)
	Private employee	208(32.7)	89(71.8)	35(28.2)	42(50.0)	42(50.0)
	Farmer	266(41.8)	35(43.8)	45(56.2)	63(33.9)	123(66.1)
	Daily laborer	81(12.7)	24(42.9)	32(57.1)	15(60.0)	10(40.0)
	Merchant	64(10.0)	29(69.0)	13(31.0)	11(50.0)	11(50.0)
Monthly income	<1200 ETB	136(21.4)	44(57.9)	32(42.1)	12(20.0)	48(80.0)
	1200-3000 ETB	207(32.5)	47(59.1)	32(40.9)	66(54.1)	56(45.9)
	3001-5000 ETB	215(33.8)	66(66.7)	33(33.3)	44(39.6)	67(60.4)
	>5000 ETB	79(12.4)	34(54.8)	28(45.2)	10(35.7)	18(64.3)

Table 1. Socio-demographic characteristics and knowledge of neonatal danger sign among health institution and home-delivered mothers in Meicha District, Northwest Ethiopia, 2018. ETB: Ethiopia Birr, HID: Health institution delivered, HD: Home Delivered, NDS: Neonatal Danger Sign.

Mother’s knowledge of neonatal danger signs at health institution and home delivery

Health workers were the most common source of information for neonatal danger signs, which was recorded in 392(73.7%)

mothers (Figure1). The majority of participants (83.4%) had information heard about neonatal danger signs for their recent birth. Out of the total participants, 80.5% of mothers knew at least one danger sign (Table 2).

Characteristics	No (%) N=637	H I Deliver	H Delivery
		Knowledge of KND	Knowledge of KND
		Yes%	Yes%
Fever	421(66.1)	237(75.0)	184(57.3)
Poor sucking or not able to breast feeding	389(61.1)	232(73.4)	157(48.9)
Information heard about NDS	531(83.4)	300(56.5)	231(43.5)
Difficulty breathing	285(44.7)	167(52.8)	118(36.8)
Lethargy, unconscious, or weakness	172(27.0)	97(30.7)	75(23.4)
Vomiting	163(25.6)	84(26.6)	79(24.6)
Umbilical cord redness or pus	121(19.0)	72(22.8)	49(15.3)
Hypothermia	97(15.2)	55(17.4)	42(13.1)
Fast breathing	78(12.2)	41(13.0)	37(11.5)
Jaundice or yellowish of palms /soles/ eye)	53(8.3)	38(12.0)	15(4.7)
Convulsion	33(5.2)	20(6.3)	13(4.0)

Table 2. Knowledge of neonatal danger signs at health institution and home delivery mothers in Meicha district, northwest Ethiopia 2018.

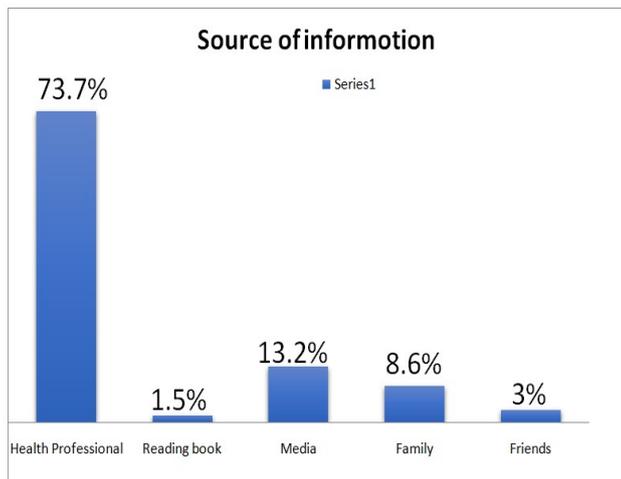


Figure 1. Diagrammatic presentation of source information with mother the last two month giving birth at home and health institution in Meicha Woreda, Northwest Ethiopia 2018.

The overall Knowledge of neonatal danger sign was 50.7% (95%, CI=45.7, 55.9). The proportion of mothers having good knowledge of neonatal danger sign was 60.1%(95%, CI=55.1, 65.8) among health Institutions delivered and 41.1% (95%, CI= 35.8, 46.1) among home-delivered mother (Figure 2).

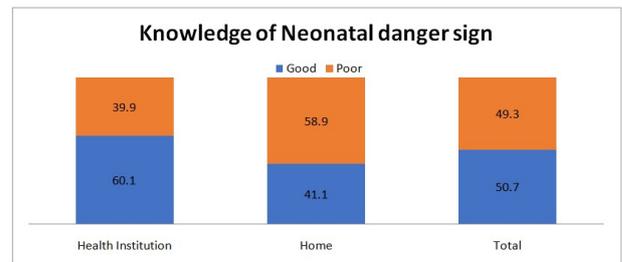


Figure 2. Diagrammatic presentation of mother’s knowledge of neonatal danger sign between Health Institution and Home delivered mothers in Meicha Woreda, north west Ethiopia 2018.

Obstetric, health institution, and maternal and child health services related factors

One hundred eleven (66.1%) of health institutions and 57 (31.7%) home delivery mothers had four and more ANC visits. Out of the total participants, 175 (60.4%) of health institutions, and 56 (71.8%) home-delivered mothers had a history of PNC attendance. Among the interviewees, 188 (61%) of health institution delivered mothers, and 126(41.0%) home-delivered mothers had access to modern health facilities in their localities. One hundred eighty-five (62.1%) of health institutions and 124 (40.3%) home-delivered mothers

Effect of place of birth on knowledge of neonatal danger signs and associated factors among mothers in Meicha district, northwest Ethiopia: A community-based comparative cross-sectional study.

had reported that health workers had a good approach for patients (Table 3).

Characteristics'		No (%) N= 637	NDS knowledge among HID mothers		NDS knowledge among HD mothers	
			Good	Poor	Good	Poor
Age of newborn	< 30 days	307(48.2)	81(62.8)	48(37.2)	85(47.8)	93(52.2)
	31-60 days	330(51.8)	110(58.8)	77(41.2)	47(32.9)	96(67.1)
Parity	1	100(15.6)	30(53.6)	26(46.4)	11(25.0)	33(75.0)
	02-Apr	344(54.0)	123(64.1)	69(35.9)	54(35.5)	98(64.5)
	≥ 4	193(30.2)	38(55.9)	30(44.1)	67(53.6)	58(46.4)
ANC attendance	Yes	471(72.5)	179(65.3)	95(34.7)	120(60.9)	77(39.1)
	No	166(25.5)	12(28.6)	30(71.4)	12(9.7)	112(90.3)
Frequency of ANC visits	<4	289(44.5)	80(54.1)	68(45.9)	75(53.2)	66(46.8)
	≥ 4	384(53.5)	111(66.1)	57(33.9)	57(31.7)	123(68.3)
Mode of delivery	SVD	507(79.6)	99(53.2)	87(46.8)	132(41.1)	189(58.9)
	Episiotomy	84(13.2)	65(77.4)	19(22.6)	0(0.0)	0(0.0)
	Instrumental Cesarean Section	23(3.6)	14(60.9)	9(39.1)	0(0.0)	0(0.0)
		23(3.6)	13(56.5)	10(43.5)	0(0.0)	0(0.0)
Faced complication during delivery	Yes	116(17.8)	32(56.1)	25(43.9)	34(57.6)	25(42.4)
	No	521(80.2)	159(61.4)	100(38.6)	98(37.4)	164(62.6)
PNC attendance	Yes	351(54.0)	165(60.4)	108(39.6)	56(71.8)	22(28.2)
	No	286(44.0)	26(60.5)	17(39.5)	76(31.3)	167(68.7)
Frequency of PNC visits	<3	606(95.1)	187(60.3)	123(39.7)	117(39.5)	179(60.5)
	≥ 3	31(4.9)	4(66.7)	2(33.3)	15(60.0)	10(40.0)
Assistance of delivery	HP	316(48.6)	190(60.5)	124(39.5)	2(100.0)	0(0.0)
	HEW	7(1.1)	1(100.0)	0(0.0)	2(33.3)	4(66.7)
	TBA	165(25.4)	0(0.0)	0(0.0)	56(33.9)	109(66.1)
	Relative (friend)	149(22.9)	0(0.0)	1(0.0)	72(48.6)	76(51.4)
Accessibility of modern health facility	Yes	615(94.6)	188(61.0)	120(39.0)	126(41.0)	181(59.0)
	No	22(3.4)	3(37.5)	5(62.5)	6(42.0)	8(57.1)
Type of modern health facility	Health post	488(75.1)	139(61.5)	87(38.5)	110(42.0)	152(58.0)
	Health center	147(22.6)	52(57.8)	38(42.2)	22(38.6)	35(61.4)
	Hospital	1(0.2)	0(0.0)	0(0.0)	0(0.0)	1(100.0)
	Private clinic	1(0.2)	0(0.0)	0(0.0)	0(0.0)	1(100.0)
Distance from HC	<10Km	508(78.2)	175(62.9)	103(37.1)	115(50.0)	115(50.0)
	>10km	129(19.8)	16(42.1)	22(57.9)	17(18.7)	74(81.3)
The price of health service affects to choice	Yes	127(19.9)	34(51.5)	32(48.5)	29(47.5)	32(52.5)
	No	510(80.1)	157(62.8)	93(37.2)	103(39.6)	157(60.4)
Health workers have a good approach to patients	Yes	606(93.2)	185(62.1)	113(37.9)	124(40.3)	184(59.7)
	No	31(4.8)	6(3.3)	12(66.7)	8(61.5)	5(38.5)

Table 3. Obstetric, health institution, and maternal and child health services related factors and knowledge of NDS among mothers in Meicha district, Northwest Ethiopia 2018. HID: Health Institution Delivered, HD: Home Delivered, HP: Health Professional, HEW: Health Extension Worker, TBA: Traditional Birth Attendance, NDS: Neonatal Danger Sign, SVD: Spontaneous Vaginal Delivery.

Factors associated with the mother's knowledge of NDS

As described in the methodology section, we have fitted three different models to assess the mother's knowledge of neonatal danger signs. The first model was fitted to assess the overall factors of the mother's knowledge of neonatal danger signs.

Variable such as place of birth, age, postnatal follow-up, parity, age of the newborn, and far from health center was significantly associated with mothers' knowledge of neonatal danger sign among all mothers irrespective of their place of birth.

This model shows that place of delivery, age of mothers, mothers who attended postnatal care, and distance from a health facility were significantly associated factors with knowledge of neonatal danger signs.

The odds of being knowledgeable about neonatal danger signs among mothers who delivered at the health facility were 11 times higher than mothers who delivered at home (AOR: 11.21, 95% CI (5.407, 24.483)). Mothers age 15-19 years (AOR: 3.99, 95% CI (1.45, 11.03)), and mothers' who participate in postnatal care (AOR: 2.42, 95% CI (1.47, 3.96)) were more likely knowledgeable than their counterparts. Mothers with a baby less than 30 days old were 47% times (AOR: 0.53, 95% CI (0.36, 0.78)) less like to know about the danger of signs of neonates than mothers a baby older than 30 days. Besides, mothers who lived more than 10 km away from the health facility were 54% (AOR: 0.46, 95% CI (0.27, 0.78)) less likely to know the danger of signs of neonates than mothers who live in a radius of 10 km of the health facility. The odds of being knowledgeable about neonatal danger signs among mothers who delivered four or more times were 27% higher than mothers who delivered two to four times (AOR: 1.27, 95% CI (1.37, 5.31)) (Table 4).

Variable		Knowledge neonatal danger sign (n=637)			
		Good	Poor	COR(95% CI)	AOR(95% CI)
Age of mothers	15-19	31(81.6)	7(18.4)	3.9(1.61,9.2)*	3.99(1.45,11.03)*
	20-24	47(44.3)	59(55.7)	0.74(0.43,1.13)	0.81(0.43-1.54)
	25-29	70(47.6)	77(52.4)	0.79(0.51,1.23)	1.011(0.57,1.79)
	30-34	73(42.4)	99(57.6)	0.64(0.42,0.98)	0.66(0.39,1.12)
	35+	93(53.4)	81(46.6)	1	1
Residence	Urban	289(52.4)	263(47.6)	1	1
	Rural	25(29.4)	60(70.6)	0.38(0.23,0.62)	0.74(0.36,1.51)
Age of new born	<30 day	166(54.1)	141(45.9)	1	1
	≥30 day	157(47.6)	173(52.4)	0.77(0.64,0.93)	0.53(0.36,0.78)**
Distance of health center	≥10k	290(57.1)	218(42.9)	0.26(0.2,0.33)	0.46(0.27,0.78)*
	<10k	33(25.6)	96(74.4)	1	1
Para	1	88(45.6)	105(54.6)	0.89(0.63,1.27)	0.68(0.43,1.07)
	02-Apr	171(48.4)	182(51.6)	1	1
	≥4	55(60.4)	36(39.6)	1.63(1.02,2.60)*	1.27(1.37,5.31)**
ANC	<4 visit	168(48.3)	180(51.7)	1	1
	≥4 visit	155(53.6)	134(46.4)	1.24(1.03,1.49)	0.95(0.68,1.33)
Place of delivery	Home	132(41.1)	189(58.9)	1	1
	Health facility	191(60.4)	125(39.6)	2.19(1.59,3.03)	11.21(5.41, 24.48)**
PNC	Yes No	221(63.0)	130(37.0)	3.07(2.27,4.24)**	2.42(1.47,3.96)**
		102(35.7)	184(64.3)	1	1

Table 4. Factors associated with knowledge of neonatal danger sign among mothers in Meicha District, Northwest Ethiopia, 2018. *: Significant results, 1: Reference category, **: p-value<0.001, *: p-value ≤ 0.05.

Effect of place of birth on knowledge of neonatal danger signs and associated factors among mothers in Meicha district, northwest Ethiopia: A community-based comparative cross-sectional study.

The second model was fitted to determine factors affecting knowledge of neonatal danger signs among mothers who delivered at the health facility. Accordingly, the residence and occupational status of the husband showed a significant statistical association. The odds of being knowledgeable about neonatal danger signs among mothers who live in urban three

times were higher than mothers who live in rural (AOR=3.09, 95% CI (1.44, 6.64). Health institutions delivered mothers with farmer occupations were 77% (AOR=0.23 95% CI (0.207, 0.67) more likely to be knowledgeable than their counterparts (Table 5).

Variable		Knowledge of NDS		COR(95% CI)	AOR(95% CI)
		Good (n %)	Poor (n %)		
Residence	Rural	13(18.1)	59(81.9)	1	1
	Urban	112(45.9)	132(45.9)	3.85(2.01-7.39)*	3.09(1.44-6.64)*
Occupation status of Husbands	Gov't employee	10(41.7)	14(58.3)	1	1
	Private employee	13(31.0)	29(69.0)	0.63(0.22-1.78)	0.599(1.95-1.84)
	Farmer	25(21.9)	89(78.1)	0.39(0.16-0.99)	0.23(0.21-0.67)*
	Daily laborer	32(57.1)	24(42.9)	1.87(0.71-4.92)	1.15(0.37-3.63)
	Merchant	45(56.2)	35(43.8)	1.8(0.72-4.54)	0.91(0.30-2.75)
Distance from Health center	<10Km	103(37.1)	175(62.9)	0.43(0.22-0.85)	0.52(0.24-1.12)
	≥ 10km	22(57.9)	16(42.1)	1	1
Monthly Income	<1200 ETB	32(42.1)	44(57.9)	0.88(0.45-1.74)	0.59(0.25-1.37)
	1200-3000 ETB	32(40.5)	47(59.5)	0.83(0.42-1.62)	0.70(0.31-1.58)
	3001- 5000 ETB	33(33.3)	66(66.7)	0.61(0.32-1.17)	0.44(0.21-0.93)
	>5000 ETB	28(25.2)	34(54.8)	1	1
Frequency of visit ANC	<4	68(45.9)	80(54.1)	1.66(1.05-2.61)	1.52(0.91-2.53)
	≥ 4	57(33.9)	111(66.1)	1	1

Table 5. Factors associated with knowledge of neonatal danger sign among health institutional delivered mothers in Meicha district, Northwest Ethiopia, 2018. *: Significant results, 1: Reference category, **: p-value<0.001, *: p-value ≤ 0.05.

The third model was fitted for home-delivered mothers only. As a result, home delivers mothers who had a baby older than 30 days were 50% (AOR=0.50, 95% CI=(0.28, 0.896) higher to be knowledgeable about neonatal danger signs than their counterparts. The odds of being knowledgeable about neonatal danger sign among mothers who attend ANC was 12 times more than mothers who did not attend ANC (AOR=12.04, 95%

CI (5.9, 24.65). Mothers who gave four or more births were three times more likely to know about neonatal danger signs than those who gave birth once (AOR=0.29, 95% CI=0.113, 0.74). Mothers who received postnatal care services were four times more likely to know (AOR=0.27, 95% CI=0.138, 0.51) than those who did not receive (Table 6).

Variable		Knowledge of NDS		COR(95% CI)	AOR(95% CI)
		Good (n%)	Poor (n%)		
Age newborn in day	<30 day	93(52.2)	85(47.8)	0.54(0.34-0.85)*	0.50(0.28-0.89)*
	≥30day	96(67.1)	47(32.9)	1	1
Residence	Urban	12(54.5)	10(45.5)	1	1
	Rural	120(40.1)	179(59.9)	1.79(0.75-4.28)*	1.035(0.38-2.85)
Monthly Income	<1200 ETB	48(80.0)	12(20.0)	2.22(0.82-6.03)	1.82(0.52-6.33)
	1200-3000 ETB	56(45.9)	66(54.1)	0.47(0.20-1.10)	0.44(0.14-1.32)
	3001- 5000 ETB	67(60.4)	44(39.6)	0.85(0.36-2.00)	0.77(0.25-2.37)
	>5000 ETB	18(64.3)	10(35.7)	1	1

Parity	1	98(64.2)	54(35.5)	0.61(0.28-1.29)	0.425(0.17-1.09)
	02-Apr	58((46.4)	67(53.6)	0.29(0.13-0.62)	0.29(0.11-0.74)*
	≥4	33(75.0)	11(25.0)	1	1
ANC attendance	No	12(9.7)	112(90.3)	1	1
	Yes	120(60.9)	77(39.1)	14.6(7.51-28.2)**	12.04(5.9-24.65)**
PNC attendance	Yes	167(68.7)	76(31.3)	1	1
	No	22(28.2)	56(71.8)	0.18(0.10-0.31)**	0.27(0.14-0.51)**

Table 6. Factors associated with knowledge of neonatal danger signs among home delivery mothers in Meicha district, Northwest Ethiopia, 2018.*: Significant results, 1: Reference category, **: p-value<0.001, *: p-value ≤ 0.05.

Discussion

This study determined the knowledge of neonatal danger signs and assessed associated factors in Ethiopia. Mothers who identified neonatal danger signs early had a great potential to reduce neonatal mortality. In this study, the overall knowledge of neonatal danger signs was about 51%. There was a significant difference in mothers' knowledge of neonatal danger signs with the place of birth where 60% of them delivered at health institutions and 41% of them at home. The odds of being knowledgeable about neonatal danger signs among mothers who delivered at the health facility were 11 times higher than mothers who delivered at home. This is not surprising as mothers who delivered at health facilities may acquire information about neonatal danger signs either through mass health information sessions provided every morning in health facilities or direct counseling from health workers during deliver [21,25,26].

The overall mother knowledge of neonatal danger sign this study was 50.7%. This finding was in line with the other study conducted in Ethiopia and Bangladesh reporting 50.3%-51% but lower than the study conduct in Egypt (68%-70%) and Ghana (72%) [16,19,27,24,28]. The possible reasons for the observed differences might be due to: (i) The effectiveness of involvement of community Health Extension Workers (HEWs), (ii) The level of attention given by health institutions, and (iii) Variations in residence (urban/rural) and cultural variations which may negatively or positively affect the level of knowledge neonatal danger sign [16,21]. The main factor influencing the level of knowledge neonatal danger sign of the district identified in this study was the age of mothers, postnatal follow-up, parity, age of the newborn, and long distance from the health center.

In the current study, the odds of being knowledgeable about neonatal danger signs among mothers who delivered four or more were 27% higher than mothers who delivered two to four times. This finding is consistent with other studies in Egypt and Bangladesh [8,17]. Our study also revealed that mothers with a baby less than 30 days old were 47% more likely to know about neonatal danger signs than their counterparts. This might be due to that mother who received the immunization package might get information on neonatal danger signs.

Mothers who participate in postnatal care were two times more likely to know about neonatal danger signs than their comparator, a finding consistent with other studies [18,19]. This could be due to that mothers who had received postnatal care services are counseled about neonatal danger signs, which in turn increases knowledge about neonatal danger signs [18]. The findings of the present study also indicate that mothers age 15-19 years were four times more likely to know about neonatal danger signs than their counterparts and this was in agreement with the studies conducted in Bangladesh and Ethiopia [8,16]. This present study also documented that mothers more than 10 km away from the health facility were 54% times less likely to know about neonatal danger signs than their counterparts. This is due to the physical proximity of health facility which affects the utilization of services [18].

This study has the following limitations. First, recognition of danger signs may be higher with different data collection techniques, such as using a list of danger signs or images. Second, the cross-sectional design of the study measures the exposures and outcomes simultaneously, which could not allow us to conclude the causative effect between exposures and outcomes. Third, the quantitative nature of the study did not allow us to explore the reasons for poor knowledge of neonatal danger signs.

Conclusion

This study confirmed that mothers who delivered at a health facility knew more about danger signs of neonates than those who delivered at home. Age, antenatal care, and postnatal care attendance showed a significant association for knowledge of neonatal danger signs among home-delivered mothers, whereas, residence and occupational status of the husband for knowledge of neonatal danger signs among health institution-delivered mothers. This implies that it is important to give emphasis, especially for home-delivered mothers to increase awareness about the advantage of ANC and PNC follow-ups, which will improve the knowledge of neonatal danger signs.

List of Abbreviations:

ANC: Antenatal Care; CSA: Central Statistically Agency; EDHS: Ethiopia Demographic Health Survey; ENC: Essential New-born Care; HC: Health Center; HEWs: Health Extension

Workers; IMNI: Integrated Management of Newborn and Childhood Illness; IMR: Infant Mortality Rate; MCH: Maternal and Child Health; NMR: Neonatal Mortality Rate; PNC: Postnatal Care; TBA: Traditional Birth Attendant; UNESCO: United Nations Educational Scientific and Cultural Organization; UNICEF: United Nation Children's Emergency Fund; WHO: World Health Organizations

Acknowledgments

We are highly indebted to all participants of the study, supervisors of data collection, and data collectors for their worthy efforts and participation in this study. We are also thankful for administrative bodies at all levels who endorsed us to undertake this study.

Availability of Data and Materials

All relevant data are within the paper. The SPSS data of individual patients are not permitted to be provided to other bodies, as outlined by the Ethics Committee who approved the study. However, Teferi can provide an anonymized data set for researchers who need further clarification.

References

1. Oza S, Lawn JE, Hogan DR, et al. Neonatal cause-of-death estimates for the early and late neonatal periods for 194 countries: 2000-2013. *Bull World Health Organ* 2014; 93(1): 19-28.
2. Parlato RP, Darmstadt GL, Tinker AG (2004) Saving newborn lives: Tools for newborn health: qualitative research to improve newborn care practices. Saving Newborn Lives Initiative, Washington, DC
3. Rajaratnam JK, Marcus JR, Flaxman AD, et al. Neonatal, postneonatal, childhood, and under-5 mortality for 187 countries, 1970-2010: a systematic analysis of progress towards Millennium Development Goal 4. *Lancet* 2010; 375(9730):1988-2008.
4. Lawn JE, Kinney MV, Black RE, et al. Newborn survival: a multi-country analysis of a decade of change. *Health policy and planning*, 2012; 27(Suppl 3): iii6-28.
5. Bryce J, Boschi-Pintio C, Shibuya K, et al. WHO estimates of the causes of death in children. *Lancet* 2005; 365(9465): 1147-52.
6. Lawn JE, Cousens S, Zupan J, et al. 4 million neonatal deaths: When? Where? Why?. *Lancet* 2005; 365(9462): 891-900.
7. Walraven GE, Mkanje RJ, Roosmalen J, et al. Perinatal mortality in home births in rural Tanzania. *Eur J ObstetGynecolReprodBiol* 1995; 58(2):131-4.
8. Baqui AH, Rahman M, Zaman K, et al. A population-based study of hospital admission incidence rate and bacterial aetiology of acute lower respiratory infections in children aged less than five years in Bangladesh. *J Health PopulNutr* 2007; 25(2):179-88.
9. Group YICSS, Clinical signs that predict severe illness in children under age 2 months: Amulticentre study. *Lancet* 2008; 371(9607):135-42.
10. UNICEF W (2012) Caring for the newborn at home, a training course for community health workers. WHO, Geneva.
11. Claeson M, Bos ER, Mawji T, et al. Reducing child mortality in India in the new millennium. *Bull World Health Organ* 2000; 78:1192-9.
12. Mrisho M, Schellenberg JA, Mushi AK, et al. Factors affecting home delivery in rural Tanzania. *Trop Med Int Health* 2007;12(7):862-72.
13. Kucho B, Mekonnen N. Delivery at home and associated factors among women in child bearing age, who gave birth in the preceding two years in ZalaWoreda, southern Ethiopia. *J Public Health Epidemiol* 2017; 9(6):177-88.
14. Sychareun V, Phengsavanh A, Hansana V, et al. (2009) Cultural beliefs and traditional rituals about child birth practices in Lao PDR. The Asian-Pacific Resource & Research Centre for Women (ARROW), Kuala Lumpur, Malaysia.
15. Central Statistical Agency Addis Ababa E (2017)Ethiopia Demographic and Health Survey 2016. The DHS Program ICF Rockville, Maryland, USA.
16. Mersha A, Assefa N, Teji K, et al. Mother's level of knowledge on neonatal danger signs and its predictors in Chenchadistrict, Southern Ethiopia. *Am J NursSci* 2017; 6(5):426-32.
17. Anmut W, Fekecha B, Demeke T. Mother's knowledge and Practice about neonatal danger signs and associated factors in Wolkite Town, Gurage Zone, SNNPR, Ethiopia, 2017. *J Biomed Sci* 2017; 6(4):33.
18. Nigatu SG, Worku AG, Dadi AF. Level of mother's knowledge about neonatal danger signs and associated factors in North West of Ethiopia: A community based study. *BMC Res Notes* 2015; 8(1):309.
19. Abiyot T, Kassa M, Buruh G, et al. Awareness of obstetric danger signs and its associated factors among pregnant women in public health institutions, Mekelle City, Tigray, Ethiopia 2014. *J Preg Child Health* 2014; 2(3):1-6.
20. EkwochiU,Ndu IK, Osuorah CDI, et al. Knowledge of danger signs in newborns and health seeking practices of mothers and care givers in Enugu state, South-East Nigeria. *ItalJPediatr* 2015; 41(1):18.
21. Kibaru EG,Otara AM. Knowledge of neonatal danger signs among mothers attending well baby clinic in Nakuru Central District, Kenya: cross sectional descriptive study. *BMC Res Notes* 2016; 9(1):481.
22. Essa R, Akl O, Mamdouh H. Factors associated with maternal knowledge of newborn care among postnatal mothers attending a rural and an urban hospital in Egypt. *JHghInst Public Health* 2010; 40(2):348-67.
23. Region MDA, Annual report. 2017.
24. Kuganab-Lem R, Yidana A. Exploring women knowledge of newborn danger signs: a case of mothers with under five children. *Public Health Research* 2014; 4(5):195-202.

25. Anmut W, Fekecha B, Demeke T. Mother's knowledge and practice about neonatal danger signs and associated factors in wolkite town, Gurage Zone, SNNPR, Ethiopia, 2017. *J Biomed Sci* 2017; 6(5):1-7.
26. Mrisho M, Schellenberg JA, Mushi AK, et al. Understanding home-based neonatal care practice in rural southern Tanzania. *Trans R Soc Trop Med Hyg* 2008; 102(7):669-78.
27. Zaman SB, Hossain N, Hussain MA, et al. Factors related to knowledge on newborn danger signs among the recently delivered women in sub-district hospitals of Bangladesh. *Public Health of Indonesia* 2017; 3(2):50-60.
28. Workineh YG, Hailu DA. Factors affecting utilization of postnatal care service in Jabitena district, Amhara region, Ethiopia. *Sci J Public Health* 2014; 23:169-76.

***Correspondence to:**

TeferiGebruGebremeskel
Department of Reproductive Health
College of Health Sciences
Aksum University
Aksum, Ethiopia
Tel: +251912897621
E-mail: teferigebru12@gmail.com