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Sex Disparities: Couple's Knowledge and Attitude Towards Obstetric Danger Signs and Maternal Health Care: in Rural Jimma Zone of Ethiopia

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Purpose: This study aimed to compare knowledge and attitudes towards obstetric danger signs and care between females receiving maternal care and their male partners.

Methods and Materials: A community-based comparative cross-sectional study was conducted in the rural setting of Jimma, Ethiopia. Female and their male partners were selected randomly. The number of participants included from each sex was 3235 totaling 6470. Face-to-face data collection was employed using open data kit (ODK) software. A pre-test was performed before the data collection. Descriptive and analytical statistical analysis was used to compare knowledge and attitudes regarding obstetric danger signs and care. Predictor variables were declared considering a 95% confidence interval, adjusted odds ratio (AOR) and P-value less than 0.05.

Results: On average, male and female participants identified at least two obstetric danger signs. More females could mention more antenatal, childbirth, and postnatal danger signs than their male partners. Both females and their male partners who listened to the radio at least once per week had a statistically significant positive attitude towards obstetric care. Nonetheless, both had an almost similar magnitude of attitude towards obstetric care irrespective of belonging to different occupational, educational, and other social strata. Males' knowledge of danger signs during pregnancy (95% CI = (1.07–1.62), AOR = 1.32, P < 0.008) and postnatal care (95% CI = (1.16–1.89), AOR = 1.48, P < 0.002) had a statistically significant association with the females utilization antenatal care (ANC) service, though not delivery care (DC) or postnatal (PNC).

Conclusion: There were inequalities in obstetric danger signs knowledge between females and their male partners. Male partners' knowledge of obstetric danger signs is not only significant during pregnancy and delivery but also has a lasting impact on post-natal service utilization, which underscores the importance of their involvement in maternal healthcare.

Keywords: sex, obstetric danger signs, knowledge, attitude, Ethiopia

Introduction

Maternal health is the health of women during the prenatal, childbirth, and postnatal period, whereas maternal morbidity refers to health conditions that complicate pregnancy, childbirth, and postnatal period; in addition, maternal mortality is described as the death of women directly related to pregnancy, childbirth, and postnatal conditions.[1] The Sustainable Development Goal-3 agenda is to reach global maternal mortality less than 70 per 100,000 live births and reduce the death rate of neonates at least as low as 12 per 1000 live births.[2] Therefore, Essential health services, including four-antenatal care (ANC), Skilled birth attendants (SBA), and postnatal care (PNC), are crucial for preventing complications, managing birth and postnatal issues, and reducing maternal and newborn morbidity, mortality, and stillbirths.[3]

Globally, male engagement in maternal health and healthcare service utilization is highly encouraged.[4,5] Full participation and involvement of females and males are essential in both productive and reproductive activities, including joint responsibility for caring for and nurturing children and maintaining the household.[6–8] According to the sexual and

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reproductive guidelines of Ethiopia, strategies of empowering the women, men, and the communities were focused on recognizing pregnancy-related risks and taking responsibility for developing and implementing appropriate to them, increasing knowledge and attitude to reduce delays in health-seeking behavior of the pregnant women, ensure utilization of maternal and neonatal health services, create a supportive environment to safe motherhood and newborn health, especially in a rural area where health facilities are limited.[9]

Hence, Ethiopia has shown progress in maternal health care;[10] as globally, it was found fifth, next to Nigeria and Democratic Congo from Africa, in maternal death, stillbirth, and neonatal death,[3] which was commonly associated with obstetric complications that occur during pregnancy, childbirth, and the postnatal period.[11] Obstetric emergency danger indicators are warning signs and symptoms that women may encounter during pregnancy, childbirth, and right after delivery that could indicate a potentially fatal issue.[12,13] Danger signs knowledge of maternal health care is critical in the safe motherhood initiative.[14,15] The leading cause of maternal mortality in Sub-Saharan Africa (SSA) was direct obstetric complications, mainly hemorrhage, infection (maternal sepsis), hypertensive disorder, and obstructed labor.[16]

Studies in Africa indicated that knowledge of women's obstetric danger signs was low.[14,17–19] The most frequently mentioned danger signs during pregnancy were: vaginal bleeding, severe headache and fever at birth, including: vaginal bleeding, prolonged labor, and severe abdominal pain.[18] However, some studies identified vaginal bleeding as a pregnancy danger sign; a study in Nigeria identified danger signs during the intrapartum period were severe vaginal bleeding, seizures, and loss of consciousness, as well as in the postnatal period, severe bleeding, seizures, and high-grade fever.[20]

Moreover, factors associated with danger sign knowledge were women with higher income and education, age, and occupation,[17,18,21] those with functional radio,[22] and exposure to media.[23,24] In studies in Oromia, Ethiopia, pregnancy-related vaginal bleeding followed by severe headache was the most identified obstetric danger sign by men.[25] A study in Nigeria indicated that females are more likely to perceive danger sign risk than males.[20] In Tanzania, men's ability to identify at least one danger sign was higher during pregnancy, 53%, than during delivery, 43.9%, and postnatal, 34.6%.[11] Although antenatal care service utilization and institutional delivery have also been associated with good knowledge of obstetric danger signs.[14,19] In southern Ethiopia, pregnant women know at least two danger signs: 30.4% during pregnancy, 41.3% during childbirth, and 37.7% in postnatal care,[26] which is nearly similar in Oromia, Goba, 31.9% during pregnancy, 27% during childbirth and 22.1% in postnatal.[27] In Eastern Ethiopia, Somali women's danger sign knowledge in the continuum of maternal health care was collectively 15.5%.[28]

This study aimed to compare knowledge and attitudes towards obstetric danger signs and care between females with maternal care and their male partners because knowledge of obstetric danger signs studies have been conducted commonly among pregnant women, irrespective of sex considerations in all maternal care. Therefore, quantified knowledge and attitude of danger sign knowledge and maternal health care, in addition to the qualitative understanding of the roles and perceptions of females and males in maternal health care, will play a substantial role in achieving maternal health or safe motherhood initiatives. In Ethiopia, the health extension programme (HEP) enrolled at the community level as well as the intervention phase of the Innovative Maternal and Child Health Care in Africa (IMCHA) Safe Motherhood project as part of the study aimed at delivering maternal health care information and education, both for females and their male partner. However, this study only focuses on the baseline data as a comparative study of danger sign knowledge and attitude toward maternal health care and its effect on maternal health care service utilization.

Methods and Materials

Study Design, Period and Setting

A comparative cross-sectional study was carried out in the Jimma Zone of the Oromia region in Ethiopia between October 2016 and January 2017. Jimma Zone is situated in the Southwest, 352 km from Addis Ababa, the capital city of Ethiopia. The Zone comprises 21 districts, 42 urban, and 512 rural kebeles.[29] According to reports from the Oromia Regional Health Bureau, the coverage of maternal health services utilization in the Jimma zone is as follows: 35.6% for ANC before the 16th week of pregnancy, 40.3% for skilled birth attendants (SBA) excluding cesarean section, and 37.6% for PNC within the first seven days.[30]

Study Population

The study population included all randomly selected index women who gave live birth, stillbirth, and abortion before data collection and their partners. During the analysis, women who did not have partners were excluded and made paired matches at the household level.

Variables

Dependent variables in the study were obstetric knowledge of danger signs during pregnancy, delivery, and the first 48 hours of postnatal time, as well as attitudes toward maternal care. Independent variables for danger sign knowledge and maternal service utilizations in the continuum of maternal healthcare included age, sex, education, occupation, annual income, literacy level (socio-demographic variables), time to health facility, and health facility evaluation (perceived accessibility and quality of services), having their mobile and listening to the radio (access to resources and exposure to media).

Sample Size and Sampling Procedure

The survey was conducted targeting a total of 3840 index women and equivalent number of their partners. The selection was conducted from three rural districts, Gomma, Seka Chekorsa, and Kersa, guided by the Jimma zonal health bureau. A total of 24 primary healthcare units (PHCU) were chosen. Eight primary healthcare units were chosen randomly from each district. Then, from each selected primary healthcare unit, 160 eligible index women (who had pregnancy outcomes of live birth, stillbirth, miscarriage, and abortion) with their partners were chosen randomly from the registered health post by the health extension workers; resulting in a final sample size of 3840. The response rate of index women initially was 3784 (98.5%), while the response rate of partners was 3255 (84.7%); this suggests that some husbands may have died or separated. However, 3235 index women and their partners who participated in the study were identified and included in the analysis. The rest of the participants were excluded from the analysis due to only one partners was involved in the study (Figure 1).

Data Collection Tool and Procedure

The structured interview questioners were adopted and adapted after reviewing relevant literature in the local socio-cultural context. First, the tool was prepared in English and then translated into the local language, Oromiffa, and back-translated into English by language experts in both languages. The tool comprises four significant parts: socio-demographic, danger sign knowledge, attitude towards maternal health services, and maternal health care service utilization. The tool was pre-tested with 5% of the sample size outside and adjacent to the actual study area, and substantial amendments were made to make it plausible to the interviewer and the respondents.

Data Collection Method

Qualified and experienced male and female interviewers have been used for the face-to-face data collection method. The interview schedules programmed into Open Data Kit (ODK) software were loaded onto tablets, and data was collected. An index woman was not available for two subsequent scheduled visits and was replaced by another eligible woman living next to the household who fulfilled the inclusion criteria. However, when male partners were not available, the basic socio-demographic information was obtained from the wives.

Data Sources

As part of the Innovative Maternal and Child Health in Africa (IMCHA) project, data was collected from three rural districts in the Jimma Zone. The project aimed to improve maternal and child health through two interventions: 1) providing information, education, and communication (IEC) on maternal health care for women and men's health development army, who acted as messengers to the target audience and health extension workers, and 2) improving maternal waiting areas with necessary equipment. This study was based on the baseline data.

Measurements

The measurement tools we used to assess knowledge were based on the participants spontaneously mentioning the true obstetric danger signs without being asked the sign by name. The knowledge was categorized into two for each pregnancy,

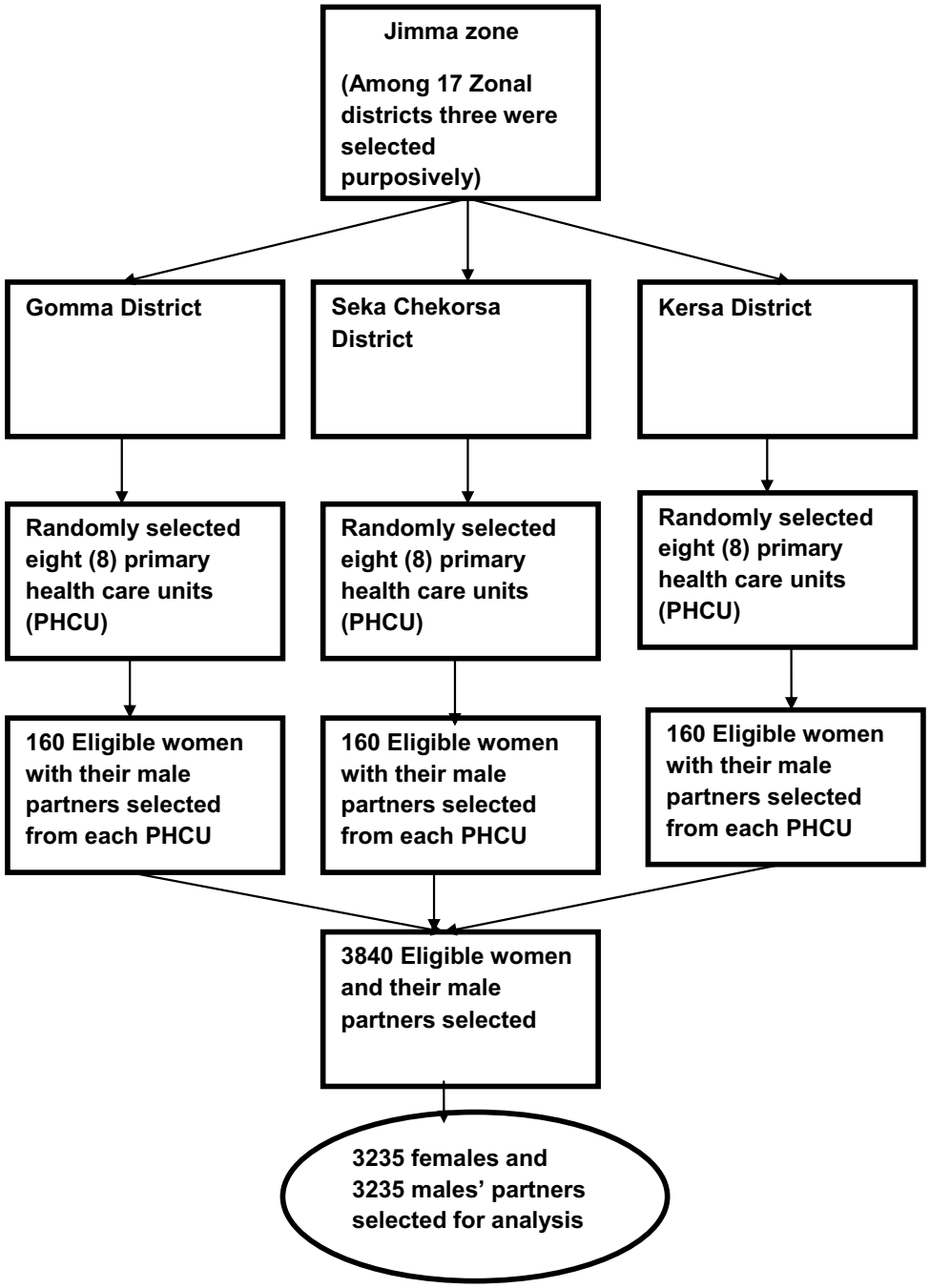

Figure 1 Schematic presentation of participants' selection in Jimma rural Zonal district.

childbirth, and postnatal danger signs: (1) good obstetric danger sign knowledge if they mentioned more than two major danger signs during pregnancy, child birth and postnatal care (2) otherwise categorized as poor obstetric danger sign knowledge.[14] Regarding maternal health care service attitudes, ten items with three categories each, such as agree (1), no opinion (2), and disagree (3) were used, hence summed up after reverse coding of the negative items and categorized into positive attitude for those scored less than or equal to the mean and negative attitude for those scored greater than the mean.

Data Quality Assurance

Data quality was given utmost importance right from the beginning of item development. We carefully recruited qualified data collectors and supervisors with a first-degree or above qualification. Some of them were even Ph.D. candidates.

They underwent rigorous theoretical and practical training, which included learning how to use tablets and GPS devices to collect data in the field. Once the data was collected, each data collector automatically sent it to a secure server, which the principal investigator authorized to maintain confidentiality.

Data Analysis

The data were meticulously analyzed using the widely recognized Statistical Package for Social Sciences (SPSS) version 20. This tool was instrumental in providing descriptive statistics that summarized the frequency and percentage of each primary and predictor variable. For knowledge of danger signs, all participants were asked to identify any danger signs they knew during pregnancy, childbirth, and the postnatal period. The most commonly identified danger signs by participants were considered for further analysis, while some rarely identified danger signs during childbirth were also noted by both participants (Table S1).

In order to assess the participants' knowledge of danger signs during pregnancy, childbirth, and postnatal care, they were coded as either (0) if not identified or (1) if identified. The total count of identified danger signs for each category was recorded, and new variables were created; those who identified at least two danger signs in each category were coded as one (1), indicating good danger signs knowledge, and those who identified less than two were coded as zero (0), representing poor danger sign knowledge.[28,31] Regarding attitudes towards obstetric maternal care, ten items with three categories: agree, no opinion, and disagree, first reverse coding of the negative items, then the items were summed up and categorized into positive attitudes when less than the mean and coded as one (1) and negative attitude when greater than the mean coded as zero (0). Furthermore, knowledge of danger signs as a predictor variable was used to determine the utilization of maternal health care in the continuum. The analysis also considered antenatal service utilization during the last pregnancy, place of delivery in the last pregnancy, and postnatal care within the first 48 hours of delivery to determine attitudes toward maternal care. Chi-square and multivariate logistic regression analyses determined the relationship and associations between dependent and explanatory variables for obstetric danger signs and attitudes toward maternal care. Variables with a p-value of less than 0.25 in bivariate analysis were considered for multivariable analysis. The final predictors were declared with statistically significance values with 95% confidence interval, adjusted odds ratio (AOR), and a p-value of less than 0.05 (Table S2; Supplementary Materials Bivariate regression analysis).

Ethical Consideration

The willingness of the potential respondents was obtained through written informed consent. The aim of the study was told by the data collectors and invited to participate with their willing consent. A face-to-face interview data collection method was employed; the participants' names were not mentioned in the study to ensure confidentiality and anonymity; all the issues above were acceptable and approved by Jimma University Research Ethics Institutional Review Board based on compliance with the ethical principles of the Declaration of Helsinki (Reference No RPGE/449/2016).

Result

Background Characteristics of the Participants

Most participants were between the age category of 26–30 years, with a mean age of 27.7 ± 6 for females and 36.7 ± 8 for males. Of the total participants, 3046 (94.2%) female and 3033 (93.8%) male were Oromo in ethnicity. In addition, 55.6% of females and 43.7% of males had no education, but at least 47.8% of males had completed primary education, which was more than the female participants. About an equal proportion of men and women reported that they have taken less than 30 minutes to reach the health facilities, and a large proportion of both sexes rated maternal health services as poor. Only a few women, 184 (5.7%), had their mobile phones. However, more than half of males have mobile phones (Table 1).

Sex-Disparities in Knowledge of Danger Signs During Pregnancy, Delivery, and Postnatal Period

The top three danger signs during pregnancy were severe weakness, severe headache, and vomiting, most frequently reported by women and men (Table 2). Specifically, 40.7% of women and 44.5% of men identified severe weakness as

Table 1 Background Characteristics of the Study Participants in Rural Jimma, Ethiopia

Variables	Category	Female		Male	
		Frequency	%	Frequency	%
Age	15–25	1276	40.6	262	8.3
	26–35	1514	48.3	1388	43.7
	36–49 (45)	350	11.1	1125	35.4
	≥46			399	12.6
	Total	3140	100	3174	100
Ethnicity	Oromo	3046	94.2	3033	93.8
	Amhara	57	1.8	56	1.7
	yem	51	1.6	58	1.8
	Dawro	23	0.7	24	0.7
	Kefa	28	0.9	28	0.9
	Other	30	0.9	36	1.1
	Total	3235	100	3235	100
Education	No education	1800	55.6	1413	43.7
	Primary	1279	39.5	1546	47.8
	Secondary	134	4.1	230	7.1
	Higher	22	0.7	46	1.4
	Total	3235	100	3235	100
Occupation	House wife	2536	78.4		
	Farmer	483	14.9	2749	85.0
	Merchant	193	6.0	453	14.0
	Government	23	0.7	33	1.0
	Total	3235	100	3235	100
Annual Income	≥10,000	2266	70.0	2266	70.0
	10,001–20,000	590	18.2	590	18.2
	20,001–30,000	119	3.7	119	3.7
	≥31.000	260	8.0	260	8.0
	Total	3235	100	3235	100
Literacy level	Able to read whole	714	22.0	1117	34.5
	Able to read part	387	12/0	611	18.9
	Cannot read all	2134	66.0	1507	46.6
	Total	3235	100	3235	100

(*Continued*)

Table 1 (Continued).

Variables	Category	Female		Male	
		Frequency	%	Frequency	%
Time to health facility	<=30 minutes	2467	79.6	2496	80.5
	≥30 minutes	633	20.4	605	19.5
	Total	3100	100	3101	100
Health facility evaluation	Good	589	19.0	770	24.8
	Not good	2511	81.0	2331	75.2
	Total	3100	100	3101	100
Own mobile	Yes	184	5.7	1724	53.3
	No	3051	94.3	1511	46.7
	Total	3235	100	3235	100
Listening radio	Not at all	1447	44.7	907	28.0
	Once/week	878	27.1	918	28.4
	More than one/week	910	28.1	1410	43.6
	Total	3235	100	3235	100

Notes: NB: 36–49(45); 49 in the age category indicate the maximum age of female and 45 is the age category of men in the cell.

Table 2 Sex-Disparity Obstetrics Danger Signs Knowledge in Maternal Health Care

Danger Signs	Female		Male	
	Yes (3235)	(%)	Yes (3235)	%
Obstetric danger sign knowledge during pregnancy				
Sever weakness	1318	40.7	1438	44.5
Vomiting	1205	46.3	957	29.6
Headache	1206	37.3	1036	32.0
Abdominal problem/Distention	852	26.3	958	29.6
Blurred vision	888	27.4	713	22.0
Bleeding	742	22.9	617	19.1
Swelling	322	10.0	339	10.5
Fetal movement problem	241	7.4	225	7.0
Fit (convulsion)	199	6.2	213	6.6
Difficulty of breathing	134	4.1	163	5.0
Faint	141	4.4	187	5.8
Water break (PROM)	111	3.4	95	2.9
Fever	354	10.9	274	8.5

(*Continued*)

Table 2 (Continued).

Danger Signs	Female		Male	
	Yes (3235)	(%)	Yes (3235)	%
Obstetric danger sign knowledge during childbirth				
Labour >12 h	2319	72.1	1980	61.2
Vaginal bleeding	1555	48.1	1387	42.9
Placenta not delivered 30 min after birth	1051	32.5	1025	31.7
Severe headache	498	18.8	398	14.6
Loss of consciousness	248	7.7	240	7.4
Blurred vision	258	8.0	228	7.0
Fit (Convulsion)	217	6.7	295	9.1
High fever	196	6.1	183	5.7
Obstetric danger sign knowledge during postnatal				
Vaginal bleeding	1356	41.9	1088	33.6
Offensive vaginal discharge	188	5.8	300	9.3
Sever weakness	769	23.8	809	25.0
Fever	208	6.4	195	6.0
Severe headache	498	15.4	367	11.3
Body swelling	213	6.6	162	5.0
Fit/convulsion	220	6.8	87	2.7
Difficulty of breathing	153	4.7	134	4.1

a danger sign. In comparison, severe headache was reported by 37.3% of women and 32.0% of men, and vomiting was reported by 46.3% of women and 35.5% of men. On the other hand, the least frequently mentioned danger sign by both women and men was the water break or Pre-Rupture of Membrane (PROM), with only 3.4% of women and 2.9% of men reporting it.

During labor and delivery, the three most frequently identified obstetric danger signs by both men and women were as follows: labor lasting more than twelve hours (women 72.1%, men 61.2%), followed by vaginal bleeding (women 48.1%, men 42.9%), and failure of the placenta to be expelled within 30 minutes (women 32.5%, men 31.7%).

In the postnatal period, vaginal bleeding was the most commonly identified danger sign, reported by 70.2% of women and 56.7% of men, followed by severe weakness, reported by 39.8% of women and 42.1% of men.

Knowledge of Obstetric Danger Signs During the Maternal Health Care

The chi-square analysis of the data found that sex has a statistically significant impact on the level of knowledge about danger signs. According to the study, women during pregnancy, delivery, and postnatal care have significantly better knowledge about danger signs than men, with $X^2(1, 3235) = 27.70$, $p < 0.001$, $X^2(1, 3235) = 4.58$, $p < 0.032$, and $X^2(1, 3235) = 5.91$, $p < 0.015$, respectively.

(Figure 2) illustrates that women had a better understanding of at least two danger signs during pregnancy (61.2%), labor and delivery (32.7%), and postnatal (30.6%) compared to their male partners who knew danger signs during

Figure 2 Percentage of sex-disparity obstetric danger signs knowledge in the continuum of maternal health care (sample for female=3235 and sample for male=3235).

pregnancy (54.7%), labor and delivery (30.2%), and postnatal (27.9%). However, both men and women had good knowledge of danger signs during pregnancy compared to delivery and postnatal.

Multivariate Analysis of Attitude Towards Maternal Healthcare

The study found that 48.0% of women and 49.8% of men have positive attitudes towards maternal health care. In the bivariate analysis, sex has no statistically significant association with attitude toward maternal health care. Variables significantly associated with the bivariate analysis were inserted together to control the confounding effect in the multivariate analysis.Eight variables for women and six variables for men were found to be significantly associated with positive attitude of maternal health care. The characteristics of women who had positive attitude were literate, $p < 0.005$, had good knowledge of obstetrics danger signs during pregnancy $p < 0.001$, postnatal care $p < 0.001$ and received antenatal care during the last pregnancy $p < 0.001$ (Table 3).

The women who evaluated the maternal health care services as good $P < 0.001$, women listened to radio at least once per week $p < 0.001$, were farmer $p < 0.014$, perceived time taken to health facility more than thirty minutes $p < 0.031$, good danger sign knowledge during delivery $p < 0.008$, and who gave birth in the health $p < 0.001$ had more likely developed positive attitude towards maternal health care (Table 3).

Table 3 Sex Disparity Multivariate Analysis of Attitude on Maternal Health Care

Sex	Variables Category	Maternal Health Care Attitude		AOR	(95% CI)
		Positive	Negative		
Male occupation	Farmer	1393	1356		
	Trader	199	254		
	Govn't	20	13		
Female occupation	House wife	1203	1333	1	1
	Farmer	276	207	1.32	(1.05–1.65)*
	Trader	69	124	0.77	(0.56–1.08)
	Govn't	6	17	0.80	(0.30–2.15)

(*Continued*)

Table 3 (Continued).

Sex	Variables Category	Maternal Health Care Attitude		AOR	(95% CI)
		Positive	Negative		
Male HH annual income	<=10,000	1122	1144	1	1
	10,001–20,000	285	305	0.97	(0.80–1.17)
	20,001–30,000	47	72	0.69	(0.46–1.04)
	≥30,001	158	102	1.69	(1.28–2.23)**
Female annual income	<=10,000	1100	1166		
	10,001–20,000	261	329		
	20,001–30,000	56	63		
	≥30,001	137	123		
Literacy level of male	Not read all	1011	496		
	Read partly	389	222		
	Read all	855	262		
Literacy level of female	Not read all	1460	674	1	1
	Read partly	274	113	0.51	(0.40–0.64)**
	Read all	584	130	0.93	(0.72–1.21)
Time to health facility by male	<=30min	1197	1299	1	1
	≥31min	333	272	1.28	(1.06–1.55)*
Time taken to health facility by female	<=30min	1124	1343	1	1
	≥31min	343	290	1.23	(1.01–1.48)*
Male listen radio	Not at all	667	240	1	1
	Once per week	612	305	1.30	(1.06–1.58)*
	More than once per week	1039	371	1.14	(0.95–1.37)
Female listen radio	Not at all	1045	402	1	1
	Once per week	592	286	1.34	(1.11–1.62)**
	More than once per week	681	229	1.15	(0.95–1.39)
Male health facility evaluative	Not good	1058	1273	1	1
	Good	472	298	1.93	(1.63–2.29)**
Female health facility evaluative	Not good	1102	1409	1	1
	Good	365	224	1.99	(1.63–2.42)**
Male danger sign knowledge during pregnancy	Poor	743	722		
	Good	869	901		
Female danger sign knowledge during pregnancy	Poor	661	595	1	1
	Good	893	1086	0.75	(0.63–0.89)*

(*Continued*)

Table 3 (Continued).

Sex	Variables Category	Maternal Health Care Attitude		AOR	(95% CI)
		Positive	Negative		
Male danger sign knowledge during labor	Poor	1104	1153	1	1
	Good	508	470	1.25	(1.06–1.48)*
Female danger sign knowledge during labor	Poor	1034	1143	1	1
	Good	520	538	1.26	(1.06–1.49)*
Male danger sign knowledge during postnatal	Poor	1223	1110	1	1
	Good	389	513	0.70	(0.59–0.83)**
Female danger sign knowledge during postnatal	Poor	1171	1073	1	1
	Good	383	608	0.63	(0.53–0.75)**
ANC last pregnancy	No	322	150	1	1
	Yes	1232	1531	0.66	(0.52–0.83)**
Place of delivery	Home	702	1008	1	1
	Health facility	852	673	1.81	(1.54–2.13)**
Postnatal first 2 hours	No	1056	906	1	1
	Yes	498	775	0.63	(0.53–0.75)**

Note: *P<0.05, **P<0.02.

Men in multivariate analysis who able to read partially $p < 0.032$, good danger sign knowledge during the postnatal period $p < 0.001$ had more likely reduced positive attitude towards maternal health care. However, men who evaluated the health facility as good $p < 0.001$ listen radio at least one per week $p < 0.009$, perceived the time taken to the health facility to be more than thirty minutes $p < 0.008$, annual income more than 30,000 Ethiopia birr (ETB) $p < 0.000$ had more likely develop positive attitude towards the maternal health care (Table 3).

Predictors of Female Obstetric Danger Signs Knowledge During Pregnancy, Childbirth, and Postnatal Period

In the multivariate logistic regression analysis, women's age between 26 and 35 $P < 0.004$), completed secondary education $P < 0.004$, being farmer $P < 0.001$, became government employee $P < 0.048$), annual income above 10,000 ETB $P < 0.001$, own mobile phone $P < 0.001$, able to read partly $P < 0.038$, listened to the radio once $P < 0.001$ and more than once per week $P < 0.027$, and evaluated positively the maternal health care $P < 0.001$ had statistically significance association with good knowledge of obstetric danger signs during pregnancy.

Women's during childbirth, age between 26 and 35 years $P< 0.005$ completed primary education $P < 0.004$ or secondary education $P < 0.013$, being farmer $P < 0.001$ and merchant $P < 0.003$, annual income between 10,000 and 20,000ETB $P < 0.047$, between 20,001 and 30,000ETB $P < 0.004$, and above 30,001ETB $P < 0.001$, own mobile phone $P < 0.019$, listened to the radio at least once or more per week $P < 0.001$, and evaluated positively the maternal health facility $P < 0.001$ had statistically significance association with good knowledge of obstetric danger signs during childbirth (Table 4).

In the postnatal period, women became farmer $P < 0.003$, merchants $P < 0.001$, government employees $P < 0.010$; annual income above 10,000 ETB $P < 0.007$), own mobile phone $P < 0.029$; able to $P < 0.006$; listened to the radio once per week $P < 0.001$); and perceived time to reach the health facility more than thirty minutes $P < 0.001$ had significantly associated with good knowledge of obstetric danger signs during postnatal care (Table 4).

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Table 4 Multivariate Logistic Regression of Obstetric Danger Signs Knowledge in Maternal Health Care

	Variable Category	Danger Sign Knowledge During Pregnancy		AOR,(95% CI) P-value	Danger Sign Knowledge During Delivery		AOR,(95% CI), P-value	Danger Sign Knowledge During Postnatal		AOR, (95% CI) P-value
		Poor	Good		Poor	Good		Poor	Good	
Male age	15–25	133	129		196	66		189	73	
	26–35	604	784		959	429		973	415	
	36–45	515	609		792	333		841	284	
	≥46	189	210		273	126		274	125	
Female age	15–25	529	747	1	881	395	1	898	378	
	26–35	558	956	1.27(1.07–1.51)** 0.005	995	519	1.30(1.09–1.57)*.004	1037	477	
	36–49	123	222	1.31(1.00–1.71)*.045	237	113	1.09(0,83–1.45))	240	110	
Male education	No education	691	722	1	1039	374	1	1082	331	1
	Primary	680	866	1.11(0.95–1.31)	1051	495	1.35(1.02–1.79)*.035	1091	455	1.30(1.10–1.55)***.002
	Secondary	84	146	1.47(1.07–2.00)*.015	143	87	2.00(1.33–3.01)*.001	138	92	2.06(1.52–2.79)***.000
	Higher	10	36	2.93(1.39–6.17)**.004	24	22	2.74(1.38–5.40)**004	22	24	3.18(1.74–5.81)***.000
Female education	No education	719	1080		1261	539	1	1279	521	
	Primary	484	795		826	453	1.31(1.09–1.57)**.003	862	417	
	Secondary	47	87		79	55	1.66(1.11–2.48)*.013	92	42	
	Higher	6	15		11	11	1.90(0.56–6.40)	11	11	
Male occupation	Farmer	1268	1481		1939	810		1983	766	
	Trader	185	268		296	157		323	130	
	Government	12	21		22	11		27	6	

Female occupation	House wife	1031	1505	1	1773	763	1	1807	729	1
	Farmer	153	330	1.75 (1.38–2.21)***.000	278	205	2.10(1.68–2.63)***.000	314	169	1.40(1.12–1.75)**.003
	Trader	68	125	1.30(0.93–1.81)	115	78	1.62(1.18–2.23)**.003	113	80	1.71(1.25–2.35)***.001
	Gover't	4	19	3.16(1.01–9.86)*.048	11	12	2.29(0.71–7.37)	10	13	3.29(1.32–8.17)**.010
Male HH Annual income	<=10,000	1043	1223	1	1591	675	1	1645	621	
	10,001–20,000	242	348	1.12(0.92–1.36)	399	191	1.03(0.84–1.27)	411	179	
	20,001–30,000	33	86	1.77(1.16–2.70)*.008	71	48	1.39(0.93–2.08)	79	40	
	≥30,001	147	113	0.56(0.43–0.74)*.000	196	64	0.67(0.49–0.92)*.015	198	62	
Female annual income	<=10,000	941	1325	1	1551	715	1	1586	680	1
	10,001–20,000	160	430	1.73(1.40–2.14)***.000	368	222	1.22(1.00–1.49)**.047	379	211	1.31(1.07–1.50)**.007
	20,001–30,000	26	93	2.23(1.40–3.54)**.001	61	58	1.79(1.20–2.65)**.004	71	48	1.42(0.95–2.22)
	≥30,001	129	131	0.68(0.51–0.90)*.007	197	63	0.58(0.42–0.81)*.001	208	52	0.53(0.38–0.75)***.001
Male own mobile	No	743	768	1	1095	416		1134	377	
	Yes	722	1002	1.17(1.00–1.38)*.048	1162	562		1199	525	
Female own mobile	No	1175	1876	1	2050	1001	1	2112	939	1
	Yes	81	103	0.57(0.40–0.80)**.001	127	57	0.64(0.44–0.92)*.019	132	52	0.66(0.46–0.95*.029)
Literacy level of male	Not read all	723	784		1093	414		1151	356	
	Read partly	256	355		398	213		443	168	
	Read all	486	631		766	351		739	378	
Literacy level of female	Not read all	861	1273	1	1488	646		1516	618	1
	Read partly	146	241	1.35(1.01–1.79)*.038	238	149		273	114	1.32(1.08–1.61)*.006
	Read all	249	465	1.16(0.85–1.57)	451	263		455	259	1.01(0.79–1.31)
Time to health facility/ Male	<=30min	1129	1367		1740	756		1771	725	
	≥31min	277	328		425	180		457	148	

(*Continued*)

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Table 4 (Continued).

	Variable Category	Danger Sign Knowledge During Pregnancy		AOR,(95% CI) P-value	Danger Sign Knowledge During Delivery		AOR,(95% CI), P-value	Danger Sign Knowledge During Postnatal		AOR, (95% CI) P-value
		Poor	Good		Poor	Good		Poor	Good	
Time to reach to health facility/ Female	<=30min	929	1538		1646	821		1658	809	1
	≥31min	250	383		437	196		478	155	0.68(0.55–0.83)***.000
Listen radio/Male	Not at all	393	514	1	658	249	1	672	235	1
	Once per week	326	591	1.36(1.12–1.65)**.002	579	338	1.58(1.27–1.96)***.000	601	316	1.50(1.20–1.86)***.000
	More than once per week	536	874	1.23(1.02–1.48)*.029	939	471	1.45(1.18–1.78)**.003	970	440	1.17(0.95–1.43)
Listen radio/Female	Not at all	642	805	1	1059	388	1	1041	406	1
	Once per week	288	590	1.61(1.33–1.94)***.000	546	332	1.62(1.34–1.97)***.000	558	320	1.40(1.15–1.69)**.001
	More than once per week	326	584	1.24(1.02–1.50)*.027	572	338	1.41(1.16–1.72)***.000	645	265	0.88(0.72–1.08)
Health facility evaluative/Male	Not good	1090	1241	1	1646	685		1670	661	
	Good	316	454	1.24(1.05–1.47)*.010	519	251		558	212	
Health facility evaluative/Female	Not good	1013	1498	1	1746	765	1	1738	773	
	Good	166	423	1.67(1.36–2.05)**.001	337	252	1.75(1.44–2.12)***.000	398	191	

Note: *P<0.05, **P<0.02, ***P<0.01.

Predictors of Male Obstetric Danger Signs Knowledge During Pregnancy, Childbirth, and Postnatal Period

In the multivariate logistic regression analysis, men who had an educational status of secondary level P < 0.015 or higher education P < 0.004), annual income above 20,001P < 0.008), own mobile phone P < 0.048, listened to the radio at least once per week P < 0.029, and positively evaluated of the maternal health care P < 0.010 had significance association with good knowledge of danger signs during pregnancy (Table 4).

During childbirth, men who had completed primary education P < 0.035, secondary education P < 0.001, and higher education P < 0.004, annual income above 30,001 ETB P < 0.015, listened to the radio at least once or more per week P < 0.001 had statistically association with knowledge of obstetric danger signs during labor and delivery (Table 4).

In the postnatal period, men who reached in primary education P < 0.002), secondary education P < 0.001), higher education P < 0.001, listened to the radio once per week P < 0.001 had statistically associated with good knowledge of obstetric danger signs during postnatal period (Table 4).

By merging all the obstetric care (ANC, childbirth (CB), PNC) events, we finally generated a latent variable that summarized sex disparity along the continuum of obstetric care. Accordingly, women identified an average of 2.96 (SD = 1.49) obstetric danger signs during pregnancy, but men identified an average of 2.28 (SD = 1.53) danger signs. During labor and delivery, women identified an average of 2.26 (SD = 1.10) danger signs, slightly higher than the men, 2.03 (SD = 1.24). On the other hand, women had more knowledge of obstetric danger signs 2.07 (SD = 1.34) during postnatal care than the men 2.02 (1.24) (Table 4).

Sex-Disparity Obstetric Danger Signs Knowledge and Maternal Health Care Utilizations

A large proportion of women, 2763 (85.4%), attended ANC services in the last pregnancy, of whom 1528 (47.2%) gave birth in the health institutes, and 1273 (39.4%) attended the postnatal care proceeding to the study. In the bivariate analysis, all knowledge of danger signs in the continuum of maternal health care was statistically significant in association with maternal health services. However, in multivariate analysis, women's good knowledge of obstetric danger signs during pregnancy P < 0.001) and postnatal care P < 0.001) had statistically associated with ANC service utilization in the last pregnancy. Women with good knowledge of obstetric danger signs during pregnancy P < 0.003 had statistically associated with birth given in the health facility (Table 5).

For postnatal services utilization, women's good knowledge of danger signs during pregnancy P < 0.001 and labor and delivery P < 0.001 had statistically associated with postnatal care service utilizations. Similarly, men knowledge of danger signs during pregnancy P < 0.008 and postnatal care P < 0.002 had statistically associated with ANC service utilization in the last pregnancy. Men's knowledge of obstetric danger signs during postnatal care P < 0.001 had statistically significant association for the women to give birth in the health institutions, men's knowledge of obstetric danger signs knowledge during pregnancy P < 0.008 had statistically associated with postnatal service utilization (Table 5).

Discussion

Key Findings

This study's discussion was centered on a comparative analysis of females and their male partners. The aim was to underscore the significant sex differences in knowledge and attitude towards obstetric danger signs and care. This comparison was particularly insightful, highlighting the unique perspectives and understanding of females receiving maternal care and their respective male partners. The profound implications of these sex differences in maternal health care underscore the importance of our findings.

The data suggested that, on average, at least two danger signs were identified by male and female participants in maternal health care. Females could mention more danger signs than males in every maternal health care (pregnancy, delivery, and postnatal). The analysis also identified that females are more knowledgeable and have statistically associated with knowledge of obstetric danger signs than male participants. Both participants identified the top three danger signs in every maternal health care, although the numbers of females were more than that of males. The data also identified that knowledge of obstetric

Table 5 Association of Obstetric Danger Sign Knowledge in the Continuum of Maternal Health Care and Maternal Health Care Service Utilization

KNOWLEDGE	Category	Women Used ANC in Last Pregnancy N=3235 (%)	AOR (95% CI) P-value	Women Gave Birth in the Health Facility N=3235 (%)	AOR (95% CI) P-value	Women Received Postnatal care with in 48 hrs N=3235 (%)	AOR (95% CI) P-value
Female danger sign knowledge during pregnancy	Poor	1019(36.9)	1	552(36.2)	1	416(32.7)	1
	Good	1744(63.1)	1.44(1.16–1.78).001***	973(63.8)	1.26(1.08–1.47).003**	857(67.3)	1.43(1.22–1.68).000***
Male danger sign knowledge during pregnancy	Poor	1216(44.0)	1	653(42.8)	1	514(40.4)	1
	Good	1547(56.0)	1.32(1.07–1.62).008*	872(57.2)	1.13(0.97–1.31).095	759(59.6)	1.34(1.15–1.55).000***
Female danger sign knowledge during labor and delivery	Poor	1827(66.1)	1	1039(68.1)	1	782(61.4)	1
	Good	936(33.9)	1.19(0.94–1.50).136	486(31.9)	0.86(0.73–1.00).057	491(38.6)	1.41(1.21–1.65).000***
Male danger sign knowledge during labor and delivery	Poor	1914(69.3)	1	1037(68.0)	1	856(67.2)	1
	Good	849(30.7)	1.00(0.80–1.26).953	488(32.0)	1.08(0.92–1.26).336	417(32.8)	1.10(0.94–1.29).215
Female danger sign knowledge during postnatal care	Poor	1865(67.5)	1	1042(68.3)	1	863(67.8)	1
	Good	898(32.5)	1.67(1.29–2.15).000***	483(31.7)	1.04(0.89–1.22).557	410(32.2)	1.10(0.79–1.10).421
Male danger sign knowledge during postnatal care	Poor	1958(70.9)	1	1055(69.2)	1	896(70.4%)	1
	Good	805(29.1)	1.48(1.16–1.89).002**	470(30.8)	1.26(1.07–1.47).005**	377(29.6)	1.10(0.89–1.23).533

Note: *P<0.05, **P<0.02, ***P<0.01.

danger signs during pregnancy was higher in both participants than during childbirth and postnatal care. The finding underscores the crucial role of women in maternal care and their heightened knowledge of danger signs.

In the logistic regression analysis during pregnancy, knowledge of danger signs was statistically associated with females' age, males' education, females' occupation, males' and females' annual income, having their mobile phones in both sexes, females' literacy level, and frequency of listened to radio in both sexes and health facility evaluation. During childbirth, knowledge of danger signs was associated with women's age, occupation, mobile owner, health facility evaluation, and occupation. In addition, education, annual income, and frequency of listening to the radio were associated with both sexes. Postnatal knowledge of danger signs was associated with male education, female occupation, annual income, mobile owner, literacy level, perception of time to reach health facilities, and frequency of listening to the radio in both sexes.

Danger signs knowledge of females during pregnancy has a statistical association with all maternal health care in the continuum. However, male knowledge of danger signs was not associated with women's institutional delivery. The study also suggests that only females' danger sign knowledge during delivery as a predictor of postnatal care service utilization, female and male postnatal danger signs knowledge, and male danger signs knowledge during postnatal were statistically significant predictors for the women's ANC utilization and institutional delivery, respectively. In both sexes, attitude towards maternal health care was associated with time taken to reach the health facility, listening to the radio, and maternal health care evaluations, which were non-obstetric common factors in both sexes.

Sex-Disparity in Knowledge of Obstetric Danger Signs in Maternal Health Care

The study suggests that males have more than females in good danger signs knowledge during pregnancy, whereas females during delivery and postnatal periods were higher than males. These gender-based differences may be associated with male being given more attention during pregnancy, and they tend to get information while they accompany. During pregnancy, most health professionals provide obstetric health information.[32] In contrast, females continue to identify and recognize unusual manifestations during and after delivery and continue maternal health communication with health professionals.

Obstetric Danger Signs Identified in the Continuum of Maternal Healthcare

As the study showed, males and females identified a nearly similar number of danger signs; the average number of danger signs identified by each of them was at least two, which was higher than for females in democratic Congo;[33] however, it was going decreased from pregnancy to delivery and postnatal, and there was no significant difference among the males and females participants, this was in agreement with the study in South Mozambique.[34] The two most frequently identified danger signs during pregnancy by the majority of the males and the females participants were severe weakness and headache, in which males were more knowledgeable of the former and females were the latter danger sign; males more knowledge may be associated with females involvement in the household activity commonly decreased during pregnancy and this could be easily identified by the males participants as well as males household chores increased. In contrast, the females became pregnant,[32] similar to the study in Kenya,[18] but not mentioned at all by the women in Ethiopia, Aleta Wendo.[26] In contrast, women in Shashemene[14] Angolela Tera district,[35] Aleta Wondo,[26] Goba,[27] and men in Burayu.[25] The most frequently identified danger sign was vaginal bleeding; severe headache was the second most identified danger sign by men in Burayu.[25] In the current study, the danger signs during pregnancy identified by females were different from the previously conducted studies; this may be associated with intensive activity to reduce maternal mortality, might reduce the leading cause such as vaginal bleeding, and could not consider a common danger sign during pregnancy, which was supported by World Health Organization African region report in 2020, in Ethiopia maternal mortality was reduced by 33%.[36] During childbirth and the postnatal period, the most frequently identified danger signs by females and male participants were labor greater than twelve hours (prolonged labor) and vaginal bleeding, respectively. However, the proportion of females was higher than the male participants in both maternal health care, despite differences in the percentage of the respondents; in many studies, there was agreement on the common danger signs identified by women during delivery and postnatal.[14,22,27,28] However, that was incongruent with a study in Tanzania.[11] Less than five percent of the men mentioned prolonged labor during childbirth; this may be associated with the current study area's expanded health extension program and improved maternal health care information among females.

Knowledge of Obstetric Danger Signs in Maternal Healthcare

The spontaneous response of at least two danger signs, which was considered as good knowledge, observed in females during pregnancy (61.2%), delivery (32.7%), and postnatal (30.6%) were higher than the males during pregnancy (54.7%), delivery (30.2%), and postnatal (27.9%), this inequality may be associated with the focus of maternal health information was commonly on females. There is an increased frequency of female contact with health professionals in maternal health care and a less male-friendly maternal health care approach in the study area. The current finding is nearly similar to the systematic review study in Ethiopia; the pregnant women's danger sign knowledge had shown a decrease in the continuum of maternal health care during pregnancy, ranging from 30% to 78%, childbirth 23%–78%, and postnatal 4%–73%.[37] The study also indicates that females during pregnancy, labor and delivery, and postnatal care have a statistically significant relationship with a good danger sign knowledge than the males, $X^2 = (1, 2594) = 27.70$. $p < 0.001$, $X^2(1, 2594) = 4.58$, $p < 0.032$, $X^2(1, 2594) = 5.91$, $p < 0.015$ respectively.

Factors Affecting Danger Sign Knowledge in the Continuum of Maternal Healthcare

In the current study, males' age, occupation, literacy level, and time to reach the health facility were not significantly associated with knowledge of danger signs in the continuum of maternal health care. However, no variables included in the multivariate analysis were associated with female danger signs knowledge in all maternal health care.

The study suggests that in multivariate analysis during pregnancy, women over 26 years have good knowledge of danger signs, supported by the meta-analysis study in Ethiopia;[37] this may be associated with an increased frequency of contact with health professionals to get more information. However, male age was not significantly associated. However, unlike females, males in secondary and higher education have 1.47 and 2.93 times more knowledge of danger signs than those without education; this was incongruent with Anglia Tera Districts in Northern Ethiopia,[35] Arba Minch,[38] and Meta-Analysis, women higher education and get formal education have good danger signs knowledge.[37] In the current study, the number of educated females was much less than the number of uneducated, which affected its significant associations.

The analysis identified both males and females whose annual income of more than 30,000 had decreased good danger signs knowledge by 44% for males and 32% for females. The qualitative study of the same study area explained that high-income females were less interested in visiting the health facility during pregnancy, assuming they could do anything at any time if they faced health problems that might reduce to get obstetric danger signs health information from the health facilities.[32] However, contradicting the Meta-Analysis study in Ethiopia,[37] this may be a previous experience of the participants and their parents and the accessibility of the health facility. Female mobile phones had reduced good danger sign knowledge by 43%, whereas male mobile phones increased by 1.17 times good danger sign knowledge. This significance was associated with the number of female having mobile phones, which was much less than the male, which might increase access to health information and improve communication with the health extension workers.[39] Listening to the radio at least once or more daily helped women and men to have a good knowledge of danger signs, which may be associated with the rural parts of Ethiopia. The primary media means was radio, and most government and nongovernment organizations preferred to broadcast health information to reduce maternal mortality, supported by the study in Northern Tigray and the Meta Analysis.[22,37] Both female and male who evaluated the maternal health facility as good were significantly associated with danger sign knowledge; this was supported by the qualitative study in which women and men had increased interest in the health facility services according to their evaluations.

In the multivariate analysis controlling other variables during the delivery and postnatal period, the likelihood of knowledge of danger signs for men's secondary and higher educational levels was higher than for the uneducated. Females with private and government employees had more good knowledge of danger signs, similar to a study in Goba;[27] this is because the female who had an opportunity to communicate with others might have a chance to get more information on danger signs than the housewives. However, male occupations have no significant association during delivery and postnatal. A female whose annual income is above 30,000 ETB has shown reduced knowledge of danger signs, unlike the male participants, who had no significant association with knowledge of danger signs. Women whose economic condition is found to be in a better condition have shown less interest in visiting maternal health care similarly. A qualitative study of the same study area explored economically better individuals showed less interest in utilizing regular maternal health care.[32] Both females and males listening to the radio at least once per day and

evaluated the maternal health facility as good, the likelihood of knowing at least two danger signs increased, which is similar to the study in Ethiopia Meta-Analysis,[37] female who evaluated the quality of the maternal health care, and exposed to media had a better danger sign knowledge, this may be associated with the more the quality of the health care the more it motivates the female and exposed to media have increased to get more health information to give value for themselves and their children.

Sex-Disparity Knowledge of Obstetric Danger Signs in Maternal Health Care

The current study identified danger signs knowledge during pregnancy, delivery, and postnatal as predictors of maternal health care; females and males good danger signs knowledge during pregnancy and postnatal had a statistically significant predictor of the utilization of antenatal care (ANC) services: this is consistence with Somali, Ethiopia,[28] this is because, in the health belief model, perceived seriousness about the health condition increased the likelihood of an action.[40] However, inconsistent with Tanzania,[41] this may be a socio-cultural and intervention difference. Females' and males' good knowledge of danger signs during delivery had no significant association with ANC service utilization. Females during pregnancy and males during postnatal good danger signs knowledge had shown significant association to the women delivery service utilization in the health facility. However, it was both males and females during pregnancy, and only females with good danger sign knowledge during delivery had a statistically significant association with postnatal service utilization in the health facility: this may be associated with men, and partly women the danger signs during delivery were considered as part of the birth process. Nevertheless, danger signs both during pregnancy and postnatal are considered life-threatening, which leads to maternal health-seeking behavior.

This study's strength was data collected from a large sample size, from female and male members of the same households, and from women who experienced pregnancy and delivery. However, the weakness might be recall bias, as the female participants were not pregnant at the time of the study, which would have caused the chicken or egg dilemma effect of the cross-sectional study design. Significant variations in some variable response categories might cause statistically significant associations.

Attitude Toward Maternal Health Care

In the current study, nearly 50% of men have formed positive attitudes towards maternal health care, consistent with the study conducted in Nigeria.[42] Factors that commonly determine the positive attitude of men and women towards maternal health care were perceived time took more than thirty minutes (Cognitive), evaluation of the maternal health care services as good (Affective), and who listens to the radio at least once per week (Behavioral), which was consistency with the theory of attitude formation in psychological studies.[43] This may be associated with the more time taken to reach the maternal health care facility, which will cost the life of the woman and the fetus; therefore, they would have developed a positive attitude. Conversely, those who perceived the health facility were near would develop the wrong perception that they would pretend to reach if any unprecedented health conditions happened they would easily reach the health facility.

Conclusion

There were inequalities in obstetric danger signs knowledge among females and their male partners. Male partners' knowledge of obstetric danger signs is not only significant during pregnancy and delivery but also has a lasting impact on post-natal service utilization, which underscores the importance of their involvement in maternal healthcare. For the proper delivery of maternal health care services, it is crucial to identify factors that affect females and their male partner's obstetric danger signs knowledge and maternal health service attitude. Experience of media exposure, like radio at least once per week, gives the partners a variety of obstetric danger signs knowledge, which helps to develop a positive attitude towards maternal health care services.

Data Sharing Statement

All relevant data are within the paper and in the supporting information file.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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