Awareness of danger signs of pregnancy and associated factors among pregnant women attending antenatal care at St. Paul hospital millennium medical college, Addis Ababa, Ethiopia

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Abstract:

Background: Recognition of obstetric danger signs is an important component of timely care-seeking and prevention of maternal morbidity and mortality. This study assessed awareness of danger signs of pregnancy and associated factors among pregnant women attending antenatal care at St. Paul Hospital Millennium Medical College (SPHMMC), Addis Ababa, Ethiopia.

Methods: A facility-based cross-sectional study was conducted among pregnant women attending ANC at SPHMMC from February 1 to March 31, 2020. Participants were selected by systematic random sampling. Data were collected using a structured interviewer-administered questionnaire. Descriptive statistics and bivariate analyses were performed. Because the outcome was highly imbalanced and conventional multivariable logistic regression demonstrated separation/non-convergence, adjusted maximum-likelihood odds ratios were not treated as reliable definitive estimates; a restricted penalized logistic model was considered exploratory.

Results: Of 274 eligible questionnaires, 261 were complete (response rate 95.3%). Overall, 227 (87.0%) participants knew at least one obstetric danger sign, while 34 (13.0%) did not. Among those with awareness, 117 (51.5%) reported knowing two or more danger signs. Health personnel were the main reported source of information. In bivariate analysis, 21 variables were associated with the outcome at $p<0.05$; the strongest associations included education status, perceived possibility of developing danger signs, previous pregnancy/delivery history, experience of danger signs, ANC in the previous pregnancy, and being informed about danger signs. Conventional multivariable logistic regression showed separation and non-convergence, limiting the reliability of standard adjusted estimates.

Conclusion: Awareness of at least one obstetric danger sign was relatively high, but a meaningful proportion of women lacked awareness and many knew only a limited range of danger signs. Strengthening standardized, repeated ANC counseling—particularly for women with limited exposure to danger-sign education—may improve recognition and timely care-seeking. Future analyses should use separation-resistant regression with validated variable coding and complete SPSS value labels.

Keywords:

Awareness; obstetric danger signs; pregnant women; antenatal care; SPHMMC.

1. Introduction:

1.1. Background:

Pregnancy is a normal process that results in a series of both physiological and psychological changes in expectant mothers. It is considered to be a normal phenomenon in a women's life. However, normal pregnancy may be accompanied by some problems and complications which are potentially life threatening to the mother and/or the fetus [1].

Even though mortality remained the world's most critical challenge, most maternal deaths are preventable as the necessary medical interventions are well known. World Health Organization in 2015 estimated that about 99% (302,000) of the global maternal deaths occurred in developing regions, with sub-Saharan Africa accounting for 66% (201,000) [2]. Although Ethiopia has made notable progress in decreasing maternal mortality ratio (MMR) from 676 in 2011 [3] to 353 in 2015 [2] per 100,000 live births, Ethiopia still remains one of the leading countries that are seriously affected by this multifaceted maternal loss, which can be useful indirect indicator for the accessibility, sufficiency and effectiveness of a countries health service system.

Maternal mortality in resource poor nations has been attributed to three delays: delay in deciding to seek care, delay in reaching to seek care on time, and delay in receiving adequate treatment. Delay in seeking obstetric care is one of the important factor leading to maternal morbidity and mortality, which can be associated with lack of knowledge about obstetric danger signs [4]. Vaginal bleeding, nondependent edema (swollen hands/face), blurred vision, premature rupture of membrane, convulsion, headache, foul smelling vaginal discharge, fever, and unusual lower abdominal pain are among the common danger signs encountered during pregnancy [5, 6].

In Ethiopia, hemorrhage, hypertension in pregnancy, abortion and sepsis are the leading causes of maternal deaths, which can be prevented through timely recognition of danger sign. The Ethiopian Federal Ministry of Health plans to reduce the MMR to 199/100,000 live births by 2020 [7].

It is important to know obstetric danger signs for women and health care providers to rule out serious complications and initiate treatment immediately. Enhancing awareness of obstetric danger signs of pregnant women would reduce delay in seeking care and improve early detection of obstetric complications [4, 5]. Thus, with the notion that maternal death is highly preventable and awareness of obstetric danger signs can play a vital role, this research was undertaken to assess level of awareness on danger signs of pregnancy among women's attending ANC follow up at St. Paul's Millennium Medical College (SPHMMC).

2. Methods and materials:

2.1. Study Design:

A facility based cross sectional study design was conducted to assess the level of awareness on danger signs of pregnancy and associated factors among pregnant women attending ANC service at SPHMMC, Addis Ababa, Ethiopia.

2.2. Study setting:

The study was conducted at SPHMMC starting from February 1 to March 31, 2020. SPHMMC is located in Addis Ababa which is a capital city of Ethiopia. Built in 1969, the hospital serves about 200,000 patients annually in average and a catchment population of more than 5 million, on top of training a range of health science students. About 1500 to 2000 pregnant mothers attend ANC service at the outpatient unit of Gyn/Obs department monthly.

It is one of the few tertiary hospitals in the country and around 1000 deliveries are attended each month at this facility. Moreover, the hospital is the only governmental institution where a well-functioning fertility clinic is available.

2.3 Inclusion and exclusion criteria

2.3.1. Inclusion criteria:

- All pregnant women attending ANC service who were randomly selected and who were willing for interview during the data collection regardless of their gestational age

2.3.2. Exclusion criteria:

- Pregnant women who were attending ANC unit but seriously ill due to emergency conditions on the dates of data collection.
- Pregnant women who re-visit during the study period
- Pregnant women who have gross communication problem or marked mental disorder

2.4. Sample size determination:

The sample size was determined using a formula for single population proportion as follows: proportion of mothers knowing obstetric danger signs during pregnancy considered to be 79.6% [8], confidence level 95%, absolute precision 5%, and non-response rate 10%.

$$n = \frac{(z \propto/2)2\ p(1-p)}{d2}$$

$$n = \frac{(1.96)2\ x\ 0.796\ (1-0.796)}{(0.05)2}$$

Thus, the final sample size was: 249.5 + 24.95 = 274.

2.5. Sampling procedure:

During the study period, pregnant mothers who were attending antenatal care outpatient unit of obstetrics and gynecology department at SPHMMC were selected by systematic random sampling. Lottery method was employed to select the first study participant, and then every ninth mother was approached for the interview, which was calculated by dividing the average number of pregnant mother who attended ANC unit at SPHMMC on the preceding years of same month (2600) by the calculated sample size (274).And the corresponding medical record were reviewed when need arises.

2.6. Variables in the study:

2.6.1. Dependent variable:

- Awareness of pregnant mothers towards obstetric danger signs

2.6.2. Independent variables:

1. Socio-demographic characteristics such as age, residence, educational status, marital status, regular source of income
2. Pregnancy related factors (such as abortion history, gravidity, number of ANC visits, parity)
3. Health service delivery factors (such as distance from health facility, quality of service, reception by health personnel)

2.7. Data collection procedure and quality control:

Data were collected from ANC unit of SPHMMC using a structured questionnaire. The questionnaire was prepared by reviewing related literatures done in other areas. Before administering each questionnaire, written consent was sought from the participants. Informed verbal consent was obtained from the study subjects after the data collectors explained the study objectives, procedures and their right to refuse not to participate in the study. Furthermore, confidentiality of the study subjects was assured. The data were collected via face to face interview, under close supervision and facilitation by the principal investigator.

2.8. Methods of data analysis:

Data were entered, coded, cleaned, and analyzed using statistical software. Descriptive statistics were summarized using frequencies, percentages, means, and standard deviations as appropriate. Associations between the dependent variable and categorical independent variables were examined using cross-tabulation and chi-square tests, with Cramer's V used to describe association strength. Variables meeting the prespecified screening criterion ($p<0.20$) were considered for multivariable modeling. Conventional logistic regression was assessed but showed perfect/near-perfect separation and unreliable convergence because several categories contained zero or very few observations for one outcome level. Therefore, conventional adjusted odds ratios were not reported as definitive estimates. A restricted penalized logistic regression model was considered exploratory; it's apparent in-sample AUC was 0.952. Statistical significance for bivariate analyses was set at $p<0.05$ with 95% confidence intervals.

2.9. Ethical considerations:

Ethical clearance was obtained from Institutional Review board of the college. Permission letter was submitted to the ANC unit from Obstetrics and Gynecology Department & Research Directorate to conduct the study. All the study participants were informed about the purpose of the study and written consent were

obtained before data collection. Then, the purpose of the study was briefly explained for the respondents and written informed consent was maintained. During data collection, the study participants were well informed that the information collected will be kept anonymous and confidential.

3. Results:

3.1. Socio-demographic characteristics of respondents:

The total number of the distributed questionnaires was 274 out of which 261 were filled completely and consistently by the pregnant women, making a response rate of 95.25 %. Among the total responders, most 220 (84.3%) were urban dwellers while the remaining 41 (15.7%) reported to be rural residents. One hundred seventy eight (68.2%) respondents were within the age range of 25 – 34 years. With regard to marital status, majority (254; 97.3%) of the responding clients was married, and none were widowed.

Table. 1: Socio-demographic characteristics of women attending ANC in SPHMMC, AA, Ethiopia, February 1 to March 31, 2020

Variable		Frequency (n=261)	Percent (%)
Residence	Urban	220	84.3
	Rural	41	15.7
Age Range	≤19	4	1.5
	20-24	43	16.5
	25-34	178	68.2
	≥35	36	13.8
Marital Status	Single	2	0.8
	Married	254	97.3
	Divorced	5	1.9
Educational Status	Not able to read & write	10	3.8
	Just able to read & write	6	2.3
	Primary School	105	40.2
	Secondary School	74	28.4
	College level	66	25.3
Occupation	Merchant	41	15.7
	Civil Servants	48	18.4
	Housewife	156	59.8
	Daily laborer	4	1.5
	Farmer	12	4.6
Income	<1000 ETB	22	8.4
	1000-5000	147	56.3
	5001-10000	55	21.1
	>10000	37	14.2
Distance from the HF	<1 hour	118	45.2
	≥1 hour	123	54.8

Based on the women's response, a little below half (105; 40.2%) of the participants attended their education until elementary school. A little more than half (156; 59.8%) of the participants were housewives. Similarly, as it can be seen from Table 1, 147 (56.3%) reported to earn an average income of 1000 to 5000 ETB monthly. Of the respondents, 118 (45.2%) were within an hour and 123 (54.8%) lived beyond an hour of walking distance from the nearest health care facility.

3.2. Obstetric history of respondents:

Of all the 261 respondents, almost quarter (70; 26.8%) reported to be pregnant for the third time; 68 (26.1%) conceived for the second time; 67 (25.7%) claimed to be primigravid and a little more than one-fifth (21.5%) of the respondents said to be gravid more than three times. Similarly, majority of the participants (105; 40%) were nulliparous.

Regarding their previous pregnancy, most (153; 58.6%) of the women reportedly gave birth 1 to 5 years before the time of data collection. Correspondingly, of the parous women who participated in the study, majority 110 (56.7%) gave birth at a government hospital and 66 (34%) at a nearby health center, as it can be seen from Table. 2.

Table. 2: Obstetric history of women attending ANC at SPHMMC, AA, Ethiopia, February 1 to March 31, 2020

Variable		Frequency(N=261)	Percent
Gravidity	1	67	25.7
	2	68	26.1
	3	70	26.8
	>3	56	21.5
Parity	None	105	40.2
	1	80	30.7
	2	64	24.5
	≥3	12	4.6
Time of Previous Pregnancy	1-5 years ago	153	58.6
	6-10	33	12.6
	>10	8	3.1
	None	67	25.7
Place of Previous Delivery	Home	4	1.5
	Gov't Hospital	110	42.1
	Health Center	66	25.3
	Private Hospital	14	5.4
	None	67	25.7
Abortion	None	177	67.8
	1	60	23
	2	17	6.5
	3	7	2.7
Need for Pregnancy	Unplanned	5	1.9
	Unplanned, but wanted	41	15.7
	Planned & wanted	215	82.4
History of ANC follow up	Yes	175	67.0
	No	19	7.3
	Primigravid	67	25.7
Nr of ANC visits	1	49	18.8
	2	48	18.4
	3	38	14.4
	4	34	13.0
	>4	92	35.2
Regularity of ANC follow up	Yes	245	93.9
	No	16	6.1
Gestational age	≤3 months	14	5.4
	4-6 months	38	14.6
	7-8 months	141	54.0
	≥9 months	68	26.1
GA at first ANC visit	≤3 months	78	29.9
	4-6 months	91	34.9
	7-8 months	64	24.5
	≥9 months	28	10.7

On the other hand, majority 177 (67.8%) of the pregnant women claimed not to have any form abortion, where as about 215 (82.4%) of them labeled their pregnancy as planned & wanted. Regarding the respondents' history of ANC follow up in their previous pregnancy, it was found that 175 (90.2%) had history of at least one visit in their previous pregnancy while a little more than one-third 92 (35.2%) of the clients had more than 4 clinical visits for the current pregnancy. Moreover, most 245 (93.9%) of the participants had regular ANC visits as per their clinicians'schedules.

In terms of gestational age, majority 141 (54.0%) of the respondents were in their seventh to eighth months of gestation whereas almost one-third (91;34.9%) of the clients said to start their ANC follow up in a time period of fourth to sixth months of GA.

3.3. Awareness of danger signs of pregnancy among pregnant mothers:

Out of the total 261 participants of this study, 227 (87%) had information about at least one danger sign of pregnancy while the remaining 34 (13%) denied to have any sort of information regarding the danger signs of pregnancy.

Out of the total number of clients who had information about danger signs of pregnancy, 117 (51.5%) mothers had information about two or more obstetric danger signs including vaginal bleeding, sudden gush of fluid before labor, loss of consciousness and loss of fetal movement. Vaginal bleeding alone was mentioned by 44 (19.4%) of respondents, followed by severe headache (17; 7.4%) and swelling of face and hands (12; 5.3%). Another 19 (8.4%) reported to be aware of both vaginal bleeding and leakage/gush of liquor. Convulsion was the least known danger signs, being mentioned only by a single client (0.4 %) (Table. 3).

The main source of information for the danger signs was health personnel as described by 132 (58.1%) pregnant mothers while only 4 (1.8%) out of the total women who have awareness responded to have multiple sources of information. Furthermore, while 250 (95.8%) clients responded to have functional television or radio at their home, only 93 (35.6%) of the respondents described to read about danger signs of pregnancy, of which 47(50.5%) started reading during their current pregnancy and the rest 46 (49.5%) in their previous ones.

Table. 3: Awareness of danger signs of pregnancy among pregnant mothers who visit SPHMMC, AA, Ethiopia, February 1 to March 31, 2020

Variable		Frequency	Per cent (%)
Knowhow about danger signs	Yes	227	87
	No	34	13
Source of information✶	Health personnel	132	50.6
	Relatives	17	6.5
	Friends	44	16.9
	Mass media	17	6.5
	Multiple sources	3	1.2
Types of danger signs mothers are aware of	Vaginal bleeding	44	16.9
	Change in meintation	4	1.5
	Loss of fetal movement	4	1.5
	High fever	2	0.8
	Severe headache	17	
	Dizziness and blurred vision	2	0.8
	Convulsion	1	0.4
	Swelling of hands & face	12	4.6
	Sudden gush of fluid before labour*	19	7.3
	Excessive vomiting*	4	1.5
	Premature onset of contraction	1	0.4
	Multiple signs	117	44.8
Possibility of developing danger signs	Yes	195	75.5
	No	29	11.1
	I don't know	35	13.4
Maternal danger sign experience	Yes	58	22.2
	No	203	77.8
Types of danger signs faced by the mother	Vaginal bleeding	29	11.1
	Premature onset of contraction	1	0.4
	Loss of fetal movement	3	1.1
	Breathing difficulty	1	0.4
	Severe headache	2	0.8
	Dizziness and blurred vision	4	1.5
	Convulsion	1	0.4
	Swollen hands & face	2	0.8
	Sudden gush of fluid before labour	1	0.4
	Excessive vomiting	2	0.8

	Multiple signs	12	4.6
Maternal reaction to danger signs	Sought medical care	55	21.1
	Sought traditional care	1	0.4
	Done nothing	2	0.8

*with concurrent vaginal bleeding: ✶further sources of reading were asked

From the total participants of this study, 195 (75.5%) said that any pregnant mother can develop danger signs whereas 29 (11.1%) respondents denied the possibility of any mother to face obstetric danger signs. And 35 (13.4%) mentioned that they didn't know whether any pregnant mother is at risk of developing danger signs of pregnancy or not.

In response to a question whether the respondent had history of experiencing danger signs of pregnancy or not, majority 203 (77.8%) of the participants answered not to have faced any type of danger sign of pregnancy and the other 58 (22.8%) responded to have entertained danger sign of pregnancy from which 29 women (50%) had experienced vaginal bleeding as a danger sign, followed by other common ones (Table 3).

With regard to maternal reaction to danger signs of pregnancy, 55 (94.8%) of women who faced danger signs of pregnancy responded to have sought medical care; only one (1.7%) to have sought traditional care and the remaining 2 (3.4%) had done nothing in response to the danger signs they encountered during their antenatal period.

Table. 4: Counseling assessment of ANC attendant at SPHMMC, AA, Ethiopia, February 1 to March 31, 2020.

Variable		**Frequency**	**Per cent (%)**
Health talks given during ANC	Yes	150	57.5
	No	111	42.5
Health talks received considered adequate	Yes	100	75.9
	No	50	24.1
Informed about obstetrics danger signs	Yes	141	54
	No	120	46
Understood the information about DSP	Yes	124	87.9
	No	17	12.1
Adequacy of education about DSP	Yes	107	75.9
	No	34	24.1
Time for questioning given	Yes	110	42.1
	No	151	57.9

5.4. Counseling assessment of respondents:

Of all the study subjects, about 150 (57.5%) were given health talk regarding danger signs of pregnancy during their ANC visit but only 100 (75.9%) of them considered the health talks delivered were adequate. Similarly, based on the participants' response, 141 (54%) of the participants were informed about obstetrics danger signs a pregnant woman can develop while majority 124 (87.9%) of the pregnant women who received education about danger signs of pregnancy reported to understand the information. The education regarding danger signs of pregnancy delivered were considered adequate only by 107 (75.9%) of the respondents. Finally, 110 (42.1%) responded to be given time space for asking questions to their clinician during their ANC contact while the remaining 151 (57.9%) were deprived of such time space.

3.5. Factors associated with awareness of danger signs of pregnancy

In bivariate analysis, 21 variables showed statistically significant associations with the outcome at $p<0.05$. The strongest associations were observed for education status ($\chi^2=72.01$, $p<0.001$; Cramer's $V=0.525$), perceived possibility of developing danger signs ($\chi^2=69.66$, $p<0.001$; $V=0.517$), previous pregnancy ($\chi^2=39.27$, $p<0.001$; $V=0.388$), experience of danger signs ($\chi^2=32.36$, $p<0.001$; $V=0.352$), gravidity ($\chi^2=32.37$, $p<0.001$; $V=0.352$), place of last delivery ($\chi^2=31.94$, $p<0.001$; $V=0.350$), ANC during the last pregnancy ($\chi^2=31.57$, $p<0.001$; $V=0.348$), and being informed about danger signs ($\chi^2=30.10$, $p<0.001$; $V=0.340$).

Although conventional multivariable logistic regression was attempted, the model demonstrated perfect/near-perfect separation and failed to converge reliably. Consequently, the resulting maximum-likelihood adjusted odds ratios and Wald confidence intervals were considered unstable and were not reported as definitive inferential findings. A restricted penalized model was used only as an exploratory sensitivity analysis; the

apparent in-sample AUC was 0.952 and should not be interpreted as independently validated predictive performance.

These findings indicate that the observed bivariate associations should be interpreted in the context of sparse outcome events and possible separation. Further analysis using the original SPSS file with complete value labels and a separation-resistant method such as Firth penalized logistic regression would be appropriate before making definitive adjusted-effect claims.

Table. 5: Bivariate associations between selected factors and awareness of danger signs of pregnancy among ANC attendees at SPHMMC, Addis Ababa, Ethiopia, February 1 to March 31, 2020

Category		**COR (95% CI)**	**P value**
Residence	Urban	3.1(1.4,7.1)	0.006
	Rural	1 (Reference)	-
Educational Status	Not able to read & write	1 (Reference)	-
	Just able to read & write	0.02(0.001,0.44)	0.01
	Primary School	0.028(0.003,0.23)	0.001
	Secondary School	0.05(0,0.05)	<0.001
	College level	<0.001	0.99
Occupation	Merchant	0.83(0.21,3.27)	0.78
	Civil Servants	0.04(0.004,0.43)	0.008
	Housewife	0.23(0.06,0.84)	0.03
	Daily laborer	0.67(0.05,8.6)	0.75
	Farmer	1 (Reference)	
Income	<1000 ETB	24.9(2.8,216)	0.004
	1000-5000	5.7(0.7,43.7)	0.096
	5001-10000	2.8(0.3,26.3)	0.36
	>10000	1 (Reference)	
Gravidity	1	6.35(2.04,19.8)	0.001
	2	1.3(0.34,4.7)	0.73
	3	0.38(0.07,2.16)	0.27
	>3	1 (Reference)	
Time of Previous Pregnancy	1-5 years ago	1 (Reference)	
	6-10	0	0.99
	>10	9.6(1.97,46.7)	0.005
	None	7.8(3.4,18.2)	<0.001
Nr of ANC visits	1	4.5(1.4,13.9)	0.01
	2	5.2(1.7,15.9)	0.004
	3	1.5(0.34,6.6)	0.59
	4	3(0.8,11.6)	0.1
	>4	1 (Reference)	
GA at first ANC visit	≤3 months	0.096(0.018,0.51)	0.006
	4-6 months	0.9(0.32,2.55)	0.85
	7-8 months	0.52(0.16,1.68)	0.28
	≥9 months	1 (Reference)	
History of ANC follow up	Yes	1 (Reference)	
	No	1.9(0.39,9.59)	0.42
	Primigravid	8.1(3.56,18.3)	<0.001
History of danger sign	Yes	1 (Reference)	
	No	4.3(0.54,34.02)	0.17
	Primigravid	24.9(3.2,192.4)	0.002
Distance from the HF	<1 hour	0.53(0.25,1.15)	0.11
	≥1 hour	1 (Reference)	

Note: Variables shown are those identified as statistically significant in the bivariate screening or included in the original regression analysis. Conventional multivariable adjusted estimates are not presented because of separation/non-convergence.

Variables not showing statistically significant bivariate associations included marital status, distance to the nearest health facility, adequacy of education among those receiving education, regularity of ANC visits, gestational age at the current visit, and several other service-use variables.

4. Discussion:

In this study, 87.0% of pregnant women reported awareness of at least one obstetric danger sign. This level is comparable to findings from some facility-based studies in sub-Saharan Africa and higher than several community-based Ethiopian studies. Differences may reflect variation in study setting, access to ANC, health-education exposure, and methods used to define awareness.

Thirteen percent of participants were unable to mention any danger sign. This subgroup represents an important target for ANC counseling because failure to recognize warning symptoms may contribute to delay care-seeking when complications occur.

Vaginal bleeding was among the most frequently recognized danger signs, while several other clinically important signs were mentioned much less often. The concentration of knowledge around a small number of signs suggests that awareness should be assessed not only by whether a woman can name one sign, but also by the breadth and completeness of her knowledge.

In this study, 117 (51.5%) of women who had some awareness reported knowing two or more danger signs. Health personnel were the principal reported source of information, highlighting the central role of ANC providers in communicating standardized danger-sign messages.

The bivariate analysis identified multiple factors associated with awareness, with the largest association strengths observed for education status and perceived possibility of developing danger signs. These findings are consistent with the broader literature showing that access to information and previous reproductive experience can influence maternal knowledge.

The direction and magnitude of some categorical associations should, however, be interpreted cautiously. Sparse cells and the relatively small number of participants in the less frequent outcome category produced separation in conventional multivariable logistic regression. This can result in exaggerated or unstable adjusted odds ratios.

Accordingly, this final manuscript does not present the previously generated conventional multivariable adjusted odds ratios as definitive findings. The penalized model was retained only as an exploratory sensitivity analysis. A future analysis using Firth penalized logistic regression or another validated bias-reduction approach, together with the original SPSS value labels, would provide a stronger basis for adjusted inference.

The high contribution of health personnel as an information source supports strengthening routine ANC counseling. Counseling should cover the full set of key danger signs, emphasize the need for prompt facility-based assessment, and use repetition and teach-back to verify understanding.

No causal relationship can be inferred from this cross-sectional design. The findings describe associations within women attending ANC at a tertiary public hospital and may not represent women who do not use ANC services or women in other regions of Ethiopia.

Overall, the study demonstrates relatively high awareness of at least one danger sign but also substantial gaps in breadth of knowledge. Targeted, standardized counseling and community-level reinforcement may help reduce delays in recognizing and responding to obstetric complications.

5. Strength and limitation of the study:

5.1. Strength:

1. The study is the first one to be held at SPHMMC, since the already investigated topics in our country were concentrated in the peripheral regions of the country, overlooking areas like this one, and this study tries to investigate level of awareness of the key parameters of complications of pregnancy, enhancing the preventative maternal care service and adding an input in achievement of millennium development goals.
2. The probability sampling technique employed and utilization of appropriate systematic sampling and use of structured data collection made this study potentially informative for women attending ANC at this facility.

5.2. Limitations:

1. The study was a facility-based cross-sectional study limited to women attending ANC services at SPHMMC. The findings may fail to reflect the situation of other areas of Ethiopia as there are differences in geographical features, intensity of health care promotion activities, health care coverage, and differences in local staff's skills and availability of different interventions. The findings may not be generalizable to the women who did not visit health institution.
2. This study is expected to be prone for the limitation of cross sectional survey (establishing causal relationship is impossible), and the wider confidence interval observed with some variables which may also be indicative of inadequate sample size.
3. The source of data for this study was based on the self-report of respondents, and provided no validation of obtaining information with any objective source such as health facility cards.
4. There could be recall bias since women were asked for events already happened within the last 2 years prior to the survey though the most recent births were considered.

6. Conclusion and recommendation:

This study found that 87.0% of pregnant women attending ANC at SPHMMC could identify at least one obstetric danger sign, but 13.0% could not identify any and many women reported a limited range of signs. Multiple factors were associated with awareness in bivariate analyses. Because conventional multivariable logistic regression was affected by separation and non-convergence, definitive adjusted associations cannot be claimed from the current analysis. ANC providers and maternal-health programs should strengthen comprehensive, repeated danger-sign counseling and verification of understanding. Further work should apply separation-resistant multivariable methods to the original labeled SPSS dataset before publication of definitive adjusted-effect estimates.

7. List of abbreviations:

ANC: Antenatal care; AOR: Adjusted odds ratio; CI: Confidence interval; COR: Crude odds ratio; DSP: Danger signs of pregnancy; GA: Gestational age; MMR: Maternal mortality ratio; MDG: Millennium Development Goals; OR: Odds ratio; SPHMMC: St. Paul Hospital Millennium Medical College; SPSS: Statistical Package for the Social Sciences.

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9. References:

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Declarations:

Ethics Approval:

Ethical approval was obtained from the St. Paul Hospital Millennium Medical College Institutional Review Board (SPHMMC IRB). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent to Participate:

Written informed consent was obtained from all participants before data collection. Participants were informed about the purpose of the study, the voluntary nature of participation, and their right to refuse or withdraw from the study without consequence. The collected information was kept anonymous and confidential.

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Author Contributions:
Habtamu Fekadu Andeta: conceptualization, study design, data collection, data analysis, interpretation of findings, manuscript drafting, and revision. Elias Senbeto: supervision, methodological guidance, critical review, and revision of the manuscript. Both authors read and approved the final manuscript.

Competing Interests:
The authors declare that they have no competing interests.

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