Knowledge of danger signs during pregnancy and health seeking behaviours among women attending antenatal care; the case of two referral hospitals in Southwest Cameroon

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Research Article

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Abstract

Background: Danger signs of pregnancy are alerts of obstetric complications which commonly occur from mid to late pregnancy and can lead to maternal and/or fetal morbidity/mortality if appropriate care is not sort in a timely manner. Delay in seeking care is one of the key factors leading to maternal death, which can be associated with poor knowledge on obstetric danger signs. In Cameroon, published data on the assessment of knowledge of danger signs in pregnancy is rare, despite the burden of maternal morbidity and mortality.

Objective: The aim of this study was to assess the knowledge of danger signs during pregnancy and health care seeking behaviours among women attending antenatal care at the Buea and Limbe Regional Hospitals, Cameroon.

Methods: This was a hospital based, cross sectional study, conducted at the Antenatal Care unit of Buea and Limbe Regional Hospitals from 24th February 2020 to 24th May 2020. Convenient sampling was used to recruit participants, and data was collected using a structured questionnaire with closed and open-ended questions. Data analysis was done using SPSS Version 25. Multivariate logistic regression was used to assess the association between dependent and independent variables. Statistical significance was set at a 95% CI, with a P-value < 0.05. Results: A total of 400 pregnant women were enrolled in study, 117(29.3%) had experienced danger signs during pregnancy and reported the healthcare seeking behaviours after recognizing the danger sign. Among those who recognized danger signs, majority 91(77.8%) visited a healthcare facility. Almost two-thirds 246(61.5%) of respondents had poor knowledge of danger signs. The most commonly mentioned danger sign was vaginal bleeding 257(64.25%). Women who were older than 19 years (AOR=3.96; 95%CI: 2.8-4.1, P=0.006), and women who attended at least high school (AOR=3.02; 95%CI: 1.7-5.3), P= 0.001) were associated with good knowledge of danger signs.

Conclusion: Knowledge of danger signs during pregnant was poor among antenatal care attendees in both hospitals. Age older than 19 years and at least high school attendance was associated with good knowledge. Also, women took appropriate healthcare seeking actions after recognizing danger signs during pregnancy. Thus, intervention programs aiming to improve women’s knowledge on pregnancy danger signs should be intensified during antenatal care visits.

Background

Pregnancy is a normal process that results in a series of both physiological, anatomical and psychological changes in expectant mothers. However, pregnancy may be accompanied by complications which are potentially life threatening to the mother and/or the foetus[1]. Globally, at least one woman dies every minute during pregnancy and childbirth [2]. According to WHO 2014 report, globally, an estimated number of 289,000 women died during and following pregnancy and childbirth related problem in 2013 alone, showing a decline of 45% from 1990 report. Developing countries like sub-

Saharan (62%) and South Asia (24%) together contribute 86% of the problem[3]. In Cameroon, its estimated that about 406 women die per 100,000 live birth[4]. Every pregnant woman faces the risk of sudden, unpredictable complications that could end up with death or injury to herself or to her infant[5]. These deaths arise from pregnancy, childbirth or postpartum complications [6]. Evidence has shown that causes of these maternal mortality are preventable and treatable with timely access to appropriate emergency obstetric care services[7,8]. Delay in seeking care is one of the key factors leading to maternal death, which can be associated with lack of knowledge on obstetric danger signs[9]. Danger signs are mainly classified into three (during pregnancy, delivery and postpartum); The commonest danger signs during pregnancy include severe vaginal bleeding, swollen hands/face and blurred vision. Key danger signs during labour and childbirth include per vaginal bleeding, prolonged labour, convulsions, and retained placenta. Danger signs during the postpartum period include vaginal bleeding, foul smelling discharge and fever[10,11]. These signs are usually predictive of poor outcome[12]. Hence, raising awareness on knowledge of obstetric danger signs is an essential step in recognizing complications and enables one to take appropriate action to access emergency care thereby preventing maternal and perinatal mortality in our setting[10,11].

Studies carried out in Afar Region State in Ethiopia[13], Jordan[14], Erer District Somali Region, Ethiopia[15], Zambia[16], Tanzania[17], and Papua New Guinea[18] revealed 7.9%, 15.1%, 25.5%, 29%, 30.4% ,31% and 39.5% had good knowledge of danger signs during pregnancy respectively. Also, high level of education, increased maternal age, parity, number of antenatal care visit among many has been reported to be associated with good knowledge of danger signs during pregnancy and positive health seeking behaviour[17,19,20]. Despite the fact that having good knowledge of danger signs of obstetric complications during pregnancy, labour and postnatal period is essential step in recognizing complications and enables one to take appropriate action to access emergency care in a timely fashion[15], to the best of our knowledge there exist little or no published data assessing the knowledge of women on obstetric danger signs and health seeking behaviours in our setting despite the high maternal mortality rate. This study therefore, sort to assess the current knowledge on danger signs during pregnancy and health seeking behaviours among women attending antenatal care at the Buea and Limbe Regional Hospitals, Cameroon.

Methods

Study design and setting

This was a hospital-based cross-sectional study carried out Antenatal Care Unit of the Buea and Limbe Regional Hospitals from the 24th February, 2020 to 24th May 2020. The Buea and Limbe Regional Hospitals are situated respectively in the Buea and Limbe health districts of Fako division in the Southwest region of Cameroon. Fako division has a population of about 534,854 as of 2016 and a total surface area of 2,093km2. These hospitals serve as a second referral level hospitals in the southwest region. The ANC department of Buea and Limbe Regional Hospitals is run by six and four nurses respectively and is carried out every day from Monday to Friday. In Buea Regional hospital an average of

100 pregnant women come for ANC in a month. The Obstetrics/Gynaecology unit of BRH has four Obstetricians, while in the Limbe Regional hospital an average of 120 pregnant women come for ANC per month and the Obstetric/Gynaecology unit has one Obstetrician. Activities during ANC visits include: Education on mother and child health, vaccination of pregnant women, administration of Intermittent Preventive Treatment of malaria, requesting routine laboratory tests, referral to the Obstetrician in cases of high-risk pregnancy, and supply of impregnated mosquito bed nets to pregnant women.

Study population and sampling

A convenient consecutive sampling was used to recruit participants. Sample size was calculated using Lorenz formular[21] and P from a study carried out by Mwilike et al in Tanzania in 2018 where 31% of the respondents had good knowledge of danger signs during pregnancy[17].

N= Minimal sample size

p= prevalence of knowledge of danger signs during pregnancy = 0.31

d=Absolute error of precision=0.05

Z = standard normal variate (if significance criterion is 0.05) = 1.96.

$$n = \frac{Z^2 P(1-P)}{d^2}$$

$$\mathbf{n} = \frac{(1.96)^2\ 0.31[1-0.31]}{(0.05)^2}$$

$$\mathbf{n} = 328$$

To cover for non-respondent cases, we added 10% of our calculated minimum to meet up the drawback. Hence, our minimum sample size was set at 362 pregnant women attending ANC.

Participants enrolment and Data collection

Data collection was done with the aid of a structured questionnaire. The questionnaire included information on the socio-demographic, obstetrics characteristics of the women, questions on knowledge of danger signs during pregnancy and health seeking action. Pregnant women were approached during their routine ANC visits in the hospitals while they were waiting to be attended to. After obtaining informed consent, clients underwent an interpersonal interview in private. To assess knowledge on danger signs, a list of danger signs stated in WHO guide for essential practice was used[22]. They include: per vaginal bleeding, high grade fever, no or reduced foetal movement, convulsions or fits, swollen (hands, face, feet or ankles), leaking of fluid from vaginal, difficulty in breathing, severe pelvic or

abdominal pain, too weak to go out of bed, and severe headache with blurred vision[22]. Pregnant women who mentioned less than four danger sign were categorized as having poor knowledge of danger signs during pregnancy while those who mentioned at least four danger signs were categorized as having good knowledge[17,23,24]. Health seeking behaviours were determined by asking a woman the action(s) she would take after recognizing a danger sign during pregnancy. The actions included: consulting a friend or relative, visiting a traditional birth attendant, self-treatment, doing nothing and visiting health facility. The appropriate action to take was to visit a health facility for early and prompt care and management. Other mentioned health seeking actions were considered inappropriate.

Statistical analysis

Data collected was coded, entered into Epi-info version 7.2 and exported into SPSS version 25 for analysis. For descriptive analysis, continuous variables were summarized using means and standard deviation while categorical variables were summarized using proportions, then presented in frequencies tables and charts. Binary logistic regression analysis was used to test association between dependent variable (knowledge of danger signs) and independent variables (sociodemographic and obstetric characteristics) and reported as Crude odd ratios at 95% confidence intervals. All variables with a $p < 0.05$ in binary logistic regression analysis were entered into a multiple logistic regression model to test for association of the dependent variable at a 95% confidence limits and reported as Adjusted odd ratios (AOR) and their 95% confidence intervals. A two-tailed p-value less than 0.05 was considered statistically significant.

Ethics considerations

The ethical clearance for this study was issued by the institutional Review Board of the Faculty of Health Sciences, University of Buea (ref. N$^{o:}$ 2020/1060-01/UB/SG/IRB/FHS). An administrative approval was obtained from the regional delegation of Public Health for the Southwest Region (ref. N$^{o:}$ R11/MINSANTE/SWR/RDPH/PS/510/768) and the Directorate of Buea and Limbe Regional Hospitals, Cameroon (ref. N$^{o:}$ 361/MPH/SWR/RHL/DO). To ensure confidentiality, all patient information was coded.

Results

A total of 400 pregnant women were enrolled in the study, who all consented to participate, giving a 100% respondents rate. The participating women responded to all the questions in the questionnaire.

Socio-demographic characteristics of the participants

The age range of participants was 16-42years with a mean age of 27.65 ± 5.4 years and median age 27years and IQR of 24-31 years. About half (56.3%) of respondents were in the age group 20-29 years while majority 252(63.0%) and 282(70.5%) were employed and married respectively. Most of the women, 181 (45.9%) had university education. Majority of the respondents were Christians 386(96.5%) and 215(53.8%) of the participants were from Buea Regional Hospital.

Table I: Socio-demographics characteristics of participants (N=400)

Characteristics	Frequency	Percentage (%)
Age (Years)		
<20	30	7.5
20-29	225	56.3
30-39	135	33.8
≥40	10	2.5
Educational Level		
Primary	33	8.4
Secondary	93	23.6
High School	87	22.1
≥University	181	45.9
Occupation		
Employed women	252	63.0
Unemployed women	148	37.0
Marital Status		
Married	282	70.5
Single	118	29.5
Religion		
Christian	386	96.5
Muslim	14	3.5
Health Facility		
Buea Regional Hospital	215	53.8
Limbe Regional Hospital	185	46.2

Employed: Civil servant, private institution, petty grade, Unemployed: Housewife, student, farmer.

Obstetric characteristics of participants

Of the 400 respondents interviewed, almost two-thirds (61.3%) of respondents were multigravida. The gravidity range of participants was 1-7 with a mean gravidity of 2.4 ± 1.4SD and median gravidity 2 and IQR of 1-3.

Table II: Obstetric Characteristics of pregnant women attending ANC (N=400)

Characteristics	Frequency	Percentages (%)
Gravidity		
Primigravida (1)	124	31.0
Multigravida (2-4)	245	61.3
Grand multigravida (≥5)	31	7.8
Number of ANC Visits		
1-3	183	45.8
≥4	217	54.2

Source of information of danger signs during pregnancy

A total of 368 (92%) women reported that they had heard about danger signs during pregnancy. The source of information about danger signs during pregnancy was from health workers for 236 women (59.0%), radio/internet for 89 women (22.2%), and relatives/social gatherings for 75 women (18.8%).

Knowledge of danger signs during pregnancy

Out of the 400 participants, when asked to spontaneously mention the danger signs, more than half of the participants 246 (61.5%) were able to mention less than four danger signs. Only 154 (38.5%) were able to mention at least four danger signs during pregnancy and were considered as having good knowledge (figure 2). The mean score for knowledge of danger signs was 2.19 (SD = 1.795).

The most commonly known danger signs were vaginal bleeding 257(64.25%), abdominal pain 147(36.75%), and fever 131(32.75%).

Table III: Frequencies of Pregnancy Danger signs mentioned

Danger Signs	Frequency	Percentage (%)
Vaginal Bleeding	257	64.25
Abdominal pain	147	36.75
Fever	131	32.75
Leakage of fluid per vaginal	80	20.00
No/Reduced Foetal Movement	68	17.0
Too weak to go out of bed	59	14.75
Swollen face, hands, legs	58	14.50
Difficulty in breathing	28	7.00
Convulsion or fits	28	7.00
Severe headache with blurred vision	23	5.75

NB. Danger sings; Multiple responses were possible

Factors associated with knowledge of pregnancy danger signs

Bivariate analysis (binary logistic regression analysis) of sociodemographic and obstetrics characteristics versus knowledge of pregnancy danger signs was performed (Table IV). Good knowledge was significantly associated with age($p<0.001$) marital status($P=0.006$), level of education($P=0.003$), occupation ($P=0.003$), gravidity and parity ($P=0.0008$). Number of ANC visits show no association.

Table IV: Factors associated with good knowledge of danger signs during pregnancy (Bivariate analysis)

Type of variable	Good knowledge	Poor knowledge	COR (95% CI)	P-value
Age of respondent				
<20years	3	27	1	
20-29years	70	155	4.1(1.2-13.9)	**0.025**
30-39years	72	63	10.29(3.0-36.0)	**<0.001**
≥40years	9	1	80.99(7.5-88.1)	**<0.001**
Educational Level				
≤Secondary	35	91	1	
≥High School	119	155	2.0(1.26-3.15)	**0.003**
Occupation				
Unemployed	40	108	1	
Employed	114	138	2.23(1.4-33.5)	**<0.001**
Marital Status				
Not Married	30	88	1	
Married	124	158	2.30(1.4-3.7)	**<0.001**
Gravidity				
Primigravida	33	91	1	
Multigravida	97	148	1.81(1.12-2.9)	**0.014**
Grand multigravida	24	7	9.44(3.72-23.96)	**<0.001**
Parity				
Nulliparity	35	96	1	
Multiparparity	119	150	2.18(1.38-3.43)	**<0.001**
Antenatalcarevisits				
1-3	0	183	1	
≥4	154	63	2873.38(123.4-33543)	0.911

CI: confidence interval, COR: crude odd ratios

In multivariate analysis the factors that were independently associated with good knowledge of danger signs in pregnancy were maternal age greater than 20 years (AOR 3.96; 95% CI: 2.8-4.1, p-0.006) and women who had above high school education (AOR 3.02; 95% CI: 1.7-5.3, p<0.001) (Table V). The other factors studied were not associated with danger signs in pregnancy.

Table V: Factors associated with good knowledge of danger signs during pregnancy (Multivariate analysis)

Type of variable	Good Knowledge	Poor Knowledge	AOR (95%CI)	P-value
Age of Respondent				
≤19years	3	27	1	
>19years	151	219	3.96(2.8-4.1)	**0.006**
Educational Level				
<High school	35	91	1	
≥High school	119	155	3.02(1.7-5.3)	**<0.001**
Occupation				
Unemployed	40	108	1	
Employed	114	138	1.41(0.9-2.3)	0.18
Marital status				
Not Married	30	88	1	
Married	124	158	1.28(0.7-2.2)	0.38
Gravidity				
Primgravida	33	91	1	
Multigravida	97	148	1.28(0.27-6.1)	0.76
Grand multigravida	24	7	5.02(0.78-32.2)	0.09
Parity				
Nulliparous	35	96	1	
Multiparous	119	150	1.05(0.23-4.83)	0.952

CI: confidence interval, AOR: Adjusted odd ratio.

Health seeking behaviours after recognizing danger signs

The healthcare seeking behaviours were categorized as either appropriate (visiting a health facility) or inappropriate (taking no action, visiting a traditional healer or traditional birth attendant, consulting a friend/relative, or self-medication). A total of 117 (29.25%) participants had recognized danger signs during their current pregnancy by the time of the interview. All the women who experienced danger signs such as reduced foetal movement, convulsion and difficulty in breathing went to a health facility for care (Table VI).

Table VI: Healthcare seeking behaviours of women who experienced danger signs during pregnancy.

Danger Signs	Total (percentage)	Went to a health facility	Did nothing	Consulted a friend/relative	Self-treatment/care
Vaginal bleeding	14(11.97%)	12	0	0	2
Fever	29(24.79%)	20	0	5	4
Reduce/No Foetal movement	6(5.13%)	6	0	0	0
Convulsion/fit	2(1.71%)	2	0	0	0
Swollen hands, legs, face	9(7.69%)	2	5	2	0
Leakage of fluid from vaginal	5(4.27%)	3	0	2	0
Difficulty in breathing	1(0.87%)	1	0	0	0
Severe pelvic or abdominal pain	29(24.79%)	22	3	0	4
Too weak to get out of bed	16(13.68%)	4	8	0	4
Trouble with vision	6(5.13%)	5	0	1	0

Discussion

We conducted a descriptive cross-sectional study at the Buea and Limbe Regional hospitals to assess the knowledge on danger sings during pregnancy, associated factors and health seeking behaviours among women attending antenatal clinic.

We enrolled 400 participants within which 154(38.5%) had good knowledge on danger signs linked to pregnancy while 246(61.5%) of the participants had poor knowledge. More than two-third of the participants that experienced danger signs during this pregnancy visited a health care facility for solutions. This study also elucidates an association between age greater than 19 years (AOR: 3.96; 95%CI: 2.8-4.1; p- 0.006), high school (AOR:3.02; CI95%; 1.7-5.3; p- <0.001) and good knowledge. Our findings indicate that knowledge of danger signs during pregnancy was low among the participants. We observed an overall good knowledge level (women who knew at least four danger signs) of danger signs during pregnancy in 38.5% of the participants. These results are consistent those revealed by Vallely et al in Papua New Guinea, who reported that 39.5% of respondents had good knowledge[18]. Our findings were however, higher compared to studies carried out in the Afar Region State in Ethiopia[13], Jordan[14], Erer District Somali Region Ethiopia[15], Zambia[16] and Tanzania[17], which revealed knowledge level of 7.9%, 15.1%, 25.5%, 29%, 30.4% and 31% respectively. A possible explanation could be because, these studies were community based and participants were women who gave birth one to two years prior to the survey, secondly majority of participants in our study 268(68%) had attended at least high school, compared to other studies where most of the participants had only secondary school education. However, our finding was low compared to studies carried out in Rural Madagascar[25] and Delhi, India[26]. This difference in results can be attributed to, firstly the different criteria used for assessing knowledge (a woman was considered to have good knowledge if she spontaneously mentioned at least two/one danger sign respectively, whereas in our study good knowledge was considered when a participant spontaneously mentioned at least four danger signs. Another reason could be due to the fact the above studies were carried out in a tertiary care facility where the respondents would have had a better awareness.

The most common spontaneously mentioned danger sign of pregnancy was vaginal bleeding (64.25%) followed by abdominal pain (36.75%). This finding is similar to studies carried out by Morhason-Bella et al in Nigeria[27] , Hailu et al in Ethiopia[7] and Kabakyenga et al in Uganda[28] where the most commonly mention danger signs were per vagina bleeding, abdominal pain severe headache/blurred vision and fever. However, this finding is contrary to findings by Kumar A et al in Delhi, India[26] were the commonly mentioned pregnancy danger sign was abdominal pain followed by per vaginal bleeding. The reason vaginal bleeding was commonly mentioned could possibly be because it is the most visible sign compared with other signs such as reduced foetal movement that need keen attention to notice. Nevertheless, emphasis should also be placed on other danger signs that were not commonly mentioned such as convulsions. A study by Hailu et al in Ethiopia revealed that this danger sign was not spontaneously mentioned even though they indicated the presence of (pre-)eclampsia[7].

From our study, we found a significant association between having good knowledge of danger signs and age of participants. Similar findings were reported from studies in Tanzania and South Africa, which found increased awareness/knowledge among older women[17,29]. This could be explained by the fact that; firstly, older women have more experience with pregnancy issues. Secondly, being young and immature may likely affect the reception of antenatal education and the recognition of signs of obstetric complications[17]. WHO reported that adolescent pregnancy remains a major contributor to maternal

mortality and that obstetric complications are the second cause of death among 15 to 19-year olds globally[30]. Most pregnant adolescents lacked social support, experienced community stigmatization, and were treated improperly by health workers[31]. In our study, level of educational was associated with knowledge of the pregnancy danger signs. Women with higher education (from high school) had more chances to identify the pregnancy danger signs. This finding is similar to studies in Papua New Guinea[18], Tanzania[17] and Ethiopia[6]. This may be explained by the fact that women with a higher level of education are more likely to have more access to information, health facilities and services.

Even though number of ANC visits (≥4 visits) have been reported to have an association with knowledge on pregnancy danger signs[6,32], that was contrary to our study despite the fact that 54.2% of our participants attended at least four ANC visits. The reason for this could probably be because most of the women turn to do their routine laboratory tests requested during health education. It could also be because of poor teaching methods since all the women are usually put in one hall during health talks and individual follow up is difficult. Also, from our study there was no association between gravidity and knowledge on pregnancy danger despite the fact that more than half our participants (61.3%) were multi gravida. This was contrary to findings which report increasing gravidity to be associated with knowledge on danger signs[20,23,33]. This discrepancy could be due to the fact that, not all pregnancy may lead to a life birth since those who had pregnancy loss through induce abortion may not have experienced any danger signs or attend ANC visit. It is usually during ANC sessions that women learn about danger signs. Secondly, studies that have reported the association between gravidity and good knowledge on danger signs justify this to be as a results of experience or repeated ANC visit. Their findings could be contrary in cases of recall bias or under reported findings by our participants.

Regarding the health seeking behaviours of participants in our study, it was revealed that 117(29.25%) had experienced danger sign during the current pregnancy. The majority of women 91(77.78%) who had recognized signs of complications during their pregnancy visited a health facility for care and management. This finding is similar to that reported by Mwilike et al in Tanzania[17]. This could likely be fear for the life of their unborn baby.

Limitations of our study

Our study was likely subjected to reporting and recall bias. To reduce this bias, we pre-tested the survey instrument for design flaws as part of the validation instrument and conducted interviews with local languages familiar to participants.

Strengths of the study

Despite the high MMR in Cameroon, to the best of our knowledge, this is the first study to assess knowledge on pregnancy danger signs and health seeking behaviours among women in our setting.

Conclusions

The findings of this study indicate that a significant proportion of women had poor knowledge of danger signs during pregnancy. Women who did not have good knowledge on pregnancy danger signs were more liable to delay seeking obstetric health care and were therefore at greater risk of obstetric complications. Furthermore, participants who had at least high school education and those who were 20years and above were associated with good knowledge on pregnancy danger signs. The majority of women who experienced danger signs during pregnancy took appropriate healthcare seeking action.

Abbreviations

ANC: Antenatal clinic

BRH: Buea Regional Hospital

CI: Confidence Interval

CS: Caesarean section

DS: Danger signs

LRH Limbe Regional Hospital

MMR: Maternal Mortality Ratio

OR: Odd Ratio

PPH: Post-partum hemorrhage

SDG: Sustainable Development Goals

VD: Vaginal delivery

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

The ethical clearance for this study was issued by the institutional Review Board of the Faculty of Health Sciences, University of Buea (Ref:2020/1060-01/UB/SG/IRB/FHS). An administrative approval was obtained from the regional delegation of Public Health for the Southwest Region (Ref: R11/MINSANTE/SWR/RDPH/PS/510/768) and the Directorate of Buea, and Limbe (Ref: 361/MPH/SWR/RHL/DO) Regional Hospitals, Cameroon. A written informed consent was obtained from

all participants. All methods were performed in accordance with ethical guidelines as outlined in the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and material

The data sets supporting the findings of this study are available, and can be provided by the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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None.

Authors' contributions

ENA wrote the research proposal and designed the study. DCN and TOE reviewed and corrected the research proposal. ENA & CAA collected the data. ENA and YLN analysed the data and wrote the initial manuscript. DCN, CAA and TOE proof-read and corrected the final manuscript. All authors approved the final manuscript.

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References

1. World Health Organization (WHO). Mother-baby package: Implementing safe motherhood in countries. Geneva, Switzerland: WHO; 1994.

2. Mulugeta AK, Giru BW, Berhanu B DTK about birth, Primigravida preparedness and complication readiness and associated factors among, women in Addis Ababa governmental health facilities, Addis Ababa, Ethiopia 2015. *Reprod Health.* 2020;17(2): 1-6.

3. Roudi F, Monem A, Ashford L, El-Adawy M, Rawe K, Moreland S. The Millennium Development Goals Report 2014, United Nations, 2014.

4. Cameroon Maternal Mortality Rate 2000-2020 [Internet]. Available from: https://www.macrotrends.net/countries/CMR/cameroon/maternal-mortality-rate.

5. Workineh Y, Hailu D, Gultie T, Degefu N, Mihrete M, Shimeles M, et al. Knowledge of Obstetric Danger Signs and its Associated Factors in Arba Minch Town. Ethiopia. *Am J Heal Res*. 2014;2(5):255–9.

6. Bililign N, Mulatu T. Knowledge of obstetric danger signs and associated factors among reproductive age women in Raya Kobo district of Ethiopia: A community based cross-sectional study. BMC Pregnancy Childbirth. 2017; 70(17):1-8.

7. Hailu M, Gebremariam A, Alemseged F. Knowledge about obstetric danger signs among pregnant women in Aleta Wondo District, Sidama Zone, Southern Ethiopia. Ethiop J Health Sci .2010;20(4):25-32

8. McCarthy A. Monitoring Emergency Obstetric Care. J Obstet Gynaecol (Lahore). 2010; 19(3):21-34.

9. Bintabara D, Mpembeni RNM, Mohamed AA. Knowledge of obstetric danger signs among recently-delivered women in Chamwino district, Tanzania: a cross-sectional study. BMC pregnancy childbirth; 2017:276(17):1-8.

10. MNH program. Birth Preparedness and Complication Readiness: A Matrix of Shared Responsbilities. Orig BP/CR Matrix. 2004;

11. Hailu D, Berhe H. Knowledge about Obstetric Danger Signs and Associated Factors among Mothers in Tsegedie District, Tigray Region, Ethiopia 2013: Community Based Cross-Sectional Study. 2014;9(2):0–7.

12. Bililign N, Mulatu T. Knowledge of obstetric danger signs and associated factors among reproductive age women in Raya Kobo district of Ethiopia: A community based cross-sectional study. BMC Pregnancy Childbirth. 2017;

13. Liben ML, Wuneh AG, Zepro NB. Knowledge of pregnancy danger signs and associated factors among pastoral women in Afar Regional State , Ethiopia Knowledge of pregnancy danger signs and associated factors among pastoral women in Afar Regional State , Ethiopia. cogent Med. 2019;6:1–9

14. Okour A, Alkhateeb M, Amarin Z. Awareness of danger signs and symptoms of pregnancy complication among women in Jordan. Int J Gynecol Obstet. 2012;118:11–4.

15. Maseresha N, Woldemichael K, Dube L. Knowledge of obstetric danger signs and associated factors among pregnant women in Erer district, Somali region, Ethiopia. BMC Womens Health. 2016;

16. Mubita-ngoma CA. Knowledge and Perception of Women Towards Danger Signs in Pregnancy in Choma Rural District , Zambia. Med J Zambia. 2015;40.

17. Mwilike B, Nalwadda G, Kagawa M, Malima K, Mselle L, Horiuchi S. Knowledge of danger signs during pregnancy and subsequent healthcare seeking actions among women in Urban Tanzania: A cross-sectional study. BMC Pregnancy Childbirth. 2018;

18. Vallely LM, Emori R, Gouda H, Phuanukoonnon S, Homer CSE, Vallely AJ. Women ' s knowledge of maternal danger signs during pregnancy : Findings from a crosssectional survey in Papua New Guinea. Midwifery. 2019;72:7–13.

19. Knowledge BJ. Knowledge of Obstetric Danger Signs and Its Determinants among Women of Reproductive Age in Kwaba Community in North-Western Nigeria. J Med Heal Dev. 2017;22(1):37–44.

20. Gebrehiwot H, Bahta S, Haile N. Awareness of Danger Signs of Pregnancy and its Associated Factors among Pregnant Women who Visit ANC in Mekelle Public Hospitals. Am J Adv Drug Deliv. 2014; 105(2):94–8.

21. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian Journal of Psychological Medicine*. 2013. 87(6):1439–49.

22. World Health Organization. Pregnancy, childbirth, postpartum and newborn care: a guide for essential practice. 3rd ed. Geneva: B, quick check, rapid assessment and management of women of childbearing age; 2015. https://www.ncbi.nlm.nih.gov/books/NBK326676.

23. Okour A, Alkhateeb M, Amarin Z. Awareness of danger signs and symptoms of pregnancy complication among women in Jordan. *Int J Gynecol Obstet*. 2012; 118(1):11-4.

24. Mbalinda SN, Nakimuli A, Kakaire O, Osinde MO, Kakande N, Kaye DK. Does knowledge of danger signs of pregnancy predict birth preparedness? A critique of the evidence from women admitted with pregnancy complications. *Heal Res Policy Syst*. 2014; 6(2):19–28.

25. Salem A, Lacour O, Scaringella S, Herinianasolo J, Benski AC, Stancanelli G, Vassilakos P, Petignat P, Schmidt NC. Cross-sectional survey of knowledge of obstetric danger signs among women in rural Madagascar. 2016;11(4):917–43.

26. Kumar A, Yadav G, Zutshi V, Bodat S. Knowledge about obstetric danger signs among pregnant women attending antenatal clinic in a tertiary care hospital of Delhi: a cross sectional study. Int J Reprod Contraception, Obstet Gynecol. 2019.

27. Morhason-Bello IO, Fagbamigbe AF, Mumuni TO, Adesina OA, Abdus-Salam AR, Ifemeje A, Ojengbede OA. Evaluation of correct knowledge of key danger signs in pregnancy among antenatal clinic attendees at a tertiary health facility in Nigeria. *Niger J Clin Pract*. 2016;

28. Kabakyenga JK, Östergren PO, Turyakira E, Pettersson KO. Knowledge of obstetric danger signs and birth preparedness practices among women in rural Uganda. *Reprod Health*. 2011; 33(8).

29. Hoque M, Hoque ME. Knowledge of danger signs for major obstetric complications among pregnant KwaZulu-Natal women: Implications for health education. *AsiaPacific J Public Heal*. 2011.

30. World Health Organization. Adolescent Pregnancy Fact Sheet N°364, (Updated September 2014). http://www.who.int/mediacentre/factsheets/ fs364/en/. Accessed 19 june 2020. In: *World Health Organization Adolescent Pregnancy Fact Sheet N°364*.

31. Atuyambe L, Mirembe F, Johansson A, Kirumira EK, Faxelid E. Experiences of pregnant adolescents-voices from Wakiso district, Uganda. *Afr Health Sci*. 2007;5(4):304–9.

32. Solomon AA, Amanta A, Chirkose E, Badi MB. Knowledge about danger signs of pregnancy and associated factors among pregnant women in Debra Birhan town, Central Ethiopia. *Sci J Public Health*. 2015;3(2):269–73.

33. Teng SP, Zuo TC, Jummaat FB, Keng SL. Knowledge of pregnancy danger signs and associated factors among Malaysian mothers. *Br J Midwifery*. 2015.

Figures

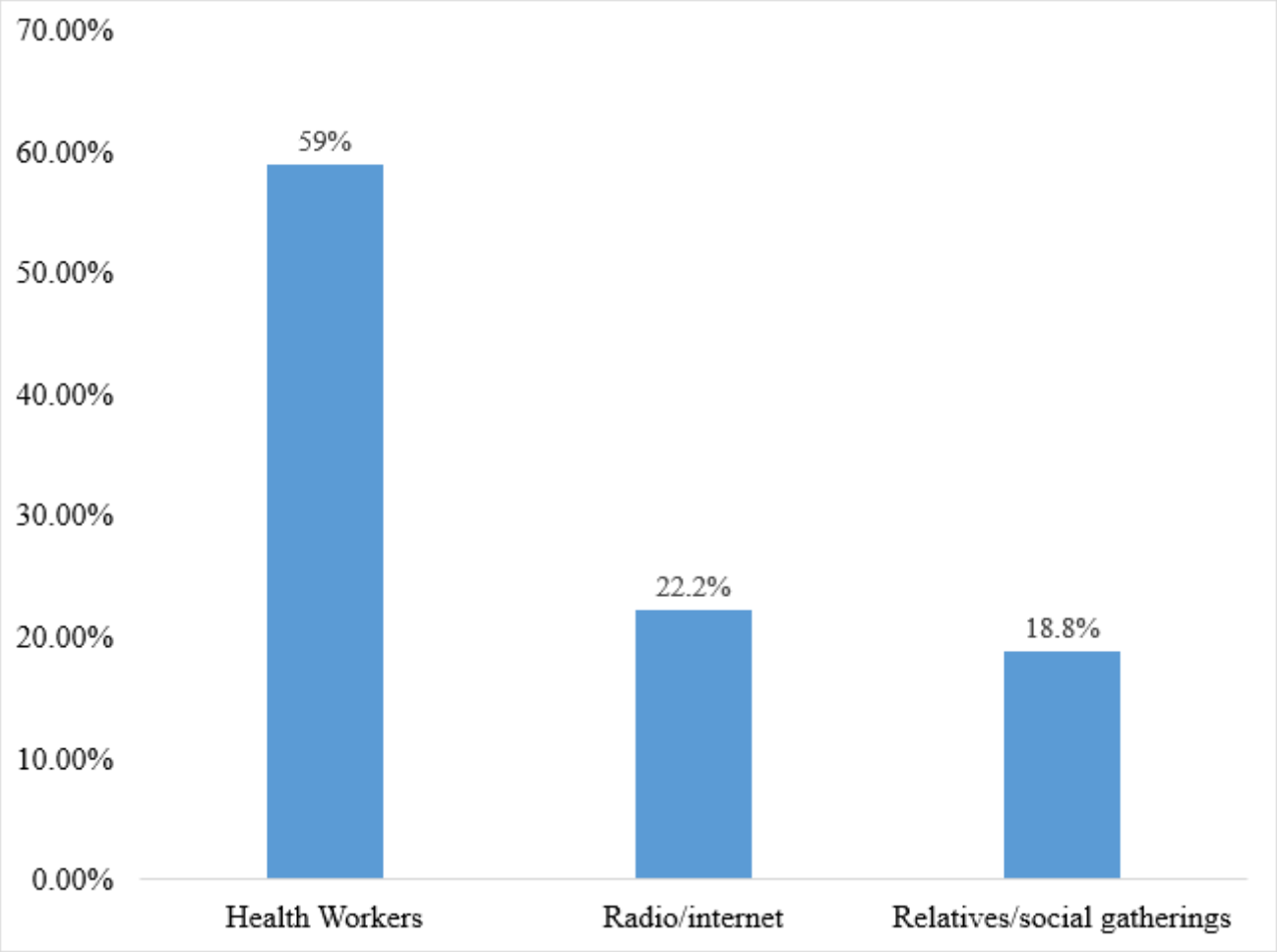

Figure 1

Source of information of danger signs.

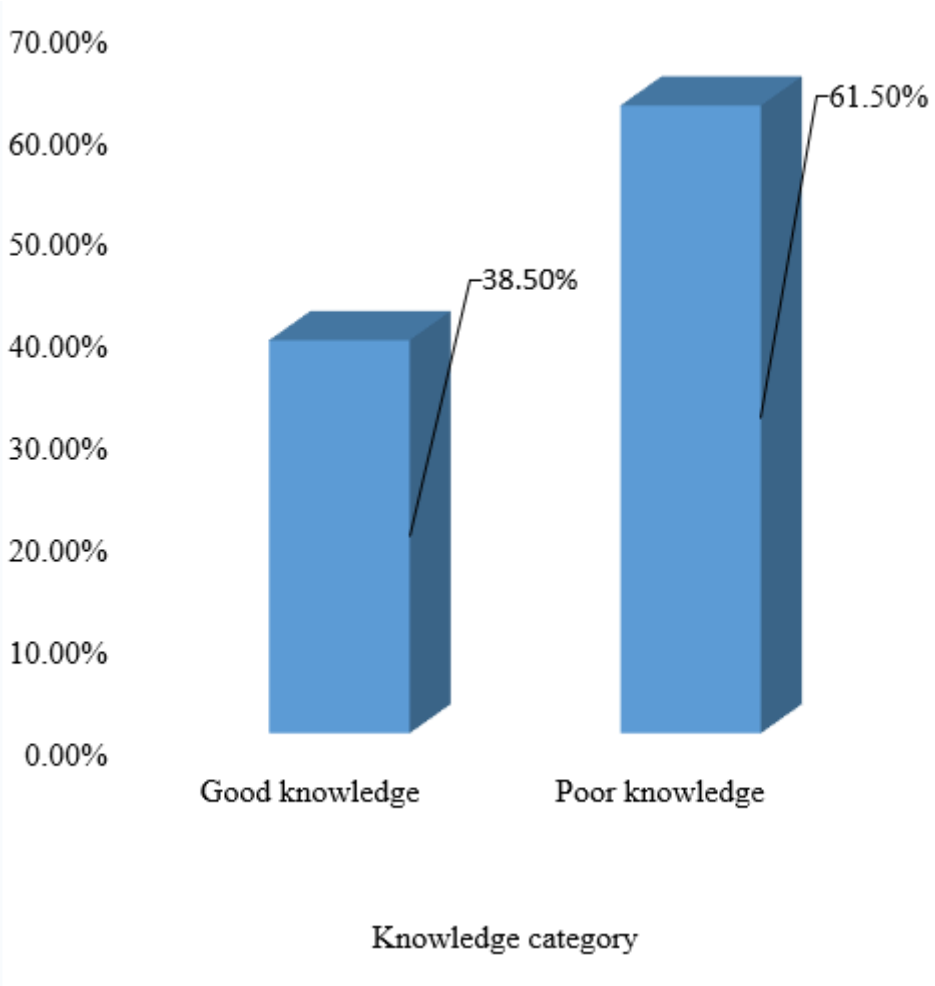

Figure 2

Distribution of knowledge level on danger signs during pregnancy.