COLLEGE OF MEDICINE AND HEALTH SCIENCE

DEPARTMENT OF MIDWIFERY

KNOWLEDGE AND ASSOCIATED FACTORS TOWARDS PREVENTABLE RISK FACTORS OF CONGENITAL ANOMALIES AMONG ANTENATAL CARE ATTENDING MOTHERS AT PUBLIC HEALTH INSTITUTIONS IN HAWASSA CITY, ETHIOPIA

MSC THESIS

BY:- DEBISO ERGINO (BSC IN MIDWIFERY)

NOVEMBER, 2023

HAWASSA, ETHIOPIA

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A THESIS REPORT TO BE SUBMITTED TO DEPARTMENT OF MIDWIFERY COLLEGE OF MEDICINE AND HEALTH SCIENCE, HAWASSA UNIVERSITY, FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTERS OF SCIENCE IN CLINICAL MIDWIFERY

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HAWASSA, ETHIOPIA

Declaration

I, the undersigned, declare that this is my original work, has never been presented in this or any other university, and that all the resources and material used for the dissertation, have been fully acknowledged

Name; ----------Signature; ----------Date; ----------

Approval Sheet

Title: Knowledge and associated factors towards preventable risk factors of congenital anomalies among antenatal care attending mothers at public health institutions in Hawassa City, Ethiopia, 2023.

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We, the undersigned, members of the board of examiners of the final open defense by **Debiso Erjino**, have read and evaluate his thesis entitled "**Knowledge and associated factors towards preventable risk factors of congenital anomalies among antenatal care attending mothers at public health institutions in Hawassa City, Ethiopia, 2023**" and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirement for the degree Master of Science in Clinical Midwifery.

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Name of External Examiner	Signature	Date
SGS Approval	Signature	Date

Final approval and acceptance of the thesis is contingent up on the submission of the final copy of the thesis to the School of Graduate Studies (SGS) through the Department/School Graduate Committee (DGC/SGC) of the candidate's department.

SGS stamp: Date----------

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Abbreviations and Acronyms

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
BD	Birth Defects
CAs	Congenital Anomalies
CI	Confidence Interval
CNS	Central Nervous System
COR	Crude Odds Ratio
LMICs	Low- and Middle-Income Countries
NTDs	Neural Tube Defects

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Abstract

Background:- Congenital anomalies are problems of structure and function that can develop during intrauterine life and can be detected during pregnancy, at birth, or later in life. The etiology is genetic, environmental, multifactorial, and unknown. Globally 1 in 33 babies is born with a birth defect. More than 90% of birth defects occurred in low and middle-income countries. In Ethiopia, there was limited evidence to assess the knowledge of pregnant mothers despite the increasing prevalence of birth defects of preventable risk factors of congenital anomalies.

Objective:- To assess the knowledge and associated factors towards preventable risk factors of congenital anomalies among antenatal care attending mothers at public health institutions in Hawassa City, Ethiopia, 2023.

Methodology:- An institutional-based cross-sectional study was conducted among 422 systematically selected pregnant mothers who attended the ANC clinic in Hawassa City public health institutions from July 20-August 20, 2023. A pretested, interviewer-administered questionnaire was used. An open data kit and statistical package for Social Science version 27 were used for data collection and analysis, respectively. To identify associated factors bivariate and multivariable analyses were carried out.

Result:- A total of 422 pregnant mothers participated in this study with a response rate of 100%. Of the total participants, 79.4% were urban residents, 45.0% attain secondary school and 73.9% had antenatal care follow-up. Only 5.9% knew that congenital anomalies are acquired by pregnant mothers, 68.2% of them knew that congenital anomalies are genetic, and 11.4% of them knew that it occur due to the sin of families. Overall 58.3% of mothers had good knowledge of preventable risk factors of congenital anomalies.

Conclusion:- Comparatively participants had moderate knowledge on overall knowledge about preventable risk factors of congenital anomalies compared to other studies. However, the knowledge was influenced by urban residence; college and above educational attainment, and antenatal care follow-up of the participants. It is advised to address pre-pregnancy and pregnancy health education, with a focus on birth defect prevention.

Keywords: antenatal care, congenital anomalies, risk factors, knowledge, pregnant mothers, Ethiopia

1. Introduction

1.1 Background

Congenital anomalies (CAs) are defined as structural and functional disorders that can occur during intrauterine life. CAs can be identified during antenatal, at birth, or later in life. CAs are also known as birth defects (BDs), congenital disorders, or congenital malformations these conditions may develop prenatally and may be identified before or at birth, or later in life (WHO, 2020). Birth defects are one of the CAs that are present at birth, and can be classified as structural like anencephaly, cleft pallet, hirschsprungs disease, infant polycystic kidney diseases, renal agenesis, spinal bifida, etc, or maybe genetic anomalies like Trisomy 21, Turners syndrome and genetic disorders like thalassemia, etc (Peter et al., 2013). Structural BDs are those that affect the development of the body part that usually develops during the first few weeks of pregnancy when the time of organ develops. (Taye et al., 2016)

Nearly 50% of congenital disorders cannot be associated with a specific cause. However, the etiologies of CAs can be briefly categorized into four: these are genetic factors (30-40%); multifactorial inheritance factors (20-35%); environmental factors (5-10%); unknown factors (30-45%) (WHO, 2020). The growing embryo may be vulnerable to internal and environmental risk factors throughout the first three months of pregnancy, which may result in the embryo in CAs. (Musumeci et al., 2015), (Ekwere et al., 2011). Environmental teratogens, micronutrient shortages, chromosomal problems, single gene defects, and multifactorial inheritance are assumed to be the causes of CAs, albeit the majority of their origins are still unknown. (Postoev el at., 2015)

During the first month of development, the growing embryo's brain, spine, and spinal column are all affected by the structural CNS deficiency known as a neural tube defect (NTD) (Taye et al., 2016). The majority of NTDs develop as the embryo's neural plate is developing or during neurulation. While insufficient secondary neurulation results in closed NTDs, failure of the neural folds to meet and fuse during primary neurulation causes NTDs. Open and closed types of neural tube defects are distinguished by the clinical variance. Anencephaly and spinal bifida are the two most prevalent NTDs overall (Makelarski et al., 2010). Spinal Bifida (SB) is considered the most common form of NTDs occur with the association of hydrocephalus. (Canada, 2018)

1.2 Statement of problem

Globally, 1 in 33 babies is currently born with a birth defect and it is a leading cause of morbidity and mortality in children (Shamnas et al., 2013),(Raisa and Galina et al. 2018). Congenital anomalies (CAs) can contribute to life-long disability and global health problems causing an estimated 303,000 newborn deaths each year (WHO, 2016).

Congenital disorders are one of the main causes of the global burden of disease, which disproportionately affects low and middle-income countries (LMICs). As infections and nutritional deficits are better addressed, congenital defects are becoming a greater cause of neonatal and infant death. Evidence indicated that 28.9 per 1000 live births in the United States of America (USA) were congenital malformations. Congenital abnormality incidence varies from place to place. (Egbe et al., 2015) The frequency of multiple congenital abnormalities was 19.7 per 10,000 live births between 1990 and 2014, according to research based on data from the European Surveillance of Congenital Abnormalities (EUROCAT) registry of the County of Funen in Denmark. (Toxvaerd and Garne et al., 2021)

According to the WHO 2015 World Health Ranking publication, in Sri Lanka every year nearly 1.13% of infant deaths occur due to fetal anomalies. The rate of fetal anomalies is 6.77%. In Sri Lanka the major cause of death and morbidity among children under the age of five is CAs. In recent years, birth defect-related mortality has grown (Fernando et al., 2014), (Family Health Bureau Annual Report, 2018). Another study carried out in a tertiary care rural teaching institute in India revealed that the incidence of gross congenital malformations was 1.7%, with the CNS accounting for 48% of these deformities and the musculoskeletal system for 28%. The occurrence of CAs was increasing from time to time and became a health burden for the country(Marwah A. et al., 2016).

The occurrence and the impact of CAs are found to be higher in LMICs which are a serious cause of infant mortality and morbidity for both developed and developing countries. More than 90% of BDs and about 95% of infant mortality occurred in LMICs. (Kishimba et al., 2015), (Sachdeva et al., 2016). Not only in developing countries but also in European countries congenital anomalies have been increasing in prevalence and which accounts for about 2 in 1000 cases of hospital admission during 2019. (Alanazi et al., 2021)

Congenital anomalies in developing countries are actually underestimated due to a lack of diagnostic techniques and their reliability. Again the prevalence of BDs among newborn infants in sub-Saharan African countries varies widely and it accounts for 9.17 in 1000 live births in Western African countries and 43 in 1000 live births in Southern Africa (Fentahun Adane et al., 2020). A survey conducted in South Western Nigeria showed that the incidence of BD was 3.7%, from this a higher prevalence of malformations (6.3%) was found in the minority ethnic groups (Bakare et al., 2009). In another study, a higher percentage of women gave birth without the availability of community education, medical genetic screening, prenatal diagnosis, and other associated services in most developing countries (WHO, 2010). In Kampala, Uganda the prevalence of BDs was 66.2 per 10,000 births from this 23.4 per 10,000 Hypospadias, 14 per 10,000 Talipes equinovarus, and 10.3 per 10,000 NTDs. (Mumpe-Mwanja., et al. 2019)

In India, very few expectant mothers are knowledgeable about the risk of consanguinity for birth defects. Women are still not knowledgeable of a factor that contributes to maternal and newborn mortality and can significantly impact both of them. Pregnant mothers with inadequate knowledge about BDs may delay interventions (Prabhuswami Hiremath et al., 2016). The knowledge of BD among antenatal mothers in Sri Lanka was moderate in all the components namely; knowledge of BD, associated factors, and prevention and management (De Silva et al., 2019).

Similarly, in developing countries, the prevalence of congenital anomalies in Ethiopia is also rising from time to time. Evidence showed that the proportion of BDs in Ethiopia increased from 1.14% in 2010 to 2.83% in 2014 (Taye et al., 2019). Despite the fact that studying the prevalence and being aware of the etiology of BDs is a crucial public health problem, which may provide insight to concerned bodies, BDs have not received much attention (Taye et al., 2016). This study showed that the prevalence of congenital anomalies increased from 1.61% to 1.99% (Taye et al. 2016) and congenital malformation is one of the direct causes of under-five children mortality which accounts for 4% in Ethiopia. (EFMOH/MCH, 2015)

There was insufficient data available in Ethiopia to evaluate pregnant mothers' knowledge of preventable congenital anomaly risk factors. Prior research on the prevalence of BDs overlooked pregnant women's knowledge, which might not be enough to lessen the impact of BDs on the family, the community, and the nation. Pregnant women were found to know less about the preventable risk factors of CAs. (Abinet et al, 2021). Despite the fact that congenital anomalies

have a substantial impact on newborn mortality, morbidity, and the social and economic burden on the family and community, there are not enough studies conducted in Ethiopia to investigate pregnant mothers' knowledge of preventable risk factors of congenital anomalies. There was little awareness of the preventable risk factors of CA among pregnant mothers and other caregivers, this may lead to not early discovery and rapid consultation with the appropriate medical attention. There hasn't been any research done on this topic in our study area, but in Arba Minch town, Gamo zone, Southern Ethiopia, only one study has been done at Arba Minch General Hospital. It didn't include other hospitals and health centers. We include study participants from particular hospitals and health centers in our investigation. Therefore, pregnant women who are adequately knowledgeable about BD may have early identification and rapid consultation with the appropriate healthcare providers.

1.3 Significance of the study

The study's findings point governmental and non-governmental health organizations in the direction of increasing their awareness of congenital anomaly risk factors that can be prevented. It gives policymakers the knowledge they need to plan primary prevention modalities into primary healthcare systems. It increases awareness about the causes and preventative strategies of preventable risk factors of congenital abnormalities and offers information on preconception counseling, prenatal health promotion, and education for health professionals. The results of this study are important because they advise pregnant mothers to abstain from dangerous behavior and to become more aware of the factors that may be prevented that raise their risk of congenital abnormalities. Finally, the findings of this study will be used as a baseline for future researchers.

2. Literature Review

2.1 Participants' knowledge of congenital anomalies

An analysis of pregnant women in the antenatal clinic of Teaching Hospital Mahamodar Galle, Sri Lanka, revealed that 69.3% of the participants had good knowledge of birth defects,

including knowledge of risk factors, causes of birth defects, and preventive measures, but a significant proportion (26.7%) of the participants had poor knowledge. (K.T.G.Kanchana et al., 2018) Another research found that pregnant women who visited prenatal clinics had an average understanding of BD across the board. The average score for overall knowledge was 56.4%, followed by average scores for linked variables and preventive of 57.6%, 55.1%, and 58.8%, respectively. (De Silva et al., 2019)

A cross-sectional research conducted in India found that 1.5% of mothers had poor knowledge of CAs, compared to 63.5% of women who had good knowledge. Of these, 87% of mothers believed that BD is a disease acquired by pregnant women, 42% of mothers are aware that it can affect baby development, and 62.5% of participants knew that it could be avoided by taking certain measures. More than 50% of mothers are aware of risk factors, including maternal age (under 18 or over 35 years) 67%, use of certain drugs without a prescription 50%, smoking before and during pregnancy 69%, alcohol consumption during pregnancy 76.5%, serious infections during pregnancy 56%, radiation exposure during pregnancy 68% and family history of BD 71%. It was surprising to see that just 44% of mothers are aware that the likelihood of having a child with BD increases with consanguineous marriage (Prabhuswami Hiremath et al., 2016)). Another study carried out in Iran in the north revealed that 32% of participants had general knowledge of birth abnormalities. According to this study about 52% of the participants, congenital abnormalities are not a disease pregnant women could contract. 81.3% of them thought that congenital malformations could be treated medically and 75.3% knew that congenital deformities might be avoided.(Masoumeh, et al., 2015)

In Ghana, a cross-sectional study found that 42.6% of participants were generally aware of birth abnormalities (Ajediran I Bello 2013). 25.6% of participants in a descriptive cross-sectional survey conducted at University College Hospital in Ibadan (Nigeria) knew about birth abnormalities such as craniofacial and anorectal malformations, congenital heart disorders, limb deformities, and CNS malformations (T.A. Lawal et al., 2017). Another study conducted at Lagos University Teaching Hospital, South-West Nigeria shows that 63% of the total participants were knowledgeable. (Ogamba et al., 2021)

A descriptive comparative study was conducted in Egypt on Congenital Anomalies among Children: Knowledge and Attitude of Egyptian and Saudi Mothers that 76% of Egyptian mothers

had satisfactory knowledge about congenital anomalies among children compared to 51% of Saudi mothers. (Ragab M, et al., 2013)

Institution based cross-sectional study was conducted at ANC clinic in Dessie town northern Ethiopia, in referral hospitals of Amhara regional state and Arba Minch General Hospital south nation nationality people region shows that overall 52% (G.E. Wake et al, 2022), 49.2% (Ferede et al., 2023) and 48.2% of the respondents had good knowledge towards preventable risk factors of congenital anomalies respectively. 11.0% of pregnant women knew that many CAs are of genetic origin, 39.0% thought that CA is an illness acquired from pregnant women, and 48.5% in a baby owing to family history. (Abinet et al., 2021)

2.2 Socio-demographic characteristics of the study participants

A descriptive cross-sectional study conducted in Sri Lanka showed that those mothers with higher educational attainment and mothers who were from wealthier families reported better knowledge in all the components compared to the others whereas age, parity, and having a child with BD did not show any association with the overall knowledge on BD. (De Silva et al., 2019) Another study found that there is an association between maternal-specific knowledge of BDs with religion and educational level. However, age, residency monthly income of the family, and ethnicity did not show any significant association with the overall knowledge level of birth defects. (K.T.G.Kanchana et al., 2018)

According to a cross-sectional study done in India, there was a significant association between pregnant mothers' knowledge of BD with the monthly income of the family, Sources of information, and residency type whereas religion, educational level, and occupation did not have any association (Prabhuswami Hiremath et al., 2016). The same study conducted in Iran showed that there were significant relationships between the overall knowledge of participants on congenital anomalies with their ages and educational levels. However, there were no significant relationships between the overall knowledge of CAs with religion, occupation, residency, and monthly income. (Masoumeh, et al., 2015)

In tertiary hospitals in Nigeria, a cross-sectional descriptive study was conducted that the educational achievement level and the age ≥25 years had a statistically significant association between the knowledge and awareness about the CAs. Higher education tends to be aware and more knowledgeable, but there was no significant relationship between awareness of religion and occupation (Owotade et al., 2014). Also, another study which was conducted at the two largest

hospitals in Ibadan, Nigeria the University College Hospital, Ibadan, and Adeoyo Maternity Hospital, Yemetu, Ibadan found that Participant educational level and social class (T.A. Lawal et al., 2017) employment of the participants were significant predictors of awareness of birth defects whereas age, religious beliefs, and marital status were not found to be significant predictors of awareness of birth defects of the participants. (Ogamba et al., 2021)

According to the cross–sectional study conducted in Ghana the age and educational level of the participants had no significant relation to overall knowledge about BD (Bello et al., 2013). Also, another descriptive comparative study in Egypt and Saudi-born mothers was conducted that mothers aged 20 - 30 years had better scores in CA in children than other age groups. In the same context, 28% of Egyptian and 32% of Saudi mothers who had a secondary school had higher scores and a satisfactory level of knowledge than other levels of education. Furthermore, the highest percentage(41%) of Egyptian mothers who scored high and achieved satisfactory knowledge were housewives. On the other hand, 39% of Saudi mothers had lower scores and unsatisfactory knowledge levels. (Ragab M, et al., 2013)

An institutional-based cross-sectional study conducted at Dessie town, northern Ethiopia, found that pregnant mothers who lived in urban areas were 6 times more likely to have good knowledge of preventable risk factors of CAs compared to mothers who lived in rural areas, those pregnant mothers who had average monthly family income of more than 4500 ETB were 6 times more likely to have good knowledge towards preventable risk factors of CAs, comparing to those who had average monthly family income was less than 1500 ETB. Those pregnant mothers with a secondary school educational and above level were 4.3 times more likely to have good knowledge about preventable risk factors of CAs when compared to those who had an education level below secondary school (G.E. Wake et al, 2022). The same study conducted at the Arba Minch General Hospital showed that residence, age, level of education, occupation, and religion have an association with the overall knowledge of participants. Pregnant women who are not educated, completed primary school and completed secondary school were 0.014, 0.067, and 0.116 times more likely to be less knowledgeable about CAs than college/university level educated respectively and merchants, and government employees were 4.9 and 7.3 times more likely to be knowledgeable than students. (Abinet et al, 2021)

2.3 Obstetric-related characteristics of the respondents

According to a descriptive cross-sectional study carried out in Sri Lanka, mothers who got more antenatal care or more frequent clinic visits reported that had good knowledge of CAs. According to research done in Sri Lanka, only 5.0% of mothers who had taken preconceptional FA were knowledgeable that it reduces birth defects (De Silva et al., 2019). However, neither parity nor having a child with birth defects has shown a meaningful correlation with general knowledge about birth defects (De Silva et al., 2019). Another study discovered a substantial correlation between planning for the current pregnancy and mother-specific knowledge of birth defects with parity (K.T.G. Kanchana et al., 2018). On the other hand, cross-sectional research conducted in India showed that the number of ANC visits and the number of children had a significant correlation with participants' knowledge about congenital anomalies (Prabhuswami Hiremath et al., 2016). However, the study conducted in Iran showed that there were no significant relationships between the overall knowledge of pregnant mothers on CAs with the gravidity and number of ANC visits. (Masoumeh et al., 2015)

According to a descriptive cross-sectional study conducted at the University College Hospital in Ibadan, Nigeria Participants who booked a tertiary hospital for ANC were three times more likely to be knowledgeable about BD than those who booked other facilities. Gravidity, Number of children, and number of ANC follow-ups were not found to have significant predictors for knowledge about BD. (T. A. Lawal et al., 2017), (Ogamba et al., 2021)

According to an institutional-based cross-sectional study conducted in Dessie town, northern Ethiopia pregnant mothers that had visited ANCs 4 or more times were 3 times more likely to be knowledgeable about preventable risk factors of CA than mothers that had less than 4 ANC visits (G.E. Wake et al, 2022). Another cross-sectional study conducted in Arba Minch General Hospital, southern Ethiopia, found that the antenatal care follow-up status of the participants had an association with overall knowledge of CAs. However, family size, number of births given before, and birth defect history were not significantly associated with the knowledge status of the participants. (Abinet et al, 2021)

Another cross-sectional study carried out at southern Ethiopia Arba Minch General Hospital revealed that smoking before and during pregnancy as well as when drinking alcohol during pregnancy increases the likelihood of giving birth to a child with CAs. However, only 28% of

women are knowledgeable that having a child with a BD is more likely when the mother is older (>40 years). Similarly, using iodinated salt and consuming folic acid/iron folate while pregnant decrease the likelihood of having a baby with BD. (Abinet et al, 2021)

2.4 Conceptual framework of pregnant women's knowledge of preventable risk factors of congenital anomalies

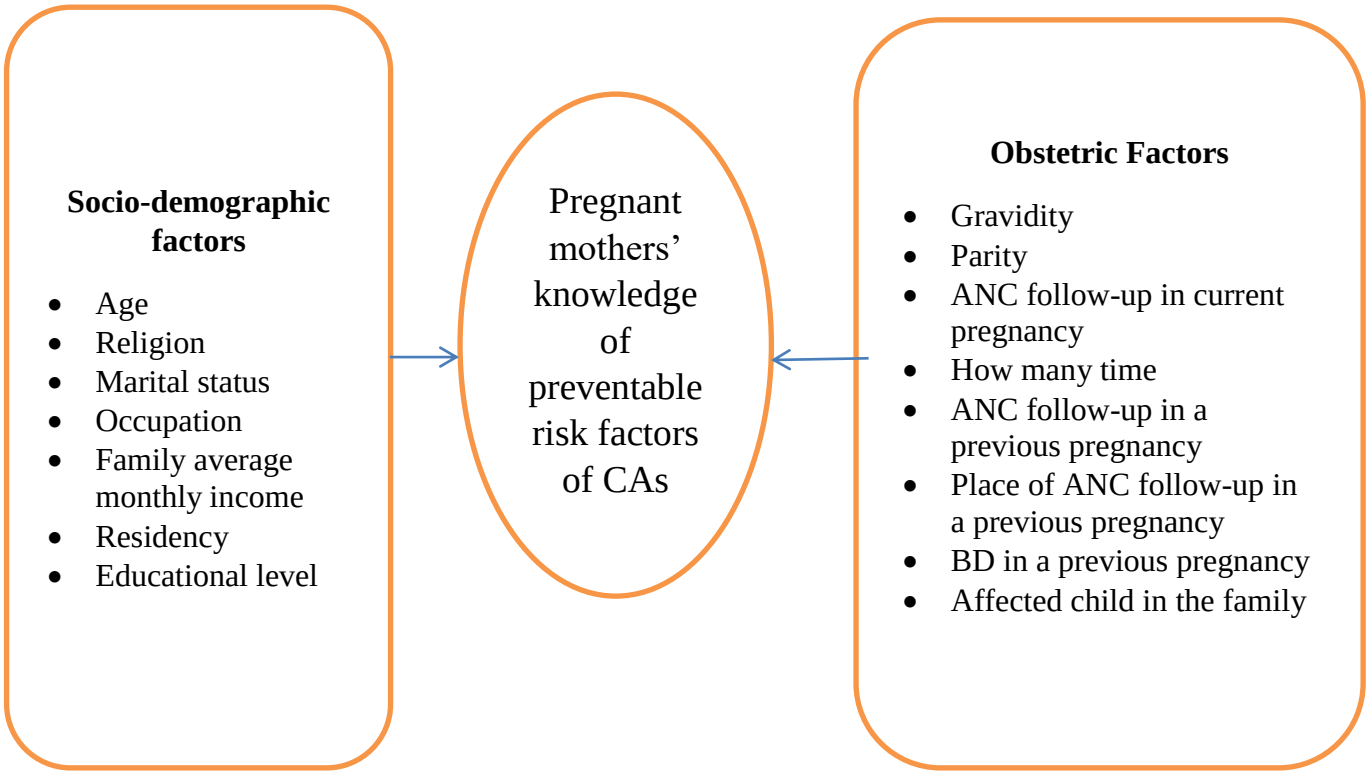


Figure 1: Conceptual framework of factors associated with participants' knowledge of CAs. adapted from the previous studies (G.E. Wake et al, 2022), (Abinet et al, 2021)

3. Objectives

3.1 General Objective

- To assess the knowledge and associated factors towards preventable risk factors of congenital anomalies among antenatal care attending mothers at public health institutions in Hawassa City, Ethiopia, 2023.

3.2 Specific Objectives

- To determine the pregnant mother's knowledge of preventable risk factors of congenital anomalies
- To identify associated factors on pregnant mother's knowledge of preventable risk factors of congenital anomalies

4. Methodology

4.1 Study area and period

This study was conducted in Hawassa City public health institutions from July 20- August 20, 2023. Hawassa is the administrative city of the Sidama regional state. It is located 275km south of Addis Ababa, the capital city of Ethiopia and it has a total area of about 157.2 km2. According to the 2021 City Health Department estimation report, 394,057 people were living in Hawassa City, and among them, 91,815 were women in the reproductive age group. The city was divided into 8 sub-cities (Kifle-ketema) and 32 kebeles, which have around 87 public and private health institutions. In the city, there are a total of 4 public hospitals (Hawassa University

Comprehensive Specialized Hospital (HUCSH), Adare General Hospital (AGH), Tula Primary Hospital (TPH), and Furamotite Primary Hospital (FMPH), 11 public health centers, 4 private primary hospitals, 17 health posts, and 52 private clinics (Hawassa city Health Department maternal and child health information database, unpublished data 2021).

4.2 Study Design

An institution-based cross-sectional study design was carried out among pregnant mothers who attended antenatal care services during the study period.

4.3 study population

4.3.1 Source population

The source population was all pregnant mothers who attended antenatal care clinics in Hawassa City public health institutions during the study period.

4.3.2 Study population

All Pregnant mothers attended antenatal care clinics at selected public health institutes during the data collection period

4.4 Eligibility Criteria

4.4.1 Inclusion criteria

All pregnant mothers who visited selected public health institutions' antenatal care clinics during the data collection period at Hawassa City were included.

4.4.2 Exclusion criteria

All pregnant mothers who were unwilling to respond, come for other purpose, primigravida at first antenatal care visit, and pregnant mothers from health backgrounds like doctors, nurses, or midwives were excluded during data collection time.

4.5 Sample size determination

The sample size for the outcome variable was determined by using a single population proportions formula based on the following assumption as population proportion (p= 48.2%) was

taken from a study conducted at Arba Minch General Hospital Gamo Zone, southern Ethiopia with a margin of error d=5% (Abinet et al, 2021)

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

Where;

n = the actual sample size

Z = the standard normal deviation at 95% confidence interval; = 1.96

P = proportion of knowledge

d = margin of error that can be tolerated, 5% (0.05)

Therefore P is the proportion of knowledge about congenital anomaly = 48.2% taken from a study conducted in Arba Minch General Hospital, Ethiopia

1-p = 0.518

n= $\frac{(1.96)^2 * 0.482 * 0.518}{(0.05)^2}$ = 383.66 ~ 384

By considering a 10% of non-response rate (n = 38), the final sample size becomes (N = 422) pregnant mothers

To check whether the above sample size is sufficient to assess the factor, the sample size of the second specific objective was calculated separately by using EpiInfo software.

Confidence interval = 95%, Power = 80% and Ratio of exposed to unexposed =1:1

Table 1: Sample size calculation for factors associated with knowledge of preventable risk factors of congenital anomalies at Hawassa City public health institutions, Ethiopia, 2023.

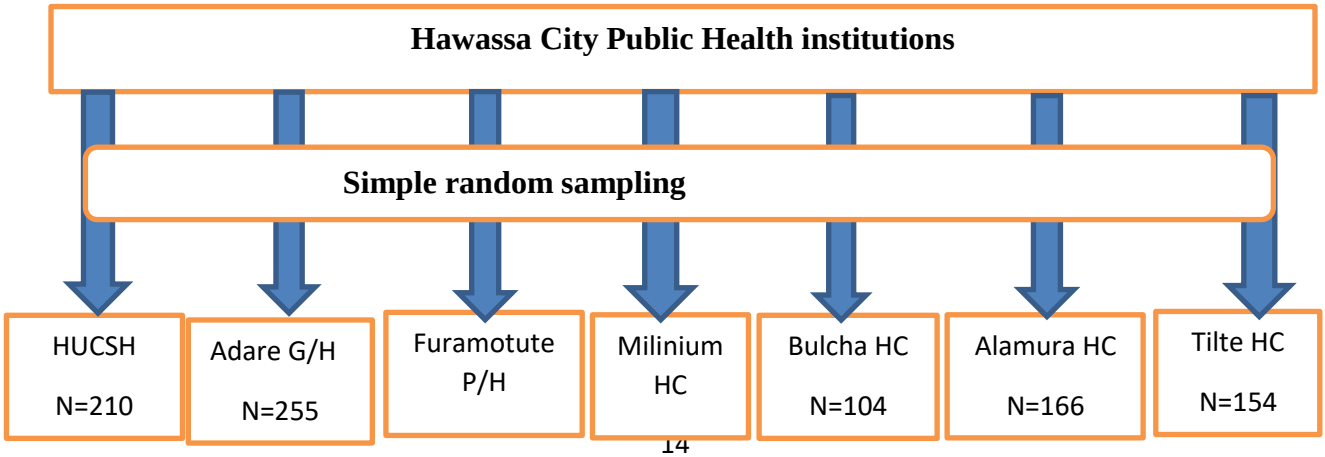
	Variables	Knowledge of pregnant mothers on preventable risk factors of CAs among exposed and non-exposed	AOR	Sample size
Factors associated with knowledge of	Occupation (Abinet et al, 2021)	18.5% Merchant (exposed)	0	180
		4.2% Students (unexposed)		

	Residence (G.E. Wake et al, 2022)	47.27% Urban (exposed)	17.2	42
		4.95% Rural (unexposed)		
	Educational status (G.E. Wake et al, 2022)	Secondary& above (exposed)	2.94	58
		Below secondary (unexposed)		
	Number of ANC visits (G.E. Wake et al, 2022)	29.45% four & above ANC (exposed)	5.1	62
		22.77% Less than four ANC (unexposed)		

The total sample size for the second objective is less than the sample size of the first objective. Therefore the first objective sample size will be used.

4.6 Sampling techniques and procedure

A total of 422 systematically sampled pregnant mothers who visited the ANC clinic of Hawassa City public health institutions from July 20- August 20, 2023 participated in this study. From a total of 4 public hospitals and 11 health centers, we selected comprehensive and specialized hospitals and general hospitals randomly, one primary hospital, and 4 health centers by using the lottery method. Then by proportional allocation, the total participants were chosen from each health institution. The individual sample was taken by the "k^{th}" interval calculated by N/n. The N value was taken average number of the last three months' visitors from the ANC registration book that the pregnant women visited. The study participants were selected systematically (k = N/n, = 1225/422=2.9 ~ 3). The first participant was selected by lottery method by numbering them from 1-3. Then data was collected from every third study participant based on the order of pregnant mothers who came to the antenatal care room.



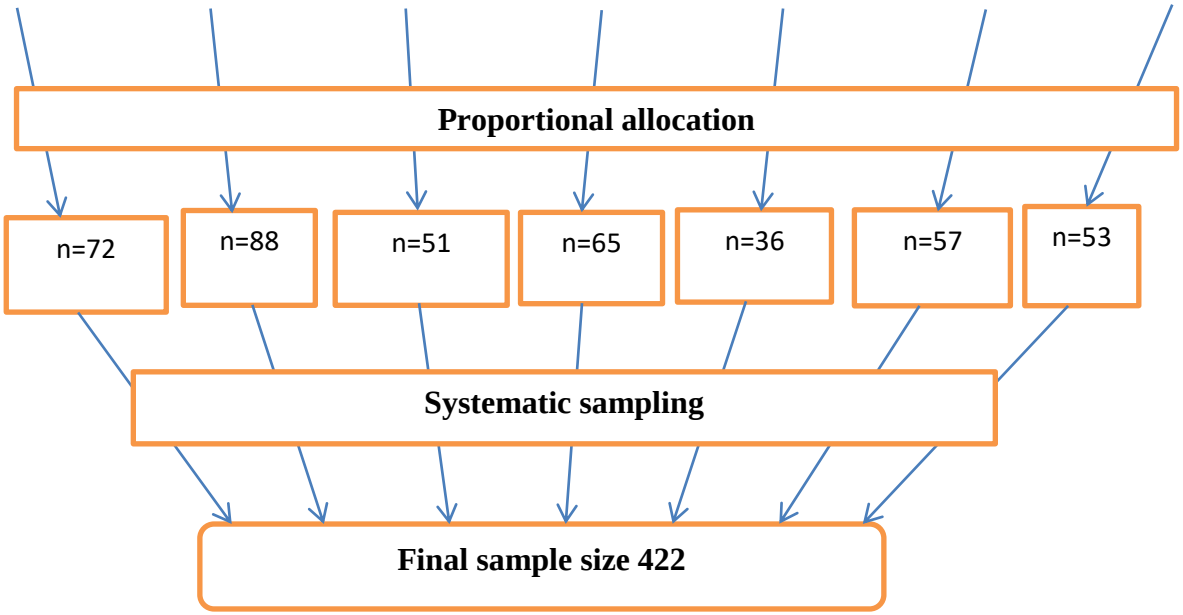


Figure 2: Schematic presentation of the sampling procedure of the study participants

4.7 Study Variable

4.7.1 Dependent variable

The dependent variable was knowledge of preventable risk factors of congenital anomalies among pregnant mothers. Knowledge was assessed by asking the participants 21 "Yes", "No" or "I don't know" item questions. One point was given for all the correct answers, while zero points for incorrect and "I don't know" answers. Then, the mother's knowledge was composed (knowledgeable which was coded as "1" and not knowing which was coded as "0").

4.7.2 Independent variables

Socio-demographic factors: The socio-demographic variables were age, residence, religion, educational status, occupation, marital status, and average monthly family income.

Obstetric Factors: The obstetric variables were reported to be gravidity, Parity, current ANC follow-up, ANC visit in a previous pregnancy, Place of ANC follow-up in the previous pregnancy, history of BD in a previous pregnancy, and affected child in the family,

4.8 Operational definition

Good knowledge:- From a total of 21 knowledge-assessing questions study participants who had responses that were greater than or equal to the mean values of knowledge-related questions were classified as having good knowledge. (G.E. Wake et al, 2022)

Poor knowledge:- Pregnant mothers who answered less than the mean values of knowledge-related questions. (G.E. Wake et al, 2022)

Preventable risks of a congenital anomaly: These are risk factors that can be prevented by food fortifications, supplementation of micronutrients, and avoiding risky behavior like alcohol consumption, cigarette smoking, and some drugs during pregnancy. (G.E. Wake et al, 2022)

4.9 Data collection tools

A partially adapted, pretested, interviewer-administered structured questionnaire was used to collect data (G.E. Wake et al, 2022), (Abinet et al, 2021). The tools were first prepared in English and then translated into Amharic languages and then back-translated to English was made to check the consistency of the questionnaires. Its validity was tested on 5% (21 participants) of the sample size at Yirgalem General Hospital. The questionnaire had four logical sections, namely; socio-demographic and obstetric-related characteristics, questions to assess the specific knowledge of mothers on the CAs, and questions to assess the knowledge of participants on risk factors and prevention of CAs. A total of 36 closed-ended questions were used. The maximum total score for knowledge was 21 (9 points for specific knowledge and 12 points for knowledge of the risk factors and prevention methods). (Annexed)

4.10 Data collectors and data collection procedures

Based on their prior data collection and supervision experience five BSc Midwifery professionals and 1 MSc in clinical midwifery professional were selected as data collectors and supervisors. One day course ongoing training on the study's objectives, data collection instruments, and data collecting techniques was provided to data collectors and supervisors. The training was concentrated on interviewing techniques, ethical concerns, ethics of the participant, reading all the questions and comprehending them, and methods of reducing under and over-reporting while maintaining confidentiality. The investigator oversaw the procedure for gathering data. As soon as the data was obtained, the supervisor and investigator checked it for completeness, accuracy, clarity, and consistency.

4.11 Data quality control

To guarantee the accuracy of the data, the questionnaire was translated into Amharic language and then back into English to check for consistency. The questionnaire was pretested among 5% (21) participants at Yirgalem General Hospital two weeks before the actual data collection began. One-day training was provided to both data collectors and supervisors in the fundamentals of data collection. As soon as the data was collected, the supervisors and investigator checked it to make sure it was accurate, complete, and consistent. The interviewers were made clear that all information was kept private and only the researcher would have access to it.

4.12 Data analysis

Data was prepared for analysis by editing, coding, and entering into the Kobo toolbox. The study population was described using descriptive statistics that include pertinent characteristics, such as frequencies, proportions, and summary statistics. Using binary logistic regression, the presence of a relationship between the dependent and independent variables was assessed. To control confounding factors; variables with a p-value of less than 0.25 in the bivariate analysis, after all assumptions of binary logistic regression were checked including; visual inspection of histogram, and outliers box, were taken for the multivariable analysis. The overall goodness-of-fit was assessed using the Hosmer–Lemeshow goodness-of-fittest. Hosmer-Lemeshow statistic was done for model fitness, which was (p=0.848) and the multi-collinearity was checked by variance inflation factors and tolerance test which was 1.77 and 0.92 respectively. The factors associated with the outcome variable were identified by using the adjusted odds ratio (AOR) and 95% confidence interval (CI). A p-value of less than 0.05 was chosen as the level for statistical significance.

4.13 Ethical Consideration

The ethical approval letter was obtained from Hawassa University College of Medicine and Health Science Institution of Review Board (IRB) by reference number IRB/353/15. An official supporting letter was obtained from the Department of Midwifery and it was submitted to Sidama region health institutions. Also supporting letter was taken from the Sidama Region Public Health Institute. Before data collection, informed consent was obtained from each study participant. All respondents were informed about the objective of the study and confidentiality

was maintained at each step of data collection and processing. The respondents were informed that the information obtained in this study was used only for research purposes. Data collection facilitators were trained strongly on how to keep participants' confidentiality. Also, an explanation about the rights of participants including their full right to not participate at all or withdraw at any time was provided.

4.14 Dissemination plan

After completion of the research, the final result will be submitted to Hawassa University College of Medicine and Health Science Department of Midwifery during thesis defense and after approval of the study, the final result/document will be disseminated to Sidama Regional Health Bureau and Hawassa City health department. The findings will also be disseminated to different stakeholders that will contribute to improving pregnant mothers' knowledge of preventable risk factors of congenital anomalies. Finally, efforts will be made to present in various seminars and workshops and to publish the research in international journals.

5. Results

5.1 Socio-demographic characteristics of the study participants

A total of 422 pregnant mothers were involved in this study, making a response rate of 100%. Of the total study participants, nearly half 206(48.8%) of them were protestant religious followers, mean age of the participants is 25.36 years with a standard deviation of ±3.1 and age ranges between 19 and 38 years. The majority 376(89.1%) of the study participants were within the age group of 21-30 years. Nearly three quarter 335(79.4%) of the study participants were urban residents. Less than half of 190(45%) of the study participants attended secondary school educational levels. According to their occupation, almost half 215(50.9%) of them were housewives. (Table 2)

Table 2:- Socio-demographic characteristics of the pregnant mothers in public health institution at Hawassa City, Ethiopia (n=422), 2023

Variables	Category	frequency	Percentage
Age	≤20	22	5.2
	21-30	376	89.1
	>31	24	5.7
Residence	Urban	335	79.4
	Rural	87	20.6
Religion	Orthodox	144	34.1
	Protestant	206	48.8
	Muslim	53	12.6
	Catholic	19	4.5
Marital status	Married	422	100.0
Educational status	Unable to write and read	44	10.4
	Primary school	133	31.5
	Secondary school	190	45.0
	College and above	55	13.0
Occupation	Housewife	215	50.9
	Governmental employee	44	10.4
	Merchant	101	23.9
	Daily laborer	23	5.5
	Student	39	9.2
Monthly income	≤1500	63	14.9
	1501-3000	156	37.0
	3001-4500	163	38.6
	>4500	40	9.5

5.2 Obstetric-related characteristics of the study participants

According to gravidity nearly half 213(50.5%) of the study participants had more than 2 pregnancies, regarding parity majority 355(84.1%) of them were less than or equal to 2 children. Concerning antenatal care (ANC) nearly three fourth 312(73.9%) of them had ANC follow-up in their current pregnancy, from this 229(73.4%) of them made less than 4 ANC contact. Less than half 177(46.6%) of the study participants took their ANC service from the health center during the previous pregnancy. A significant proportion of 15(3.6%) study participants had a history of congenital anomalies in their own previous pregnancies and 40(9.5%) of study participants had a previous Birth defect history within their families. (Table 3)

Table 3:- obstetric characteristics of the pregnant mothers in public health institution at Hawassa City, Ethiopia (n=422), 2023

Variables	Category	frequency	Percentage
Gravida	≤2	209	49.5
	> 2	213	50.5
Parity	≤2	355	84.1
	>2	67	15.9
ANC follow-up for current pregnancy	Yes	312	73.9
	No	110	26.1
If yes how many times (n=312)	Less than 4 ANC visits	229	73.4
	4 and above ANC visits	83	26.6
ANC follow-up in a previous pregnancy	Yes	380	90.0
	No	42	10.0
If yes where was your ANC follow-up (n=380)	Health center	177	46.6
	Primary hospital	43	11.3
	General Hospital	107	28.2
	Referral hospital	53	13.95
Birth defect history in own previous baby	Yes	15	3.6
	No	407	96.4
Family history of birth defect	No	382	90.5
	Yes	40	9.5

5.3 Pregnant mother's Specific Knowledge of congenital anomalies

From the total of 422 pregnant mothers, nearly two-thirds 288(68.2%) answered that many of the congenital anomalies are of genetic origin, and more than half 233(54.5%) of the pregnant mothers answered that birth defects can be acquired by a baby developing in the womb. More than half 261(61.8%) of the mothers answered that most birth defects are preventable and almost two-thirds 298(70.6%) of them answered that most birth defects can be treated or managed medically, however, only 158(37.4%) of them have known that deformities from congenital malformation can be reduced through physiotherapy. Less than one-fourth 78(18.5%) of the pregnant mothers who participated in this study knew that a birth defect is a supernatural origin and the majority 372(88.2%) answered that congenital anomalies can't be transmitted by social contact with an affected individual. However, 25(5.9%) of the pregnant mothers had answered that birth defect is a disease acquired by pregnant mothers and 48(11.4%) of them answered that birth defects can occur in the baby due to the sin of families. (Table 4)

Table 4:- Pregnant Mother's Specific Knowledge of Congenital Anomalies in Public Health Institution at Hawassa City, (n=422) Ethiopia, 2023

Variables	Category	frequency	Percentage
A birth defect is a disease acquired by pregnant women	Yes	25	5.9
	No	370	87.7
	I don't know	27	6.4
A birth defect is of supernatural origin	Yes	78	18.5
	No	314	74.4
	I don't know	30	7.1
Birth defects can affect a baby's development in the womb	Yes	230	54.5
	No	142	33.6
	I don't know	50	11.8
Birth defects can be transmitted by contact with affected individuals	Yes	23	5.5
	No	372	88.2
	I don't know	27	6.4
Most birth defects are preventable	Yes	261	61.8
	No	103	24.4
	I don't know	58	13.7
Most birth defects can be treated or managed medically	Yes	298	70.6
	No	85	20.1
	I don't know	39	9.2
Deformities from congenital malformation can be reduced through physiotherapy	Yes	158	37.4
	No	226	53.6
	I don't know	38	9.0
Many of birth defects are of genetic origin	Yes	288	68.2
	No	95	22.5
	I don't know	39	9.2
The birth defect occurs in the baby due to the sin of families	Yes	48	11.4
	No	363	86.0
	I don't know	11	2.6

5.4 Pregnant mother's knowledge of the preventable risk factors of congenital anomalies

More than half 256(60.7%) of the pregnant mothers answered that alcohol consumption during pregnancy increases the risk of giving birth to a child with CAs. Nearly two-thirds 264(62.6%) of the pregnant mothers answered that the use of some unprescribed medications and 328(77.7%) of pregnant mothers answered that smoking before and during pregnancy increases the risk of giving birth to a baby with CAs. Nearly one-third 147(34.8%) of pregnant mothers knew that advanced maternal age (≥40 years) increases the risk of giving birth to a child with a birth defect.

More than half 256(60.7%) of pregnant mothers have the knowledge that exposure to radiation (X-ray), almost half 210(49.8%) obesity, and nearly half 217(51.4%) uncontrolled diabetes of the mother during pregnancy are at risk factors of BD. However, more than half 249(59%) of the pregnant mothers knew that a history of birth defect in their own baby previously or within relatives, and only a few 19(4.5%) pregnant mothers answered that consanguinity increases the risk of giving birth to a child with BD. (Table 5)

Table 5:- Pregnant mother's knowledge of the preventable risk factors of congenital anomalies in public health institution of Hawassa City, Ethiopia 2023 (n=422)

Variables	Category	frequency	Percentage
Alcohol consumption during pregnancy increases the risk of giving birth to a child with a birth defect	Yes	256	60.7
	No	128	30.3
	I don't know	38	9.0
Use of some unprescribed medications increases the risk of giving birth to a child with a birth defect	Yes	264	62.6
	No	129	30.6
	I don't know	29	6.9
Smoking before and during pregnancy increases the risk of giving birth to a child with a birth defect	Yes	328	77.7
	No	72	17.1
	I don't know	22	5.2
Advanced maternal age (≥40 years) increases the risk of giving birth to a child with a birth defect	Yes	147	34.8
	No	246	58.3
	I don't know	29	6.9
Exposure to radiation (X-ray) during pregnancy increases the risk of giving birth to a child with a birth defect	Yes	256	60.7
	No	141	33.4
	I don't know	25	5.9
Obesity during pregnancy increases the risk of giving birth to a child with a birth defect	Yes	210	49.8
	No	174	41.2
	I don't know	38	9.0
Uncontrolled diabetes of a mother during pregnancy increases the risk of giving birth to a child with a birth defect	Yes	217	51.4
	No	167	39.6
	I don't know	38	9.0
A history of birth defects in one's baby previously or relatives increases the risk of giving birth to a child with a birth defect	Yes	249	59.0
	No	150	35.5
	I don't know	23	5.5
Consanguinity increases the risk of giving birth to a child with a birth defect	Yes	19	4.5
	No	378	89.6
	I don't know	25	5.9

5.5 Pregnant mother's knowledge of the prevention methods of congenital anomalies

Nearly two-thirds 297(70.4%) of the pregnant mothers knew that regular ANC follow-up throughout the pregnancy period reduces the chance of giving birth to a child with BD. Two thirds 280(66.4%) of the pregnant mothers answered that consumption of iodinated salt during pregnancy and 295(69.9%) consumption of folic acid/iron folate during pregnancy reduces the chance of giving birth to a child with BD.(table 6)

Table 6:- Pregnant mother's knowledge of the prevention methods of congenital anomalies in public health institution of Hawassa City, Ethiopia 2023 (n=422)

Variables	Category	frequency	Percentage
Regular ANC follow-up throughout the pregnancy period reduces the chances of giving birth to a child with a birth defect	Yes	297	70.4
	No	90	21.3
	I don't know	35	8.3
Consumption of folic acid/iron folate during pregnancy reduces the chance of giving birth to a child with a birth defect	Yes	295	69.9
	No	95	22.5
	I don't know	32	7.6
Consumption of iodinated salt during pregnancy reduces the chance of giving birth to a child with a birth defect	Yes	280	66.4
	No	103	24.4
	I don't know	39	9.2

5.6 Pregnant mother's overall knowledge of preventable risk factors of congenital anomalies

The mean score value of pregnant mothers' knowledge about preventable risk factors of congenital anomalies was 13.98 out of 21 knowledge-related questions. Of the total pregnant mothers, more than half 246(58.3%; 95%CI=53.6, 63.0) answered correctly more than the mean score and had good knowledge about preventable risk factors of congenital anomalies.

Table 7:- Pregnant mother's overall knowledge of preventable risk factors of congenital anomalies in public health institution at Hawassa City, 2023

Variable	Category	Frequency	Percentage
Pregnant mother's overall knowledge(n=422)	Good	246	58.3
	Poor	176	41.7

5.7 Factors associated with the pregnant mother's knowledge of preventable risk factors of congenital anomalies

Bivariate and multivariable logistic regression analyses were done to examine the association between the selected predictor variables and knowledge of preventable risk factors of CAs. In bivariate logistic regression analysis variables like; residence, educational status, occupation, monthly income of the family, ANC follow-up in current pregnancy, ANC follow-up in previous pregnancy, place of ANC follow-up in the previous pregnancy, and history of having a birth defect in previous own pregnancy were significantly associated with pregnant mothers knowledge of preventable risk factors of CAs ($P<0.25$). On multivariable logistic regression analysis, three variables were significantly associated ($P<0.05$) with the overall knowledge of pregnant mothers towards preventable risk factors of congenital anomalies. These variables were; residence, education status, and ANC follow-up in the current pregnancy. The odds of having good knowledge of preventable risk factors of CAs among urban pregnant mothers were 2.4 times higher than those who reside in rural areas (Adjusted Odds Ratio [AOR] = 2.43; 95% Confidence Interval [CI]: 1.3 – 4.5). The study also found that the odds of having good knowledge of preventable risk factors of CAs among pregnant mothers whose educational status was college and above were 4.8 times compared to those who were unable to write and read (AOR = 4.5; 95% CI: 1.02 – 12.1). According to this finding pregnant mothers who had attended ANC follow-up in their current pregnancy were 1.7 times more likely to have good knowledge of preventable risk factors of CAs than pregnant mothers who had not attended ANC follow-up in their current pregnancy [AOR = 1.73, 95% CI: (1.02- 2.94)]. (Table 8)

Table 8:- Factors associated with the pregnant mother's knowledge of preventable risk factors of congenital anomalies in the public health institution of Hawassa City, Ethiopia, 2023

Variables	Categories	Good knowledge		Poor Knowledge		COR(95% CI)	AOR(95% CI)	P-value
		No.	%	No.	%			
Residence	Urban	216	87.8	119	67.6	3.45 (2.1-5.7)	2.43 (1.3-4.5)	0.006*
	Rural	30	12.2	57	32.4	1	1	
Educational status	Unable to write and read	16	6.5	27	15.34	1	1	
	Primary school	71	28.86	60	34.1	1.99(0.98-4.1)	1.58 (0.7-3.6)	0.277
	Secondary school	115	46.75	75	42.6	2.59 (1.3-5.1)	1.99(0.88-4.5)	0.100
	College and above	44	17.89	14	7.95	5.3 (2.2-12.6)	4.8 (1.02-12.1)	0.047*
Occupation	Housewife	120	48.8	95	54	0.98 (0.5-1.9)	1.98 (0.9-4.5)	0.101
	Governmental employee	32	13	12	6.8	2.06 (0.8-5.2)	0.9 (0.17-4.9)	0.920
	Merchant	60	24.4	41	23.3	1.13 (0.5-2.4)	1.4 (0.6-3.4)	0.457
	Daily laborer	12	4.9	11	6.2	0.84 (0.3- 2.4)	1.1 (0.3-3.4)	0.937
	Students	22	8.9	17	9.7	1	1	
Family monthly income	≤1500	32	13	31	17.6	0.56(0.25-1.3)	0.9 (0.33-2.5)	0.846
	1501-3000	91	37	65	37	0.75(0.37-1.6)	0.98(0.4-2.3)	0.964
	3001-4500	97	39.4	66	37.5	0.79(0.39-1.6)	0.87(0.4-2.0)	0.748
	>4500	26	10.6	14	7.9	1	1	
ANC follow up	Yes	197	80	120	68.2	1.88(1.2- 2.9)	1.7(1.02- 2.9)	0.042*
	No	49	20	56	31.8	1	1	
Place of previous ANC follow-up	Health center	101	45.3	74	49	0.7(0.4-1.4)	1.0(0.5-2.1)	0.991
	Primary hospital	22	9.9	20	13.2	0.57(0.24-1.3)	0.9(0.34-2.3)	0.786
	General Hospital	67	30	40	26.5	0.86(0.4-1.8)	0.97(0.5-2.1)	0.939
	Referral hospital	33	14.8	17	11.3	1	1	
DB in a previous pregnancy	Yes	4	1.6	11	6.3	1	1	
	No	242	98.4	165	93.7	4.0(1.3-12.9)	1.87(0.5-6.9)	0.349

Key:- CI Confidence interval, COR crude odds ratio, AOR adjusted odds ratio *statistically significant ($p < 0.05$), '1' reference category

6. Discussion

The purpose of this study was to assess pregnant mothers' knowledge and associated factors towards preventable risk factors of congenital anomalies among pregnant mothers who attended their antenatal care visit at public health institutions in Hawassa City, Sidama region, Ethiopia. Thus, overall more than half of pregnant mothers (58.3%) had good knowledge of preventable risk factors of congenital anomalies. This finding is consistent with the result of a study conducted in Sri Lanka (56.4%) (De Silva et al., 2019) and South-West Nigeria (63%) (Ogamba et al., 2021). This is because of the same study designs, information on preventable risk factors of congenital anomalies from different sources, the same sampling method, sample size, and study setting. However, the current study finding is lower than the finding of the same study conducted in Egypt (76%) (Ragab M, et al., 2013). This discrepancy could be caused by differences in the methods used to collect the data as well as the educational background, study area, and study setting of the participants. In the Egypt study, data was collected from a single hospital but in the current study, data was collected from selected health centers and hospitals. Also, this finding is lower than the finding of a study done in India (63.5%) (Prabhuswami Hiremath et al., 2016) and Srilanka (69.3%) (K.T.G.Kanchana et al., 2018). This difference might be related to the difference in socio-demographic status, the cultural difference of study participants, sample size, sampling methods, and the number and types of health institutions from which the data was collected. However, this finding is higher than the finding of the study conducted in Ghana (42.6%) (Ajediran I Bello et al., 2013), Nigeria (25.6%) (T. A. Lawal et al., 2017) and Northern Iran (32%) (Masoumeh et al., 2015) respectively. The reason for this difference might be due to the time gap. The current study was recently conducted as compared to other studies. As maternal health becomes more prominent on national and global agendas, healthcare-seeking behavior, access to health institutions, and professional competence are likely to improve, resulting in improved knowledge of the BDs among pregnant mothers. Another reason for this difference might be that most previous studies used consecutive and convenience sampling methods to collect the data. In addition, the study conducted in Ghana was used as a self-administered technique in which pregnant women may not easily understand the questions. Furthermore, this variation might be due to the characteristics of the respondents. For instance, the majority (84.2%) and (29%) of the participants in Nigeria were single and had no formal education, respectively, while the current study showed that 100% were married and 45.0% had

Secondary school education. Also, our finding was higher than the studies conducted in Dessie northern Ethiopia (52%) (G.E. Wake et al, 2022) and Arba Minch Southern Ethiopia 48.2% (Abinet et al, 2021). This variation might be related to the difference in place of data gathered i,e the study conducted in Arba Minch data was collected from a single hospital but in our study data was collected from selected health centers and hospitals, improvement in antenatal care service from time to time and awareness of the people about CAs.

Participant's residence, educational status, and antenatal care follow-up in the current pregnancy were significantly associated factors with the pregnant mother's knowledge of preventable risk factors of congenital anomalies. Those Pregnant mothers who had attended antenatal care follow-up were 1.7 times more likely to have good knowledge of preventable risk factors of congenital anomalies compared to pregnant mothers who had not attended ANC follow-up in their current pregnancies. This finding is similar to the finding of a study conducted in Dessie northern Ethiopia, Sri Lanka, and India (G.E. Wake et al, 2022), (De Silva et al., 2019), (Prabhuswami Hiremath et al., 2016). This might be related to frequent health facility visits for antenatal care, good counseling by skilled health professionals, and awareness about BD from mass media and other sources play them to increase their knowledge of preventable risk factors of congenital anomalies. However, the finding of this study regarding the association between antenatal care with mother knowledge about BD is different from the result of the study conducted in Arba Minch southern Ethiopia and Ghana (Abinet et al, 2021), (Ajediran I Bello et al., 2013) which reported that there was no association between the number of antenatal care visits and knowledge level of pregnant mothers towards preventable risk factors of congenital anomalies. This difference might be due to the difference in the frequency of antenatal care services with pregnant mothers and the nature of health institutions providing antenatal care in the study area.

Those pregnant mothers who had an educational status of college and above were 5 times more likely to have good knowledge of the preventable risk of congenital anomalies compared to mothers who were unable to write and read. This finding is in line with the results of the study conducted in Dessie northern Ethiopia and North of Iran (G.E. Wake et al, 2022), (Masoumeh et al., 2015). This finding was higher than the study conducted in Sri Lanka (De Silva et al., 2019). This might be related to sociocultural characteristics, time of the study, and those pregnant mothers who had college and above educational status were read, watched, and listened to

different materials and media regarding preventable risk factors of congenital anomalies updated their knowledge, and developed good healthcare-seeking behavior.

Regarding residence, pregnant mothers who reside in urban were 2.4 times more knowledgeable about preventable risk factors of congenital anomalies as compared with those residing in rural areas. This was supported by the study conducted in India (Prabhuswami Hiremath et al., 2016). The reason could be due to those pregnant mothers who live in rural areas may not be exposed to different media material, may not receive much attention, and may prioritize their jobs over their health needs. This finding is lower than the finding of the study conducted in Dessie northern Ethiopia (G.E. Wake et al, 2022). This discrepancy might be due to socio-cultural status, sources of information, and access to health care services of the participants regarding preventable risk factors of congenital anomalies.

7. Limitations of the study

This study does not include women of all reproductive ages; rather, it only includes pregnant mothers who visited antenatal care clinics on a daily basis as outpatients. The study design made it impossible to evaluate temporal relations. The use of a questionnaire in this study limited its applicability; no qualitative method was used to assess the knowledge metric in order to potentially triangulate the results.

8. Conclusion and Recommendations

8.1 Conclusion

In general, participants' knowledge of specific and overall preventable risk factors for congenital anomalies was moderate compare to other studies. However, the participants' urban residence, college and above level of education, and antenatal care follow-up all had an impact on their knowledge of preventable risk factors of congenital anomalies. It is important to take the right steps to increase pregnant mothers' knowledge of the preventable risk factors of congenital abnormalities. Adequate preconception counseling before conception, during pregnancy, and postpartum counseling at health centers and hospitals generally could be some of the measures.

8.2 Recommendations

Governmental and non-governmental health institutions

- Should establish a conductive atmosphere that enables healthcare professionals to raise consciousness about preventable risk factors of congenital malformations among women in their reproductive age group, couples, pregnant mothers, and the general public.

Policymakers

- Preconception care services ought to be incorporated into Ethiopia's primary healthcare system, offered right away, and tracked at every stage of the country's healthcare institutions.
- Should implement genetic screening programs at all Ethiopian health institution levels for all pregnant women.

Health care professionals

- Should offer pre-pregnancy and pregnancy health education and information, especially regarding birth defect prevention, to women in the reproductive age group, couples, and the community as a whole.
- Should raise awareness of the risk factors, dangerous behaviors, and preventive measures for congenital abnormalities, with a focus on rural mothers and mothers with low educational attainment, as well as all women in the reproductive age group, couples, and the community as a whole.

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10. Annexes

Information and consent sheet

Good morning/afternoon. My name is _____. I am working as a data collector for Mr. Debiso Erjino MSC candidate from Hawassa University who conducted this study. **Research title:-** Knowledge and associated factors towards preventable risk factors of congenital anomalies among antenatal care attending mothers at public health institutions in Hawassa City, Ethiopia, 2023.

Aim of the study- to determine the Knowledge and associated factors towards preventable risk factors of congenital anomalies among antenatal care attending mothers at public health institutions. It also has a great contribution for researchers to prepare graduation thesis papers for the fulfilling degrees of master in clinical midwifery.

Process and time of the research: I read the question for you, please give me a response to those questions for 25-30 minutes with me. The total questions are 36. So, I read the question and your answer was filled in properly according to the question arrangements.

Benefits and risks- This research has no risk except taking your time. You do not benefit directly from participating in this research. But, the result of this study gives important information for health offices and organizations.

Confidentiality- I would like to inform you that for some personal issues, your answers, and ideas are completely confidential and secured. Your name will not be written on this form. The research does not present the identity of individuals by any means written or in words.

Participant's rights- Your participation is voluntary. Please take as much time as you need to read/listen to the information sheet. You have the right to participate or not participate in this research. You can refuse to answer a single question and even to the extent stopping the interview at any time you want if you are not comfortable. I read the agreement properly and He/she also clearly explained the research to me. I understand well when I have issues like the risks, benefits, confidentiality, rights, and questions and comments for, whom it arises. He/she told me any time has the right to stop the interview or refuse to answer a single question. He/she gives a chance for any unclear doubt or ambiguity. So, I decided to voluntarily participate in this research and put my signature below.

Parcipants Signature _____ Date _____

Data collectors name _____ signature _____ Date _____

Thank you for your participation.

Person to contact for more detailed information and explanation:

Name of investigator Debiso Erjino (BSc, in Midwifery)

Cell phone: +251912381382

Email Address: devierjino@yahoo.com or debisodebiso6@gmail.com

Name of advisors

Gedion Asnake (MSc, assistant professor)

Email address:

Yewulsew Woldeyes (MSc, lecturer)

Email address:

Annex I Questionnaires English version

Section A: Questions on socio-demographic characteristics of participants in Hawassa City Public Health Institutions, Ethiopia, 2023

Instruction: Encircle the responses of the respondents in front of each question.

Part I: Socio-demographic Information			
No	**Questions**	Possible response	Skip
101	What is your Age`	…… year (in number)	
102	What is your residence	1. Urban 2. Rural	
103	What is your Religion	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other(specify)	
104	What is your marital status?	1. Married 2. Unmarried	
105	What is your education level?	1. Unable to write and read 2. Primary school 3. Secondary school 4. College and above	
106	What is your occupation?	1. Housewife 2. Governmental employee 3. Merchant 4. Daily laborer 5. Student	
107	What is your family's average monthly income?		
Obstetric factors			
108	Gravidity		
109	Parity		
110	Do you have an ANC follow-up for this pregnancy?	1. Yes 2. No	If no pass to 112
111	If your response is "Yes" how many	___ (in number)	
112	Is there ANC follow-up in the previous pregnancy?	1. Yes 2. No	If no pass to 114
113	Where was your ANC follow-up in the previous pregnancy	1. Health center 2. Primary hospital 3. General Hospital 4. Referral hospital 5. Not applicable	

		6. Other specify	
114	Is there any affected child in your previous pregnancy	1. Yes 2. No	
115	Is there any affected child in your family	1. Yes 2. No	

Section B: Specific knowledge of congenital anomalies

201	BD is a disease acquired by pregnant women	1. Yes 2. No 3. I don't know	
202	BD is of supernatural origin	1. Yes 2. No 3. I don't know	
203	BDs can be acquired by a baby developing in the womb	1. Yes 2. No 3. I don't know	
204	BDs can be transmitted by contact with an affected individuals	1. Yes 2. No 3. I don't know	
205	Most birth defects are preventable	1. Yes 2. No 3. I don't know	
206	Most birth defects can be treated or managed medically	1. Yes 2. No 3. I don't know	
207	Deformities from congenital malformation can be reduced through physiotherapy	1. Yes 2. No 3. I don't know	
208	Many of BDs are of genetic origin	1. Yes 2. No 3. I don't know	
209	BD occurs in the baby due to the sin of Families	1. Yes 2. No 3. I don't know	

Section C: Participants' knowledge of risk factors and prevention.

Participants' knowledge of risk factors and prevention			
301	Will alcohol consumption during pregnancy increase your risk of giving birth to a child with congenital anomalies?	1. Yes 2. No 3. I don't know	
302	Will the use of some unprescribed medications during pregnancy increase your risk of giving birth to a child with congenital anomalies?	1. Yes 2. No 3. I don't know	
303	Will smoking before and during pregnancy increase your risk of giving birth to a child with congenital anomalies?	1. Yes 2. No	

		3. I don't know	
304	Will advanced maternal age (≥40 years) increase the risk of giving birth to a child with congenital anomalies?	1. Yes 2. No 3. I don't know	
305	Will consumption of folic acid/iron folate during pregnancy reduces the chance of giving birth to a child with BD	1. Yes 2. No 3. I don't know	
306	Will consumption of iodinated salt during pregnancy reduces the chance of giving birth to a child with BD	1. Yes 2. No 3. I don't know	
307	Will regular ANC follow-up throughout the pregnancy period reduces the chances of giving birth to a child with BD	1. Yes 2. No 3. I don't know	
308	Will exposure to radiation (X-ray) during pregnancy increases the risk of giving birth to a child with BD	1. Yes 2. No 3. I don't know	
309	Will obesity during pregnancy increase the risk of giving birth to a child with BD	1. Yes 2. No 3. I don't know	
310	Will uncontrolled diabetes in a mother during pregnancy increases the risk of giving birth to a child with BD	1. Yes 2. No 3. I don't know	
311	Will a history of birth defects in one's baby previously or relatives increase the risk of giving birth to a child with BD	1. Yes 2. No 3. I don't know	
312	Will consanguinity increase the risk of giving birth to a child with BD	1. Yes 2. No 3. I don't know	

የመረጃ እና የፍቃድ ወረቀት

እንደምን አደሩ/ ከሰአት። የኔ ስም _____. ይህንን ጥናት ላደረጉት ከሐዋሳ ዩኒቨርሲቲ እጩ አቶ ደቢሶ ኤርጂኖ ኤም.ኤስ.ሲ መረጃ ሰብሳቢ ሆኜ እየሰራሁ ነው። የምርምር ርዕስ፡- በሐዋሳ ከተማ፣ ኢትዮጵያ፣ 2023 በቅድመ ወሊድ እናቶች ክትትል በሚደረግላቸው የወሊድ አገልግሎት ላይ ሊከሰቱ ለሚችሉ የወሊድ ችግሮች ተጋላጭነት ላይ እውቀት እና ተያያዥ ምክንያቶች። የጥናቱ ዓላማ - በሕዝብ ጤና ተቋማት ውስጥ እናቶች በቅድመ ወሊድ እንክብካቤ መካከል ሊከላከሉ በሚችሉ ተላላፊ በሽታዎች መከላከል ላይ ያለውን እውቀት እና ተያያዥ ምክንያቶችን ለመወሰን። እንዲሁም በክሊኒካል አዋላጅነት የማስተርስ ዲግሪን ለተመራማሪዎች የመመረቂያ ፅሁፎችን ለማዘጋጀት ትልቅ አስተዋፅኦ አለው።

የጥናቱ ሂደት እና ጊዜ: ጥያቄውን ለእርስዎ አነበብኩኝ, እባክዎን ለእነዚያ ጥያቄዎች ከእኔ ጋር ለ 25-30 ደቂቃዎች ምላሽ ይስጡኝ። አጠቃላይ ጥያቄዎች 36 ስለዚህ ጥያቄውን አንብቤ መልስዎ በጥያቄው ዝግጅት መሰረት በትክክል ተሞልቷል።

ጥቅሞች እና አደጋዎች- ይህ ምርምር ጊዜዎን ከመውሰድ በስተቀር ምንም አይነት አደጋ የለውም. በዚህ ጥናት ውስጥ በመሳተፍ በቀጥታ ምንም ጥቅም የለዎትም። ነገር ግን የዚህ ጥናት ውጤት ለጤና ቢሮዎችና ድርጅቶች ጠቃሚ መረጃ ይሰጣል።

ሚስጥራዊነት - ለአንዳንድ ግላዊ ጉዳዮች፣ የእርስዎ መልሶች እና ሃሳቦች ሙሉ በሙሉ ሚስጥራዊ እና ደህንነታቸው የተጠበቁ መሆናቸውን ላሳውቅዎ እወዳለሁ። ስምህ በዚህ ቅጽ ላይ አይጻፍም። ጥናቱ የግለሰቦችን ማንነት በምንም መንገድ በጽሁፍም ሆነ በቃላት አያቀርብም።

የተሳታፊ መብቶች - የእርስዎ ተሳትፎ በፈቃደኝነት ነው። እባክዎ የመረጃ ወረቀቱን ለማንበብ/ ለማዳመጥ የሚፈልጉትን ያህል ጊዜ ይውሰዱ። በዚህ ጥናት ውስጥ የመሳተፍ ወይም ያለመሳተፍ መብት አልዎት። አንድ ነጠላ ጥያቄ ለመመለስ እምቢ ማለት እና ምንም እንኳን ካልተመቸዎት በማንኛውም ጊዜ ቃለ መጠይቁን ማቆም ይችላሉ። ስምምነቱን በትክክል አንብቤዋለሁ እና እሱ / እሷ ደግሞ ጥናቱን በግልፅ አብራርተውልኛል. እንደ አደጋዎች፣ ጥቅማ ጥቅሞች፣ ሚስጥራዊነት፣ መብቶች እና ጥያቄዎች እና አስተያየቶች ለማን እንደሚነሱ ያሉ ጉዳዮች ሲኖሩኝ በደንብ ይገባኛል። እሱ/እሷ በማንኛውም ጊዜ ቃለ መጠይቁን የማቆም ወይም አንድን ጥያቄ ለመመለስ እምቢ ማለት መብት እንዳለው ነግሮኛል። እሱ/ እሷ ለማንኛውም ግልጽ ያልሆነ ጥርጣሬ ወይም አሻሚነት እድል ይሰጣል። እናም በዚህ ጥናት ውስጥ በፈቃደኝነት ለመሳተፍ ወሰንኩኝ እና ፊርሜን ከታች አስቀምጫለሁ.

<u>ክፍል ሀ</u> ፡ <u>በሀዋሳ ከተማ የህዝብ ጤና ተቋማት ተሳታፊዎች ማህበራዊና ስነ-ህዝብ ባህሪያት ላይ የሚነሱ ጥያቄዎች ፣ ኢትዮጵያ፣ 2023</u>

መመሪያ ፡ የምላሾችን ምላሽ ከእያንዳንዱ ጥያቄ ፊት ክበበው።

ክፍል አንድ፡ የሶሺዮ ዲሞግራፊ መረጃ			
አይ	**ጥያቄዎች**	ሊሆን የሚችል ምላሽ	ዝለል
101	ዕድሜሽ ስንት ነው?	…… (በቁጥር)	
102	መኖሪያሽ ምንድን ነው?	1. ከተማ 2. ገጠር	
103	ሃይማኖትሽ ምንድን ነው	1. ኦርቶዶክስ 2. ሙስሊም 3. ፕሮቴስታንት 4. ካቶሊክ 5. ሌላ (ይግለጹ)	
104	የጋብቻ ሁኔታዎ ምንድ ነው?	1. ያገባ 2. ያላገባ	
105	የትምህርት ደረጃዎ ስንት ነው?	1. መጻፍ እና ማንበብ አልተቻለም 2. የመጀመሪያ ደረጃ ትምህርት ቤት 3. ሁለተኛ ደረጃ ትምህርት ቤት 4. ኮሌጅ እና ከዚያ በላይ	
106	ሥራሽ ምንድን ነው?	1. የቤት ሚስት 2. የመንግስት ሰራተኛ 3. ነጋዴ 4. የቀን ሰራተኛ 5. ተማሪ	
107	የቤተሰብዎ አማካይ ወርሃዊ ገቢ ምን ያህል ነው?	…… (በቁጥር)	
የማጎጸን መንስኤዎች			
108	ስንተኛ እርግዝነዎ ነው	…… (በቁጥር)	
109	ስንት ልጅ ዎልደዋሉ		
110	ለዚህ እርግዝና ቅድመ ወሊድ ክትትል አለዎ?	1. አዎ 2. አይ	አይ ከሆነ ወደ_በቁጥር 112
111	ምላሽህ "አዎ" ከሆነ ስንት	…… (በቁጥር)	
112	ባለፈው እርግዝና የቅድመ ወሊድ ክትትል አለዎ?	1. አዎ 2. አይ	አይ ከሆነ ወደ_በቁጥር 114

113	ባለፈው እርግዝና የቅድመ ወሊድ ክትትልዎ የት ነበር?	1. ጤና ጣቢያ 2. የመጀመሪያ ደረጃ ሆስፒታል 3. አጠቃላይ ሆስፒታል 4. ሪፈራል ሆስፒታል	
114	በቀድሞ እርግዝናዎ ውስጥ የተጎዳ ልጅ አለ?	1. አዎ 2. አይ	
115	በቤተሰብዎ ውስጥ የተጎዳ ልጅ አለ?	1. አዎ 2. አይ	

ክፍል ለ ፡ የተወሰነ በተወለዱ ያልተለመዱ ችግሮች ላይ እውቀት

201	ቢዲ በነፍሰ ጡር ሴቶች የተገኘ በሽታ ነው።	1. አዎ 2. አይ 3. አላውቅም	
202	BD ከተፈጥሮ በላይ የሆነ መነሻ ነው።	1. አዎ 2. አይ 3. አላውቅም	
203	ቢዲዎች በማህፀን ውስጥ በማደግ ላይ ባሉ ሕፃን ሊገኙ ይችላሉ።	1. አዎ 2. አይ 3. አላውቅም	
204	ቢዲዎች ከተጎዱት ሰዎች ጋር በመገናኘት ሊተላለፉ ይችላሉ	1. አዎ 2. አይ 3. አላውቅም	
205	አብዛኛዎቹ የወሊድ ጉድለቶች መከላከል ይቻላል	1. አዎ 2. አይ 3. አላውቅም	
206	አብዛኞቹ የልደት ጉድለቶች በሕክምና ሊታከሙ ወይም ሊታከሙ ይችላሉ።	1. አዎ 2. አይ 3. አላውቅም	
207	በፊዚዮቴራፒ አማካኝነት ከትውልድ ወደ ትውልድ የሚመጣ የአካል ጉዳት መዛባት መቀነስ ይቻላል	1. አዎ 2. አይ 3. አላውቅም	
208	ብዙዎቹ BDs የጄኔቲክ መነሻዎች ናቸው።	1. አዎ 2. አይ 3. አላውቅም	
209	BD በሕፃኑ ውስጥ በኃጢአት ምክንያት ይከሰታል ቤተሰቦች	1. አዎ 2. አይ 3. አላውቅም	

ክፍል ሐ : በአደጋ ምክንያቶች እና በመከላከል ላይ የተሳታፊዎች እውቀት .

በአደገኛ ሁኔታዎች እና በሞከላከል ላይ የተሳታፊዎች እውቀት			
301	በእርግዝና ወቅት አልኮሆል መጠጣት ልጅን የሞውለድ እድልን ይጨምራል?	1. አዎ 2. አይ 3. አላውቅም	
302	በእርግዝና ወቅት አንዳንድ ያልታዘዙ መድሃኒቶችን መጠቀማችሁ ልጅን በመውለድ ችግር ያለበት ልጅ የመውለድ እድልን ይጨምራል?	1. አዎ 2. አይ 3.አላውቅም	
303	ከእርግዝና በፊት እና በእርግዝና ወቅት ማጨስ ልጅን የመውለድ አደጋን ይጨምራል?	1. አዎ 2. አይ 3.አላውቅም	
304	የእናቶች ዕድሜ (≥40 ዓመት) ልጅን በመውለድ ያልተለመዱ ችግሮች የመውለድ አደጋን ይጨምራል?	1. አዎ 2. አይ 3.አላውቅም	
305	በዚህ ጊዜ ፎሊክ አሲድ/የብረት ፎሌት (የብረት ፎሌት) መጠቀም እርግዝና የመውለድ እድልን ይቀንሳል ሀ BD ያለበት ልጅ	1. አዎ 2. አይ 3.አላውቅም	
306	በዚህ ጊዜ አዮዲን ያለው ጨው ይጠጡ እርግዝና የመውለድ እድልን ይቀንሳል ሀ BD ያለበት ልጅ	1. አዎ 2. አይ 3.አላውቅም	
307	መደበኛ ኤኤንሲ በጠቅላላው ይከታተላል የእርግዝና ወቅት የመስጠት እድልን ይቀንሳል ከቢዲ ጋር ልጅ መወለድ	1. አዎ 2. አይ 3.አላውቅም	
308	በዚህ ጊዜ ለጨረር (ኤክስሬይ) መጋለጥ ይሆናል እርግዝና የመውለድ አደጋን ይጨምራል ሀ BD ያለበት ልጅ	1. አዎ 2. አይ 3.አላውቅም	
309	በእርግዝና ወቅት ከመጠን በላይ መወፈር አደጋን ይጨምራል ከቢዲ ጋር ልጅ መውለድ	1. አዎ 2. አይ 3.አላውቅም	
310	በእናትየው ወቅት ከቁጥጥር ውጭ የሆነ የስኳር በሽታ ይኖራል እርግዝና የመውለድ አደጋን ይጨምራል ሀ BD ያለበት ልጅ	1. አዎ 2. አይ 3.አላውቅም	
311	በአንድ ሕፃን ውስጥ የልደት ጉድለት ታሪክ ይሆናል ቀደም ሲል ወይም ዘመዶች የመስጠት አደጋን ይጨምራሉ ከቢዲ ጋር ልጅ መወለድ	1. አዎ 2. አይ 3.አላውቅም	
312	ንክኪ የመስጠት አደጋን ይጨምራል ከቢዲ ጋር ልጅ መወለድ	1. አዎ 2. አይ 3.አላውቅም	