DEBRE BEREHAN UNIVERSITY ASRAT WOLDEYES HEALTH SCIENCE CAMPUS, SCHOOL OF PUBLIC HEALTH DEPARTMENT OF PUBLIC HEALTH.

MAGNITUDEAND ASSOCIATED FACTORS OF NEURAL TUBE DEFECT AMONG PREGNANCY OUTCOME IN HOSPITALS OF ADDIS ABABA, ETHIOPIA, 2023.

BY: HANA WORKU(BSC)

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DEBRE BERHAN UNIVERSITY

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Approval Sheet

DebreBerhan University

AsratWoldeyes Health Science Campus

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ABSTRACT

Background: Neural tube defect is a central nervous system structural defect that affects the developing embryo's brain, spine, and spinal column during the first month of development. There no inclusive studies conducted involving private hospitals to assess prevalence and risk factors of neural tube defectin Ethiopia which arise the question of representativeness,additionally there tube defects and their risk factors and many studies in birth defects caused by stillbirths, elective terminations, and aborted fetuses because no organized data on these types of pregnancy losses is gathered.

Objective:the aim of this study to assess the magnitude and risk factors ofneural tube defect among newborn and pregnancy outcome at both public and private hospital in Addis Ababa, Ethiopia, 2022.

Methods: Cross-sectional study was conducted from Augest -September,2022 among pregnancy outcome and newborns delivered in 9 hospitals of Addis Ababa selected using lottery method with sample size of 329. Consecutive sampling technique was used to get study participants. Data was`collected by interviewing the mothers. Data was entered using Epi-data version 7.2.0.1 and analysis was done using SPSS version 23. Binary logistic regression model was used and Variables that show significant association in the univariable analysis of $p<0.25$ was entered in multivariable analysis. Adjusted odds ratio with 95% confidence interval (CI) and p value ≤ 0.05 was used to claim statistical significance.

Result: Out of the 326 pregnancy outcome, 8 (2.5%) wereNTDs.Among the total NTDs, Spina bifidia were the common NTDs4 (5%) followed by Anencephaly 3(3.75%).Family member with history of NTDs history, History of NTD and having ANC follow up have a statistically significant association with NTD.

Conclusion andrecommendation:relatively lower prevalence of neural tube defects(7,33)was noted but this is high figure due to the severe complication of NTD and health care workers should givehealth education about history of NTDs history, History of NTD and having ANC follow upand preventive measures for all family and women's of child bearing age (15-49).

Key word: neural tube defect, spina bifidia,anencephaly,hydrocephaly ,meningocele.

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ABREVETION And ACRONYMS

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CDC	Central Disease Controle And Prevention
CI	Confidence Interval
COR	Cruds odds Raio
CSF	Cerebro Spinal Fliud
DM	Diabetes Melitus
FA	Folate Acid
ICD	International Classification Of Disease
MTHF	Metheylen Tetrahydrofolate Reductase
NICU	Neonatal Intensive Care Unit
NTD	Nural Tub Defect
SPSS	Statistical Package for Social Science
WHO	World Health Organization

1: INTRODUCTION

1.1. Background

The early stages of embryo development are a critical period which may mark vulnerability to disruption by teratogenic agents that lead to neural tube defect (NTD). NTDs are structural defects of the central nervous system that affects the brain, spine and spinal column of the developing embryo during the first month of developmental process and they are most common congenital malformations, are potentially preventable cause of perinatal morbidity and mortality(1,2).The neural tube closure usually occurs between the third and fourth weeks of intrauterine life. NTDs are the second most common class of malformations after cardiac anomalies and Spinal bifida, encephalocele, and anencephaly are major subgroups of these congenital disabilities (3). Early screening programs are beneficial to decrease mortality and morbidity; furthermore, it allows the families to make informed reproductive choices and design appropriate prenatal care and delivery(4) .

Birth defects are structural, functional, or metabolic abnormalities that are present at the time of a baby's birth. Birth defects that impact the development of a bodily part are known as structural birth defects. Organogenesis is when birth abnormalities commonly begin. Birth defects can be seen before, during, or after birth, and are a leading cause of hospitalization and mortality in children(5,6).

Globally 7.9 million infants are born with significant NTDs, accounting for 6% of all births and in low and middle income nations, under five morbidity and mortality owing to birth defects is increasing, despite the fact that mortality and morbidity due to diarrhea and infection are reducing(7,8,9,10).

1.2. Statement of the problem

Neural Tubes Defect is severe birth abnormalities caused by the failure of the neural tube to shut properly. Any woman who is capable of becoming pregnant is at risk of having a pregnancy compromised by NTD. It's impossible to predict which women will experience NTD during their pregnancy.

Ninety-five percent of women who have pregnancies affected by NTD have no personal or family history of the disease(11).

Different studies showed that mother who live vin rural area,maternal age of greater than 35 years old ,illiterate mother and those with grand multipara are more affected with pregnancy outcome with NTDs (3,7,8,12).

Neuraltube defect pose psychologico- social impacts on the individual and family and evonomical burden on the community. NTDs Affected individual got physical and hindered daily living, bodily pain, vitality, emotional functioning, mental health, self-esteem, self-image, social functioning, relationships, and sexual functioning. Caregivers' or family lives affected included activities of daily living, work impact, time consumption, parental responsibilities (including responsibilities to other children), confidence, feelings and emotions, mental health, stress, social impact, psychological adjustment, relationships (with siblings and qother family members), social support, coping strategies, and termination decisions. Cost burdens on patients and caregivers also include out-of-pocket costs, lost wages, or household production due to increased morbidity and mortality, transportation and other nonmedical costs and hence has a great economic reduction impact on country level (5,7).

In study done in Saudi Arabia shows that, those mothers taking periconceptional folic acid and vitamin us has 65 percent reduction than those who didn't take it and folic acid fortification in staple foods have been shown to reduce the incidence of NTD-affected pregnacy by 70%, however, a significant proportion of cases of NTDs continue to develop, and the reason is idiopathic(15,16).

Many studies in Ethiopiaon NTDsexclude birth defects caused by stillbirths, elective terminations, and aborted fetuses because no organized data on these types of pregnancy losses is gathered. This study will be done by including those mother diagnosed having NTD and undergoing elective termination on ANC follow-up to fill this gap. And also despite the fact that there are researches available to illustrate the causes of NTD across the country, notably in Addis Ababa, these studies were involves only public hospitals neglecting private hospitals which arises the question of representativeness.

There is no inclusive studies conducted involving private hospitals to assess prevalence and risk factors of NTD and, therefore this study will be aimed at assessing prevalence and factor of NTD among abortus and newborn delivered in selected both governmental and private hospitals in Addis abeba.In Ethiopia, there is a scarcity of published data on the prevalence of NTDs, their risk factors, and recognized prevention strategies.

1.3 Significance of the study

This Study primarily focused on identifying possible risk variables associated as contributing factors for NTDs are still scarce in study area, and hence it can help to bridge the knowledge gap. This study would provide Ethiopia with a fertile soil of information about NTDs, allowing it to adjust policies and programs by fortifying food with folic acid, counseling and screening, as well as health education. For the most part, this study offered useful information on associated risk factors and the prevalence of NTDs, which will be useful to health planners and policymakers in their efforts to monitor and prevent NTDs and their associated risk factors. This could apply to both governmental and non-governmental organizations (NGOs). The study may also evaluate the role of health professionals in the development of interventional projects aimed at improving mother and child health. The will provide a baseline data on prevalence and preventive strategies for NTD-related risk factors in the Addis Abeba. The study was also become baseline data for others investigator who want to search further on related issues.

2.LITERATURE REVIEW

2.1. Prevalence of NTD

The prevalence of NTDs in developing countries has risen to up to four times that of developed countries. According to a study conducted in eighteen countries across six WHO regions, the prevalence of NTDs in low and middle-income countries is 1.67/1000 births for total NTD prevalence, 1.13/1000 births for spina bifida, 0.25/1000 for anencephaly, and 0.15/1000 for Encephalocele(1,13).

Mean while studies done in Malawi, south africa and Sudan the reported prevalence of spina bifida was 0.47 per 1000 births , 1.74 per 1000 births and 3.48 per 1000 births, respectively (13,17)

Similarly a descriptive, cross-sectional study in Pakistan shows that a total of 2,360 patients were admitted in NICU during the study period and 76patients were noted to having NTDs; among these males were more (77%, than females (23%)(18).

Additionaly according to a descriptive, cross-sectional study conducted at Ayub Teaching Hospital in Abbottabad, Pakistan, a total of 2,360 babies were admitted to the NICU throughout the study period, with 76 patients diagnosed with NTDs (19) .

And also a cross-sectional study in Dares Salam revealed that a total of 28217 resident births occurred. The overall birth defect prevalence was 28.3/10000 live births. The most and least prevalent anomalies at birth 9 (9.9 and 1.1/10 000 live births, respectively) were neural tube defects and undetermined sex. Stillbirths (66.7%) and deaths within 5 days of an impacted live birth were the most common causes of mortality (18.5 percent) neural tube defects were the most frequently associated structural defect (12)

The overall incidence of NTDs among live born neonates was 2.5 percent, according to a study conducted in Egypt, where the majority of the cases were referred for delivery (18).

In Ethiopia, a hospital-based cross-sectional study at Addis Ababa found that the overall prevalence of NTDs is 6.1/1000 births, and a retrospective chart review from Addis Ababa teaching hospitals found that the overall prevalence of NTDs is 55/8677(14, 15,19).

Another studies in the Tigray region found that anencephaly is present in 6.6/1000 live births, spina bifida is present in 6.4/1000 live births, and Encephalocele is present in 0.67/1000 live births, for a total frequency of 13.8/1000 live births (6,20).

2.2. Associated risk factors for developments of NTDs

Genetic variables, prenatal exposure to environmental dangers, maternal Sociodemographic factors, maternal medical conditions, and drug usage all play a role in the development of NTDs, but the exact number of causes is unknown (16,21). In Ethiopia genetic and environmental variables have a significant impact on the development of NTDs, while dietary deficiencies, obesity, and medicines play a little role in the prevalence of NTDs(17,22).

2.2.1 Socio Demographic Factors

A study done in Benue State shows mother in the age group(45-49) had nearly two and half times high risk of having NTD than mother in the early age group of (18-23)(7). According to a study conducted in Italy, as mother get higher in age the risk of having NTD is getting higher. Mother in age group of 35-41 has almost two times higher risk of having NTD (19,23).

And also according to a study conducted in Nigeria shows that mother that have no education has two times higher risk of having NTD in their pregnancy than that of mother having diploma and higher educational level (24).

According to studies conducted in Riyadh and Algeria, female gender offspring had a higher prevalence of NTDs than male gender offspring (36.6 percent vs. 70%)(21). Similarly study done in Addis Ababa shows that female kid have 1.3 times higher risk of developing NTD than male gender kids(25).

With regard to maternal age a study conducted in Tigray region shows that maternal age >35 had nearly two and half times more likely to develop NTD than in the age group of(20-24). And this study indicated that as the age of mother increases the risk of having NTD also increases(6).

According to a California study, having a neural tube defect-affected pregnancy increases with lower socioeconomic status(20,26). Another study on the magnitude and risk factors of NTD in Addis Ababa found that annual cash family income less than $1,300 USD had two and half times higher risk of getting NTD than those having greater than 1,800 USD (14).

2.2 Mothernal previous history of NTD affected pregnancy.

Non-syndromic NTDs are also thought to have some genetic basis as evidenced by a two to five percent risk of recurrence for mothers with a previous NTD-affected birth, a fifty -fold increase over the general population risk. In addition, consanguineous marriages, a positive family history has been associated with an increased risk of an NTD-affected pregnancy (2,14,27) .

A Population based case-control study conducted in China showed a history of a previous birth defect-affected pregnancy was significantly associated with NTD (15) .

Another hospital based study conducted at Riyadh and Algeria showed that consanguineous marriage was observed among cases (39.1% and 30%) respectively (28).

2.2.3 Maternal Nutrition and Folic Acid Consumption

According to a study conducted in Iran, obesity in women is closely associated with a risk of NTDs that is two and a half times higher than that of non-obese women (24).

Similarly, an Algerian research demonstrates that mothers who have poorly managed blood sugar levels are about twice as likely to undergo uterine environment changes. This can be the reason for the abnormal organogenesis. A higher risk of NTD was associated with eating meals high in sucrose and/or glycemic index, especially in obese women(23).The risk of NTDs is significantly influenced by the mother's folate status (9,29). The intracellular one-carbon metabolism that produces the pyrimidines and purines needed for DNA synthesis requires folates. The physiologically active form of folate that functions as a cofactor in enzymatic processes is 5-methyltetrahydrofolate (MTHF), a micronutrient form of folate that circulates in plasma. Demand for folate increases during pregnancy since it is necessary for the growth and development of the fetus(21).

Studies done in Ethiopia shows that maternal supplementation with folic acid during pregnancy reduces NTD frequency around 46 persent than those mother who dint take the folate supplementation during pregnancy(2,30,31).

The World Health Organization recommended folic acid supplementation during pregnancy, but studies suggest that many women, particularly those from low socioeconomic backgrounds, do not follow the advice (24). A case-control study conducted in Italy and Algeria found a substantial link between NTDs and mothers who did not take folic acid before conception

(AOR=27 CI, 9.31–78, and 86 percent, respectively) (18, 21). According to a case-control research in Sudan, Iran, found that maternal obesity around five persent was substantially linked with NTDs among all pregnancies with NTD afflicted babies (n=91)(12).

Preconception folic acid supplementation has a preventative impact compared to those who don't take it, according to a study done in Addis Abeba (14).

Another hospital-based study in the Tigray region discovered that moms who did not start folic acid supplementation pre-conceptionally had a three times higher risk of having a baby with NTD than those who did(6, 14).

2.2.4 Maternal Reproductive History

Maternal reproductive history such as history of abortion, still birth, early neonatal loss, multiparty was associated with increase of risk factors for NTDs. According to Catania, Italy study mother with spontaneous abortion were have a higher risk of having NTD fetus or baby than those not having spontaneous abortion. Another study done in Addis abeba Ethiopia revealed that mother with history of still birth has nearly two times higher risk of having a baby with NTD than those mothers not having history of still birth (14).

Study conducted in Debre berehan stated that mothers with Early neonatal death were having 2 times higher risk of having NTD than those not having early neonatal loss (33).

A 4-year period case-control study conducted in Riyadh conclude that significantly higher risk mothers with history of stillbirth to have NTD two times affected baby two times than those not having stillbirth history(3).

A case-control study conducted among pregnancies with NTD affected newborns (n=91) in Iran, indicated that maternal history of abortion nearly five and significantly associated with NTDs(29)

Study done in Addis Ababa show that there is significant association between multiparty 1.7times risk of NTDs than primgravida mother (14).

2.2.5 Maternal Chemical Exposure

Pesticides (insecticides, herbicides, and fungicides) have the potential to cross the placenta and affect embryonic development (18). These substances have been demonstrated in animal experiments to modify neuro epithelial cell proliferation and differentiation during neurulation, as well as cause excessive neuroepithelial cell death, which has a negative impact on neural tube closure. Women who reported applying pesticides in their houses or yards were two times more likely to have NTD-affected pregnancies than women who did not report these exposures.(26).

Study done in Italy shows that mother in use of pesticide has ten times higher risk of NTD than those mother not in use of pesticide. This study also stated that mothers living near waste sites or polluting industries three times were found to be higher risk and two present developing NTD than those are not living near pollutant industry or waste disposal (19).

According to a case control study conducted in Addis abeba shows that maternal who are secondary smoker exposed to cigarette smoke was 1.9times higer risk of developing NTD (AOR 2.49), And also this study shows that three cups of caffeine per day had a higher risk having NTD than those who were not drink coffee nearly nine persent, and coffee was the most common source of caffeine (AOR 34.17) (27).

2.2.6 Maternal Febrile Illness

According to a recent meta-analysis, the risk of NTD was nearly three times higher in cases of maternal fever during the first trimester than mother lacking fever during this trimester and as a result, maternal fever in early pregnancy as a risk factor for NTD-affected pregnancies, as well as heat that negatively affects development, can lead to increased cell death, decreased 8 proliferations, gene expression disruption, and damage to the embryonic vasculature, resulting in induction of apoptosis, inhibition of proliferation/slow differentiation (28, 29).

In a case-control research conducted in California, maternal febrile illness in the first trimester was linked to an elevated chance of having an NTD-affected pregnancy nearly two times than those not having fever (30). Mothers having fever history have a higher risk of having NTD 3.36 than those with no fever history as well as the mothers who were in use of antipyretic medicines five present wes linked to higher risk of having NTDs than those not using antipyretics in a study conducted in Northern China (31).

According to a case control study conducted in Ethiopia, mother with Periconceptional hyperthermia is linked to the one and half times higher risk of NTDs than those with no history of Periconceptional hyperthermia (27).

2.2.7 Maternal Medical and drug factors

A study done in Nigeria discovered that the offspring of diabetes mellitus affected women have a 2 fold increased risk of NTDs when compared to the general population (32). Study done on role of maternal reproductive history in the factors of neural tube defects Showed that mothers with epilepsy have a higher risk of having one and half times NTD than those mother who are not epileptic (18).

Other variables that may predispose kids to NTDs is that use of oral contraceptives (30). According to a study conducted in Addis Ababa, mothers with history of contraceptive use have a two times greater risk of having a baby with NTD than those who are no history of contraceptive use (32).

2.2.8 Maternal Life Style

According to a study done in Addis abeba mother with High coffee intake (3 cups per day) has nearly two times higher risk of developing NTDs, (27).

In Italian hospital-based investigation mothers who has alcohol intake behavior have four times higher risk of having NTDs than those who have no alcohol drinking habit. (18). Furthermore, a research in Northern China found that daily passive exposure to cigarette smoke two times rate of linked to NTDs (31).

Another Ethiopian study found that mothers who were passively exposure to cigarette smoke have two and half times higher risk of having NTDs affected pregnancy than those who were not have history of passive exposure to cigarette smoke and this study also shows that mothers who took three cups of caffeine per day were shown to have a higher risks 1.14times of a baby having of NTD affected than those mothers who did not take less than three cups of coffee(2,32).

2.3 Conceptual frame work

This conceptual frame work is developed by reviewing different studies (3, 15, 6, 19, 21, 24).NTD is multi-factorial in etiology, and this conceptual framework shows that genetic factors, reproductive history, medical and drug factors, maternal lifestyle and child characteristics could have direct association with NTDs.

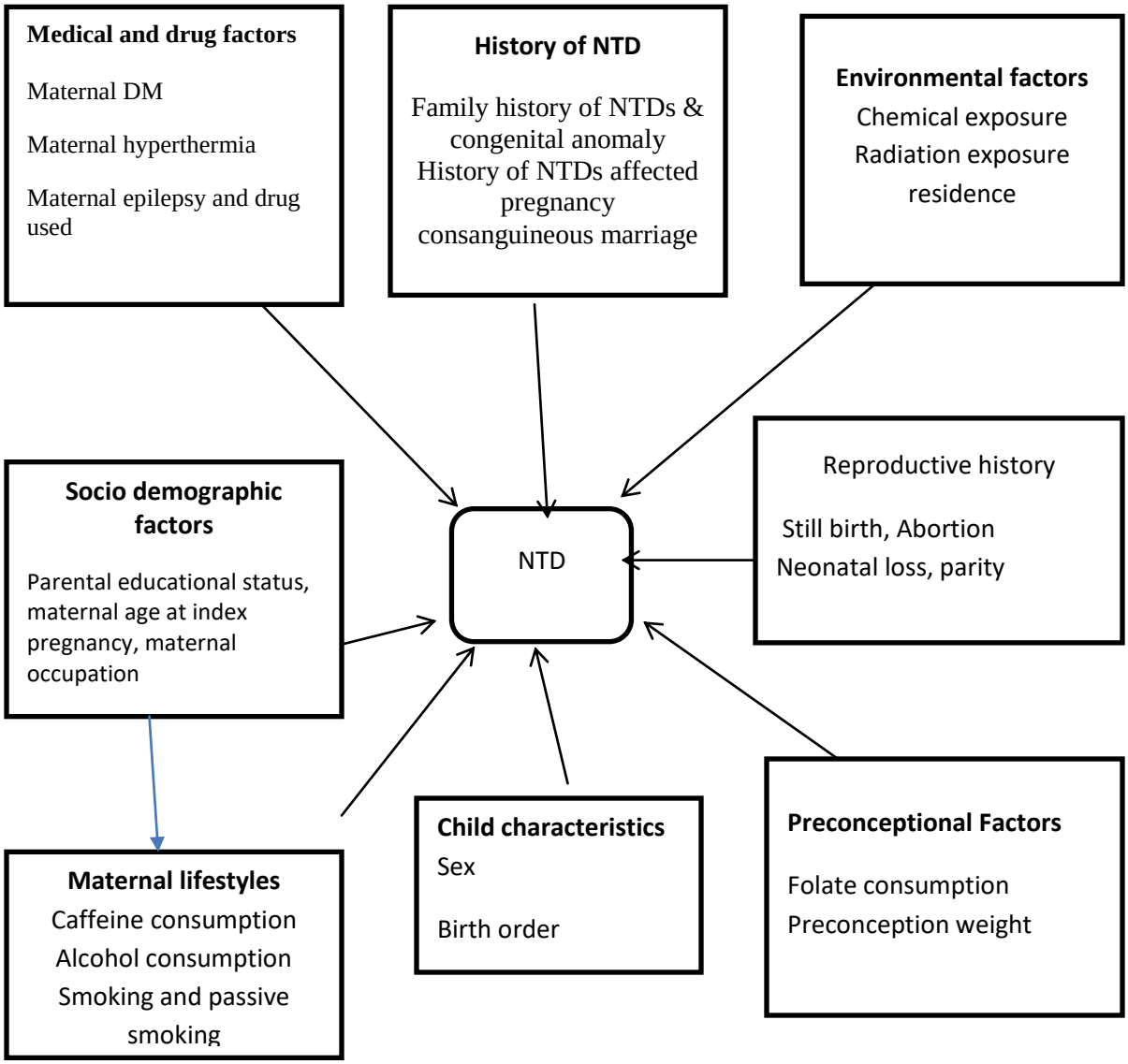

figure 1 1Conceptual frame work of associated factors of NTDs among newborn and pregnancy outcome, 2023.

3.Objectives

3.1. General Objective

To assess magnitude and associated risk factors of NTDs among pregnancy out come in both public and private hospitals of Addis Ababa, Ethiopia, 2023.

3.2. Specific Objectives

- To assess the magnitude of Neural tube defect among pregnancy outcome in both public and private hospitals of Addis, Ethiopia, 2023.
- To identify factors associated to Neural tube defect among pregnancy outcome in public and private hospitals of Addis, Ethiopia, 2023.

4. METHODS AND MATERIALS

4.1 Study Area and Period

The study was conducted in Addis Ababa city which is the capital and largest city of Ethiopia from March to october 2022. Addis Ababa is located at the geographic center of the country and it covers about 540 km2and is divided in to 10 sub-cities containing 116 woreda at which the City lies at an altitude of 7,546 feet (2,300metres). According to the Central Statistics Agency (CSA) 2007 national census the projected population of Addis Ababa in 2018 was estimated to be more than 3.5 million. Addis Ababa city has a total of 14 public hospitals, 22 private and 3 Non-Governmental Organization hospitals (FMOH, 2020). Out of the 14 public hospitals, four are under the Federal Ministry of Health (FMOH), one University Hospital (Tikur Anbesa Specialized Hospital under Addis Ababa University) and three of them are Armed Force, Federal Prison and Federal Police hospitals. The remaining six hospitals are managed under Addis Ababa City Health Bureau (AACHB).The study was conducted in nine selected governmental and private hospitals in Addis Ababa.

4.2 Study Design

- Hospital based Cross-sectional study design was conducted

4.3. Population

4.3.1 Source Population

- All birth and medically terminated abortus the public and private hospitals of Addis Abeba 2023.

4.3.2 Study Population

- All selected live birth and abortus in selected public and private hospitals of Addis Ababa ,2023 who fulfill the inclusion criteria.

4. 4 Inclusion and Exclusion Criteria

4.4.1 Inclusion Criteria

- All delivered and medically terminated fetus (gestational age > 12 weeks) from in selected public and private hospitals of Addis Ababa, Ethiopia, 2022.

4.4.2 Exclusion Criteria

- Critically ill during the data collection and Cases with any ambiguity were excluded.

4.5. Sample size determination and sampling procedure

4.5.1 Sample size determination

Single population proportion

The sample size was determined using single population proportion formula for cross-sectional survey as follows: +Non-response rate.

By taking Prevalence of neural tube defect P=10.9% from hospital-based cross-sectional study on determine prevalence and risk factors of NTDs conducted at three teaching hospitals of Addis Ababa University(14).

Then, the initial sample size (n_0) is given by

$$n_0 = \frac{z^2_{\alpha/2} \times p(1-p)}{d^2}.$$

q= (1-p) =89.1%

Confidence level = 95% = 1.96

Desired precision (d) = 0.03

Non-response rate= 10%

Then multiplying the result by 2 for design effect the total required sample size becomes 329.

4.5.2 Sampling procedure

A multi-stage sampling technique is used to select the study participants. First, all of the 39 hospitals were listed and among the 12 hospitalsYekatit 12, St. Paul's minillikII, Rasdesta, damtew memorial hospital,zewdituhospital,Addis hiwot, Betezata, legehar, haleluya ,ICMC, Hayat and st.yared hospitals were selected by lottery method applingsimple random sampling method from the 39 hospitals (both public and private) in Addis Abeba. Proportional allocation is made for each hospital by fixing three month delivery and abortion report and dividing by three, then study participants are selected by systematic sampling techniques.

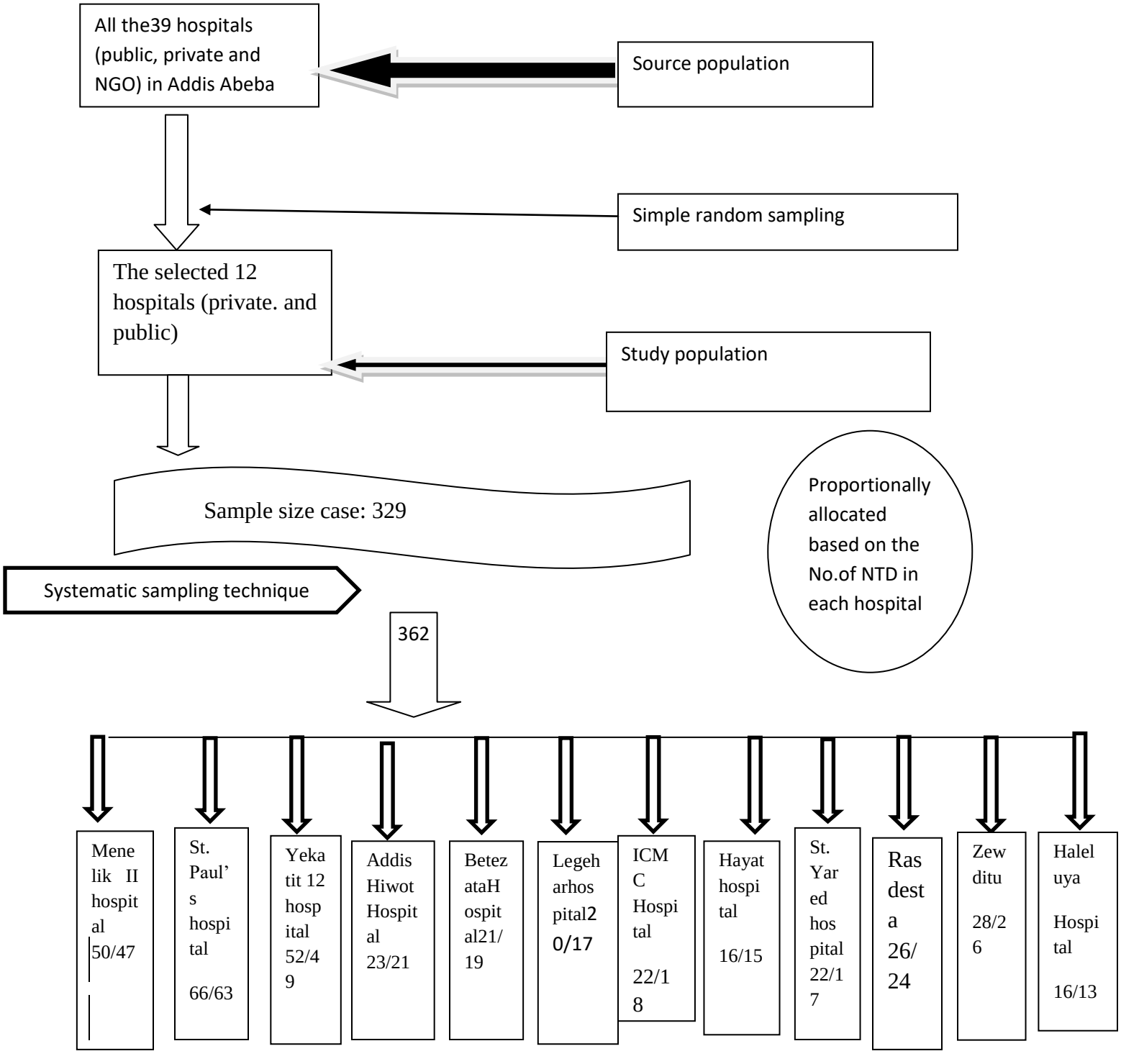

Figure 2.1:Diagrammatic representation of sampling techniques for pregnancy outcomesincluded in the study in governmental and private hospitals of Addis Ababa, March, 2023

4.6 Data collection and data management

4.6.1 Data collection tools

A pretested interviewer administered questionnaire written in English was prepared byreviewing Different peer-reviewed articles and some of questionnairepart was adapted from the WHO birth defect surveillance tool (6,12, 33) were used to develop the questionnaire.In order to address the objectives of the study, contents of questionnaire was reviewed by senior Gynecologist. The questionnaire was translated into the local language (Amharic) to the guardians then translated back to English toto ensure that the wording is consistent.

Interviewing mothers, using a systematic and pretestedquestionnaire at black lion and Amen generalhospital was used to obtain data.The interview was made within24 hours of delivery or of abortion.Eight trained midwives and fournurses working in the delivery and abortion room of the facilities wereperform the interview and one supervisor follow the overall data collection process.

The questionnaire included questions on socio-demographic characteristics of respondentsand factors related to NTD with data extraction format.

4.6.2Data processing and analysis

During data collection process the data was checked for its completeness and consistency. The completed data was cleaned, coded, entered in to Epidata version 7software and analyzed by using Statistical Package for Social Sciences (SPSS) version 23 software. Descriptive statistics such as frequency and percentages was used to present the data. The responses to the open ended questions was grouped, coded, analyzed and presented with frequencies of similar responses. Moreover, to determine factors associated with NTD, Bivariate logistic regression and multi-variable statistical analysiswas conducted. Variables found to have ($p<0.25$) in the Bivariate analyses was computed together. Those that with a $p < 0.05$ value were considered statistically significant.

4.6.3 Data quality management

The questionnaire was pre-tested on 17 of respondents in the non-selected public and private hospital in Addis Abeba before the start of actual data collection. The test was done to check whether the questions are clear and could be consistently communicated and consequently only slight modification was made in using some words. The data collectors will be trained by the principal investigators for a day on how to give standard instruction, clarify questions, approach respondents, how to obtain informed consent and how to secure confidentiality during the data collection. The collected data was checked by supervisors on daily basis for its accuracy and completeness.

4.7 Study Variables

Dependent variable

- Magnitude of NTDs

Independent variable

Socio-demographic characteristics

- Parental education status, Maternal age at pregnancy, Maternal occupation

Maternal reproductive factors

- Still birth, Abortion, Parity, ANC visit, Planning of pregnancy

Maternal life style factors

- Alcohol, Smoking status

Maternal exposure to environment Chemical exposure Radiation exposure

Preconception factors

- Maternal weight, Folic acid supplementation

Maternal history of previous NTD.

- Previous history of NTDs or congenital anomalies, Family history of NTDs, history of NTDs or congenital anomalies

Maternal medical and drugs factors

- Maternal drug use, Maternal herbal use, Maternal medical history

Neonatal characteristics

- Sex, Birth index.

4.8. Operational Definition

NTDs: any types of neural tube defect that is diagnosed by gynaecologist and obstetrician using U/S and MRI during delivery or during ANC follow up(1,2).

Spina bifida occulta: is defect the outer part of some of the vertebrae is not completely closed, Spinal cord does not protrude and Skin may be normal, or some hair growing from it(2).

Spina bifida meningocele: herniation of meninges between the vertebrae and the nervous system remains undamaged(2,3).

Spina bifida myelomeningocele: is a condition where the spinal cord and the tissues covering it protrude out of an opening in the back.

Anencephaly is the absence of a major portion of the brain, skull, and scalp that occurs during embryonic development(12,16).

Encephalocele: is a kind of neural tube defect that results in a sac like protrusion of the brain and its surrounding membranes through an opening in the skull(2,8,32).

Alcohol Consumption: Averagically two or more bottle per day had significant to risk factors NTDs during pregnancy(5,18).

Caffeine Consumption: On average, two or more coffee or tea which had risk of NTDsduring pregnacy(9,22).

Smoking: exposure to smoking or smoking of more than one pack per day during pregnacy(3,4).

Periconceptional period: a time one month before conception until12 weeks of gestation is taken(8,22).

Body Mass Index (BMI): BMI is a measurement of pregnant mother weight(kg) with respect to his/her height (Meter square) based on the WHO BMI score is classified as; <18.5- underweight ,18.5-24.9 - normal weight, 25-29.0 - over weight , 30.0 – obese(24,33).

4.9 Ethical consideration

Ethical approval for this study was obtained from Ethics Review Committee of the department of public health, Debre Berhan University and Addis Ababa health bureau and all selected hospitals was communicated with formal letter written from Addis Ababa health bureau and data collection was started after permission is obtained from hospitals administration. Participants were consented for their participation in the study. During the consent process, each participant was provided information regarding the purpose of the study, why and how they are selected to

be involved in the study, what was expected of them and the confidentiality of information acquired. Confidentiality was assured by not using any personal identifiers in the questionnaire and analyzing data in aggregate. They was informed their full right not to answer any of the questions in the questionnaire.

5.Result

5.1. Socio-demographic characteristics of the participants

A total of 326 respondents were properly interviewed with the questionnaires making a response rate of 99%.Among the 326 respondents majority 110 (37.7%) of them were in the age group between 20-25years old. Regarding their occupation, majority of the respondents were house wife 106 (32.5%) and the least are students19 (5.8%), About level of education majority of mothers 130 (39.9%) of them were primary education holder. In addition, 149 (45.7%) of the pregnancy outcomeare second pregnacy(Table 1).

Table 1 showing sociodemographic characteristics of pregnancy outcome included in the study in governmental and private hospitals of Addis Ababa, March2023 N=326

Socio-demographic	**Frequency (n)**	**Present (%)**
Maternal age		
<20	62	19
20-25	110	33.7
26-30	101	31
31-35	32	9.8
>35	21	6.4
Maternal educational status		
No education	97	29.8
Primary	130	39.9
Secondary	39	12.0
Occupational training	15	4.6
Diploma/degree/above	45	13.8
Maternal occupation		
House wife	106	32.5
Farmer	87	26.7
Factory worker	73	22.4
Office worker	41	12.6
student	19	5.8
Sex of the fetus and newborn		
male	104	45.2

female	126	54.8
pregnacyorder		
First	99	30.4
Second	149	45.7
Third and above	78	23.9

5.2 Maternal Genetic and obstetric Factors in the study area2023

Majority of mothers 305(93.6%) have no any close family member with history of NTD. With regard to history of NTDs affected pregnancy,majority of mothers 302(92.7%) have no history of NTD affected pregnacy and the rest 24(7.3%).And among the total mother 18(5.5%) have genetically relationship with their husband and 57(17.4%) of them have history of abortion.

Concerning ANC follow up majority 273(83.7%) of mothers have ANC follow up and the rest 53(16.3%) of them have no ANC follow up and majority of mothers 157(48.1%) are with para two parity(table2).

Table 2 showing genetic and obstetric factors of mothersincluded in the study in governmental and private hospitals of Addis Ababa, March2023 N=32

Variables		Frequency	percentage
Is there any close family member with history of NTD/other congenital anomalies	1. Yes	21	6.4
	2. NO	305	93.6
Do you have history of NTDs affected pregnancy	1. Yes	24	7.3
	2. NO	302	92.7
Do you have genetically relationship with your husband(relative).	1.Yes	18	5.5
	2.No	308	94.5
Do you have any history of abortion	1. Yes	57	17.4
	2. NO	269	82.6
Do you have any history still birth	1. Yes	32	9.8
	2. NO	294	90.2
Do you have any history of early neonatal loss	1. Yes	14	4.3
	2. NO	312	95.7
Was the pregnancy for the index child planned	1. Yes	289	88.6
	2. NO	37	11.4
Had ANC follow up	1. Yes	273	83.7
	2. NO	53	16.3
Parity	Para 1	75	23.1
	Para 2	157	48.1
	multiparous	94	28.8

5.3. Prevalence of NTDs in the study area2023.

Out of the 326 pregnancy outcome, 8 (2.5%) wereNTDs. Among the total NTDs, Spina bifidia were the common NTDs(50%) followed by Anencephaly(37.5%)andencephalocele (12.5%).

From a total of 8 cases, maternal occupation was house wife 6(75%)and farmer 2(25%). From 8 NTDs case, (75%) and (87.5%) were not taken folic acid prior to conception and were not taken folic acid at any time, respectively.

Multiparous and prim parous were the commonest gravidities each accounting for 75% and 12.5% respectively. Most of NTDs, 50% , 25% and 12.5% gestational age were 37-41 weeks, 32-37weeks and <28 weeks, respectively.

5.3. Factors associated with NTDs among birth outcome in selected hospitals in Addis 2022

All variables under the study are intered into univaraible logistic regression thenfamily member with history of NTDs,history of NTDs affected pregnancy,Having genetically relationship with husband,Had ANC follow up,Folic acid supplements and Smoking history are viriables with Pvalue of <=0.25 and all those variables are taken into multivariable anaylysis.

Among thopse variables family member with history of NTDs history, History of NTD and having ANC follow up have a statistically significant association in multivariable logistic regression analysis (Table 3).

The odd of having NTD is 17 times higher in those with no family member that has NTDs than those having a family member with NTDs AOR=**17.1**, 95% CI: **(11.4 27.5)**. Furthermore, the odd of having NTD affected pregnancy is seven times higher in mother previous history of NTDs affectedpregnancy,than those mothers with no previous history of NTD affected pregnancy AOR=**7.3**, 95% CI: **(**2.44 22.38**)**.Likewise the odds of having NTD affected pregnancy is 32%less in mothers having ANC follow up than those with no ANC follow up AOR=0.68, 95% CI: **(**2.06 14.57**)**

Table 3:Showing factors associated with NTDs among birth outcome in selected hospitals in Addis 2023.

Variable	**Category (n=326)**	**NTD**		**COR at 95% CI**	**AOR at 95% CI**	**P-value**
		Yes	**No**			
family member with history of NTDs	Yes	4	17	1	**1**	
	No	4	301	3.1(2, 8.2)	**17.1(11.4 27.5) ****	**0.01**
Do you have history of NTDs affected pregnancy?	Yes	6	18	0.15(0.08, 0.82)	**7.3(2.44 22.38) ****	**0.03**
	No	2	300	1	**1**	
Having genetically relationship with husband(are relatves)	Yes	4	14	2.3 (0.2 8.2)	2.3 (0.2 8.2)	1.02
	No	4	304	1	1	
Had ANC follow up	Yes	4	269	.39(0.18 8.21)	**0.68(2.06 14.57) ****	**0.021**
	No	4	49	1	**1**	
Folic acid supplements	Yes	5	291	1	1	
	No	3	27	1.9(1.28 11.21)	1.7(0.98 16.43)	0. 68
Smoking history	Yes	0	8	1	1	
	No	8	310	1.53(3.08, 19.11)	2.8(0.43, 9.7)	0. 14

6. Discussion

In this study, the total prevalence for all types of NTDs was found to be 2.5%, 95%, CI: (1.7-5.1)this prevalence of NTD is higher than the study done in Sudan (12).This difference might be due to differences in sample size, setting, socioeconomic difference.The prevalence in this studyisless than the prevalence of NTDs in Tigray region 13.8%(7). This might be the fact that due to the difference folic acid taking of study population.

The prevalence of NTD8(2.5%) is higher than prevalence of NTDs reported in Malawi 3.0 (16).This might be due the difference in the study population involved in those studies and the difference in the study setup used.

This study had higher prevalence of NTD (2.5%) compare to studies in Malawi 0.47(17) and Cape Town 1.74 (7).These variations might be explained by the influence of racial, geographical, nutritional, socioeconomic, and biological differences. Rates may also be affected by the differences in national NTDs prevention intervention programs in various countries (7).

In this study, having history of NTDsis significantly associated with having. This finding is Similar to the studies done in Debre Berhan(33) .This might be the fact that due genetic and environmental factors that increase the change of NTDs.

In this study having ANC follow up and family member with history of NTDsis significantly associated with occurrence of NTDs. This finding is Similar to the studies done in Nigeria(7).This might bedue tofact that the not having ANC follow up may lead not taking iron folic acid ,not getting nutritional councelling and hence this may lead increased risk of having NTD affected pregnancy.

7.Strength and limitation of the study

7.1Strength of the Study

This study is more inclusive and representative.

7.2Limitation of the Study

The study did not identify the number of ANC follow up as a risk factor of NTD.

8. Conclusion

The prevalence of neural tube defects in this study was found to be less than most studies in Ethiopia and other areas but this is high figure due to the severe complication of NTD .The result indicated that the most prevalent NTD being spina bifida and anencephaly. This study showed that family history of NTDs, history of NTD and ANC follow-up were significantly associated with occuranceNTDs.

9. Recommendation

Addis abeba health bureaushould be strengthenANC follows up for all pregnant mothers in order to achieve early prevention NTDs.

Health professional should give inphasis for mother with family history of NTD while screeing for NTD.

Researchers should do large scale prospective studies to have reliable estimates on burden of NTDs and associated factors

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Annex I Information Sheet

Debre Berehan University, School of Public Health, a research to assess prevalence of neural tube defect and associated factors among newborns in public hospitals and private hospitals of Addis Ababa.,2022.

Good morning/Good afternoon, my name is _____. I am working with Hana Worku doing a research as partial fulfillment for the requirement of MPH student at Debre Berehan university Department of public health. Currently I am conducting a research to assess prevalence of neural tube defect and associated factors among newborns delivered in public hospitals and privet hospital of Addis Ababa 2022. The main objective of this study is to describe the prevalence of NTD and factors associated with it among newborn delivered in selected public hospitals in Addis Ababa and to recommend possible solutions for the gap to be identified. To attain the objective of this study your ideas, experience and insights would be very valuable and I will be very grateful if you are participating in this study. The questionnaire will take a few minutes. The information you provide is kept confidential with unique code. Data will be analyzed in aggregate. If you have any question, don't hesitate to ask the data collector and you can withdraw from the study at any time. Your participation is voluntary, the information you will provide is very important.

Therefore, kindly ask you to participate in this study.

Do I have your agreement to participate? 1. YES 2. No. Stop

For any information you can contact:

Hana Worku Tel. 0910694399

ANNEX II: Consent Form

I have read/listen the information sheet above and clearly understood the purpose and anticipated benefit of the research. I hereby need to assure with my signature below that without any Coercion or forceful act by the research team, have decided to voluntarily participate in the study to contribute my part in the effort being made.

Client unique ID No_____ Signature _____ Date_____

Interviewer's name_____ Signature_____ Date_____

Date of interview_____ Time started_____ Time finished_____

Supervisor's Name_____ Signature_____ Date_____

For any information you can contact:

Hana Worku Tell,0910694399

I thank you for your cooperation

Annex III. Questionnaire (English version)

Code ---------- data collector----------supervisor----------

Extraction format

Ntd case diagnosed 1 yes 2. No

If diagnosed what type of NTD cases:……

Part 1.Socio-demographic status of study participant.

Instruction: Ask the following questions carefully and circle the response

S.№	Variables	Categorical codes	Remarks
101	Maternal age (in years)	_____	
102	Parental educational level	1. No education 2. Primary school 3. Secondary school 4. Higher Education Mater_____ Paternal_____	
103	Current Marital status?	1. Single 2. Married 3. Divorced 4. Widowed 5. Other Mather_____ Partner_____	
104	What is your current Occupation?	1. No occupation 2. Government employed. 3. Factory employee 4. House wife 5. Merchant 6. Daily laborer. 7. Farmer Other	
105	Sex of the new born?	1. Male 8. Female----------	
106	Pregnancy order of newborn	1. First 2. Second 2. Third and above	
107	Type of NTD Diagnose (see for patient chart)	3. _____	

Part 2: Maternal Genetic and obstetric Factors

S.№	Variables	Categorical codes	Remarks
201	Is there any close family member with history of NTD/other congenital anomalies	1. Yes 2. NO	
202	Do you have history of NTDs affected pregnancy?	1. Yes 2. NO	
203	Do you have genetically relationship with your husband?	1.Yes 2.No	
204	Do you have any history of abortion?	1. Yes 2. NO	
205	Do you have any history still birth?	1. Yes 2. NO	
206	Do you have any history of early neonatal loss?	1. Yes 2. NO	
207	Was the pregnancy for the index child planned?	1. Yes 2. NO	
208	Had ANC follow up?	1. Yes 2. NO	
209	Parity	_____	

Part 3. Maternal Medical and Drug History

S.№	Variable	Categorical code	Skip
301	Have you ever been told by a doctor that you had any of these diseases Hypertension? Hyper/hypothyroidism Bladder/urinary tract infection, Tumor	1. Yes 2. No	
302	If the answer is yes which one do you have	1. Hypertension 2. Hyper/hypothyroidism 3. DM 4. Bladder/urinary tract infection 5. Tumor 6. Epilepsy	
303	Did you take any medication (for the medical condition)	1. Yes 2. NO	
304	Do you take any oral contraceptive use?	1. Yes 2. NO	
305	Have you experienced any fever/ febrile illness?	1. Yes 2. NO	
306	If "yes" did you take any antipyretic (fever reducing medication)	1. Yes 2. NO	

Part 4. Maternal chemical Exposure

S. №	Variable	Categorical code	Skip
301	Is there waste disposal site or industry near to your residence	1. Yes 2. NO	
302	If "yes" state the distance	_____	
303	Have you used any pesticides, insecticides, herbicides or fungicides at home /work place?	1. Yes 2. NO	
304	Have you ever used sauna/hot tub?	1. Yes 2. NO	
305	If "yes" for the above question for how long in average (in minutes)	_____	
306	Have you experienced any diagnostic/therapeutic radiations?	1. Yes 2. NO	

Part 4.Maternal nutritional, folic acid consumption and maternal lifestyle.

S.№	Variable	Categorical code	Skip
401	What was your pre-pregnancy weight(kg)	1. Weight(kg)_____ 2. Height(meter)_____	
402	Did you take Folic acid supplement	1. Never 2. Periconceptional intake 3. After 3 months of conception	
403	Did you take any caffeine	1. Yes 2. No	
404	If your answer is "Yes" which caffeine source	1. Coffee 2. Tea	
405	How many cups per day (in average)	_____	
406	Other traditional herbal use(specify)	_____	
407	Do you drink alcohol	1. Yes 2. No	
406	If your answer "Yes" (amount in average)	1. >500ml/day 2. <500ml/day 3. Occasional (500ml/week)	
407	Do you smoke	1. Yes 2. No	
408	Did you have any home /occupational exposure to tobacco smoke	1. Yes 2. No	

ANNEX 3: Information Sheet (Amharic Version)

የጥናቱ ተሳታፊ አጠቃላይ መረጃ

ሰላም!!!ስሜ_____ ይባላል በደብረብርሃንዩኒቨርሲቲ፣የፐፑሊክ ሄልዝ ት/ምህርት ክፍል የድህረ ምረቃ ተማሪ ስሆን በአዲስ አበባ የሚገገኙ የመንግስት ሆስፒታል ዉስጥ በህብረ-ሰረስርት በአለመግጠም ተዛማጅምክንያቶች እናስርጭቱ ዙሪያ የጥናትና ምርምር ስራ በመስራት ላይ እገኛለሁ፡፡

የጥናቱአላማ፡- በህብረ- ሰረስርት ቦአለመግጠም ተዛማጅ ምክንያቶችና ስርጭቱን መለየትና ችግሩንለሚመለከተዉ አካል ማሳወቅነዉ፡፡

ጥናቱ፡- ለተሳታፊዎች ቀጥተኛ የሆነ ጥቅም የለዉም፡፡ነገርግን ከእርስዎ የሚገኝ መረጃቸ ግሩን ለመቅረፍ ወሳኝነት አለዉ፡፡ጥናቱ በተሳታፊዎች ላይ ምንም አይነት አደጋ የማያስከትል ሲሆን የሚከናወነዉም በተሳታፊዉ ፍቃደኝነት ላይ ተመስርቶ ነዉ እንድሁም የጥናቱ ተሳታፊ በፊለገዉ ጊዜ ምላሽ አለመስጠት ይችላል የጥናቱ ተሳታፊ የሚሰጡት መረጃ ከአጥኝዉ ቡድን ዉጭ ለሌላ አካል ተላልፎ አይሰጥም፡፡ስለዚህ ፍቃደኛ ከሆኑ ቃለመጠይቁ ከ15-25 ደቂቃዎች ዉስጥ ማከናወን ይችላል፡፡ስለሆነም መቀጠል እችላለን፡፡

የመረጃስነድ

ስለጥናቱ በቂ የሆነ መረጃ አግኝቻለሁ በምችለዉ ቋንቋ በጥናቱ በመሳተፍ ተስማምቻለሁ፡፡በጥናቱም ላይ ምንም አይነት ጉዳት እንዲሁም ቀጥተኛ ጥቅም እንደ ማላገኝ ተረድቻለሁ፡፡

አዎ ከሆነ ወደሚቀጥለዉ ጥያቄ ሂድ / ሂጅ

አይደለም ከሆነ ተሳታፊዉን በማመስገን ወደ ሚቀጥለዉ ተሳታፊ ሂድ / ሂጅ

መረጃ ሰብሳቢዉ ስም ---------- ፊርማ ----------

መረጃዉ የተሰጠበት ቀን ----------

ANNEX 4: Questionnaire (Amharic Version)

መጠይቅ

ክፍል 1 የእናት ማህበራዊ እና ኢኮኖሚያዊ እና የህፃኑ ባህርያት

101. የወላጅ የትምህርት ትደረጃ

1. አልተማሩም

2. የመጀመሪያ ደረጃ ወይም ከ1-8

3. ሁለተኛ ደረጃ ከ 9-12

4. ዲፕሎማ ወይም ዲግሪ ወይም ሌላ ----------

እናት ---------- አባት ----------

102. የናት የስራ ድርሻ----------

1. የቤት እመቤት

2. የግብርና ስራ

3. የፋብሪካ ሰራተኛ

4. የቢሮ ሰራተኛ

5. ሌላ ----------

103. ህፃኑንየሚመለከቱመጠይቆችህፃኑያታ?

1. ሴት
2. ወንድ

104. ስንተኛ ልጅ ነዉ ወይ ምናት_____

ክፍል 2.የዘር ምክንያቶች የበሽታ ዉስይነት (ህብረ ስራስር ትቦ አለመግጠም ላለባቸዉ ብቻ)

201. ህፃኑ ወይም ህፃኗ ሲረገዝ የእናትየዋ እድሜ ስንት ነዉ?_____

202. የህብርስራስር ትቦ አለመግጠም ችግር ያለባት የቅር ብዘመድ አለ?

1. አዎ
2. የለም

203. በባለፉት የእርግዝናዎ የህብረስራስር ትቦ አለመግጠም ገጥመዎት ያዉቃል?

1. አዎ
2. የለም

204. ከባለቤትዎጋር ዝምድና አለዎት ?

1. አዎ
2. የለም

ክፍል 3 የእናት የወሊድና የስነተዋልዶ ምክንያቶች

301. ስንት ልጅ ወልደዋል? ----------

302. ከሚከተሉት ዙሪያ ታሪክ አለዎት?

1. ፅንስ ማቋረጥ
2. ሞቶ የተወለደ
3. ጨቅላ ህፃን የሞተ

303. አቅደዉ ነዉ ያረገዙት?

1. አዎ
2. የለም

304. ቅድመ ወሊድ የእርግዝና ክትትል ነበረዎ?

1.አዎ

2.የለም

ክፍል 4 የእናት በእርግዝና ወቅት የህክምና እና የመደሀኒት ታሪኮች

401.ከሚከተሉት የህመም አይነቶች ዉስጥ በዶክተር ተነግረዎት ያዉቃል?

1.የደም ግፊት

2.የእንቅርት መብዛትና ማነስ

3.የሽንት ትቦ ህመም

4.እጢ

5.የሚጥል በሽታ 6.የስኳር ህመም

402. አዎ ከሆነ የወሰዱትን መድሃኒት ይጥቀሱ ----------

403. ማንኛውም አይነት የወሊድ መከላከያ ተጠቅመዉ ያዉቃሉ?

1.አዎ

2.የለም

404. ህክምና አድርገዉ ያዉቃሉ?

1.አዎ

2.የለም

405.ትኩሳትና ከትኩሳት የሚመጡ ህመሞች ታመዉ ያዉቃሉ?

1. አዎ

2.የለም

406. አዎ ከሆነ የወሰዱትን መድሃኒትአለ?

1.አዎ

2.የለም

ክፍል 5 እናት በኬሚካል የተጋላጭነት መጠን መጠይቅ

501. በመኖሪያ አካባቢዎ የቆሻሻ መጣያ ወይም ኢንዱስትሪ አለ ?

1.አዎ

2.የለም

502. አዎ ከሆነ ከመኖሪያ ቤትዎ ምን ያህል ይርቃል ----------

503.ከቤት ስራ /ቦታዎ /ማንኛዉም ቦታ ፀረተባይ / አረም መዲሀኒት ተጠቅመዉ ያዉቃሉ ?

1.አዎ

2.አይደለም

504. ሳሙና .ሙቅ ዉሃ ተጠቅመዉ ያዉቃሉ ?

1.አዎ

2.የለም

505. አዎ ከሆነ ምን ያህል ደቂቃ? _____

506. የህክምና ጨረር ተደርጎለዎት ያዉቃል ?

1.አዎ

2.የለም

ክፍል 6 የእናቶች የስነ -ምግብና ፎሊክአሲድ አወሳሰድ መጠይቅ

601. ከማርገዝዎ በፊት ክብደትዎ ምን ያህል ነበር ----------

602. ማንኛዉም አይነት ፎሊክአሉድ ወስደዉ ያዉቃሉ ?

1.ከፅንስ በፊት 3 ወር

2.የመጀመሪያ እርግዝና ወራት ከፀነስኩ ከ3 ወርበኋላ

3. በፍፁም

ክፍል 7.የእናት አኗኗር ዘይቤ መጠይቅ

701. ቡና ወይም ሻይ ወስደዉ ያዉቃሉ

1.አዎ

2.የለም

702.አዎ ከሆነ የትኛዉን አይነት?

1.ቡና

2.ሻይ

703. በቀን ምን ያህል ኩባያ ይወስዳሉ? _____

704. የባህል መድሃኒት በእርግዝና ወቅት ወስደዉ ያዉቃሉ?

1.ቡና

2.ሻይ

705. የአልኮል መጠጥ ወስደዉያዉቃሉ?

1.አዎ

2.የለም

706. መልስዎ አዎ ከሆነ ምን ያህል ቀን?

1.ከ500 ሚሊሊትር በላይ በቀን

2.ከ500 ሚሊሊትር በታች

707. ትንባሆ ወስደዉ ያዉቃሉ ያጨሳሉ ?

1.አዎ

2.የለም

708. በቤትዎ ወይም በስራ ቦታዎ ሲሆኑ ትንባሆ ጭስ ተጋላጭነዎት ?

1.አዎ

2.አይደለሁም

ጨርሰናል

አመሰግናለሁ !!