HAWASSA UNIVERSTY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

ASSESSMENT OF MAGNITUDE, AND ASSOCIATED FACTORS OF MATERNAL MORBIDITY IN NORTHERN ZONE OF SIDAMA REGION, ETHIOPIA: A COMMUNITY BASED CROSS-SECTIONAL STUDY.

INVESTIGATOR: NEGASH LAMISO (BSC)

A THESIS SUBMITTED TO HAWASSA UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR MASTER OF PUBLIC HEALTH IN EPIDEMIOLOGY

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CO- ADVISOR: Dr. Sewhareg Belay (PhD)

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DECLARATION

I hereby declare that this MPH thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged.

Name: Negash Lamiso

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HAWASSA UNIVERSITY

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EXAMINERS' APPROVAL SHEET

We, the undersigned, members of the Board of Examiners of the final open defense by Negash Lamiso Oda have read and evaluated his thesis entitled "Assessment of magnitude and associated factors of maternal morbidity in Northern Zone of sidama regional state, Ethiopia" 2024 GC" submitted in partial fulfillment of the requirements for the degree of Masters of **Public Health in Epidemiology**"and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirements for the master's degree.

Name of chairperson	Signature	Date
Name of major advisor	Signature	Date
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SGS approval	Signature	Date

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

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ABBREVIATIONS

ANC	Antenatal care
AOR	Adjusted odd ratio
CS	Cesarean-section
CSA	Central Statistics Agency
COR	Crude odd ratio
HEW	Health extension workers
HTN	Hypertension
MMR	Maternal Mortality Rate
MNM	Maternal Near-Miss
PHCU	Primary health care unit
PNC	Post- natal care
PPH	Post-partum hemorrhage
PSU	Primary Sampling unit
SMM	Sever Maternal Morbidity
SPSS	Statistical Package for Social Sciences
SRS	Sidama Regional State
SSU	Secondary Sampling unit
WHO	World health Organization

Abstract

Background: Globally, maternal morbidity and mortality remain major public health problems. For every woman that dies of maternal causes, there are at least 20 more women who suffer from infection, disabilities, and injuries relating to pregnancy and childbirth. Despite the increasing magnitude of maternal morbidity in Ethiopia, only a few studies have been conducted in a community-based setting to determine the magnitude and risk factors for maternal illness. **Objective**: The aim of this study was to assess the magnitude and associated factors of maternal morbidity during pregnancy, delivery, and postnatal in Northern Zone of Sidama Regional state.

Methods: A community-based cross-sectional study design was conducted, in which a secondary data that was used. A total of 2044 mothers were included in analyses. Data were collected using the Kobo data collection tool. It was extracted and exported to SPSS Version 26 for cleaning and analysis. Bivariate and multivariable logistic regression was done. Statistically significant results were considered at a confidence interval of 95% and a p-value of < 0.05

Result: The prevalence of maternal morbidity was 21.4% (95%CI [19.8, 23.4]) of women who reporting at least one morbidity during their last pregnancy, delivery and postpartum. Factors associated with maternal morbidity were women in poorest,[AOR=1.7,95%CI (1.22,2.4)],house wife,[AOR =1.98, 95%CI(1.01,3.89)], daily worker and trade [AOR= 2.13, 95%CI (1.07, 4.22)], parity ≥7 [AOR=2.45, 95%CI (1.26, 4.79)], assisted vaginal delivery[AOR=4.6,95%CI (2.26, 9.37)], cesarean section [AOR=1.64, 95%CI (1.07, 2.51)], and duration of labor (>12hrs) [AOR =1.48, 95%CI (1.13, 1.95)].

Conclusions: There is a high prevalence of maternal morbidity among women during pregnancy, childbirth and the postpartum. Factors such as being poorest, house wife and daily worker/trader), parity, operative delivery and assisted vaginal delivery and duration of labor are associated with an increased risk of maternal morbidity.

Recommendation: Access to quality maternal health care services, education on complications of pregnancy and childbirth, and improvement of overall maternal health outcomes by early detection and management of risk factors could help reduce the prevalence of maternal morbidity.

Keywords: Maternal Morbidity, Magnitude, associated factors, Northern Sidama zone, Ethiopia.

1. INTRODUCTION

1.1 Backgrounds:

The World Health Organization (WHO) defines maternal morbidity as any health condition attributed to and/or aggravated by during pregnancy and childbirth that has negative consequences to the woman's well-being and can impact quality of life. As with maternal mortality, maternal morbidity has also seen increasing numbers in international(1, 2) Whereas it is likely that for every maternal death, 20–30 women suffer morbidity, these approximations are not based on standardized methods and measures. Since lack of an agreed-upon definition, identification criteria, standardized assessment tools, and indicators has limited valid, routine, and comparable measurements of maternal morbidity (3).

Maternal deaths have been described as the tip of the iceberg, considering maternal morbidity as the basis .It is estimated that annually thousands of women worldwide suffer from complications associated with pregnancy or the postpartum period (4). The major maternal illness that mostly causes maternal deaths were severe bleeding (mostly bleeding after childbirth), infections (usually after childbirth), high blood pressure during pregnancy (pre-eclampsia and eclampsia), complications from delivery, and unsafe abortion (5).

Pregnancy and labor related complications include physical and mental conditions that affect the health of the pregnant or postpartum women, their baby, or both. The common complications were, preeclampsia, gestational diabetes, placenta previa and abruption, hyperemesis gravid still birth, abortion, preterm labor, low birth weight, Breech position, Anemia, Anxiety, depression, infection and others (6, 7). Most common illness during postpartum period were sepsis, excessive vaginal bleeding after giving birth, High blood pressure, offensive vaginal discharge, surgical site infection, cardiovascular diseases, postpartum depression and others (6).

Some are common diseases and conditions that can cause complications during pregnancy, diabetes, cancer, high blood pressure, infections, and sexually transmitted diseases, including HIV, kidney problems, and epilepsy. And other factors that may increase the risk for complications include, pregnancy at older age ≥35, being pregnant age < 20, smoking cigarettes,

drinking alcohol, using illegal drugs, anorexia, having a history of pregnancy loss or preterm birth and carrying multiples pregnancy (7).

Many women are estimated to suffer pregnancy-related illnesses, around 9.5 million, near-miss events which are the life-threatening complications that women survive nearby 1.4 million and other potentially devastating consequences after birth. Pregnancy-related illnesses and complications during pregnancy and delivery are related with a significant effect on the fetus, resulting in poor pregnancy outcomes for both the mother and newborn and a large proportion of maternal morbidity can be addressed by developing a community-based approach to improved maternal care during pregnancy, delivery and after delivery (8).

In Ethiopia's every year, roughly 12,000 mothers pass away, from this 85% are related to direct complications during pregnancy (9). Every year direct obstetric complications account for 85% from approximately 12,000 mothers' deaths. The long-term conditions disable women following delivery-related complications, such as fistula, uterine prolapsed, chronic pelvic pain, depression and exhaustion (10). Reducing maternal morbidity is a global significance which is mainly important to developing countries like Ethiopia (11).

1.2 statement of problem

In international, every day from preventable causes related to pregnancy and childbirth approximately 830 women pass away, 99% of all maternal deaths occur in developing nations. In 2015 during or immediately following pregnancy and childbirth related complication an estimated 303,000 women lost their lives. Women who live in rural areas and poor communities have higher rates of maternal morbidity. Adolescents face a higher risk of complications and death as a result of pregnancy than adult women (12).

Every year, at least 40 million women are likely to experience a long-term health problem caused by childbirth. A high burden of postpartum illness that persist in the months or even years after giving birth, include pain during sexual intercourse (dyspareunia) 35%, low back pain 32%, anal incontinence 19%, urinary incontinence 8-31%, anxiety 9-24%, depression 11-17%, perineal pain 11%, fear of childbirth (tokophobia) 6-15% and secondary infertility 11% (5).

In 2017, every day around 810 women died from preventable causes, related to pregnancy and childbirth. Pregnant young adolescents (aged 10-14) face a higher risk of complications and death as a result of pregnancy related than older women. Appropriate care provided by skilled health professionals expert in sexual and reproductive health care: before, during and after delivery can save the lives of women and newborn babies (13).

Maternal morbidity rates are high in developing nations due to delayed access to timely healthcare (14). There numbers are far higher than previous estimates of 20 women with complications and 40 with postpartum morbidities/disabilities for every maternal death (2). Almost 80 per cent of the maternal deaths are due to direct obstetric causes including severe bleeding (hemorrhage), infection, complications of unsafe abortion, eclampsia, and obstructed labor, with other causes being related to the unfavorable conditions created by lack of access to healthcare, illiteracy and factors related to poverty (6).

While Policy makers, program managers, healthcare practitioners, and women's families seldom record or discuss the experiences of women throughout pregnancy and childbirth, nor do they often consider it or possibly even her. Possible reasons for this lack of consideration and a common understanding of “wellbeing” during pregnancy, labor, childbirth, and in the immediate postpartum period (15).

Globally, there are 40–60 pregnancy-related illnesses or injuries for every maternal mortality. Major causes of maternal morbidity are obstetric fistula and other birth-related trauma, severe anemia, PID (pelvic inflammatory disease), pelvic pain. On average, 3 million women in Ethiopia are pregnant each year and 2 million give birth 42% of pregnancies are unintended and more than half a million pregnancies are terminated more than 25,000 mothers die related to pregnancy each year and up to 500,000 may have short term or long term disabilities (16).

In Ethiopia study utilized secondary data obtained from the Ethiopian maternal death surveillance system of a total 4316 reviewed maternal death from 645 districts revealed that postpartum accounts 65.1% of maternal deaths. The factors associated with postpartum death included previous medical history (history of ANC follow up and parity), medical causes (obstetrics hemorrhage, hypertensive disorder of pregnancy, pregnancy-related infection (17).

Maternal morbidity is recognized as a common and serious health problem particularly in poor countries. However, measurement of the actual magnitude of the problem remains to be a challenge. In Ethiopia there were a few studies in community based on magnitude and factors associated maternal morbidity during pregnancy, delivery and postpartum simultaneously, which one study done two districts (Butajira and Wukuro) by year 2012 was 14.2% that was not latest. And in order to measure the magnitude and factors associated with diseases or illnesses during pregnancy, antepartum, and postpartum simultaneously, I was conducted a community-based cross-sectional study on women who had given birth within the year prior to the survey in a rural area of selected districts of the Sidama region in southern Ethiopia. Therefore, this study aim was to assess the magnitude and associated factors of maternal morbidity in Northern Zone of Sidama Regional state, Ethiopia, 2024.

1.3 Significance of Study

Studying maternal morbidity will provide useful information as it gives us first hand involvements of women's exposure to a health facility and also to improvement the country's scarce data in the topic under the study. In addition, the result can be utilized as literature for the future researchers. In order to reduce high maternal morbidity and mortality, identifying the determinant factors is crucial, to create awareness for women about the importance of how to protect themselves from related factors which contribute to the risk of getting morbidity. However studies on determinants of maternal morbidity and mortality are scarce in Ethiopia. Even though there are few studies on maternal morbidity in community based, they exclusively depended on hospital records which hardly capture complete socio-economic and other factors responsible for maternal morbidity.

Furthermore, the findings of this study may aid health policy makers in developing locally effective prevention and health promotion strategies for identified risk factors. The assessment of the prevalence and the factors associated to maternal morbidity will be presented as an important strategy to improve maternal health. The finding of this study can be used as base line information for further study.

2. LITERATUREREVIEW

2.1 Magnitude of maternal morbidity

Global maternal mortality, since 1990, there has been overall a 34% decline in global maternal mortality now estimated at 358,000 maternal deaths per year (down from 530,000). Countries in South Asia and sub-Saharan Africa account for 87% of maternal mortality (313,000) from these deaths. A country of 147 experienced some decline in MMR from 1990-2008. Countries of 23 had an increase in MMR; most of these are in sub-Saharan Africa. In addition to Afghanistan, Laos, Bangladesh, Haiti, and Cambodia (16).

Study was in rural Upper Egypt of maternal morbidity as reported by mothers of perceived morbidity in pregnancy, childbirth, and the postpartum period, the most common reported symptoms were easy fatigability 59.7%, headache 39.8%, abdominal pain 34.6%, blurred vision 29.9%, vomiting 24.7%, vaginal bleeding 14.7%, and lower limb edema 11.7%. Loss of consciousness and convulsions were reported in 3.9% and 2.2% of the cases, respectively (18).

2.1.1Magnitude of maternal morbidity during pregnancy and Delivery

The study done in Uganda in 2022 magnitude of pregnancy-related complication was 27.4%. The most reported complications were anemia 10.9%, eclampsia 8.1%, and still births4.9% (19).

A study conducted community based cross sectional study in Ethiopia two districts kebeles of Wukro and Butajira, shows that 14.2% women reported that they had at least one form of maternal morbidity. The three most commonly reported antenatal period were severe headache 17.2%, lower abdominal pain 15.1% and excessive vomiting 11.4%.And also, prolonged labor (more than 24 hours) was accounted for 40.5% followed by hemorrhage and premature rapture of membranes in 33.6% and 10.5% of the cases respectively (20).

Similarly a research conducted in Jimma zone, community based cross sectional study the prevalence of self-reported pregnancy-related complications was 15.9%, a most commonly reported vaginal bleeding 5.6%, severe headache 5.6%, persistent vomiting 4.2%, HTN 0.8%, face/hand swelling 2.80%, premature labor 0.4%, convulsion 0.6%, and others 2.2% (21). Another study conducted in Rural southern Ethiopia indicates that the incidence rate of episodes of illnesses was 93 per100 pregnant-woman-weeks, with an average of eight episodes of

illnesses per woman, Anemia accounted for 22%, and hypertension 3%, others illness during pregnancy were tiredness 72.4%, heart burn 62.5%,pain in the pelvic area 52.6%, severe headache 46.5% and dizziness 42.9% (22).

2.1.2 Maternal morbidity during postpartum period

A research conducted in India Approximately 39.8% of rural women suffered from at least one of the six postpartum illnesses including, lower abdominal pain, high fever, vaginal discharge, foul-smelling, excessive bleeding, convulsions, and severe headache (23). Similarly study in India indicates that prevalence of postpartum morbidities was 48.9% women from this back pain 23.6% and perianal pain 15.7% were most commonly reported physical morbidities and similarly, anxiety 10% and irritability 7.9% were the most common psychological problems (17).

Similarly a research conducted in Morocco, the self-reported postpartum morbidity prevalence was 13.1 % while hemorrhage, pregnancy-induced hypertension and fever were the main complications: 71.92 %; 12.18 % and 10.64 % respectively (24). And the same country study shows that prevalence of maternal morbidity during postpartum was 9.09% of reported by the attending physician. Among 16.34% had direct (obstetric) conditions and 15.56% indirect (medical) problems and 15.02% had preterm birth (24). While Study conducted in rural Upper Egypt of maternal morbidity shows that a woman reported that 5.6% of deliveries were prolonged and 3.9% were obstructed. Puerperal fever and vaginal bleeding were reported in 18.6% and 8.2% of the cases respectively (18).

Similarly, research done on Gondar town, among pregnant women who attended for antenatal care, postpartum morbidity conditions were found among 23.6% of mothers; from this 5.9% mothers had suffered two or more morbidity conditions. Overall, morbidity from postpartum hemorrhage had the highest prevalence 14.8% followed by sepsis and anemia (25). Another prospective cohort study conducted in rural communities, southern Ethiopia shows that incidence of postpartum illness was 31 per 100 women-weeks, from this accounted Anemia 19%, LBW 15%, Blurred vision with headache 16%, Excessive vaginal bleeding 14.2%, severe abdominal pain 8.7%, foul smelling discharge 6.2%, breast pain 5.5% and urinary incontinence 6.2% (26).

2.2 Factor Associated with Maternal morbidity

2.2.1 Socio- Economic and Demographic Factors

For every pregnancy-related death in the United States, 70 women experience a "near miss" or sever maternal morbidity (SMM). And most affected by SMM, more likely to occur for women who are Age 20 or younger , Age 40 or older , Receiving Medical aid and Residents of a low-income (27).

Study conducted in a Population-based Survey of a City in Northeastern Brazil shows that the prevalence of maternal morbidity was of 21.2%. According of this study a poorer socioeconomic situation had higher magnitude of maternal morbidity. Additionally, the women who delivered in public services had higher prevalence of maternal morbidity (28). Another study was conducted in Washington State, US, a population-based retrospective cohort study, show that Severe maternal morbidity was significantly 1.5 times higher among teenage mothers than among those 25–29 years old mothers and increased 1.2 times exponentially with maternal age over 39 years. Among women aged 35–39 years 5.4 times the elevated risk of severe morbidity than other age groups (29). According to study conducted in rural India revealed that postpartum morbidities were significantly associated with among poor, illiterate, Muslim and high-parity women (23)

Study done in rural Upper Egypt of maternal morbidity as reported by mothers indicated that Utilization of care was shown to be low and significantly associated with poverty and husband illiteracy. Likewise, illiteracy, no ownership of cattle, and inaccessibility to potable water have related with maternal morbidity (18). While Study done in Kenya to assess risk factors related with maternal morbidity, shows that age less than 20 and greater than 35, and parity greater than five were significantly associated with maternal morbidity (30).

A cross-sectional study conducted in North Gondar on Maternal Complications of women study displays that a woman 28.5% reported some kind of complication. The most common complications reported were; excessive bleeding and prolonged labor that occurred frequently at the time of delivery and postpartum period. While Inability to judge the severity of illnesses, lack of money/cost, distance/transport problems, considerations and use of traditional alternatives at home were the major reasons for not seeking care from skilled providers (31). Similarly a research done on Gondar town, revealed that Intra-partum deviations and monthly

income below 600 were the main contributing factor to the postpartum morbidity conditions and the postpartum morbidity related with low birth and still birth among pregnant women attending and giving birth at health institution was significant health concern. And intra-partum abnormalities were the main predictive factor triggering maternal morbidity conditions (25).

A study done Northern part Ethiopia indicated that educational level of women education level of husband, being referred from other health facilities, cesarean section and medical disorder during pregnancy were establish to significantly increase the risk of maternal near-miss. However, the younger age of women significantly decreased the risk of MNM (32).

2.2.2. Obstetrics and Maternal Health Services Utilization related factors

In a Prospective cohort study, conducted in 9 research sites in 8 countries of South Asia and sub-Saharan Africa, overall, 32.7% of included pregnancies had at least one major direct maternal morbidity; South Asia had 60.0% and sub-Saharan Africa had 23.7%. Antepartum and postpartum hemorrhage was reported in 2.2% and 1.7% respectively. Preeclampsia or eclampsia, and gestational hypertension alone were 1.4% and7.4% correspondingly in pregnancies. Prolonged or obstructed labor was 11.1%. Late third trimester antepartum and postpartum infection was present 9.1% and 8.6% respectively. As well as, there were 187 per 100,000 births pregnancy related deaths, 27 stillbirths per 1,000 births, and 28 neonatal deaths per 1,000 live births with variation by country and region. Direct maternal morbidities were associated with each of these outcomes(33).

According to study conducted in Brazil, analyzed a database from the most recent national demographic health survey, showed that maternal morbidity was significantly associated with No of living children (>2), Caesarean section and Place of delivery for excessive bleeding hospital (34). While study conducted in India indicate that of women of advanced maternal age, women with past pregnancy complications, those who underwent caesarean section deliveries, those who delivered preterm and the mothers referred to tertiary centers as they are at increased risk of severe maternal morbidity (17).

Research conducted in the Netherlands shows that High age, multiple pregnancies, and the use of artificial reproduction techniques were significant risk factors for developing sepsis. And also The overall case fatality rate for sepsis during 2004 to 2006 was 7.7% (35).

Study done in rural Upper Egypt indicated that most deliveries were not attended by trained health care workers, and these unattended deliveries were shown to be associated with no utilization of antenatal care have related with maternal morbidity (18). Similarly Study done in Uganda shows that a higher gravidity of 4-6 and more, late first ANC 1.85 times, parity of ≥ 3 3.69 time and induced abortion prior to current pregnancy 1.64 time were significantly associated with Pregnancy-related complications(18).

According to research was conducted, Institutional based cross-sectional study in Debre Markos town public health institutions, show that magnitude of postpartum morbidity was 32.8%. From this study Divorced/widowed women 10.920 times, women who didn't have ANC follow up 3.710 times, and abnormal labour 3.496 times more likely to develop maternal postpartum morbidity (36).

A hospital-based cross-sectional study was conducted in North Shewa Zone, Factors Associated with Maternal Near-Miss (MNM) during pregnancy, childbirth, or post-partum found that the prevalence of MNM was 14.3%. In addition not using partograph for labor monitoring, history of abortion and any other pregnancy complications were factors significantly associated with higher MNM (37).

In year 2022, a systematic review and meta-analysis of Postpartum hemorrhage, A total of 21 studies were included in this meta-analysis in Ethiopia was moderate high 8.24% , by Nigussie et al revealed that Older age 5.038 times develop Postpartum hemorrhage than other age groups. In addition, prolonged labor, absence of ANC, grand-multiparty and history of postpartum hemorrhage were factors associated with the occurrence of postpartum hemorrhage (38).

A systematic review and meta-analysis conducted Burden of puerperal sepsis in Ethiopia by Melkie.A and Dagnew.E in 2021, displays that a total of 2222 respondents were involved from seven studies. The prevalence of puerperal sepsis was 14.811%. Cesarean section delivery (CSD) 3.26 times developed puerperal sepsis than women who delivery spontaneous vaginal delivery and membrane rupture≥24 hours 4.04times, multiparous mother 3.99 times, vaginal examination≥5 times 3.15 times and anemia 5.68 times more likely to puerperal sepsis (39).

Research done a community based cross- sectional study design in Bench Maji zone, shows that the magnitude of postpartum depression was 22.4%, Postpartum depression is relatively higher

in the first 6 weeks after birth. Postpartum depression is higher among mothers with age between 18 and 23 years, unplanned pregnancy, child having sleeping problems, domestic violence, unsatisfied marital relation, poor social support, history of previous depression and substance use were significantly associated with postpartum depression(40).

According research done Prospective Study on Birth Outcome and Prevalence of Postpartum Morbidity among Pregnant Women Who Attended for ANC in Gondar Town, shows that unmarried women, CS, episiotomy or perennial tear, not received iron and folic acid during pregnancy, women who had preeclampsia have independent predictors of postpartum morbidity and a women who have abnormal labor 4 times to develop postpartum hemorrhage than normal labor (25)

A study conducted community based cross sectional survey was to assess magnitude and factors affecting maternal morbidity in selected kebeles of Wukro and Butajira districts, shows that a High parity (5-6 and ≥7 children) 1.52 and 2.01 times respectively, and facility delivery 3.73 times were significantly associated with maternal morbidity (20).

The study conducted in Jimma zone prevalence of self-reported pregnancy-related complications shows that a Women who did not face vaginal bleeding and severe headache were five and nearly three times more like to give birth at home than those who faced this problem respectively. This indicates that vaginal bleeding and severe headache were identified as protective factors for facility delivery (21).

Generally, from literature review greatly majority of studies were done maternal morbidity in health facility rather than community based and also most of studies conducted of maternal morbidity during pregnancy, delivery and postpartum period separately than simultaneously. In Ethiopia there were a few studies in community based on magnitude and factors associated maternal morbidity during pregnancy, delivery and postpartum simultaneously, which one study done two districts (Butajira and Wukuro) by year 2012, that was not latest.

2.3 Conceptual frame work

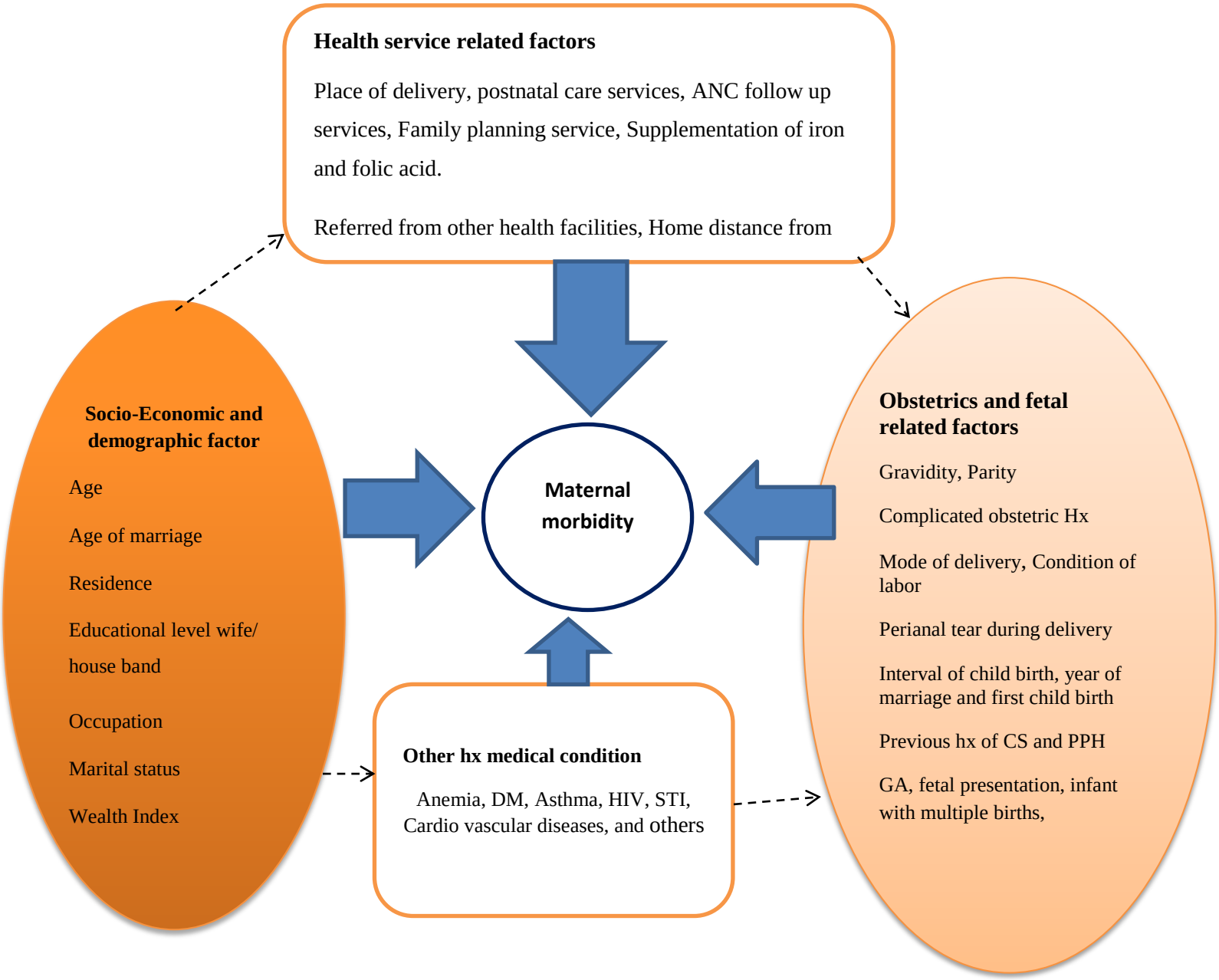

Figure 1 conceptual framework for magnitude, and factors associated with maternal morbidity in Northern zone of sidama regional states. 2024. (19, 20, 25, 33, 34, 36)

3. OBJECTIVES OF STUDY

3.1 General Objective

- To assess the magnitude and associated factors of maternal morbidity during pregnancy, delivery and postnatal period in Northern Zone of Sidama Regional state, Ethiopia, 2024.

3.2 Specific objectives

- To assess the magnitude of maternal morbidity during pregnancy, delivery and postnatal period in Northern Zone of Sidama Regional state.
- To determine factors associated with maternal morbidity during pregnancy, delivery and postnatal period in Northern Zone of Sidama Regional state.

4. METHOD AND MATERIAL

4.2 Study area

The study was conducted in Northern Zone of Sidama regional state. SRS is one of the new established regional states of the Federal Democratic Republic of Ethiopia. It is located in the South part of the country. The capital is Hawassa, 273 km from Addis Ababa. The region has 37 Woreda (districts) in 4 zones, one city administration, and 602 (536 Rural & 66 Urban) kebeles (the smallest administrative structure) with total populations of 4,647,670. Of this 2,303,850 (49.57%) are males and 2,343,820 (50.43%) are female. Female reproductive age was 1,068,964, and expected pregnancy and live birth 160,809 in the region. There are 21 hospitals, 135 PHCU health centers, and 551 health posts. Based on the Sidama regional state health report of 2022, early initiation of ANC for the year 2022 was 29% and about 60% of all districts provided ANC below the regional coverage. There are approximately 1102 health extension workers in the Sidama region, each health post having two HEWs. This study was carried out in Northern Zone Sidama regional state of 4 selected districts(Boricha, Hawassa Zuriya, Shebedino and Bilate Zuria) with a total population of 665,526 and an estimated pregnancy of 23,175 and 247 HEWs (41).

4.2. Study Design and period

A Community based cross sectional study design was conducted, where by using secondary data that was collected as a baseline data for a cluster randomized controlled trial on maternal and newborn continuum of care improvement.

4.3 populations

4.3.1 Source population

All women who gave birth with in the last year in the selected districts of Sidama regional state.

4.3.2 Study population

Selected women who had given birth with in the last one year preceding the survey

4.4 Eligibility criteria

4.4.1 Inclusion criteria

All women who gave birth in the last one year and up to 42 days of postpartum, and who lived in the area for more than 6 months were included in the study.

4.4.2 Exclusion criteria

Woman who had accidental or incidental causes and those who decline to participate were excluded from the study.

4.5. Sample size determination

The sample size (n) was calculated using a single population proportion formula. The prevalence of self-reported pregnancy-related complications was found to be 15.9% (21) based on a study conducted in Jimma zone. We assumed a confidence level of 95%, a design effect of two, and a margin of error of 5%. The formula used to calculate sample size was

$$n = \frac{(\mathrm{Z}\alpha/2)^2 \mathrm{p}(1-\mathrm{p})}{d^2}$$

Where: n: estimated sample size required

p: an estimate of prevalence of the population rate=0.6

Z: is the standard normal value at (100%-α) level of confidence = 1.96

d: the margin of error (d) =0.05.

Therefore, the calculated sample size to assess maternal morbidity during pregnancy was 206.5

When multiplied by a design effect of two=2(207) =414, and 10% of non-response rate was added, the final sample size became 455.

Prevalence of 50% was considered to calculate Sample size calculation for to assess maternal morbidity during delivery as there is no previous study on maternal morbidity during delivery. And for maternal morbidity during the postpartum period; there were prospective cohort studies (22, 26) , but they were not considered as, their study design was different.

So, n= (0.96)/ (0.05)2=384, multiplied by a design effect of two=2(384) =768

By adding a non-response rate of 10% the final sample size became 845. No community-based study was found which assessed factors associated with maternal morbidity.

Therefore, the largest sample size (845) from above calculation was considered.

However, as I used a secondary data, I considered the sample size calculated **(2044)** for a baseline survey of the larger cluster randomized controlled trial study on maternal and neonatal continuum care improvement.

4.6. Sampling Technique and procedure

A multistage sampling technique was used to identify participants of the study. There were total 80 kebeles in the four districts (Hawassa Zuriya, Shebedino, Bilate Zuriya, and Boricha). From the 80 kebeles (the smallest unit of administration), 40 kebeles were selected using a simple random sampling technique, using a sampling frame obtained from woreda health bureaus of the four districts, with proportion allocation of size to the kebeles. Finally, Systematic random sampling technique was used to select mothers who gave birth in the last one year. Interval (K) value was calculated by using a sampling frame of mothers from each selected kebele. To identify the interval (K) value, the total number of mothers who gave birth in the last one year found in each selected kebele was divided by the number of the mothers who were proportionally allocated for each randomly selected kebeles and the first respondent was selected by lottery method then after every k interval.

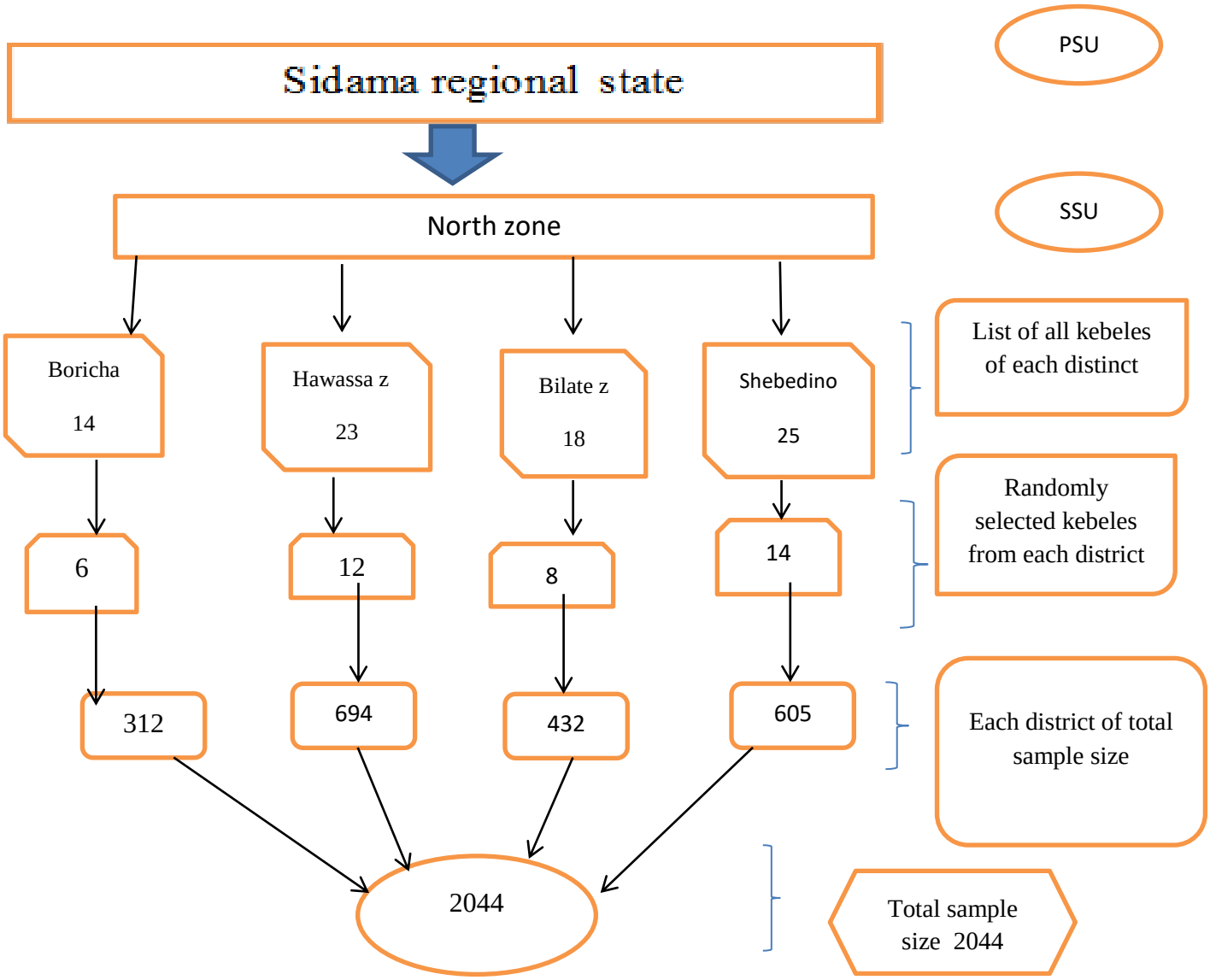

Figure 2: sampling techniques for magnitude and factors associated with maternal morbidity in Northern zone of sidama regional states.2024.

4.7. Variables

4.7.1 Dependent variable

- Maternal morbidity during pregnancy, delivery and postnatal period.

4.7.2 Independent variables

Socio- Economic and demographic factor: Age**,** Residence**,** Educational level mothers/house band**,** Occupation, Marital status, Wealth Index (House hold Income, types of toilet, water, roof, availability of items etc.).

Obstetrics, fetal and health service related factors: gravidity**,** parity**,** Mode of delivery**,** Condition of labor**,** Perianal tear during delivery**,** Previous history of CS**,** Previous history of PPH**,** Place of delivery**,** postnatal care services, birth interval, first age of marriage, age of first child birth, ANC follow up services, Family planning service, Referred from other health facilities, time of first initiation ANC in GA, Distance from health facility GA, fetal presentation, birth weight, infant with multiple births.

Other medical condition: Anemia, Antepartum hemorrhage, Placenta previa, Diabetes mellitus, Asthma, cardio vascular diseases, and others.

4.8. Operational definition

Maternal morbidity during antenatal period: defines as any health condition like (severe headache, lower abdominal pain, excessive vomiting, high grade fever, hemorrhage, low baby movement, dizziness fainting, fall down, varicose vein, convulsion, jaundice/yellow eye color and others attributed to and/or aggravated by a pregnancy, that has negative outcomes to the woman's well-being and can impact quality of life.

Maternal morbidity during labor and delivery: refers to any health condition like (prolonged labor/more than 24 hours, hemorrhage ,premature rapture of membrane, severe headache, high grade fever, dizziness fainting, convulsion/fits, jaundice and others) attributed by during labor and child birth, that has negative outcomes to the woman's well-being.

Maternal morbidity during post-partum period: is any health condition like (foul smelling discharge, hemorrhage severe headache, high grade fever, dizziness fainting, convulsion/fits and others) attributed or aggravated by during post-partum period (after delivery of placenta to 6 weeks of delivery) that has negative outcomes to the woman's well-being and can impact quality of life.

Wealth Index: is the value of all natural, physical and financial assets owned by a household, reduced by its liabilities and composite index composed of key asset ownership variables; it is used as a proxy indicator of household level wealth (42).

Gravidity: refers to the number of times of female has been pregnant (43).

Parity: Number of prior pregnancies with delivery of babies more than 28 weeks gestation or over and weighs more than 500g (43).

Mode of delivery: the way a baby is delivered which can vaginal delivery , assisted vaginal delivery, Cesarean-section or VBAC(vaginal birth after cesarean section) (43).

4.9. Data collection tools and procedures

A questionnaire was developed by reviewing various references (20, 34, 44, 45). A secondary data was used, that was collected as baseline data for a cluster randomized control trial study on maternal and newborn for continuum of care improvement. A structured questionnaire was developed and interviewer-administered techniques were used to collect data. The data was collected through Kobo box data collection tool.

The questionnaire was prepared in English and translated into local language (Sidamu afoo) and translated back into English by language expert to check it consistency. The data was collected by trained HEW from the community by their own local language. A supervising health professional with BSc degree was assigned to oversee the entire data collection process.

4.10. Data quality control method

Three days pre-test was conducted on 5% of the total sample size on a population, which were not included in the actual study in the four districts. Eight days training was provided to data collectors to have common understanding about data collection tool and show how to approach study participants. Supervisors were assigned to closely monitor data collection process throughout data collection time. The collected data was checked for completeness, accuracy and consistency daily. Any error, ambiguity or incompleteness identified was corrected immediately.

4.11 Data analysis

The collected data was checked for completeness and consistencies and clear it. The data was extracting and exported to SPSS version 26 for analysis. Descriptive statistics was used to describe the socio-demographic and other characteristics of respondent, and the result was presented by using tables, figures and graphs.

Bivariable and multivariable logistic regression analysis was used to determine the association between independent and outcome variables. Variables which had p-value <0.25 in bivariate

logistic regression and variables significantly associated with maternal morbidity based on literature (Ref) was fitted to final multivariable model to control for confounding. Model fitness was assessed by Hosmer-lomeshow goodness of fit test that was 0.15 and multi collinearity was assessed by using variance inflating factor (VIF). Crude Odds Ratios (COR) and Adjusted Odds Ratios (AOR) were presented with 95 % confidence intervals. And the association of maternal morbidity was declared significant at p value < 0.05 in the final multivariable logistic regression model.

4.12 Ethical consideration

Ethical clearance was obtained by the reproductive health team leader before data collection from the institutional review board (IRB) at Hawassa University, College of Medicine and Health Sciences and a formal letter from the department of public health. Respondents were asked to give informed consent after explaining the purpose the study, the potential risks and benefits of participating and the right to withdraw from the study at any time throughout their interview using their own language. Confidentiality was assured by explaining the participants that, their answers would not be shared with anyone other than the study team. In addition, instead of study participant names, codes were used for identification purpose to maintain participants' trustworthiness of confidentiality. Participants had the right to stop the interview if they encounter any question they wouldn't want to answer. Participants were interviewed in a private setting at a place where they felt comfortable

5. RESULT

5.1 Demographic and Socio- Economic Characteristics of the Respondents

A total of 2044 mothers who delivered a baby in the year preceding the survey were included in the study from four districts of 40(forty) kebeles in the Sidama region. Of the 2044 mothers, 694 (34%) lived in Shebedino district, 605 (29.6%) in Hawassa Zuriya, 432(21.1%) in Bilate district and the remaining 313 (15.3%) in Boricha district areas. The mean age of study participants was 27, and standard deviation ((SD±5.05), with most women 1192(58.3%) aged between 20- and 29-years and. The great majority of the study population 1924 (94.1%), were married, 4.9%, were single/never married, 0.7%, were divorced 0.2%, were widowed. Among the respondents 461 (22.7) are married under the age of 18 years.

Just over half of the women taking part in the study, 1124 (55%), were housewives and almost half of the husbands, 1052 (51.5%), were engaged in farming. Most of the women surveyed, 1592 (77.9%), and their partners, 1721 (84.2%), were able to read and write. Only a few study participants, 621 (30.4%), had mobile phones. Piped water was the main source of water in the majority of households (90%). The vast majority of these (96.1%) had their water source elsewhere. Most households had pit latrines (94.8%), used wood for cooking (98.8%), used kerosene for light (82.9%) and lived in wooden/mud houses (82.4%). Almost three-thirds lived in thatched or wooden houses (64.3%) and earth or mud houses (71.2%). Women who categorized under lowest wealth quintiles were 21.9%, followed by highest wealth quintiles 18.9%.

Table 1a- Demographic and Socio- Economic Characteristics of women who delivered a baby in the one years preceding the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

Characteristics	**Number**	**Percent (%)**
District (Woreda)		
Hawassa zuriya,	694	34.0
Shebedino,	605	29.6
Bilate zuriya	432	15.3
Boricha	313	21.1
Age of respondents		
15-19	50	2.4
20-29	1192	58.3
30-39	763	37.3
40-49	39	1.9
Age of marriage		
<18 years	461	22.7
≥18 years	1583	77.3
Marital status		
Currently married	1924	94.1
Never married/single	101	4.9
Widowed	5	0.2
Divorced,	14	0.7
Number of family member		
2-3	433	21.2
4-5	1094	53.5
6-7	420	20.5
≥8	97	4.7

Table 1b- Demographic and Socio- Economic Characteristics of women who delivered a baby in the one years preceding the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

level of education mothers		
Cannot read and write/illiterate	452	22.1
Primary education	1158	56.7
Secondary education	356	17.4
Higher education	78	3.8
level of education partner/husband		
Cannot read and write/illiterate	323	15.8
Primary education/can read and write	1094	53.5
Secondary education	494	24.2
Higher education	133	6.5
Occupation of mother		
House wife	1124	55.0
Daily worker, Farmer and trade	785	38.4
Government Employee	97	4.7
Others	38	1.9
Occupation of partner		
Farmer	1052	51.6
Daily worker	428	20.9
Trade/others	449	21.9
Employee	115	5.6
Type of toilet		
pit latrine	1938	94.8
No facility but bush/open field	97	4.7
other specify	9	0.4

Table 1c- Demographic and Socio- Economic Characteristics of women who delivered a baby in the one years preceding the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

Main source of drinking water		
Piped water	1849	90.5
Spring	146	7.1
Dug well River/stream Others	49	2.4
Type of wall material		
Stone with lime/cement/ bricks	331	16.3
Wood plank	3	0.1
wooden and mud/ other	1710	83.6
Type of roof made up		
Corrugated iron sheet	729	35.7
Thatch/leaf	1315	64.3
Do you have a mobile		
Yes	621	30.4
No	1423	69.6

5.2 Past reproductive health/obstetric and health service utilization characteristics

Eleven percent of respondents had more than five pregnancies, whereas most of study participants 1811 (88.8%), had fewer than or equal to four pregnancies. The vast majority of mothers (89%) reported a parity of less than or equal to four children, and more than half of the study participants gave birth to between one and two children. For the majority of women in the study 92.1%, the mode of delivery was spontaneous vaginal delivery, followed by assisted vaginal delivery and caesarean section delivery(C/S): 118(5.8%) and 43 (2.1%) respectively. The Duration of labor was prolonged (labor >12 hours): 17.2% (351), compared to 1693(82.8%) where labor lasted <12 hours.

Table 2: Past reproductive characteristics and Maternal Health Services Utilization among women who delivered in the one year preceding the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

Variables	Number	Percent (%)
Number of Pregnancies		
1	583	28.5
2-4	1228	60.1
5-6	193	9.4
≥7	40	2
Number of Deliveries		
1-2	1201	58.8
3-4	629	30.7
5-6	189	9.25
≥7	24	1.2
Mode of delivery of child		
Spontaneous vaginal delivery	1883	92.1
Assisted vaginal delivery (delivery assessed with instrument)	118	5.8
C/S (delivered with operation)	43	2.1
Duration of your labor		
≤12 hours	1693	82.8
>12 hours	351	17.2
Time takes to reach at that health care facility		
<30 min.	535	26.2
30 min. to 1 hour	538	26.3
1 to 2 hours	12	0.4
>2 hours	7	0.3
I do not know	711	34.7

5.3 Magnitude of maternal morbidity

The prevalence of self-reported pregnancy, delivery and postpartum related complications among the study participants of 2044 women was 438 (21.4%), (95%CI [19.8, 23.4]) of a woman who reported that they had at least one form of morbidity during their last pregnancy, childbirth and postnatal periods.

5.3.1 Types of Maternal morbidity during pregnancy

Of the total 344 (16.8%) women who reported to experience morbidities during pregnancy. The most frequent reported maternal morbidity during pregnancy period were dizziness 229(11.2%), loss of appetite or excessive vomiting 143(7.0%), severe headache 142 (6.9%), tiredness 126(6.2%),abdominal cramp 123(6.0%), Dysuria 110(5.4%), backache 109 (5.3%), heart burn or regurgitation(4.7%), shortness of breath (3.7%), lack of sleep (3.4%), high grade fever (2.9%), convulsion (2.2%), Abdominal distension (2.0%), pain in pelvic area (2.4%), swollen leg (1.6%) and others (4.8%) (figure 3).

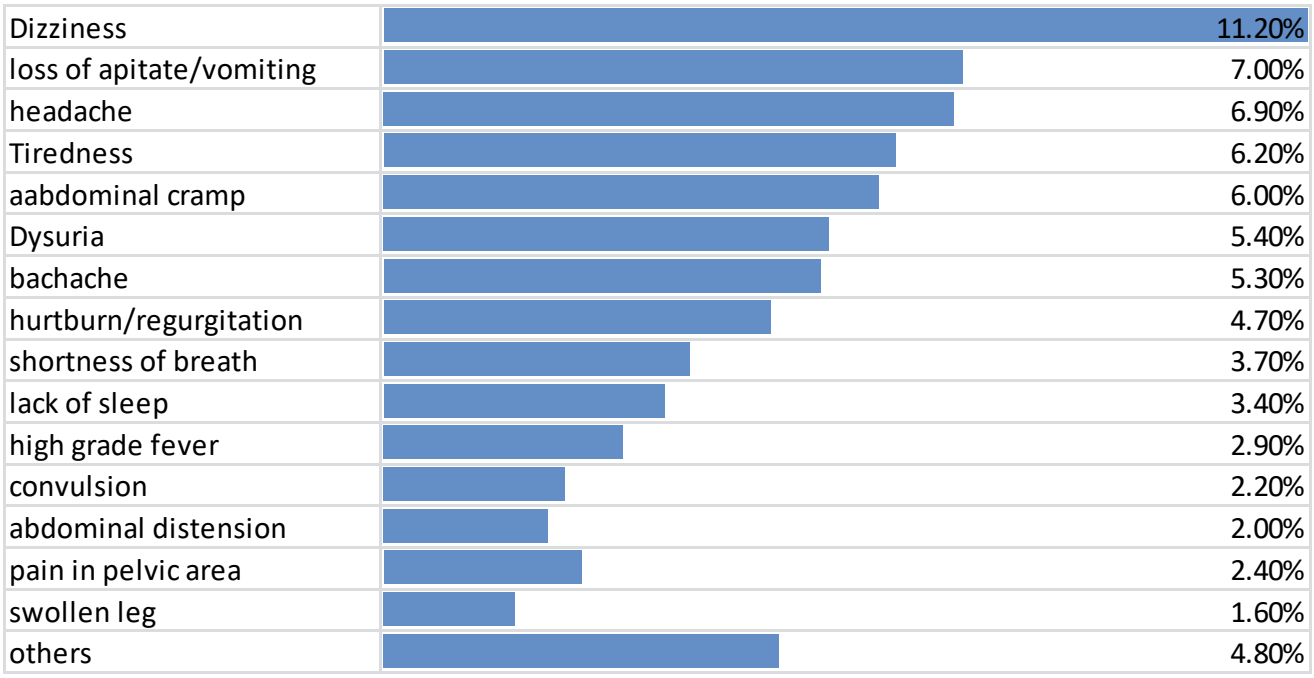

Figure 3. Percent distribution of reported maternal morbidity during antenatal/pregnancy period of women who delivered in the one year preceding the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

5.3.2 Types of Maternal morbidity during delivery/labor

From the total study participants, 132 (6.5%) women reported having morbidities during labor and delivery. From these, high grade fever was reported by 65 (3.2%), of women, followed by convulsions and excessive vaginal bleeding in 53 (2.6%) and 51 (2.5%) of the cases, respectively. Prolonged labor (>12 hours) 29 (1.4%), retained placenta 23 (1.1%), preeclampsia (0.6%), rapture of the uterus (0.6%), baby hand or feet coming first (0.5%), baby abnormal position (0.5%); and others, (1.9%) (figure 4).

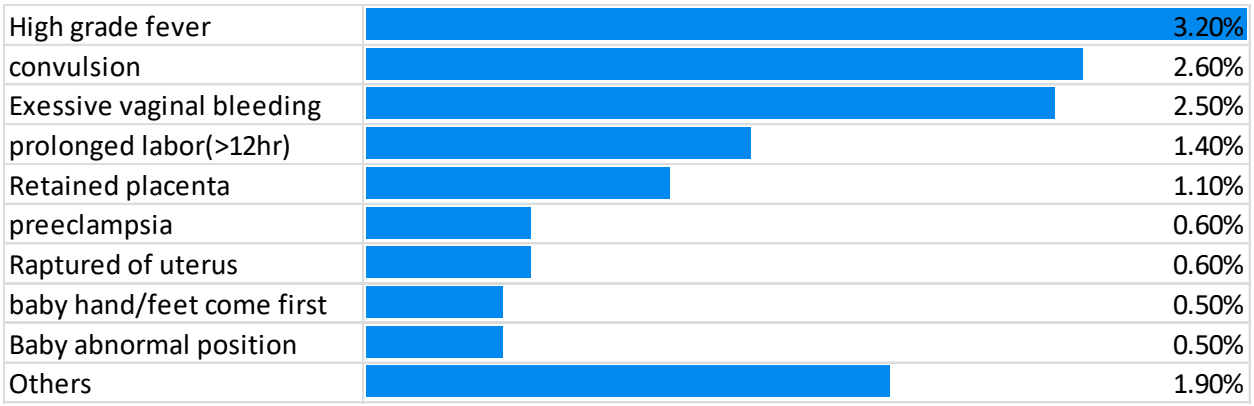

Figure 4 percent distribution of reported maternal morbidity during labor and delivery of women who delivered in the one year preceding the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

5.3.3 Types of Maternal morbidity during postpartum period

Among the postnatal women in the survey claimed to have morbidities during the postnatal period was 149 (7.3%), the most frequent responses were high grade fever 77 (3.8%), convulsion 66(3.2%), excessive vaginal bleeding 41(2.0%), micturition or urinary incontinency 39 (1.9%) while blurred vision with sever head ache (1.8%), severe abdominal pain (1.5%), excessive tiredness or fatigue (1.4%), engorged breast or sore (1.0%), foul vaginal discharge (0.5 %) and others (1.5%) (figure5)

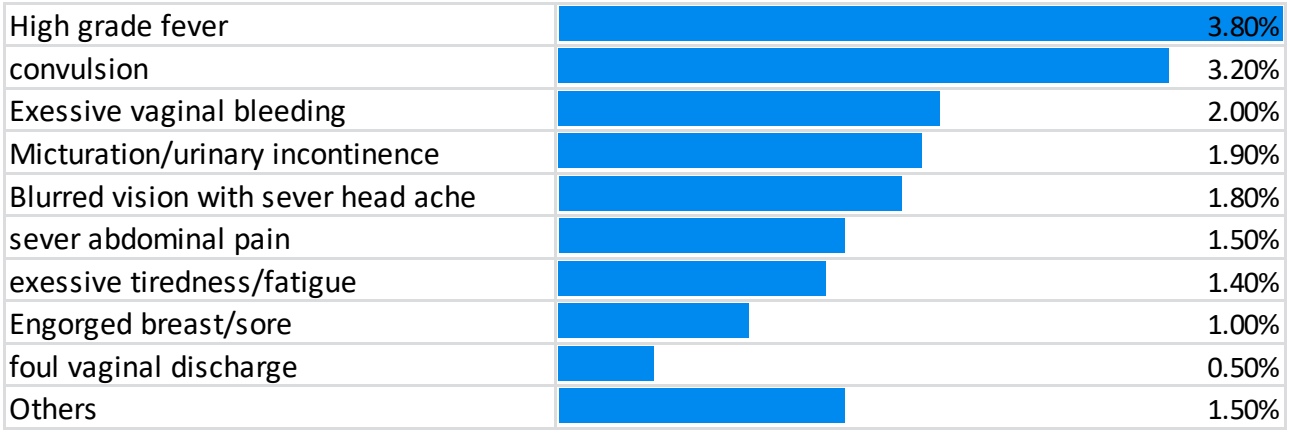

Figure5. Percent distribution of reported maternal morbidity during postpartum period of women who delivered in the one year preceding the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

5.4 Factors associated with maternal morbidity

In bivariate logistic regression 15 variables were significant with p-value of <0.25, these variables further taken to multivariable analyses. In multi variable logistic regression five factors were significantly associated (P-value <0.05), after adjusting different variables. From bivariate analysis 15 variables were candidate for multi variable analysis. women age (categorized), age of marriage (categorized) women education level, partner education level, marital status, occupation of women and partner, economic status (Wealth index), number of family size, number of pregnancy and childbirth(parity), mode of delivery, duration of labor, length of refer time, Distances to take health facilities and primary source of Income.

5.4.1 Socio- Economic and Demographic Factors associated with maternal morbidity

Associated factors found were wealth index (poorest) and occupation of mother (housewife and combined of daily labor, trade/others). From compared to the richest wealth status, women in the poorest, categories were found to have a higher chance of getting maternal morbidity. And adjusting for other factors, those who poorest women was 1.7 times more likely to be morbidity [AOR = 1.7, 95%CI (1.22, 2.4)]. Compared to those women who were government employee, a woman in house wife and daily worker and trade/others categories were found to have more chance of getting maternal illness [AOR= 1.98, 95%CI (1.01,3.89)] and [AOR= 2.13 95%CI (1.07, 4.22)] respectively. In a crude analysis other variables wealth status middle categories and occupation of partner combined of daily worker and trade/others together were 1.2 and 1.4 time

were found to have statistically significant association with the occurrence of maternal morbidity respectively. However, the relationship was not significant in a regression analysis (p- value >0.05). Even though from candidate variables like marital status, age categories of a women, age of marriage, level of education of women and her partner, occupation categories of women and her partner, wealth status of (poor, medium and rich) and family size were not statistically significant association with the occurrence of maternal morbidity according to our study.

Table 3. Socio-demographic and economic characteristics with maternal morbidity during the last pregnancy prior to the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024 2024.

Variables	Maternal illness		COR (95% CI)	AOR (95% CI)
	No (%)	Yes (%)		
Age group (years)				
15-19	35(70)	15(30)	1	1
20-29	951(79.8)	241(20.2)	0.59(0.32, 1.1)	0.69(0.34, 1.40)
30-39	589(77.2)	174(22.8)	0.69(0.37, 1.3)	0.56(0.27, 1.16)
40-49	31(79.5)	8(20.5)	0.60(0.23, 161)	0.61(0.12, 1.74)
Wealth index				
Poorest	321(71.8)	126(28.2)	1.61(1.16, 2.22) *	1.7(1.22, 2.4) **
Poor	331(80.9)	78(19.1)	0.96(0.68, 1.37)	1.1(0.74, 1.54)
Medium	333(79.5)	86(20.5)	1.1(0.75, 1.49)	1.2(0.8, 1.6)
Rich	310(81.2)	72(18.8)	0.95(0.66, 1.36)	1.1(0.76, 1.59)
Richest	311(80.4)	76(19.6)	1	1
Age of marriage (years)				
<18	320(69.6.8)	140(30.4)	1.89(14.9,2.39) *	0.51(0.4, 0.65)
≥18	1285(81.2)	298(18.8)	1	1
Marital status				
Married	1503(78.1)	421(21.9)	1	1
Widowed, Divorced and single	103(85.8)	17(14.2)	0.59(0.35, 1) *	0.46(0.26, 0.80)
Occupation of mother				
Government employee	86(5.4)	11(2.5)	1	1
House wife	884(55)	240(54.8)	2.12(1.12, 4) *	1.98(1.01, 3.89) *
Dailylabor, merchant/others	636(39.6)	187(42.7	2.3(1.2, 4.4) *	2.13(1.07, 4.22) *
Occupation of partner				
Employee (Go/NGO)	96(6.0)	19(4.3)	1	1
Farmer	844(52.6)	208(47.5)	1.25(0.74, 2.08)	0.92(0.53,1.58)
Daily worker, merchant/others	666(41.5)	211(48.2)	1.60(0.96, 2.68)	1.23(0.72, 2.1)

5.4.2 Past reproductive health/obstetric factors associated with maternal morbidity

The result from multiple logistic regression analyses showed that factors associated with maternal morbidity were number of delivery (parity greater than or equal seven), mode of delivery (C/S or operational delivery and assisted vaginal delivery) and duration of labor of a woman. A woman with parity seven (7) and more children had 2.45 times more likely to getting maternal illness than to compare those who had 1-2 children. [AOR=2.45, 95%CI (1.26, 4.79)]. And a women gave birth by assisted vaginal delivery/delivery assessed with instruments and C/S or delivery with operation had 4.6 and1.64 times having risk of maternal morbidity than spontaneous vaginal delivery of a women adjusting of other factors, [AOR=4.6, 95%CI (2.26, 9.37)] and [AOR=1.64, 95%CI (1.07, 2.51)] respectively. Compared to a woman whose labor duration of time (<12hours), a woman who had prolonged labor (>12 hours) had 1.48 times more likely to reported morbidity, [AOR=1.48 95%CI (1.13, 1.95)]. Whereas others variables like number of pregnancy (gravida) and distance home from health facilities were not statistically associated with maternal morbidity according to our study.

Table 4. Relationship between selected reproductive characteristics and reported maternal morbidity during the last pregnancy prior to the survey in Hawassa zuriya, Shebedino, Bilate zuriya and Boricha districts, Sidama region, Ethiopia, 2024.

Variables		**Maternal illness (%)**		**COR (95% CI)**	**AOR (95% CI)**
		Yes	**No**		
Number of pregnancy (gravida)	1 2-4 5-6 7+	433(74.3) 999(81.4) 151(78.2) 23(57.5)	150(25.7) 229(18.6) 42(21.8) 17(42.5)	1 0.66(0.52, 0.84) 0.8(0.54, 1.19) 2.13(1.11, 4.1) *	1 0.49(0.34, 0.72) 0.61(0.36, 1.04) 1.79(0.75, 4.270)
Number of Deliveries (parity)	1-2 3-4 5-6 7+	927(780) 505(81.1) 151(78.2) 23(57.5)	261(22) 118(18.9) 42(21.8) 17(42.5)	1 0.83(0.65, 1.06) 0.99(0.68, 1.43) 2.63(1.38, 4.50)	1 1.03(0.77, 1.39) 0.86(0.57, 1.28) 2.45(1.26, 4.79) **
Duration of labor	<12 hours >12 hours	1353(84.2) 253(15.8)	340(77.6) 98(22.4)	1 1.54(1.19, 2) *	1 1.48(1.13, 1.95) **
Mode of delivery	C/S Assisted vaginal delivery SVD	83(70.3) 15(44.1) 1508(79.7)	35(29.7) 19(55.9) 384(20.3)	1.66(1.1, 2.5) * 4.97(2.51, 9.88) * 1	1.64 (1.07, 2.51) * 4.60(2.26, 9.37) ** 1

NB: Significant (*) at P- value < 0.05, and Significant (**) at P- value <0.01.

6. Discussion

We assessed the magnitude and factors associated with maternal morbidity during pregnancy, delivery and postpartum in the Sidama region. According to this study, the magnitude of maternal morbidity, maternal morbidity during pregnancy, delivery and postpartum was 21.4%, 16.8 %, 6.5 % and 7.3 per cent, respectively. Factors associated with maternal morbidity were being the poorest woman, being a housewife, a daily laborer and a trader, parity ≥7 children, assisted vaginal delivery, C/S (operative delivery) and prolonged labor.

In our current study, maternal morbidity was 21.4%, and this result is consistent with studies conducted in different settings: a population-based survey of a city in northeastern Brazil (21.1%), a prospective cohort study conducted in 9 research sites in Saharan Africa on maternal morbidity, 23.7%,(28),(33), respectively. And an institutional-based cross-sectional study on postpartum morbidity in Gonder, Ethiopia 23.6%, (25).

The magnitude of maternal morbidity was higher than the magnitude of a previous similar study in Ethiopia, Butajira, and Wukuro districts together, which was 14.2%, and in Jimma zone, pregnancy related complication 15.9%,(20, 21), It was also higher to institution-based postpartum morbidity in Morocco 9%, (24). The differences might be these studies were done on pregnancy and postpartum morbidity separately rather than simultaneously, with ecological variation and a smaller sample size.

Other studies also showed a varied degree of reported maternal morbidities; for example, a study done in Debre Markos, Ethiopia, and in rural communities in the southern Ethiopia Gedio zone on postpartum morbidity (32.8%, 31%), respectively (26, 36) , which is higher than in our study. The possible reason for this discrepancy might be that the study was done on a public health institution-based rather than a community-based and the study design varied in either one. In addition, other studies were higher than the magnitude of our study: health facilities based on pregnancy-related morbidity in Uganda 27%, (19), postpartum morbidity in two different places and years in India were 39.8% (23) and 48.9% (17), and health facilities based on maternal complications in north Gonder, Ethiopia, were 28.5%, (31). These observed differences in the magnitude of maternal morbidity across the studies might be due to discrepancies in the setting, sample sizes, design of the study, and socio-demographic characteristics of the study.

In this study, a pattern of maternal morbidity indicated variation between the phases of pregnancy, labour/delivery, and the postpartum periods of 16.8%, 6.5%, and 7.3%, respectively. It is thought that some women might have experienced the same symptoms at different times. However, during the pregnancy period, the most often reported problems, one to three, were dizziness, loss of appetite, and severe headaches. During the period of labour and delivery, high-grade fever, convulsions, and excessive vaginal bleeding were reported most commonly, while in the postpartum period, high-grade fever and severe headaches were the leading causes of reported maternal morbidity. Comparing the pattern and type of health problems reported by women in this similar study with that of the study in two regions, Butajira and Wukuro district (20). We find similar reported leading complications in one to three orders during pregnancy, labour, delivery, and the postpartum period; these are severe headaches, excessive vaginal bleeding, and high-grade fever, respectively. Whereas there is a difference in leading causes of morbidity, it was only the order of leading one to three orders. This finding of severe headaches being the most common reported symptoms during pregnancy was supported by another study on self-reported pregnancy-related complications in the Jimma Zone (21).

In this study, women in the lowest wealth quintiles (poorest) were 1.7 times more likely to report maternal illness than women in the highest wealth quintiles (richest). This study was supported by similar studies of community-based maternal morbidity in Butajira and Wukuro districts, Ethiopia (20), and this finding was also consistent with a study in a population-based survey of a city in northeastern Brazil, a study of postpartum morbidity in rural India, and a study in rural Upper Egypt (18, 23, 28). Poverty is always a significant factor in maternal morbidity in the area studied.

This finding show that women occupations living were on housewife and daily worker with trade/ others had 1.98 and 2.13 times more likely to develop maternal complication than as compare to government employee. However, no comparative studies have been conducted. The possible reason might be a majority of a women lived in rural area were housewife and a few were government employee and also this implies that socio-economic status of a women. Therefore, research with a strong design is needed for further study.

In this study, women having seven or more children are 2.45 times more likely to report some illness compared to those with only one or two children. This shows that high-parity women

have high risk factors for maternal health complications during their next childbearing period. This is consistent with the findings of different studies conducted in a systematic review and meta-analysis of post-partum hemorrhage in Ethiopia; a study done in rural Upper Egypt on maternal morbidity; a study done on a recent national demographic health survey in Brazil; a study conducted on the burden of puerperal sepsis in Ethiopia; and the results found in Butajira and Wukuro districts (18, 20, 34, 38, 39).

Our study shows that mothers who had caesarean section and assisted vaginal deliveries were 1.64 and 4.6 times more likely to develop maternal morbidity than those who had spontaneous vaginal deliveries, respectively. The finding of operative delivery is supported by research conducted in Brazil on the prevalence of postpartum morbidity, a study conducted in the town of Gondar in northern Ethiopia, a study conducted in India, and a study conducted on a systematic review and meta-analysis of the burden of puerperal sepsis in Ethiopia (17, 25, 34, 39). Although assisted vaginal delivery is one of the factors influencing maternal morbidity, no comparative studies have been conducted. Therefore, research with a strong design is needed for further study.

In this study, duration of labour showed a significant association with maternal morbidity. Women with a labour duration of more than 12 hours had 1.48 times the risk of developing a maternal complication compared to women with a labour duration of less than 12 hours. This result is similar to a study conducted in a systematic review and meta-analysis of postpartum hemorrhage in Ethiopia (38).

6.1 Conclusion

The study findings revealed that the magnitude of maternal morbidity was somewhat higher compared to most other studies. In our current study, the lowest wealth quintiles (poorest), occupation of a women housewife and daily worker/trade, high parity, prolonged labour, mode of delivery of C/S or operational delivery, and assisted vaginal delivery were found to be important predictors of experiencing illness through a number of factors related to the health status of mothers.

6.2 Recommendation

The following significant recommendations are put forward based on the study's findings for the relevant bodies, including the government, healthcare facilities, physicians, patients, health educators, policy makers, program implementers, and researchers who will work in the areas of reproductive health as an essential public health concern.

For organizations and institutions: (Minster of health, Sidama region Health bureau and Hawassa University)

- Effort to reduce maternal morbidity, health profession should promote ANC and PNC follow up and provide information on the problems of pregnancy, delivery/labor and postpartum period.
- During ANC and PNC follow up health care providers should give information for mothers about danger signs during pregnancy, delivery and postpartum period what they will do if maternal complication occurs.
- There should be increasing educational opportunities for both women and her partner health related complication during pregnancy, child birth and post-partum periods.
- Multi-para women were more likely to develop maternal complications than women who had one or two children. This implies that this group should be one of the priorities for targeting family planning education campaigns based on its benefits.
- Community health activities such as community awareness programs, home visits and community-based health delivery system through HEW and others stake holders.

Researcher

- There were a few studies on community-based maternal morbidity during pregnancy, delivery, and the postpartum period. So further studies should be conducted on community-based maternal morbidity related to pregnancy, childbirth, and the postpartum period simultaneously.

6.3 Strength and Limitation

Strength of study

- A large sample size of mothers was involved in the study
- Validity was ensured by the use of pre-test that was not included in the actual study area.
- Data collectors and supervisors were well trained based on manuals to use in conducting the interview
- Furthermore, much effort has been made to help identify symptoms of potential maternal health complications, employing a nearly comprehensive list of symptoms in the questionnaire

Limitation of study

- Asking of mothers to tell previous maternal complication of last pregnancy, delivery and postpartum period, so has a potential recall bias by a woman and not recognizing some symptoms as known.
- When compare to a medical diagnosis, the maternal morbidity status and nature may be not accurately determined from self-reported maternal morbidity.
- The data was used as secondary data, so didn't have to get some important variables related to ANC and PNC follow up and place of delivery.
- The cross-sectional study nature of the study design limited the ability to draw causal Inferences
- It would have been more appropriate to use non-health worker data collectors to avoid the possibility of introducing desirable answers.
- I did not get adequate references related my objectives; I was used old references in somewhere.

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ANNEX

Annex I: English version Information sheet and consent form

- **Title of the Research Project:** Assessment of magnitude and factors associated with maternal morbidity in Northern Zone of Sidama Regional state, Ethiopia 2024.

Name of Investigator: Negash Lamiso, phone no +251916436270

Email lamisonegash@gmail.com

Introduction:

This information sheet and consent form is prepared to explain the study you are being asked to join. Please listen carefully and ask any questions about the study before you agree to join. You may ask questions at any time after joining the study. This research team includes one principal investigator and two advisors from Hawassa University.

Purpose of the study: The main aim of this study is to write a thesis as a partial requirement for the fulfillment of a master's degree in Epidemiology. Moreover, the result of study can be used as a baseline for further studies that can be done in the same topic area and identify factor associated to maternal morbidity in Northern Zone of Sidama Regional state as well as in our country.

Procedure and duration: I was interviewing you using questionnaire to provide me with pertinent data that is helpful for the study. There are about 25 questions to answer, where I was filled the questionnaire by interviewing you. The interview was taken about 22 minutes, so I kindly request you to spare me this time for the interview.

Risk and benefits: The risk of being participated in this study is very minimal, but only taking few minutes from your time. There would not be any direct payment for participating in this study. But the findings from this research may reveal important information for sidama Regional state health Institution and other stalk holder in planning preventive and curative health service.

Confidentiality: The data you will provide us will be confidential. There will be no information that will identify you in particular. The findings of the study will be general for the study population and will not reflect anything particular of individual person. The questionnaire will be coded to exclude showing names. No reference will be made in oral or written reports that could link participants to the research.

Rights: Participation in this study is fully voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefit which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

Declaration of informed voluntary consent:

I have read/was read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues to confidentiality, the rights of participating and contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to stop the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study to be conducted with my initials (signature) as indicated below.

Name and signature of the participant: _____

Signature of data collector: _____ Date: _____

Annex II English version Questionnaire to assess risk factor

Part one: Socio-Economic and demographic related factors.

s.no.	Questions	Alternatives	skip
001	What is your age?	---------- (in Yrs.)	
002	Where is your distincts/woreda?	_____	
003	Ethnicity	1. Sidama 2. Oromo 3. Wolayita 4. Amhara 5. Other(specify)_____	
004	Maternal religion	1. Protestant 2. catholic 3. Orthodox 4. 4. Muslim	
006	Where is your usual place of residence?	1. Urban 2. Rural	
007	What is your educational status?	1. No formal education 2. Tenth grade completed or below 3. Pre-university complete or below 4. Graduate or post graduate and above	
008	What is your current marital status?	1. Married 2. Widowed 3. Divorced/separated 4. Single (never married) 5. Cohabiting (live together)	

008	What is your occupation?	1. House wife 2. Private employee 3. Farmer 4. Government employee 5. Daily laborer 6. Merchant 7. Student 8. Others (specify)_____	
009	What is your monthly family income in Birr?	----------	
008	Type of roof	1.Corrugated iron sheet 2.Thatched, 3.wood, 4. other_____	
009	Do you have land?	1. Yes 2. No	If yes go to next
010	Land size (Timad) i.e 1 timad is equal to half a hectare?	1. < 2 2. 2-4 3. >= 5	
011	What types of items do you have?	1. Radio 2. Television 3. Telephone/mobile 4. refrigerator 5. an electric mitad 6. table 7. a chair 8. a bed with cotton/sponge/spring mattress 9. Tractor 10. Watch/clock	

012	What types of water do you have used?	1. Piped into dwelling 2. Piped outside dwelling 3. Well 4. Protected spring	
013	What types of Toilet do you have used?	1. Pit latrine 2. VIP(ventilated improved pit) 3. Flush toilet 4. No facility/Bush/field	
014	Does any member of this household have a bank account?	1. Yes 2. No	
015	What type of fuel does your household Mainly use for cooking?	1. Electricity 2. Wood 3. Others_____	
016	What is the main material of the floor in your Household	1. Earth 2. Sand 3. Others_____	
017	What is the main material of the exterior Walls in your household?	1. Bamboo with mud 2. Sand with cement 3. Others_____	
018	Does your household have electricity?	1. Yes 2. No	
019	Do you have a cattle's	2. Yes 2. No	If yes go to next
020	Number of cattle's do you have	_____	

Part two: Obstetrics, fetal and Maternal Health Services related factors.

S no	**Questions**	**Alternatives**	**Skip**
01	what is your age of marriage	_____	
02	what is your age of first child birth (by years)?	_____	
03	What is distance from home to health institution?(write in km /meter)	_____	
04	Does road of your home suitable for ambulance enters?	1. Yes 2. No	
05.	What is your total number of Pregnancies?	1. 1 2. 5-6 2. 2-4 4. 7 and above	
06.	What is your total number of Deliveries after 28 weeks of gestational age?	1. 1-2 2. 3-4 3. 5-6 4. 7+	
07	What is birth interval between children (by years)?	1. ≤ 2 2. > 2	
08	Do you have bad obstetric history at least once?	2. Yes 2. No	
08a	If yes,	1. Abortion 2. Stillbirth 3. Child death	No skip
09	Do you have history of CS (cesarean section)?	1. Yes 2. No	
09a	If yes, how many times of CS	1. One times, 2. two times 3. three times and more	
10	How long labors continue from start of contraction to Delivered child?	_____	

11	Where was your child where delivery?	1. Home 2. Health post 3. Health center 4. Government hospital 5. Private hospital	
11a	If you delivery in home, who was labor attendant	1. Mother 2. Mother in law 3. Traditional trained birth attendant 4. Women from my neighbor 5. HEW 6. Others_____	
11b	If you delivery in health institution , who was labor attendant	1. HEW 2. Nurse 3. Midwife 4. Health officer 5. Doctor	
12	Before delivery of child, which came first?	1. Rapture of membrane 2. Uterus contraction	If rapture of membrane go next
12a	If rapture of membrane, how long take to start of labor?	_____	
13	When you delivered of child, which mode of give birth?	1. SVD (spontaneous vaginal delivery) 2. CS (cesarean section) 3. Assisted vaginal delivery	
13a	If you delivered child with SVD ,do you have perianal tear	1. Yes 2. No	Answer not SVD skip

13b	If you delivered child with assisted vaginal, what was done during delivery?	1. Episiotomy 2. Forceps 3. Vacuum 4. Others_____	
14	Do you Had Antenatal Care for before child birth pregnancy?	1. Yes 2. No	
14a	If yes, how many times attended for antenatal care?	1. One times 2. Two time 3. Three times 4. 4+ times	
15	When was antenatal care service initiation in gestational age in months?	1. 1 to 3 months 2. 4 to 6 months 3. 7 to 9 months 4. Don't remember exactly	
16	Where did you get the antenatal care service?	1. Health post 2. Health center 3. Public hospital 4. Private clinic/hospital 5. Other(specify)_____	
17	Do you have taken iron and folic acid tablet supplements?	1. Yes 2. No	
18	Do you have taken ant parasite (deworm) tablet during pregnancy?	1. Yes 2. No	
18a	If yes, how long do you take the tablet?	1. Less than one month 2. One month 3. Two months 4. Three months and above	
19	Have you advised on diet and nutrition	1. Yes 2. No	

20	Do you have referred from one health institution to another during child delivery?	1. Yes 2. No	if yes go to Q13a
20a	If yes, where to where?	1. Health post to health center(HC) 2. health center to primary hospital 3. primary hospital to general hospital 4. general hospital to referral hospital 5. others ----------	
21	Did you have any postnatal checkup in your last pregnancy (either at health facility or at home by any one)?	1. Yes 2. No	
21a	If yes, how many times you were visited by HEW or health profession?	1. One times 2. Two time 3. Three times 4. Four 5. 4+ times	
22	How long after the delivery did the second check take place by health extension workers?(write in days)	1. < 24hrs 2. Within 25-48 hrs 3. 49-72hrs 4. 73 hrs -6 wks 5. >6 wks	

23	Where did you get the post natal service?	1. At own home 2. Health post 3. Health center 4. Public hospital 5. Private clinic/hospital 6. Other(specify)_____	
24	Have you advised on family planning?	1. Yes 2. No	
25	Have you used family planning previous time	1. Yes 2. No	
26	If yes, which type of family planning used before?	1. Oral pills 2. Depo/injection 3. Implant/jaddele 4. IUCD	
27	Do you have history of post-partum hemorrhage during child birth?	1. Yes 2. No	
28	What is Weight of a new born	1. <2.5kg 2. 2.5kg- 4kg 3. >4kg 4. unknown	
29	What is Fetal gestational age	1. Term 2. Preterm 3. Post term	
30	What is Fetal presentation	1. vertex 2. Non vertex	
31	What was Type of birth	1. Singleton 2. Twins 3. Multiple	

Part three: Maternal morbidity during antenatal period, maternal morbidity during ant partum and post-partum period.

S no	Questions	Alternatives	Skip
101	Do you have following health condition problems during pregnancy until start of labor?	1. Yes 2. No	
102	If yes, mention following health condition problems	A. severe headache, B. lower abdominal pain, C. excessive vomiting, D. high grade fever, E. hemorrhage/excessive vaginal bleeding, F. epigastria pain G. constipation H. fatigue I. leg, hand and face swelling J. anal hemorrhoid K. baby movement was low, L. dizziness fainting, M. fell down, N. varicose vein, O. convulsion/fits P. jaundice/yellow eye color and Q. others_____	
103	If you had above health condition problems, what Should you do at that time?	1. visit to health institution (HC, Hospital 2. consult health profession, 3. visit to traditional birth attendant, 4. praying of god, 5. use traditional medicine and 6. others(specify)_____	
	Who have known this above health condition problems?	1. You 2. Your husband 3. HEW 4. Heath professional 5. Others(specify)_____	

104	Do you have following health condition problems during labor and delivery?	1. Yes 2. No	
105	If yes, mention following health condition problems	A. prolonged labor/more than 24 hours, B. hemorrhage/excessive vaginal bleeding C. premature rapture of membrane, D. severe headache, E. fatigue F. high grade fever, G. dizziness fainting, H. convulsion/fits, I. jaundice and J. others_____	
106	Who have known this above health condition problems?	1. You 2. Your husband 3. HEW 4. Heath professional 5. Others(specify)_____	
107	If you had above health condition problems, what Should you do at that time?	1. visit to health institution (HC, Hospital/clinics) 2. consult health profession, 3. visit to traditional birth attendant, 4. praying of god, 5. use traditional medicine and others(specify)_____	
108	Do you have following health condition during post -partum period start from delivery of placenta to 6 weeks of post-partum?	1. Yes 2. No	

109.	If yes, mention following health condition problems	A. foul smelling discharge, B. hemorrhage/excessive vaginal bleeding C. severe headache, D. high grade fever, E. fatigue F. dizziness fainting, G. convulsion/fits and H. others_____	
110	Who have known this above health condition problems?	1. You 2. Your husband 3. HEW 4. Heath professional 5. Others(specify)_____	
111	If you had above health condition problems, what Should you do at that time?	1. visit to health institution (HC, Hospital/clinics) 2. consult health profession, 3. visit to traditional birth attendant, 4. praying of god, 5. use traditional medicine and 6. others(specify)_____	
112	Do you have any suffer from previous maternal medical conditions	1. Yes 2. No	
112a	If yes, states which condition	1. Anemia 2. Elevated blood pressure 3. Chronic hypertension 4. Preeclampsia 5. Antepartum hemorrhage 6. Placenta prevea 7. DM 8. STI 9. HIV 10. Asthma 11. Others_____	