ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Effect of Maternal Waiting Home Utilization on Maternal and Perinatal Health Outcomes, in Selekleka Primary Hospital, Northern Ethiopia: Retrospective Cohort Study.

By: Tekia Zafu Gebremeskel (BSc in Public Health)

ID number: GSR/5711/09

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2. Mr. Mengistu Yilma (MPH)

A Research Thesis Submitted to the School of public health, Addis Ababa University for Partial Fulfillment of the Requirements for Master's Degree of Public Health in Epidemiology.

Jun. 2018

Addis Ababa, Ethiopia

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Approved by Examining Board

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External Examiner	Signature	Date

Acknowledgement

First and for most my acknowledgement goes to Almighty God for giving me health and strength. I am particularly thankful to my dearest advisors Dr Naod Firdu and Mr. Mengistu Yilma who are working in Addis Ababa University, College of health science for their unreserved supports and guidance in each step of this thesis.

And I would like to thank Addis Ababa University for giving me this chance, and medical faculty main library staffs for their free internet access which was helpful for searching relevant literature and reports.

My heartfelt gratitude goes to all my best friends especially to Mr. Mebrahtu Abay, and Mr. Teklit Angesom who are working in Aksum University, College of health science for continues encouragement, comments, suggestions and corrections in each step of this thesis.

My deepest gratitude goes to my Dad Mr. Zafu Gebremeskel, to my Mom Mrs. Fkadu Araya, my brother Efream Zafu and my sisters Alem Zafu, Adeni Zafu and Genet Zafu for their countless encouragement.

I also thank Selekleka primary hospital administration office and to all staff for their cooperative. And I wish to express my thanks to the data collectors.

Working with the above great individuals have brought me much enlightenment: Without your enthusiastic support, the timely completion of this work would not have materialized.

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Abbreviations and Acronyms

AAU	Addis Ababa University
AHR	Adjusted Hazard Ratio
ANC	Antenatal Care
AOR	Adjusted Odds Ratio
APH	Antepartum Hemorrhage
BSc	Bachelor of Science
C/S	Cesarean Suction
CHR	Crude Hazard Ratio
CI	Confidence Interval
CL	Confidence Level
COR	Crude Odds Ratio
DM	Diabetes mellitus
EDHS	Ethiopian Demographic and Health Survey
EmONC	Emergency Obstetric and Newborn care
ERC	Ethical Review Committee
FGD	Focus Group Discussion
HDP	Hypertensive Disorder during Pregnancy
HIV	Human Immune Deficiency Virus
HMIS	Health Management Information System
IDR	Incidence Density Rate
IR	Incidence Rate
IUFD	Intra-Uterine Fetal Death
KM	Kilo Meter
MMR	Maternal Mortality Ratio
MSc	Master of Science
MWA	Maternal Waiting Area
MWH	Maternal Waiting Home

OR	Odds Ratio
PMR	Perinatal Mortality Rate
PNC	Post-natal care
PPH	Postpartum Hemorrhage
PRM	pregnancy-related maternal mortality ratio
RR	Relative Risk
SBA	Skilled Birth Attendance
SBR	Stillbirth Rate
SD	standard deviation
SE	standard Error
SVD	Spontaneous Virginal delivery
TB	Tuberculosis
WHO	World Health Organization
X^2	Chi-square

Abstract

Background: Maternal waiting home is a facility within easy reach of a hospital or health center which provides emergency obstetric and newborn care (EmONC) to accommodate women in their final weeks of pregnancy. World health organization has been introducing maternal waiting home services in order to increases maternal health utilization to improve maternal and newborn health outcomes. However, according to previous studies, its effect on maternal and perinatal health outcomes is controversial.

Objective: This study was aimed to assess the effect of maternal waiting home utilization on maternal and perinatal health outcomes.

Methods: Retrospective cohort study was conducted from 01/01/2018 to 30/01/2018 and compared maternal waiting home user (330) and non-user (343) mothers who were admitted for delivery between 01/01/2015 and 31/12/2017 in Selekleka primary hospital, Tigray, Ethiopia. They were selected using simple random sampling method. The survival time of the mothers and their newborns were evaluated using life table and Kaplan Meier survival function. Cox proportional hazard regression model was used to determine the hazard ratio of maternal and perinatal death and complications for each predictor.

Result: The incidence rates of maternal complications and perinatal death and complications were significantly lower among the maternal waiting home users than non-users. Maternal waiting home user mothers [AHR: 0.11 95% CI: 0.07 - 0.19] and mothers who gave birth twin [AHR: 3.4, 95% CI: 1.5 - 7.4] were the independent predictors of the maternal complication. Similarly newborn born from maternal waiting home user mothers [AHR: 0.16, 95%CI: 0.08-0.31], born from complicated mothers [AHR=2.91, 95% CI: 1.68 - 5.05], newborn lives in rural area [AHR=0.49, 95% CI: 0.25 - 0.96] and newborn weighted <2500 gm [AHR: 2.26, 95% CI: 1.1, 4.64] were the independent predictors of the perinatal death and complications.

Conclusion and recommendations: The incidence rate of maternal and perinatal death and complications were significantly lower among the maternal waiting home users' group, and the government should have to encourage and support to the mothers to use maternal waiting home services.

1. Introduction

1.1. Background

About 830 women die from pregnancy or childbirth-related complications around the world every day(1,2). In Africa and other developing regions, the risk of a woman dying from a maternal cause is about 23 times higher than for a woman living in a developed country (1). Most of those deaths have occurred due to poor access to health facilities. In order to overcome this difficulty world health organization (WHO) has introduced maternal waiting home (MWH) services especially in developing countries; with assumptions to reduce maternal and perinatal mortality by increasing access to health facilities especially for mothers who are living in remote areas and high-risk pregnant mothers (3).

MWH is a facility within easy reach of a hospital or health center which provides emergency obstetric and newborn care (EmONC) and they are residential facilities located near a hospital or a health center to accommodate women in their final weeks of pregnancy to overcome health seeking delay, transportation delay and health professional delay (3). The idea of homes for pregnant women with obstetric and social problems is not new. For many centuries, voluntary organizations in Europe have provided shelters for single mothers in an effort to reduce abortion and infanticide. Since the beginning of the 20th century, waiting homes have existed in Northern Europe, Canada and the United States to serve women in remote geographic areas with few obstetric facilities. In Africa, one of the early trials with maternity waiting homes (known as "Maternity Villages") was in Eastern Nigeria in the 1950s. Similarly, in Ethiopia, the first MWH was started in Attat Hospital in 1976, then after the service is expanding in most part of the country(3). Selekleka primary hospital MWH has been giving services since 2013.

Maternity waiting homes (MWHs) have been promoted to improve pregnant women's access to quality and timely maternal health care services, especially for women with high-risk pregnancy or women who live in remote areas. Once labour starts, women would move to the health facility so that they can be assisted by a skilled birth attendant and the mothers and their newborns could stay postpartum at MWHs for some more days to ensure all is well before going back home, long distances (4).

1.2. Statement of the problems

Globally in 2015; the MMR, annual number of maternal deaths, the global lifetime risk of a maternal death were estimated 216 maternal deaths per 100 000 live births, 303 000, and 1 in 180 mothers respectively. Developing regions account for approximately 99% (302 000) of the global maternal deaths, with sub-Saharan Africa alone accounting for roughly 66% (201 000), followed by Southern Asia (66 000). The lifetime risk of maternal mortality is estimated at 1 in 36 in sub-Saharan Africa, contrasting sharply with approximately 1 in 4900 in developed countries (5).

In Ethiopia, the estimated pregnancy-related mortality ratio (PRM) is 412 deaths per 100,000 live births and four women die during pregnancy and childbirth-related, The lifetime risk of pregnancy-related death (0.021) indicates that of 1,000 women of exact age 15, about 21 (one per 48 women) would die before age 50 during pregnancy and childbirth-related (6).

Nearly 75% of all maternal deaths on the continent are attributable to the following complications of pregnancy and childbirth: severe bleeding (mostly postpartum), infections (usually after childbirth), high blood pressure during pregnancy (pre-eclampsia and eclampsia), and complications from delivery and unsafe abortion (1).

In 2015, the neonatal mortality rate was 19 per 1000 and 29 per 1000 live births globally and in Africa respectively. The neonatal period is the most vulnerable time for a child's survival. Of the estimated 5.9 million child deaths in 2015 globally, almost 1 million occurred in the first day of life and approximately 2 million in the first week. The current neonatal mortality rate in Africa (27 deaths per 1,000 live births) is the highest in the world and contributes nearly 40% to the global burden. Preterm birth complications (35 percent), intrapartum-related complications (24 percent), and sepsis (15 percent) were the major causes of neonatal deaths globally in 2015 (1).

According to 2016 EDHS result in Ethiopia the neonatal mortality rate was 29 per 1000 live births, the perinatal mortality rate was 33 deaths per 1,000 pregnancies and in Tigray, the perinatal mortality rate was 36 per 1000 (6).

Most maternal and infant deaths occur during the time of childbirth and in the first few hours and days after birth: more than 40% of maternal and newborn deaths and stillbirths occur during the time of birth, 45% maternal deaths and 36% of neonatal deaths occur during the first 24 hours.

Hemorrhages, hypertension in pregnancy, obstructed labour, abortion, and sepsis are the major causes of maternal death. Indicating the interventions to address these threats require institutional care (4). Delivery by a skilled birth attendant (SBA) serves as an indicator of progress towards maternal mortality worldwide as it is estimated that between 13% and 33% of maternal deaths could be averted by the presence of a skilled birth attendant(1).

In the last decade, obstructed labour/uterine rupture (36%), haemorrhage (22%), hypertensive disorders of pregnancy (19%) and sepsis/infection (13%) are the top four causes of maternal mortality in Ethiopia. And these deadly obstetric complications are the result of lack of or delay in getting obstetric services(7).

The perinatal mortality rate (PMR) of Ethiopia is among the highest in Sub Saharan Africa, and the major Causes of this are obstructed labour (27%), HDP (7%), infection (5%), hemorrhage (5%), prematurity (7%), malpresentation (11%), unexplained (18%), others (20%). The majority of perinatal deaths are attributed to mechanical causes of low levels of skilled attendance and poor access to obstetric care(8).

In Tigray, 75% of the neonatal death has occurred during the early neonatal period, and the leading causes are prematurity 34%, and asphyxia 31% which accounted for 2 of every 3 deaths. The remaining deaths are caused by infections (12%), congenital abnormalities 7%, and other causes 16%. And mainly these deaths are associated with early age at marriage, distance to care, and residence (9). WHO has been introducing maternal waiting home services in order to increases maternal health utilization and through to improve maternal and newborn health outcomes. Hereafter many health institutions attempt to improve the health outcomes of the mothers and their children through having maternal waiting home services. However, there is no enough evidence which can show the effect of MWH utilizations on maternal and prenatal health outcomes. That is, Several studies show that MWH services decrease maternal and prenatal health complications (10–15). In contrast, to this other several studies shows that MWH has no any associations with maternal and prenatal health outcomes(16–20). In addition to my best of knowledge, there is no study done in the study area, this indicated that it is not well studied or understood. Therefore in order to overcome the information gap and controversial results of previous studies the present study aiming to assess the effect of MWH utilization on maternal and prenatal health outcomes with retrospective cohort study.

1.3. Rationale of the study

The findings from this research will benefit for mothers and their babies to avert maternally and childhood morbidity and mortality due to pregnancy-related complications. And it also creates awareness on MWH for themselves and for the community at large. It will provide adequate information's for Selekleka primary hospital and Medabay Zana health office how to improve the quality of MWH services and its expansion to the rest of health facilities.

To have effective strategies, the government in general and the District Health office in particular need to have scientific bases on the effect of MWH services on the maternal and prenatal health outcomes for which this study will supply valuable baseline information on the continuation and expanding of the service. The recommendations from this study may help for decision makers on developing policies and strategies to promote and for further improvement of MWH services. Findings from this research can also contribute to the body of knowledge and formulate the basis for other research on the effectiveness of MWH utilization. Hence, this study will have a great role to achieve sustainable development goals by 2020 which is to Reduce Maternal Mortality Ratio (MMR) from 420 to 199 per 100,000 live births and Reduce Under five-year, Infant and Neonatal mortality rates from 64, 44 and 28 to 30, 20 and 10 per 1,000 live births(21). And then to achieve 2030 SDG agenda (goal 3) to reduce MMR less than 70 per 1000000 live births, under five and neonatal mortality rate less 25 and 12 per 1000 live birth respectively(22).

2. Literature review

2.1. Maternal waiting home and maternal outcomes

The study done in Leo PDR in 2008 shows that since the opening of thateng silk home in the first 10 months 86 women have used the facility and with a total of 78 deliveries, even though all mothers have survived and no morbidity has been reported, since the Silk Homes have only been operating for a matter of months it would be premature to assess at that stage the impact on MMR and maternal complications (13).

A systematic review in 2009 in the Netherlands revealed that there is insufficient evidence about the effectiveness of MWH services (17).

A systematic review which was conducted in 2014 shows that there is insufficient evidence to determine the effectiveness of maternity waiting facilities for improving maternal outcomes (16).

Other systematic review done in 2017 shows that the maternal mortality ratio for MWH is 105/100,000 and 1,066/100,000 for non-MWH, Relative Risk (RR) 0.145 (95% Confidence Interval (CI) 0.062 to 0.204). Cesarean deliveries rate is 24/100 for MWH and 18/100 in non-MWH, RR 1.229 (CI 1.226-1.555). The results indicated that MWH significantly reduces maternal deaths however statistically increases cesarean deliveries (12).

A cross-sectional Study done in 15 rural health centres of Zambia in 2014 shows that there is no association between the presence of MWH and the likelihood of a woman developing complications during and after labour (AOR = 1.75; 95% CI: 0.96–3.19) (15).

The study done in 2017 in Tanzania indicates that six maternal deaths are recorded during the study period, with data on MWH stay missing for one. One of the women who died had stayed in the MWH (intra-hospital mortality 1/334; 0.3%, 95% CI 0.0–1.7), and four had accessed the hospital directly (intra-hospital mortality 4/710; 0.6%, 95% CI 0.2–1.4): P-value was non-significant (P ¼ 0.566) (23).

A retrospective cohort study was done at Attat rural hospital of Ethiopia in 2010, and it measures primarily MMR and stillbirth rate and they reviewed a data of 24148 mothers who had been given birth between1987 and 2008. And the Maternal mortality is 89.9 per 100 000 live births (95% CI, 41.1–195.2) for MWA women and 1333.1 per 100 000 live births (95%

CI,1156.2–1536.7) for non-MWA women; 38.5% of MWA women are delivered by caesarean section compared with 20.3% of non-MWA women, and none had a uterine rupture, compared with 5.8% in the non-MWA group. For the 1714 women admitted in 2008, relatively small differences in socio-demographic characteristics, distance and antenatal care uptake were found between groups. The author concluded that maternal mortality is substantially lower in women admitted via MWA. It is likely that at least part of this difference is accounted for by the timely and appropriate obstetric management of women using this facility (11).

Others study also held in nine health facilities (8 hospitals and 1 health center) which had MWH services throughout Ethiopia in 2012 to describe the status of MWH services; of which in Attat hospital, the oldest health facility in Ethiopia to introduce the concept of MWH, included aspects of MWH service utilization in its annual service statistics for 2010. A total of 642 mothers have been admitted to the MWA in 2011 as compared to 1,101 non-MWH users who delivered at the hospital during the same time period. Caesarean section rates were 40.6% among MWA users which were double the 20% among the non-MWH users. The instrumental delivery rate was lower at 19.3% as compared to 29% among the non-MWH user mothers. Craniotomy rate (for obstructed labour) was much higher among the non-MWH (1.4% vs. 0%). Stillbirth rate was markedly lower among MWH users (1.2%) compared to 10% among non-MWA users. There were no maternal deaths among MWH users compared to 3 (0.27%) non-MWH user mothers who died. There was indirect evidence that the service improved maternal health outcome while caesarean sections rates were much higher among clients' admitted to maternity waiting homes compared to non-users. They concluded that Provided that maternity waiting for home service is standardized and institutionalized, it can be one approach to improving access to comprehensive emergency obstetric care for rural mothers in Ethiopia who are challenged by the distance to access services (24).

2.2. Maternal waiting home and perinatal outcomes

A study done in Leo PDR in 2008 shows that even though all babies are survived and no morbidity has been reported since the opening of silk home, it is premature to assess at that stage its impact on infant mortality and morbidity (13).

A systematic review was done in the University of Aberdeen, Scotland in 2012 revealed that community-targeted interventions reduce neonatal mortality but not how the referral components contributed, and the reduction in stillbirths observed in studies of maternity waiting homes makes this a potentially promising intervention (19).

The systematic review which was conducted in 2014 shows that there is insufficient evidence to determine the effectiveness of maternity waiting facilities for improving neonatal outcomes (16).

Other systematic review done in 2017 indicated that perinatal mortality rate is 60/1,000 in MWH compared to 65/1,000, RR 0.782 (CI 0.602 to 1.120) in non-MWH. Stillbirth rate is 18/1,000 in MWH and 184/1,000 in non-MWH, RR 0.204 (CI 63.88 to 94.08). Neonatal mortality rates are 16/1,000 in MWH and 15/1,000 in non-MWH, RR 0.862 (CI 0.392 to 1.628). The results indicate that MWH significantly reduces stillbirths. However, Perinatal and neonatal deaths are not statistically different between the two groups (12).

In 2017, Study done in Tanzania shows that; there were no differences in the proportion of babies born alive in the two groups, though there are significant differences in birth weight distribution, with more babies weighing < 2500 g in the group with direct hospital access (5.6 vs 1.4%). Very early and early neonatal mortality are lower in the MWH group, while perinatal mortality is not different between the two groups (23).

Retrospective cohort study done in Attat rural hospital of Ethiopia in 2010 shows that Stillbirth rates are 17.6 per1000 births (95% CI, 14.8–21.0) and 191.2 per 1000 births (95% CI,185.4–197.1 MWA women and non- MWA women respectively (11).

2.3. Maternal waiting home and Utilizations of health facility

The qualitative (FGD) part of the study done in Leo PDR in 2008 indicated that many women who were potential clients of the facilities of the Silk Homes said they want to use the Silk Homes because they perceived the Silk Homes as “free” and “safe” (13).

A study done in Timor-Leste in 2011 shows there is no significant difference in the distribution of births between distance categories after the maternity waiting home was implemented. That is women from remote areas are no more likely to have a facility-based birth once the maternity waiting home was functioning than before it was available (18).

Retrospective cohort study done in six sub-zobas of Northern and Southern Red Sea Zones of Eritrea in 2009 shows that, they compare before and after MWH services started in 11 health facilities, and they found that during the year prior to the introduction of the homes, there were 266 deliveries, 5 maternal deaths in the health facilities and the maternal mortality rate was nearly 2%. After the introduction of maternity waiting homes, 866 deliveries averaging 415 annually; an increase of more than 50 %, from 2007 to 2009 for a period of 20 months were recorded with no maternal death. The perinatal mortality rate of 1.6% was reported after the introduction of the maternity waiting homes. And they concluded that Deliveries in the maternal waiting homes increased deliveries by 56% with no maternal deaths reported, making it a successful strategy targeted at reducing maternal and perinatal mortality rates (10).

Literature review done in 2015 in Sera lion shows that the review does not identify any studies that offered quantitative evidence of the impact of MWHs on the time taken between complications arising and receiving appropriate care. However, there is qualitative evidence which suggests that MWHs can help to reduce the delay in accessing EmONC by enabling women to travel before complications arise (20).

The study done in Malawi suggested that; Type two delay (reaching the healthcare facility) is one of the predictors of maternal death and the main reasons for type 2 delays are; Delays in reaching a healthcare facility due to long distance was reported for 49 women (52.1%). An ox cart, the slowest mode of transport, was used in six cases. A total of 37 (39.4%) women were delayed due to high transport cost. It took an average of two hours to secure adequate money for transport when the decision to seek care was made (25).

The study done in 2017 in Zambia showed that including implementation of Saving Mothers Giving Life, a large-scale maternal health systems strengthening program, among women whose catchment area facilities, had an MWH, those women with MWHs in their catchment area that is rated medium or high quality had a 95% increase in the odds of facility delivery than those whose catchment area MWHs are of poor quality (OR: 1.95, 95% CI 1.76, 2.16) (14).

In 2016, a Cross-sectional study done among 134 health centers in 4 regions of Ethiopia and it shows that; 94 (70%) health centers-79% in SNNP, 73% in Amhara, 67% in Oromia and 55% in Tigray- had MWHs at the time of the survey mainly to house prenatal mothers. At the time of the survey, 41 (44%) MWHs had mothers and hosted 137 (mean of 1.3) women. Typologies of MWHs, their capabilities of holding clients at a time and availability of social and health care services vary from region to region. Protocols to manage the maternity waiting homes and admission and discharge criteria are not available elsewhere. And the qualitative part of this study also shows that; most mothers liked their interaction with each other, they are not satisfied with the health care services. The absence of someone who could care for their families at home; the negative perception of the community; the lack of bathrooms, kitchen and toilets in the MWHs; the fear of staying in a crowded room; problems related to food (cooking, amount, and/or frequency); and the lengthy stay at the homes prior to giving birth, are some of the challenging factors the women stated (4).

2.4. Other factors related with maternal and perinatal health outcomes

Census done at 4 million health facility (births between 2012 and 2014) in china in 2016 found that; stillbirth rate of 8.8 per 1000 births (95% CI; 8.8–8.9). The stillbirth rate was particularly high for women younger than 15 years of age, those who had not sought antenatal care, the unmarried, those with no education and those who had had four or more births with 59.9, 38.3, 32.5, 26.9, 23.2per 1000 births respectively. A high proportion 78.2% of stillbirths occurred at gestational ages of less than 37 weeks. Of babies born at normal gestations (37–41 weeks), maternal complications substantially increased the risk of stillbirth (odds ratio comparing antepartum or intrapartum complications with no complication 3.96 [95% CI 3.66–4.29] (26).

A systematic review was done in Sub-Saharan Africa in 2014 which found that the overall weighted PMR and MMR was 63 (95% CI: 54–73) per 1000 births and 727 (95% CI: 570–913) deaths per 100, 000 live births respectively. MMR was lower for home based than facility based delivery (599 Vs 945 per 100000 live births). Whereas PMR was higher home than facility based delivery (70 vs 56 per 1000 births)(27).

A prospective longitudinal study was done at northwest Ethiopia in 2013, revealed that PMR, SBR and ENMR was 50.2, 23.4, 27.5 per 1000 total births respectively. and the main predictors associated with increased risk of perinatal death were previous still birth [(AOR = 8.38, 95% CI: 3.94, 17.83)], twin birth [(AOR = 7.09, 95% CI: (3.22, 15.61)], not receiving tetanus toxoid vaccine during the index pregnancy [(AOR = 3.62, 95% CI: 1.57, 8.34)], short birth interval of less than 24 months [(AOR = 2.58, 95% CI: (1.61, 4.13)], maternal illiteracy [(AOR = 4.83, 95% CI: (1.45, 16.05)] and mothers' running own business [(AOR = 5.40, 95% CI: 1.40, 27.96)](28).

Study done in north and south central Ethiopia in 2013 shows that a total of 688 (14.2%) women reported that they had at least one form of morbidity. Of the 220 women who reported to have morbidity during labor and delivery, prolonged labor, hemorrhage and premature rapture of membranes was accounted for 89 (40.5%), 74 (33.6%) and 23 (10.5%) of the cases respectively. And the independent predictors of maternal morbidity were High parity, wealth status and facility delivery(29).

Other study also done in Ethiopia in 2014, found that in Ethiopia, factors which were contributed to the high maternal mortality ratio, stillbirth and neonatal mortality rates were the high total fertility rate, low utilization of contraceptive methods, low adult literacy rate, low income and prevalent harmful traditional practices and the three delays had a great contribution as well(30,31).

Systematical analysis done in 2016 shows that the estimated global SBR in 2015 was 18.4 per 1000 births (2.6 million stillbirth), of which 98% of all stillbirths occur in low-income and middle-income countries; and 77% in south Asia and sub-Saharan Africa(32).

A population based nested case control study done at rural north Ethiopia in 2017 shows that; the NMR was 18.6 (14.8, 23.2) per 1000 live births. Neonatal mortality declined with an increase in family size, but it inclined with previous history of losing a newborn(33).

Study done at Bonga General and Mizan Tepi University Teaching Hospitals southwestern Ethiopia in 2016 revealed that; women who attended antenatal care, had labor length ≥ 24h, developed uterine rupture, have different antenatal risks, and weight of baby ≥ 2.5 kg were 40% less risk, 2.4 times at risk, 5 times more likely, 4.5 times more likely, 73% less likely for stillbirth respectively(34).

Study done in Ethiopia in 2017 which evaluated survival status of the under five children and it revealed that; under-five children who live in Addis Ababa had a lower hazard (risk) of death (p value = 0.048) than others regions. Under-five children who lived in rural areas had 18% (p value = 0.01) more risk of death than those living in urban areas. Furthermore, with older mothers, the chance of a child dying before reaching the age of 5 is lower(35).

Study done in Jimma University specialized hospital, Ethiopia in 2017 shows that; the incidence rate of stillbirth was 80 per 1000 total births. Absence of mother complication (OR = 0.1, 95% CI (0.04-0.2)), referral from other health facility (OR = 0.3, 95% CI (0.1-0.7)), having antenatal care (OR = 0.3, 95% CI (0.1-0.7)) and normal vaginal delivery (OR = 0.2, 95% CI (0.1-0.8)) were an independent close association with stillbirth(36).

As a summary of this literature review there are a controversial results regarding the effect of MWH utilization on maternal and perinatal health outcomes this may result due to selection bias, that is almost all the studies all mothers who stayed in the MWH even for an hour they were considered as MWH utilizers, therefore, this may hide the true effect of MWH utilization on maternal and perinatal health outcomes. Hence this study will address the gap.

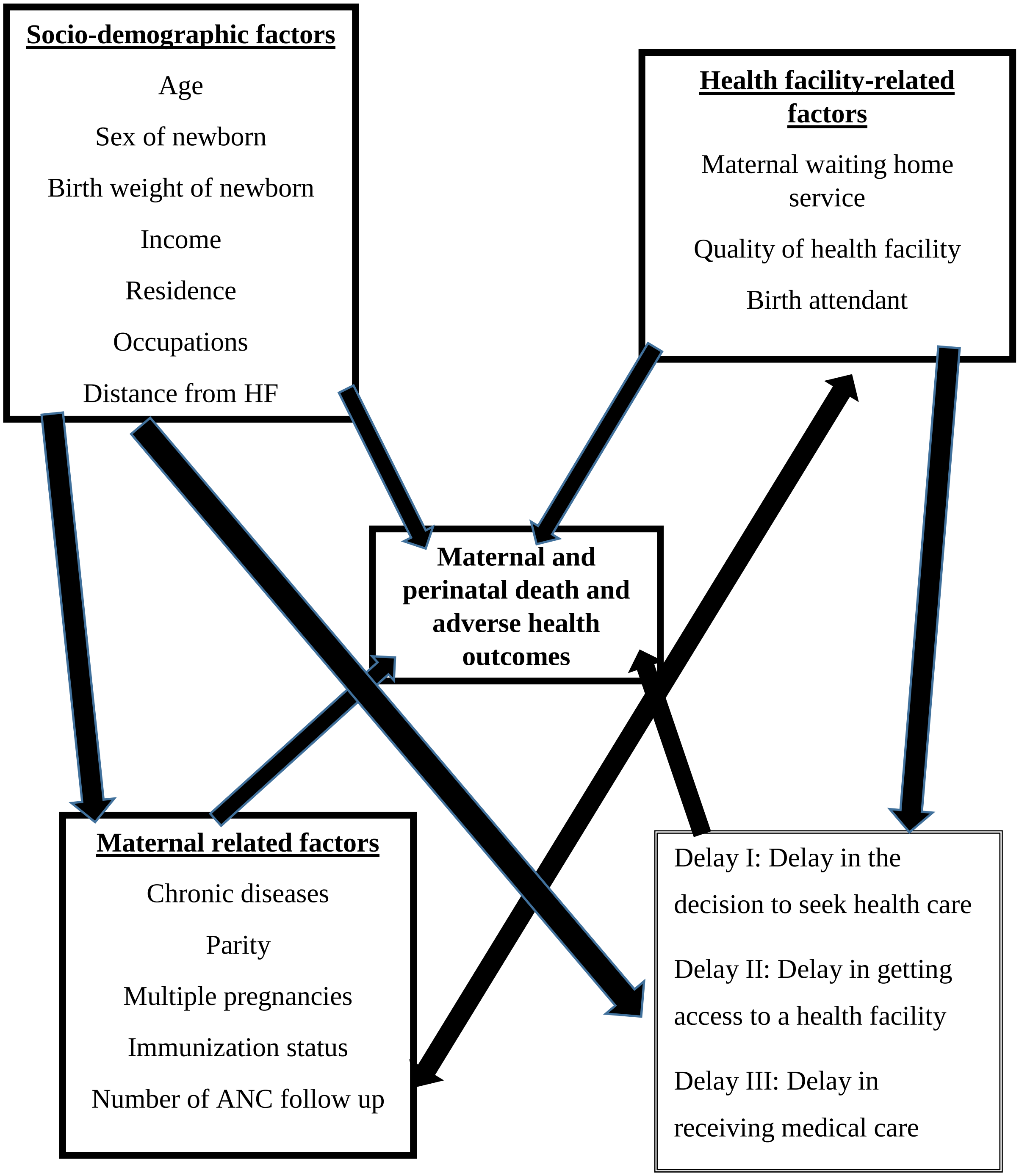

Figure 1: Conceptual framework adopted after revising thorough literature

3. Objectives

3.1. General objective:

To assess the effect of MWH utilization on maternal and perinatal health outcomes, among mothers who gave birth in Selekleka primary hospital, Tigray, Ethiopia, 2017/2018.

3.2. Specific objectives

1. To determine the effect of MWH utilization on maternal health outcomes.
2. To assess the effect of MWH utilization on prenatal health outcomes.

4. Methodology

4.1. Study design

Institutional based retrospective cohort study was conducted.

Exposed: mothers who gave birth in the last 3 years (01/01/2015 - 31/12/2017) at Selekleka primary hospital after admitted through MWH and who were stayed in MWH at least for 7 days.

Non-exposed: mothers who gave birth in the last 3 years (01/01/2015 -31/12/2017) at Selekleka primary hospital admitted directly without MWH or stayed in MWH for less than 7 days.

4.2. Study area and period

This study was conducted from 01/01/2018 to 30/01/ 2018 in Selekleka primary hospital, which is found in Medabay Zana district, northwest Tigray Ethiopia, which is located 1054 Km far from Addis Ababa the capital city of Ethiopia and 274 Km far from Mekele the capital city of Tigray. In its catchment area, there are 6 health posts with 44,799 total populations. In addition to this, it is serving as a referral to the 6 health centres for a total of 144,000 people of woreda Medabay Zana. It gives C/S services in additions to other routine services. The total numbers of staff in this hospital are 77 of which 8 are midwives, 1 medical doctor and 2 are MSc.

This hospital has been starting MWH services since 2013. For this service, there is separated one room with 10 beds, and one diploma midwifery and health assistant are assigned permanently to providing care and health educations. The service is given free of charge including their food. But they prepare their food by themselves.

Location of the study area:

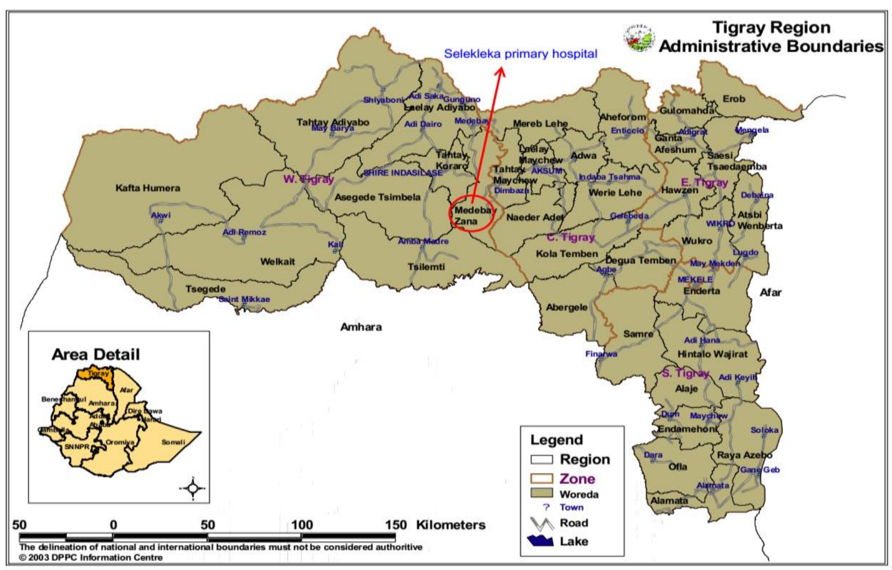

Figure 2: location of Ethiopia in Africa, 2017,

Figure 3: location of Selekleka primary hospital in Tigray region, 2017

4.3. Source and study populations

4.3.1. Source populations

All mothers who gave birth in Selekleka primary hospital in the last three years.

4.3.2. Study populations

For Exposed: All randomly selected mothers who gave birth in Selekleka primary hospital in the last 3 years (from 01/01/2015 to 31/12/2017) who were stayed in the maternal waiting home for at least 7 days.

For Non-Exposed: All randomly selected mothers who gave birth in Selekleka primary hospital in the last 3 years (from 01/01/2015 to 31/12/2017) who were not stayed at all or stayed for less than 7 days in the MWH.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion criteria

Mothers who gave birth in the last 3 years at Selekleka primary hospital (from 01/01/2015 to 31/12/2017).

4.4.2. Exclusion criteria

Mothers who were referred to other hospitals and didn't have any feedback later about their health status.

4.5. Sample size determinations

Sample size was calculated using Epi info version 7.2.0.1.

For the first objective, with the assumptions of 95% CL, 80% power, 19.3% of maternal complications (instrumental delivery) among the exposed, 29% maternal complications (instrumental delivery) among non-exposed, Relative Risk of 0.67 and exposed to a non-exposed ratio of 1:1. The total number of sample size calculated was then 624 (exposed to MWH = 312 and non-exposed to MWH = 312) (24).

For the second objective, with assumptions of 95% CL, 80% power, 1.2% of stillbirth among exposed, 10% stillbirth among non-exposed, Relative Risk of 0.12 and exposed to a non-exposed ratio of 1:1. a total of sample size of 212 (exposed = 106 and non-exposed = 106) was determined (24).

According to the above results, the total number of sample size for the first objective was greater than for the second. Therefore the total number of sample size in this study after adding 10% for data incompleteness was determined as **686** with **343** exposed and **343** non-exposed.

4.6. Sampling procedure

A pre-sampling survey was conducted from registrations in Selekleka primary hospital and then developed two independent sampling frames by taking MWH utilizing (exposure) status of mothers as stratifying variable. The sampling frames constituted 606 for MWH user (exposed) and 3,404 for MWH non-user (non-exposed) mothers registered during the study period. From each sampling frame 343 exposed and 343 non-exposed mothers were selected using simple random sampling with computer-generated random numbers. But for mothers having more than one child, only the recent one was included. Finally, relevant data of each selected mother was extracted from medical records.

4.7. Data collection procedures

4.7.1. Data collection tools

Secondary data was extracted from different medical records (delivery, MWH, PNC, HMIS, Neonatal, perinatal, maternal mortality registrations and patients folder) using structured data extraction tools which were prepared based on EDHS questionnaires related to maternal health with some modifications.

4.7.2. Data collection personnel

The data were collected by two BSC nurses, and one health officer as a supervisor, who were working in other facilities of Medabay Zana district.

4.7.3. Data quality control

Two days training were given to data collectors about the objective of the study, sampling and data extraction procedures. Pretest was conducted among 5% of the total sample size to assess the competency of data collectors and to check reliability of data extraction tool. Data collection was supervised daily by the supervisor and principal investigator at the center to check consistency, clarity and completeness of the filled questionnaires.

4.8. Study Variables

4.8.1. Dependent Variables:

1. Maternal health outcomes (Mothers who were diagnosed with either of sepsis, uterine rupture, PPH, APH, obstructed labour, preeclampsia and eclampsia or maternal death)
2. Perinatal health outcomes (stillbirth or neonates who were diagnosed with either of asphyxia, pneumonia, perinatal sepsis, or early neonatal death)

Survival time in days for mothers and newborns from the time of admission to the hospital up to the development of either of the health outcomes or discharge from the hospital.

Mothers or newborns develop either of the health outcomes between admission to the hospital and discharge from the hospital were considered as having an event.

Mothers or newborns discharged before developing complications or death were considered as censored.

4.8.2. Main exposure variable:

- Maternal waiting home utilization(utilizers versus non-utilizers)

4.8.3. Possible confounders

1. Socio-demographic variables: Age, Residence, Occupations, Education and Religion.
2. Maternally related variables: Chronic diseases (DM, HIV, Cardiac diseases, TB, Cancer, Anemia), Previous C/S, Nutritional status, Immunization status of the mother (tetanus), ANC follow up, Parity and Multiple pregnancies.
3. Health facility related variable: primary attendant of the delivery.

4.9. Operational and standard definitions

4.9.1. Operational definitions

MWH Utilizers; pregnant mothers who were admitted and waited in MWH service for at least 7 days before starting of labour.

4.9.2. Definitions of terms

Maternal health outcomes; Mothers who were diagnosed with either of Sepsis, Uterine rupture, PPH, APH, obstructed labour, preeclampsia and eclampsia or maternal death.

Perinatal health outcomes; Neonates who were diagnosed with either of Asphyxia, perinatal sepsis, pneumonia, stillbirth or early neonatal death.

4.9.3. Standard definitions

Maternal mortality ratio; the number of maternal death per 100,000 live birth. Maternal death is the death of a woman while pregnant or within 42 days of termination of the pregnancy, irrespective of the duration and site of the pregnancy, and can stem from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

Perinatal mortality rate; it is calculated as the number of perinatal deaths per 1,000 births. Perinatal deaths comprise stillbirths (pregnancy loss that occurs after 7 months of gestation) and early neonatal deaths (deaths of live births within the first 7 days of life).

4.10. Data Management and Analysis procedures

4.10.1. Data Management

The data was extracted from different medical registrations of Selekleka primary hospital and then entered into a computer using Epi Info version 7.2.0.01 software and then exported to STATA V.12 statistical software for data cleaning, coding and for further data analysis.

4.10.2. Data Analysis

Descriptive statistics such as frequencies, proportions, incidence rate, measures of central tendency and dispersion were calculated to describe socio-demographic and other related variables of the study population that were displayed using tables, figures and graphs. In addition, Chi-square test was performed to check the significant differences of socio-demographic factors and possible confounders among exposed and non-exposed. Incidence density rate was calculated to describe the outcome variables among exposure and non-exposure. The degree of association of dependent variables between exposed and control group was measured using hazard ratio with 95% confidence interval.

A survival analysis was employed using life table and Kaplan-Meier to see the survival function of cohorts and Log-rank test to compare the survival curves of exposed and non-exposed groups.

A bivariable analysis was carried out using Cox proportional hazard regression model. Six and eight variables with P-value less than 0.3 were entered in to the multivariable analysis in the first and second model respectively.

The assumptions of proportional hazard were checked using Goodness fit of test that is Schoenfeld test result of the mothers (P-value = 0.894) and newborns (P-value = 0.998). Both the results were >0.1. Which indicated that the proportional hazard assumptions were fulfilled in both models. A multivariable analysis was carried out with enter method to fit two models (maternal and perinatal health outcomes) using Cox proportional hazard regression model to determine crude and adjusted Hazard Ratios (HR) with their 95% CI and it verified time-to-event relationship by controlling potential covariates. Variables with P-value < 0.05 were considered as significant in the final two models.

4.11. Ethical considerations

Ethical clearance and permission letter were taken from the Ethical Review Committee (ERC) of Addis Ababa University Medical faculty, School of Public Health. An official letter was written to Selekleka primary hospital requesting facilitation to conduct the research study and this official letter approved and distributed to the respective units of Selekleka primary hospital. Confidentiality and privacy was maintained during data collection, analysis and reporting in which the information obtained from the data will not be shared other than the data collectors and principal investigator and this was assured by obtaining institutional written consent from Selekleka primary hospital and by providing Information sheet which explains the purpose, benefit, and short and long-term effect of the study on the study participants.

4.12. Dissemination Plan

The result of this study will be presented to Addis Ababa University, school of public health and the copies will be given to Selekleka primary hospital administration office and Medabay Zana woreda health office. The findings will also be disseminated to other concerned bodies via presentation and publication.

5. Results

5.1. Characteristics of mothers and their newborns who attended their delivery in Selekleka primary hospital from Jan 2015 to Dec 2017

Out of the total 686 estimated sample size, 673 mothers were included in the study, 1.89% were excluded due to data incompleteness. Among these, 330 were using MWH (exposed) and the remaining 343 were not using MWH (non-exposed). All mothers who gave birth between January 2015 and December 2017 were retrospectively followed with their child from the time of admission to discharge. The total time at risk of mothers and their children were 5298 and 5572 person-days respectively. With total time at risk of 4,346 and 952 person-days for exposed and non-exposed mothers respectively. And time at risk of newborns born from exposed and non-exposed mothers were 4,425 and 1,147 person-days respectively.

5.1.1. Maternal characteristics

Comparing baseline characteristics of exposed (MWH users) and non-exposed (MWH non-users) mothers in Selekleka primary hospital, all of the exposed mothers 330 (100%) and almost all of the non-exposed (99.13%) mothers were orthodox Christians, Relating to their occupational status almost similar proportion of the exposed (43.3%) and non-exposed (42.6%) mothers were farmers; Associating with their residence all of exposed (100%) and relatively lower proportion of the non-exposed (80.5%) mothers were living in rural area. In most of the baseline maternal characteristics [religion, occupation, age, parity, history of CS] except that of residence there was no significant baseline difference between exposed and non-exposed mothers.

Likewise, regarding other characteristics of the mothers; all exposed mothers had at least one ANC follow up and the lowest number 236 (68.8%) were among the non-exposed. In both cohorts low proportion of non-exposed (4.4%) mothers gave birth by C/S and similarly among exposed (5.8%). All the mothers were attended by health professionals in both cohorts. Similar proportion 1.8% and 2.6% of exposed and non-exposed respectively were gave birth twins. Furthermore regarding the status of the chronic diseases; in both cohorts, there were no recorded TB, cancer, HIV, and DM. and there was no recorded maternal death in both of the groups as well. From the above-listed variables; ANC follow (P-value < 0.001) were statistical significant difference among the exposed and non- exposed mothers while in the rest of the variables there was no statistically significant difference among exposed and non- exposed mothers (Table 1).

Table 1: Characteristics of mothers attending delivery service in Selekleka Primary Hospital, from Jan 2015- Dec 2017 (N= 673, Exposed = 330, Non-exposed = 343).

Variable	Category	Exposure Status				X^2	P-value
		Exposed		Non-Exposed			
		Number	%	Number	%		
Occupation	Farmer	142	43.0	146	42.6	2.45	0.294
	Housewife	115	34.9	105	30.6		
	Unknown	73	22.1	92	26.8		
Residence	Urban	0	0.0	67	19.5	71.59	< 0.001
	Rural	330	100	276	80.5		
ANC	0	0	0.0	104	30.3	118.47	< 0.001
	1 - 3	269	81.5	192	56		
	≥4	61	18.5	47	13.7		
History of C/S	No	329	99.7	340	99.1	0.93	0.335
	Yes	1	0.3	3	0.9		
Mood of delivery	SVD	304	92.1	309	90.1	5.80	0.055
	Instrumental	7	2.1	19	5.5		
	C/S	19	5.8	15	4.4		
Type of birth given	Singleton	324	98.2	334	97.4	0.50	0.479
	Twin	6	1.8	9	2.6		
Age	<20	56	17.0	53	16.2	0.86	0.652
	20 – 34	230	69.7	250	71.3		
	≥35	44	13.3	40	12.5		
Parity	1	176	53.3	194	56.6	1.02	0.599
	2 – 4	113	34.3	105	30.6		
	≥5	41	12.4	44	12.8		

ANC: antenatal care, C/S: caesarean sanctions, SVD: spontaneous vaginal delivery, X^2: chi-square

5.1.2. Perinatal characteristics

Relatively less proportion of males born from exposed 179 (54.2%) than non-exposed 198 (57.7%) mothers. Relating to the birth outcome of the newborns there were comparatively less number of stillbirths from exposed 11 (3.3%) than non-exposed 17 (5.0%) mothers. But in both sex, and outcome of the newborn, there was no statically significant difference among the cohorts. Regarding their birth weight relatively high proportion of newborns with low birthweight (<2500gm) born from non-exposed mothers than exposed mothers and there was statically significant difference between the groups (Table 2).

Table 2: Characteristics of newborns born from exposed and non-exposed mothers, in Selekleka Primary Hospital from Jan 2015- Dec 2017, (N = 673, exposed =330, non-exposed = 343).

Variable	Category	Exposure status				X^2	P-value
		Exposed		Non -Exposed			
		Number	%	Number	%		
Sex of the newborn	Male	179	54.2	198	57.7	0.83	0.363
	Female	151	45.8	145	42.3		
Outcome of the newborn	Alive	317	96.1	324	94.4	1.11	0.574
	Stillbirth	11	3.3	17	5.0		
	Early neonatal death	2	0.6	2	0.6		
Newborn weight in grams	≥2500gm	319	96.7	314	91.5	7.89	0.005
	<2500gm	11	3.3	29	8.5		

X^2: chi-square, gm: gram, N: number

5.2. Incidence of maternal complications and deaths among exposed and non-exposed mothers

Thirty-seven (11.2%) exposed, and 66 (19.2%) non-exposed mothers have developed at least one maternal complications. The overall estimated incidence of maternal complication, with its corresponding 95% CI was 19 (16 - 23) per1000 person days. Comparing the exposed and non-exposed mothers, it was 8.5 (6.2 – 11.7) per 1000 person- days among the exposed and 69 (54 - 88) per 1000 person- days among the non-exposed mothers.

From the type of complications obstructed labour was relatively highest incidence rate in both exposed and non-exposed mothers with 33.6 (23.8, 47.5) and 2.5 (1.4, 4.6) per 1000 person days respectively. And the relatively lowest incidence rate in both exposed and no-exposed mothers was puerperal sepsis with 0.5(0.1, 1.8) and 1.1 (0.1, 7.5) per 1000 person days respectively. And there was no maternal death recorded in both cohorts.

Table 3: Incidence rate of maternal complications per 1000 person days among mothers who gave birth in Selekleka primary hospital, north Ethiopia, from Jan 2015 to Dec 2017.

Variables	Exposed (4346 person days)		Non exposed (952 person days)		Over all (5298 person days)	
	Event	IDR(95%CI)	Event	IDR(95%CI)	Event	IDR(95%CI)
P. sepsis	2	0.5 (0.1 - 1.8)	1	1.1 (0.1 - 7.5)	3	0.6 (0.2 - 1.7)
PPH	9	2.1(1.1 - 4.0)	14	14.7 (8.7 - 24.8)	23	4.3 (2.9 - 6.5)
APH	9	2.1(1.1 - 4.0)	2	2.1 (0.5 - 8.4)	11	2.1 (1.1 - 3.7)
Obstructed labour	11	2.5(1.4 - 4.6)	32	33.6(23.8 - 47.5)	43	8.1 (6.0 - 10.9)
Preeclampsia	6	1.4(0.6 - 3.1)	10	10.5 (5.7 - 19.5)	16	3.0 (1.9 - 4.9)
Eclampsia	0	--------	7	7.4 (3.5 - 15.4)		1.3 (0.6 - 2.8)
M. death	0	--------	0	-------	0	------
Total Cx	37	8.5(6.2 - 11.7)	66	69.3(54.5 -88.2)	103	19.4(16.0 -23.6)

P. sepsis = puerperal sepsis, PPH = postpartum haemorrhage, APH = antepartum haemorrhage, M. death = maternal death, Cx = complications, IDR = incidence density rate, CI= confidence interval, RR= relative risk

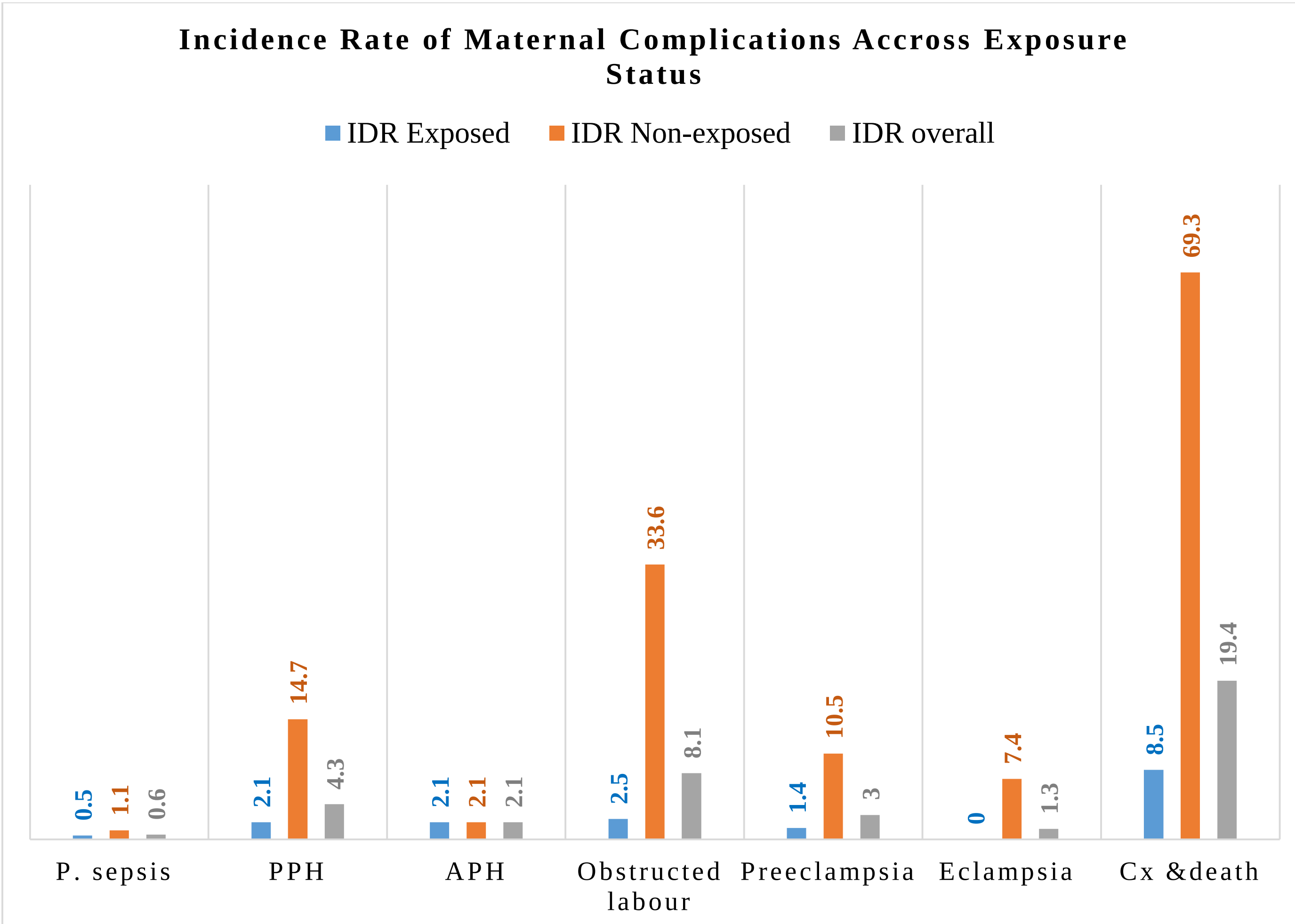

Figure 4: Incidence rate of maternal complications per 1000 person days among mothers who gave birth in Selekleka primary hospital, north Ethiopia, from Jan 2015 to Dec 2017.

5.3. Incidence of perinatal complications and deaths among exposed and non-exposed newborns.

The occurrence of complication or death of newborns born from exposed and non-exposed mothers were 29 (11.2%) and 54 (19.2%) respectively. The overall incidence rate with its corresponding 95% CI was 15(12 - 18) per 1000 person-days with 6 (4 - 9) and 50 (38 - 66) per 1000 person-days for newborns born from exposed and non-exposed mothers respectively.

Cumulative perinatal mortality rate with its 95% CI was 5.7 (4.1 - 8.1) per 1000 person-days, with 2.9 (1.7 - 5.0), and 16.6 (10.6 - 26.0) per 1000 person-days for the newborns born from exposed and non-exposed mothers respectively. Similarly, SBR was higher among the newborns born from non-exposed 14.8 (9.2 - 23.8) than exposed mothers 2.5 (1.4 - 4.5) per 1000 person-days. Cumulative morbidity rate of the newborns were 10.1(7.7 - 13.1) per 1000 person-days, with higher among newborns born from non-exposed 32.3(23.4 - 44.5) than exposed mothers 4.3 (2.7 - 6.7) per 1000 person-days.

Table 4: Incidence rate of perinatal complications (morbidity and mortality) per 1000 person days of the newborn who was born in Selekleka primary hospital, from Jan 2015 to Dec 2017.

Variables	Exposed (4428 person days)		Non exposed (1147 person days)		Over all (5572 person days)	
	Event	IDR (95% CI)	Event	IDR (95% CI)	Eve nt	IDR (95% CI)
Still birth	11	2.5 (1.4 - 4.5)	17	14.8 (9.2 - 23.8)	28	5.0 (3.5 - 7.3)
E.N. death	2	0.4 (0.1 - 1.8)	2	1.7(0.4 - 6.9)	4	0.7 (0.3 - 1.9)
P. death	13	2.9 (1.7 - 5.0)	19	16.6 (10.6 - 26.0)	32	5.7 (4.1 - 8.1)
Asphyxia	12	2.7 (1.5 – 4.8)	26	22.7 (15.4 - 33.3)	38	6.8 (5.0 – 9.4)
N. sepsis	4	0.9 (0.3 - 2.4)	9	7.8(4.1 - 15.1)	13	2.3 (1.4 - 4.0)
Total morbidity	16	3.6 (2.7 - 6.7)	35	30.5 (23.4 - 44.5)	51	9.2 (7.7-13.1)
Total Cxs or deaths	29	6.5 (4.5 - 9.4)	54	47.1(36.1 – 61.5)	83	14.9 (12 – 18.5)

IDR = incidence density rate, RR = relative risk, CI = confidence interval, E.N. death = early neonatal death, P. death = perinatal death, Cxs = complications, N. sepsis = neonatal sepsis.

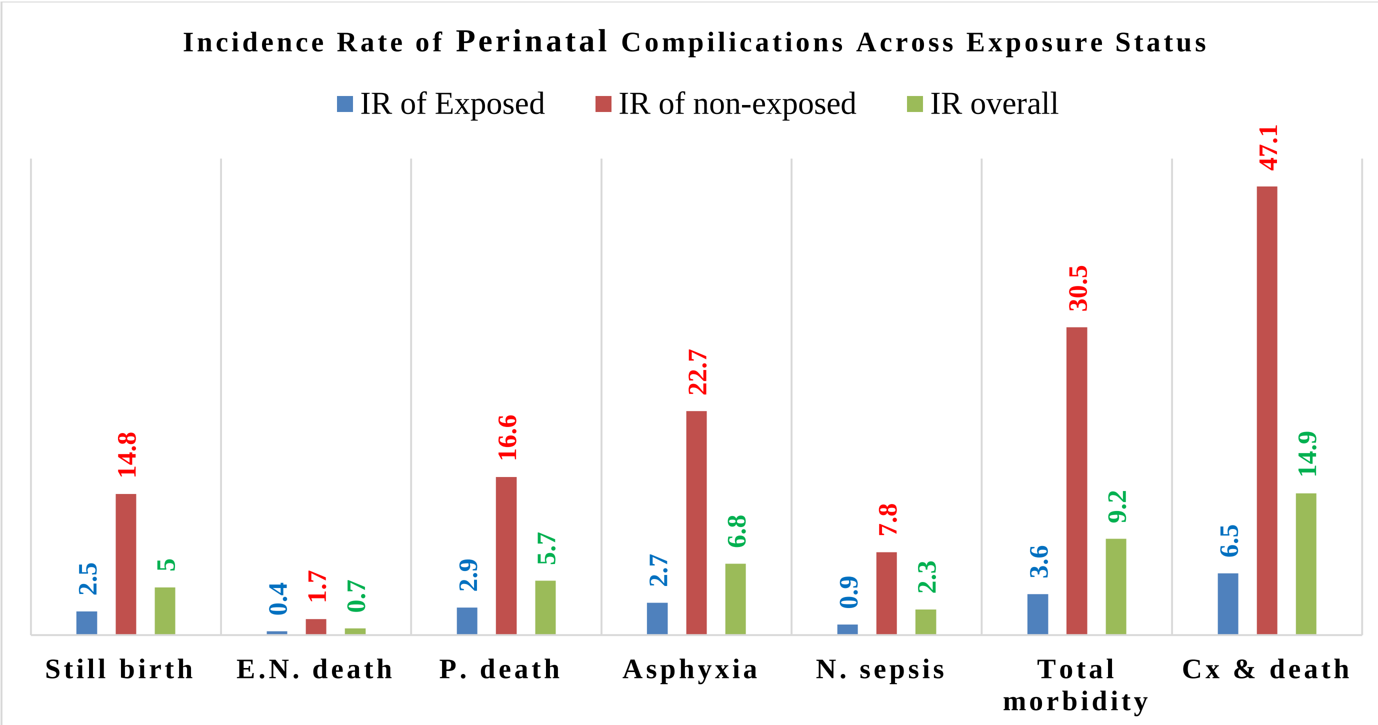

Figure 5: Incidence rate of perinatal complications (morbidity and mortality) per 1000 person-days of the newborn who was born in Selekleka primary hospital, north Ethiopia from Jan 2015 to Dec 2017.

5.4. Survival analysis of the study subjects

Thirty-seven (11.2%) of exposed, 66 (19.2%) of non-exposed mothers have developed complications and were treated as an event in the analysis. The minimum follow up period in days was 1 day for both of them and the maximum days of follow up were 59 and 31 for exposed and non-exposed respectively.

In both group majority of the complications were occurred in the first 5 days of follow up with higher magnitude among the non-exposed mothers 45(68.2%) than exposed mothers 12 (32.4%).

Life table analysis was used to estimate the survival probabilities of mothers who gave birth in Selekleka primary hospital, The rate of survival at the end of 5 days where higher among the exposed mothers (96.36%) than the non-exposed mothers (79.41), and then the survival rate of exposed mothers at the end of 50 days were 42.11% and remain till all mothers were censored (60 days), whereas the survival rate of non-exposed mothers was sharply declined to 23.0% at the end of 20 days of follow up and it remained till all mothers censored (30 days) (table 3). In agreement with life table survival estimate, the Kaplan Meier survival curve using log-rank test showed a statistically significant difference in survival among the cohorts with a log-rank statistic of 90.35, df= 1, P-value <0.001(Figure 6).

Table 5: Survival of mothers using life table by MWH user status, Selekleka primary hospital, 2015-2017

Interval	Exposed (MWH users)				Non-Exposed (MWH non-users)			
(days)	N	Death or complicated	Censored	Survival	N	Death or complicated	Censored	Survival
0-5	330	12	1	0.9636	343	45	249	0.7941
5-10	317	9	116	0.9301	49	13	17	0.5392
10-15	192	6	100	0.8908	19	7	7	0.2957
15-20	86	4	34	0.8392	5	1	1	0.2300
20-25	48	0	21	0.8392	3	0	2	0.2300
25-30	27	2	9	0.7646	1	0	1	0.2300
30-35	16	0	4	0.7646	0	0	0	0.2300
35-40	12	2	1	0.6316	0	0	0	0.2300
40-45	9	0	2	0.6316	0	0	0	0.2300
45-50	7	2	2	0.4211	0	0	0	0.2300
50-55	3	0	2	0.4211	0	0	0	0.2300
55-60	1	0	1	0.4211	0	0	0	0.2300

Twenty-nine (8.8%) of exposed, 54(15.7%) of non-exposed newborns were developed complications (dead or complicated) and were considered as an event in the analysis. The minimum follow up period in days was 1 day and 3 days for newborns born from exposed and non-exposed mothers respectively, and the maximum days of follow up were 59 and 24 days for newborns born from exposed and non-exposed respectively.

Life table analysis was used to estimate the survival probabilities of newborns born from exposed and non-exposed mothers in Selekleka primary hospital, The rate of survival at the end of 5 days where higher among the exposed mothers (99.7%) than the non-exposed mothers (82.87%), and at the end of 15 days of follow up the survival rate of non-exposed mothers were sharply declined to35.91% and were remain till all newborn censored (25 days) whereas the survival rate of exposed mothers at the end of 40 days of follow up were sharply declined to 40.65 and was remain till all the newborns censored (60 days) (table 4). In agreement with life table survival estimate, the Kaplan Meier survival curve using log-rank test showed statistically significant difference among the cohorts with a log-rank statistic of 90.06, df= 1, P-value <0.001 (Figure 7).

Table 6: Survival of newborns born from exposed and non-exposed mothers by MWH user status, Selekleka primary hospital, 2015-2017.

Interval (days)	Newborn born from Exposed (MWH users)				Newborn born from Non-Exposed (MWH non-users)			
	N	Death or complicated	Censored	Survival	N	Death or complicated	Censored	Survival
0-5	330	1	1	0.9970	343	37	254	0.8287
5-10	328	16	112	0.9383	52	14	4	0.5387
10-15	200	3	106	0.9192	14	3	10	0.3591
15-20	91	1	35	0.9067	1	0	0	0.3591
20-25	55	1	23	0.8858	1	0	1	0.3591
25-30	31	1	10	0.8518	0	0	0	0.3591
30-35	20	4	8	0.6388	0	0	0	0.3591
35-40	8	2	5	0.4065	0	0	0	0.3591
40-45	1	0	0	0.4065	0	0	0	0.3591
45-50	1	0	0	0.4065	0	0	0	0.3591
50-55	1	0	0	0.4065	0	0	0	0.3591
55-60	1	0	1	0.4065	0	0	0	0.3591

MWH: maternal waiting home, N: number

Using Kaplan Meier survival test, survival probabilities were > 40% among MWH user mothers, about 20% among MWH non-user mothers. The Kaplan Meier survival test result using log-rank test showed that there were statistically significant differences in survival among the exposed and non-exposed mothers with X2 = 90.35, df = 1 and p < 0.001 (Figure 6).

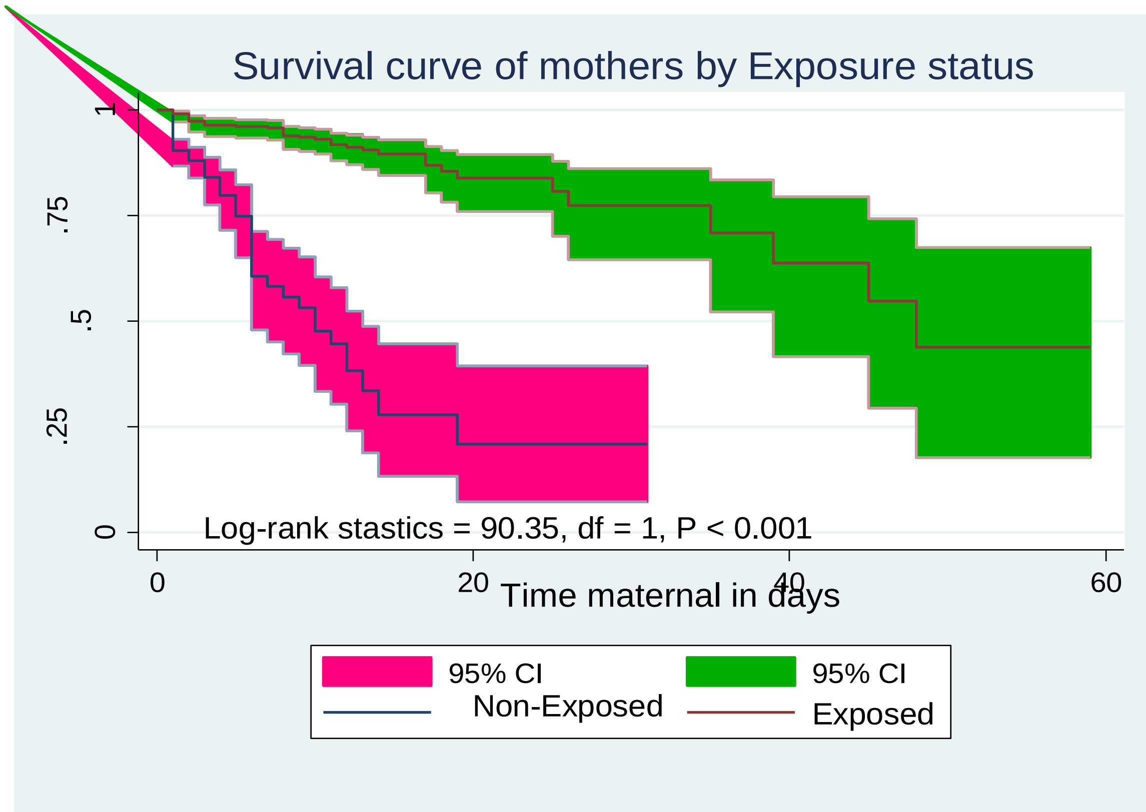

Figure 6: Survival curve of the mothers who gave birth at Selekleka primary hospital, north Ethiopia from Jan 2015- Dec 2017, using Kaplan Meier survival curve across their exposure status.

Similarly using Kaplan Meier survival test, the crude survival probabilities of newborns born from MWH user mothers was >40% and newborns born from MWH non-user mothers was about 35%. The Kaplan Meier survival was tested its significance level using log-rank test showed that there was statistically significant differences of survival among the cohorts with $X^2 = 90.06$, df = 1 and $p < 0.001$ (Figure 7).

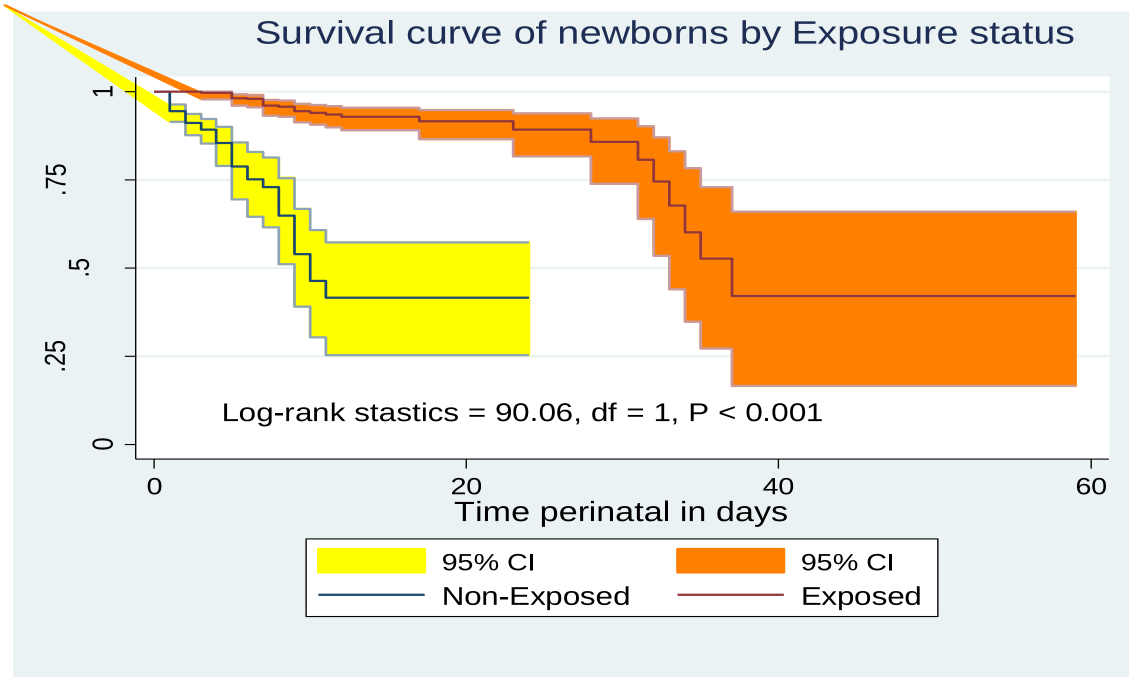

Figure 6: Survival curve of the newborn who was born at Selekleka primary hospital, north Ethiopia, from Jan 2015 – Dec 2017, using Kaplan Meier survival curve across their exposure status.

The estimated median survival time with its 95% CI of exposed 48(36 – 60) mothers were higher than non-exposed 10 (6.29 – 13.71) mothers.

Table 7: Mean and median survival time of mothers who gave birth in Selekleka primary hospital, from Jan 2015 – Dec 2017.

Means and Medians for Survival Time of the mothers

Exposure to MWH	Mean			Median		
	Estimate	SE	95% CI	Estimate	SE	95% CI
Non-Exposed	12.99	1.69	9.68 - 16.30	10	1.90	6.29 - 13.71
Exposed	43.64	2.73	38.29 - 48.98	48	6.13	36.0 - 60.01
Overall	38.35	2.43	33.59 - 43.11	45	5.72	33.80 - 56.23

SE: standard error, CI: confidence interval, MWH: maternal waiting home

Similarly estimated median survival time of the newborns with its 95% CI of newborns born from exposed 37(32.6 - 41.4) mothers were higher than born from non-exposed 10(8 - 12) mothers (Table 8).

Table 8: Mean and median survival time of newborns who were born at Selekleka primary hospital, north Ethiopia from Jan 2015 – Dec 2017.

Means and Medians for Survival Time of newborns						
Exposure MWH	Mean			Median		
	Estimate	SE	95% CI	Estimate	SE	95% CI
Non-Exposed	13.94	1.31	11.37 - 16.51	10.0	1.03	7.98 - 12.02
Exposed	42.01	3.44	35.27 - 48.75	37.0	2.26	32.58 - 41.42
Overall	38.08	3.12	31.96 - 44.19	35.0	1.91	31.25 - 38.75

SE: standard error, CI: confidence interval, MWH: maternal waiting home

5.5. Bi-variable and multivariable analysis (Cox regression) of maternal and perinatal health outcomes

5.5.1. Maternal health outcomes

Exposure status, ANC visit and type of birth were significantly associated with maternal health outcomes in the bivariate analysis.

Before multi variable analysis (final model) proportional hazard assumption of each variable was checked using regressing 'Schoenfeld' residuals and their corresponding P-values. The overall global test result were (X^2 = 0.74, df = 7, P-value = 0.998). Fortunately, all the P-values were > 0.1, which indicate that all variables full fill the proportional hazard assumptions.

Therefore, after controlling other possible confounders two variables became statistically significant predictors of maternal complications in the final model. Exposed mothers were 89% less likely to develop maternal complication [AHR = 0.11, 95% CI = 0.07 - 0.15] than non-exposed and mother gave twin birth 3.4 time high risk to develop maternal compilation [AHR = 3.4, 95% CI = 1.5 – 7.4] than mothers gave singleton (Table 9).

Table 9: Determinants of maternal health outcomes who gave birth in Selekleka primary hospital, north Ethiopia, from 2015 to 2017.

Variable	Category	Complication status		CHR (95% CI)	P-value	AHR(95% CI)
		Complicated	Uncomplicated			
		Number (%)	Number (%)			
Exposure status	Non-Exposed	66 (64.1)	277 (48.6)	1		0.11(0.07 - 0.19)**
	Exposed	37(35.9)	293(51.4)	0.12(0.07 - 0.19)	<0.001*	
Residence	Urban	10 (9.7)	57 (10)	1		1.79(0.86 - 3.76)
	Rural	93 (90.3)	513 (90)	0.55 (0.28 - 1.07)	0.076	
Religion	Christian	102 (99.0)	568 (99.6)	1		6.6(0.82 - 53.2)
	Muslim	1 (1.0)	2 (0.4)	6.4(0.87, 46.6)	0.068*	
Occupation	Farmer	50 (58.8)	238 (56.3)	1.12(0.73, 1.72)	0.612	NI
	Housewife	35 (41.2)	185 (43.7)	1		
History of CS	No	101 (98.1)	568 (99.6)	1		1.85 (0.38 - 8.9)
	Yes	2 (1.9)	2 (0.4)	3.12(0.75, 12.9)	0.119*	
ANC visit	0	24(23.3)	80(14)	1		1
	1-3	61(59.2)	400(70.2)	0.23(0.14, 0.39)	< 0.001*	0.7(0.41 - 1.19)
	≥4	18(17.5)	90(15.8)	0.28(0.15, 0.54)	<0.001*	0.96(0.48 - 1.92)
Birth type	Singleton	95 (92.2)	563 (98.8)	1		3.4 (1.5 - 7.4)**
	Twin	8 (7.8)	7 (1.2)	3.6 (1.7, 7.4)	0.001*	
Age	<20	14(13.6)	95(16.7)	1		NI
	20 - 34	76(73.8)	404(70.9)	1.3(0.73, 2.28)	0.384	NI
	≥35	13(12.6)	71(12.4)	1.2(0.58, 2.64)	0.576	NI
Parity	1	56(54.4)	314(55.1)	1		NI
	2 - 4	35(34.0)	183(32.1)	1.02(0.67,1.55)	0.934	NI
	≥5	12(11.6)	73(12.8)	0.88(0.47, 1.65)	0.693	NI

AHR: Adjusted hazard ratio, CHR: Crude hazard ratio, CI: Confidence interval, CS: Caesarian sections, SPH: Selekleka primary hospital, ANC: Antenatal care, SD: Standard deviations, NI: Not included, *variables which included to the multivariable analysis, **significant in the final model (P-value <0.05).

5.5.2. Perinatal health outcomes

Exposure status, residence, and ANC visit, mood of delivery and weight of the newborn were significantly associated with perinatal health outcomes in the bivariate analysis (Table 10).

Before multi variable analysis (final model) proportional hazard assumption of each variable was checked using regressing 'Schoenfeld' residuals and their corresponding P-values. The overall global test result was (X^2 = 3.77, df = 9, P-value = 0.926) and fortunately, all the P-values were above 0.1, which indicate that all variables full fill the proportional hazard assumptions.

Therefore, after controlling other possible confounders four variables became statistically significant predictors of perinatal health outcomes in the final model, those variables are; newborns born from exposed mothers were 84% less likely to develop perinatal complication [AHR = 0.16, 95% CI: 0.08 - 0.31] than born from non-exposed**,** newborns born from complicated mothers were 2.91 times high risk to develop perinatal complications [AHR=2.91, 95% CI: 1.68 - 5.05] than born from uncomplicated mothers, newborn born from mothers came from rural area were 51% less likely to develop perinatal complications [AHR= 0.49 95% CI: 0.25 - 0.96] than born from mothers came from urban area, and newborns weighted less than 2500gm were 2.26 times more likely to develop perinatal complications [AHR = 2.26, 95% CI: 1.1 – 4.64] than newborn weighted 2500gm and above(Table 10).

Table 10: Determinants of perinatal health outcomes at Selekleka primary hospital, from 2015 to 2017.

Variable	Category	Health outcomes		CHR(95% CI)	P-value	AHR (95%CI)
		Dead/Complicated N (%)	Uncomplicated N (%)			
Exposure status	Non-Exposed	54(15.7)	289(84.3)	1		1
	Exposed	29(8.8)	301(91.2)	0.09(0.05-0.15)	<0.001*	0.16(0.08, 0.31)**
Residence	Urban	15 (22.4)	52 (77.6)	1		1
	Rural	68 (11.2)	538 (88.8)	0.20 (0.11, 0.36)	<0.001*	0.49(0.25, 0.96)**
Occupation	Farmer	39 (13.5)	249 (86.5)	1		NI
	Housewife	29 (13.2)	191 (86.8)	0.93 (0.58, 1.50)	0.764	NI
Type of birth	Singleton	79 (12.0)	579 (88.0)	1		1
	Twin	4 (26.7)	11 (73.3)	2.36 (0.86, 6.47)	0.094*	1.14(0.35, 3.70)
ANC visit	0	16(19.3)	88(14.9)	1		1
	1-3	49(59)	412(69.8)	0.24(0.13, 0.45)	<0.001*	0.61(0.32, 1.17)
	≥4	18(21.7)	90(15.3)	0.4(0.19, 0.81)	0.012*	0.89(0.42, 1.89)
Parity	1	42(50.6)	328(55.6)	1		1
	2-4	27(32.5)	191(32.4)	1.07(0.66, 1.73)	0.786	NI
	≥5	14(16.9)	71(12)	1.24(0.67, 2.3)	0.486	NI
Age	<20	11(13.2)	98(16.6)	1		NI
	20 - 34	59(71.1)	421(71.4)	1.17(0.62, 2.24)	0.626	NI
	≥35	13(15.7)	71(12)	1.41(0.63, 3.16)	0.398	NI
Mode of delivery	SVD	65 (78.3)	548 (92.9)	1		1
	Instrumental	8 (9.6)	18 (3.0)	4(1.9, 8.4)	0.001*	1.11 (0.48, 2.56)
	CS	10 (12.1)	24 (4.1)	2.11 (1.08, 4.13)	0.030*	0.51(0.21, 1.23)
Maternal Cx	No	520(88.1)	50(60.2)	3.77(2.43, 5.86)		1
	Yes	70(11.9)	33(39.8)	1	<0.001*	2.91(1.68, 5.05)**
Weight of newborn	<2500gm	13(15.7)	27(4.6)	3.67(2.02, 6.68)	0.026*	2.26(1.1, 4.64)**
	≥2500gm	70(84.3)	563(95.4)	1		1
Sex of newborn	Male	53 (63.9)	324 (54.9)	1		1
	Female	30 (36.1)	266 (45.1)	0.74 (0.47, 1.15)	0.184*	0.72(0.45, 1.15)

AHR: Adjusted hazard ratio, CHR: Crude hazard ratio, CI: Confidence interval, CS: Caesarian sections, ANC: Antenatal care, SD: Standard deviations, NI: Not included, *variables which included to the multivariable analysis, **significant in the final model (P-value <0.05), Cx: complication.

6. Discussion

Survival probability is significantly better among MWH user mothers and their newborns. Maternal morbidity rate is significantly lower among MWH user mothers. But there was no recorded maternal death in both groups. Similarly, perinatal morbidity and mortality rate is significantly lower among newborns born from MWH user mothers. Multiple births are another independent predictor of maternal complication. Newborns weighted less than 2500 gm at birth, born from mothers with complication and born from those lives in urban are found to be other independent predictors of perinatal complications (morbidity and mortality).

This study found that survival probability among the mothers who were used MWH (log-rank statistic= 90.35, df = 1, P-value <0.001) and their newborns (log-rank statistic= 90.06, df= 1, P-value <0.001) were significantly higher than non-user. Which is these mothers who admitted without using MWH were at high risk of developing a complications. This result is internally consistency with earlier findings; a significantly lower proportion of maternal morbidity and perinatal morbidity and mortality among MWH user mothers and their newborn respectively.

The maternal complication rate was significantly lower among the MWH users [AHR: 0.11, 95% CI: 0.07 - 0.19] than MWH non-user mothers. This result is consistent with the study done by (10–14) which founds that those being MWH users had significantly associated with better maternal outcome. But this result is inconsistent with the study done in Zambia which described that there is no association between the presence of MWH and the likelihood of a woman developing complications during and after labour (AOR = 1.75; 95% CI: 0.96–3.19) (15). This variation could be occurred due to selection criteria of the study subjects which is relatively better in the present study to show the effect of MWH. The second possible reason could be during their stay in the present study area they had daily follow up this might be lead to early detection and treated before they developed sever complications. The third reason might be in the study area these who used MWH come from a rural area which is far from the health facility so this may overcome complications which would occurred due to the delaines in their home and transport. The fourth reason might be due to most of the MWH non-users come after having the complications this may also be occurred due to selection bias this because most mothers who didn’t use MWH might come to the hospital after experienced the complications but those who didn’t experience complications might give birth in their home. However, there was no documented maternal death in both MWH users and non-user mothers. The main reason for this could be due to highly investing the government in the maternal and child health, and the second possible reason could be due to rare occurrence of maternal death.

Having multiple birth was found to be another independent predictor of maternal complications. Even if this factor can independently increases maternal complications, using of MWH service can decrease significantly maternal complications. This is consistent with study done by Grum T. et al , Joshua P. Vogel et al and J. Wei et al. which found that Women who had twin pregnancies had higher risk of pre-eclampsia comparing to women with singleton pregnancy (AOR:8.22, 95% CI: 2.97, 22.78)(38), the odds of severe adverse maternal outcomes were significantly higher in twin pregnancies (AOR 1.85, 95% CI 1.60–2.14) compared to singleton pregnancies(39). women who experienced complications had a higher twin birth rate than women without complications ($P < 0.05$)(40). The possible reason for this could be due to an environmental factor that is having poor set up for detecting and management of multiple pregnancies.

Perinatal (death and complication) rate was significantly lower rate among the newborn born from MWH users [AHR: 0.16, 95% CI: 0.08 – 0.31] than born from non-user mothers. Even though there is no study done so far which shows the effect of MWH on both perinatal mortality and morbidity together as single variable but there are studies which shows the association of MWH with perinatal morbidity and mortality separately. So this result is consistent with the study done by Kelly et al, Braat F et al, Akua Boatemaa Ekunwe et al, which described that there were significantly lower SBR among the MWH users (11,12). However, the result of this study is an inconsistence with study done by Piera Fogliati et al which found that there was no significant difference in PMR among newborns born from MWH users and non-users (21). Similarly, the result of this study is also in consistent with systematic review done by Luc van Lonkhuijzen et al. Which found that there was no enough evidence which shows the effect of MWH on still birth (16,17). The possible reasons for this variation could be due to study design and the outcome variable because in the present study both prenatal death and complications was combined as one outcome variable. The second possible reason could be in the present study area their mothers were received like antibiotics, iron, and TT vaccination and daily follow up during their stay in the MWH. So this could help them to prevent complications and then decreased complications and death which can be occurred due to maternal complications.

Birth weight less than 2500gm, born from mother with compilation, born from mother lives in urban area are also found to be other independent predictors of perinatal complications. Although these factors can independently increase perinatal morbidity and mortality, using of MWH service can significantly reduce perinatal morbidity and mortality.

Newborns with the birth weight of less than 2500gm were significantly increase the risk of perinatal morbidity and mortality. This is in line with the study done at Bonga General and Mizan Tepi University Teaching Hospitals which found that ≥2500gm at birth were 73% less likely to develop stillbirth (34). This is due to the general fact newborns born with low birth weight have low immunity and they easily develop perinatal complication and then they could die.

Being born from mothers with complications was significantly increases perinatal morbidity and mortality. This is consistent with studies done at Jimma University specialized hospital and Bonga General and Mizan Tepi University Teaching Hospitals which described that newborns born from mother without complication [OR = 0.1, 95% CI (0.04-0.2)] was less likely to have stillbirth(36), mothers with uterine ruptured 2.4 times at risk to have stillbirth (34). The possible reason for this could be due to the fact that when the mother is with complications the first thing there might be increase from mother to child and the infant there may be intra uterine growth restrictions and this lead to perinatal complications or may end up with stillbirth or early neonatal death.

7. Strengths and Limitations

7.1. Strengths

- Comparability of the MWH users and non-users using retrospective cohort from the same hospital.
- Presence of clear and distinct classification of individuals based on their exposure status.
- To be classified as MWH users they must have stayed at least 7 days which helps to see the effect of MWH clearly
- Comparing both morbidity and mortality which may help to see more the impact of MWH
- Allowed direct measurement of incidence of mortality in terms of person-days contributed and use of Cox regression analysis
- Large sample size with strong power and using a statistical software package (Stata version 12) which is strong for analysis purpose
- Having two model for each of the maternal and perinatal may help to see the predictors for each easily.

7.2. Limitations

- Using secondary data, which might have incomplete data.
- Selection bias was possibly introduced during secondary data extraction because mothers with incomplete records, referred to other facility and mothers who gave birth in their home were excluded

8. Conclusion

The results of this study indicate that MWH user mothers and their newborns had a significantly low incidence rate of maternal and perinatal complications (morbidity and mortality) respectively. MWH user mothers and their newborns have better survival time.

Multiple births were found to be another independent predictor of maternal complications. Birth weight less than 2500gm, born from mother with compilation, born from mother lives in urban area are also found to be other independent predictors of perinatal morbidity and mortality. Though these factors can independently increase maternal and perinatal complications, being using MWH service can significantly reduce maternal and perinatal complications (morbidity and mortality).

9. Recommendations

- Health policy makers should have to give more emphasis on the maternal waiting home services to have a standard admission and discharge criteria and standard registration book.
- Health extension workers, community leaders, governmental and nongovernmental organizations should involve in encouraging and giving care and support to mothers to use maternal waiting home services especially for those who lives in inaccessible areas.
- The health facilities should have a daily follow up for the mothers who are staying in the MWH. Moreover, the health professionals should give enough information about the MWH service for the mothers during their ANC visits especially for those who came from the remote area. Furthermore, the health facility should give more emphasis on multiple pregnancy and newborns weighted underweight at birth since they are a risk to develop maternal and perinatal complications respectively.
- Researchers should conduct further studies, which can overcome the selection bias which occurred due to excluding mothers who gave birth in their home.

10. Reference

1. Africana U. African union union africaine união africana. 2017;(March).
2. L'IV Com Sàrl, Villars-sous-Yens S. World health statistics 2017: monitoring health for the SDGs, Sustainable Development Goals. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.
3. Michele Andina RP and DI figa-T. safemother hood maternal waiting home a review of exprience WHO-96. 1996;7–8.
4. Tiruneh GT, Taye BW, Karim AM, Betemariam WA, Zemichael F, Wereta TG, et al. Original article Maternity waiting homes in Rural Health Centers of Ethiop : The situation , women ' s experiences and challenges.
5. Group WB. Trends in Maternal Mortality : 1990 to 2015. 2015;
6. Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and Rockville, Maryland, USA: CSA and ICF.
7. Yifru B et al. review causes of maternal mortality in ethiopia : a significant decline in abortion related death. 2014.
8. Yifru B et al. review perinatal mortality trends in ethiopia 2014.
9. Mengesha HG, Sahle BW. Cause of neonatal deaths in Northern Ethiopia : a prospective cohort study. BMC Public Health [Internet]. 2017;1–8. Available from: http://dx.doi.org/10.1186/s12889-016-3979-8
10. Andemichael G, Haile B, Kosia A, Mbchb JM. Maternity waiting homes : A panacea for maternal / neonatal conundrums in Eritrea Introduction : :18–21.
11. Kelly J, Kohls E, Poovan P, Schiffer R, Redito A, Winter H, et al. The role of a maternity waiting area (MWA) in reducing maternal mortality and stillbirths in high-risk women in rural Ethiopia. 2010;1377–83.
12. Akua B. et al. The efficacy of maternity waiting homes in decreasing maternal and perinatal sytematic review 2017.
13. Deakin Research Online. 2008;34(5):767–75.
14. Henry EG, Semrau K, Hamer DH, Vian T, Nambao M, Mataka K, et al. The influence of quality maternity waiting homes on utilization of facilities for delivery in rural Zambia. 2017;1–10.
15. Sialubanje C, Massar K, Hamer DH, Ruiter RAC. Personal and environmental factors associated with the utilisation of maternity waiting homes in rural Zambia. 2017;1–14.
16. Lonkhuijzen L Van, Stekelenburg J, Roosmalen J Van. Europe PMC Funders Group Maternity waiting facilities for improving maternal and neonatal outcome in low-resource countries. 2014;(Appendix 2).

17. Lonkhuijzen V, Roosmalen V. Maternity waiting facilities for improving maternal and neonatal outcome in low- resource countries COCHRANE DATABASE OF SYSTEMATIC REVIEWS Maternity waiting facilities for improving maternal and neonatal outcome in low-resource countries (Review) van Lonkhuijzen L , Stekelenburg J , van Roosmalen J. 2009;2–10.

18. Wild K, Barclay L, Martins N. The tyranny of distance : maternity waiting homes and access to birthing facilities in rural Timor-Leste. 2012;(April 2011):97–103.

19. Hussein J, Kanguru L, Astin M, Munjanja S. The Effectiveness of Emergency Obstetric Referral Interventions in Developing Country Settings : A Systematic Review. 2012;9(7).

20. Management P, Pmel L. Literature Review of Maternity Waiting Homes. 2015;(November).

21. Newborn N, Strategy CS, Summary DB. 2015/16-2019/20. 2019;(June 2015).

22. Nations U. Transforming our world: the 2030 agenda for sustainable development.

23. Fogliati P, Straneo M, Mangi S, Azzimonti G, Kisika F, Putoto G. A new use for an old tool : maternity waiting homes to improve equity in rural childbirth care . Results from a cross-sectional hospital and community survey in Tanzania. 2017;(October):1–7.

24. Unicef AG, Unicef LP, Win K, Soe W, New U, View Y, et al. Maternity waiting homes in Ethiopia--three decades experience. 2012;(July).

25. Mgawadere F, Unkels R, Kazembe A, Broek N Van Den. Factors associated with maternal mortality in Malawi : application of the three delays model. 2017;1–9.

26. Zhu J, Liang J, Mu Y, Li X, Guo S, Scherpbier R, et al. Sociodemographic and obstetric characteristics of stillbirths in China : a census of nearly 4 million health facility births between 2012 and 2014. Lancet Glob Heal [Internet]. 2016;4(2):e109–18. Available from: http://dx.doi.org/10.1016/S2214-109X(15)00271-5

27. Chinkhumba J, Allegri M De, Muula AS, Robberstad B. Maternal and perinatal mortality by place of delivery in sub-Saharan Africa : a meta-analysis of population-based cohort studies. 2014;1–9.

28. Andargie G, Berhane Y, Worku A, Kebede Y. Predictors of perinatal mortality in rural population of Northwest Ethiopia : a prospective longitudinal study. BMC Public Health [Internet]. 2013;13(1):1. Available from: BMC Public Health

29. Hassen EM, Gebreyesus S. Maternal morbidity in Butajira and Wukro districts , North and South Central Ethiopia maternal morbidity in Butajira and Wukro districts , north and. 2013;(September 2015).

30. Berhan y, Berhan a. review reasons for persistently high maternal and perinatal mortalities in ethiopia : part ii-socio- economic and cultural factors. September 2014 :119–36.

31. Berhan y, Berhan a. review commentary : reasons for persistently high maternal and perinatal mortalities in ethiopia : part III – perspective of the “ three delays ” model. September 2014:137–48.

32. Blencowe H, Cousens S, Jassir FB, Say L, Chou D, Mathers C, et al. National , regional , and worldwide estimates of stillbirth rates in 2015 , with trends from 2000 : a systematic analysis. Lancet Glob Heal [Internet]. 2015;4(2):e98–108. Available from: http://dx.doi.org/10.1016/S2214-109X(15)00275-2

33. Yirgu R, Molla M, Sibley L. Determinants of neonatal mortality in rural Northern Ethiopia : A population based nested case control study. 2017;6:1–10.

34. Welegebriel TK, Dadi TL, Mihrete KM. Determinants of stillbirth in Bonga General and Mizan Tepi University Teaching Hospitals southwestern Ethiopia , 2016 : a case – control study. BMC Res Notes [Internet]. 2017;1–5. Available from: https://doi.org/10.1186/s13104-017-3058-y

35. Ayele DG, Zewotir TT, Mwambi H. Survival analysis of under-five mortality using Cox and frailty models in Ethiopia. 2017;1–9.

36. Access O. Incidence and determinants of stillbirth among women who gave birth in Jimma University specialized hospital, Ethiopia. 2017;8688:1–11.

37. Braat F, Vermeiden T, Getnet G, Schiffer R, Akker T Van Den. Comparison of pregnancy outcomes between maternity waiting home users and non-users at hospitals with and without a maternity waiting home : retrospective cohort study. 2018;(January):1–7.

38. Grum T, Seifu A, Abay M, Angesom T, Tsegay L. Determinants of pre-eclampsia / Eclampsia among women attending delivery Services in Selected Public Hospitals of Addis Ababa , Ethiopia : a case control study. 2017;1–7.

39. Widmer M, Vogel JP, Torloni MR, Seuc A, Betra AP, Souza P, et al. Maternal and Perinatal Outcomes of Twin Pregnancy in 23 Low- and Middle-Income Countries. 2013;8(8).

40. Wei J, Wu Q, Zhang T, Shen Z, Liu H, Zheng D. Complications in multiple gestation pregnancy : A cross-sectional study of ten maternal-fetal medicine centers in China. 2016;7(21).

11. Appendices

11.1. Institutional Consent Form English version

On the behalf of the study participants I, the undersigned, am told that the researcher about the aim of the study and it is going to conduct in this hospital. I am also informed that the result of the study will be used by both the government, Selekleka primary hospital and the Woreda health office to commence appropriate strategies. I am too, told that the research will benefit the community in general including study participants, but it doesn't have any direct benefit to the study participants and that the research will not inflict any short and long-term risk to the study subject. I have been told that I have full right to have enough time to understand and then take part in the study on the basis of my interest. Besides I am let know that study participant was selected randomly by the investigator. Moreover, I am notified that the participation in the study is entirely voluntary and that I can quit the study any time I want. Likewise, I am enlightened that I will not be subjected to any form of punishment following failure to participate in the study. In the same way, I am explained that the information collected from the files of study participants will not by any means be disclosed to any people other than those participating in the study unless obtained permission from me. Equally, I am told that I can ask them questions I found difficult or any type otherwise. So according to this on the behalf of the study participants, I agreed on data to be extracted from the hospital.

Name of the person who gives the consent ___________________

Position ________________________

Signature ________________________.

Date______________

Address: Tele _______________

Email ______________

11.2. **Institutional Consent Tigrigna version**

ናይ ፍቓደኝነት ስምምዕነት ፎርም

ኣነ ብሽም ኣብዚ ፅንዓት ዝሳተፉ ሰባት ኣነ ብዛዕባ ዓላማ ናይቲ ፅንዓትን ኣብዚ ሆስፒታል ከምዝካየድን ከም ዝተነገረኒ ከምኡ እውን ውፅኢት ናይዚ መፅናዕቲ ንማሕበረሰብ ፣ ንሰለክለካ መባእታዊ ሆስፒታል፣ ንወረዳ ጥዕና ቤትፅሕፈትን ንመንግስትን ብዙሕ ጥቕሚ ከም ዘበርክት ተሓብሩኒ እዩ፡፡ ብተወሳኪ እውን እዚ ፅንዓት ኒዞም ኣብዚ ፅንዓት ንዝሳተፉ ወገናት ቀጥታቂ ዝኮነ ምንም ዓይነት ጥቕሚ ከም ዘይብሉ ተሓብሩኒ እዩ፡፡

ብምቕፃል ኣብዚ ፅንዓት ንዝሳተፉ ወገናት ኣብ ሓፅር ግዜ ይኩን ድሕሪ ነዊሕ ጊዜ ምንም ዓይነት ጉድኣት ከም ዘይህልዎ ከም ዝተረጋገፀለይ ፤ ኣብዚ ፅንዓት ንዝሳተፉ ወገናት ብ ዕጫ ከም ዝተሓረዩን ፤ብፍቃደኝነት ዝተመርኮሰ ከምዝኮነ ፤እቲ መረዳእታ ምእካብ ከቋርፆ እንተደልየ ሙሉእ መሰል ከምዘለኒ፤ መረዳእታ ንከይውሰድ እንተገይረ ምንም ዓይነት ቅፅዓት ከምዘይ በፅሓኒ ፤ ከምኡ እውን ካብዚ መረዳእታ ዝተረከቡ ዝኮነ ይኩን ግላዊ መረዳእታ ብዘይካ ኣብዚ መፅናዕቲ ዚሳተፉ ሰባትን ናይዚ ሆስፒታል ፍቓድን ምስጥራዉንቱ ዝተሓለወ ምዃኑ ተረጋግፁለይ እዩ። ከምኡ እውን ዝኾነ ይኹን ዘይበረሃለይ ነገር ኣብ ዘጋጥመኒ ክሓትት ከም ዘኽእል ከምዝተሓበረኒ ከረጋግፅልኩም ይፈቱ። ስለዚ ኣነ በዚ መሰረት ብሽም ኣብዚ ፅንዓት ዝሳተፉ ወገናት መረዳእታ ንክእከብ ከምዝተስማዕማዕኩ ብ ፌርማይ የረጋግፅ።

ስምምዕነት ዝፈፀመ ኣካል ሽም -----------------------------------

ሓላፍነት----------------------------------

ፌርማ --------------------------

ዕለት ---

ኣድራሻ ፡ ስልኪ ቁፅሪ -----------------

ኢሜል ------------------------

11.3. **Information Sheet form English version**

ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

the aim of this study is to assess the effect of maternal waiting home utilization on maternal and perinatal health outcomes, in Selekleka primary hospital northern Ethiopia.

Introduction:

Hello, My name is ___ I am data collector and working with Tekia Zafu who is doing a research on the effect of maternal waiting home utilization on maternal and perinatal health outcomes as partial fulfillment for the requirement of Masters in Public Health in epidemiology and biostatistics at Addis Ababa University, school of public health. I am going to extract very personal related data of the mother and newborn from different medical registrations from your hospital. The result that will come out of this study will be used by the government, the district health office and Selekleka primary hospital to base their rational decision to develop appropriate strategies to promote and for further improvement of maternal waiting home services and maternal and newborn health. The research is intended to benefit the community including the people that will be participating in this research and will introduce no short and long-term risk to the participant. And the study participants will not have a direct benefit from this study. For the data, extraction requires the maximum of 30 minutes to complete. Besides, the name of the participant will not be written in this form and the information extracted from the registration is kept confidential. If you don't want to be extracted all of or some of the questions, you do have the right to do so. Even you may end this data extraction any time you want too. However, your willingness to be extracted all the data would be appreciated. For any question you want to ask us, you can use the contact address hereunder. May I now begin the data extraction?

1. If Yes continue to the next page
2. If No, ask the reason, thank and skip to the next respondent

Name of the Data collector_________________ signature __________ date ___________

Name of the Supervisor ___________________signature ____________ date _________

Address of the principal investigator: cell phone +251920256201, Email:tekish2014@gmail.com

11.4. **Information Sheet form Tigrigna version**

<u>ናይ መረዳእታ ገለፃን መብራህርህን</u>

ጥዕና ይሃበለይ ሸመይ -------------- ይበሃል። ኣነ መረዳእታ ኣካቢ ኮይነ ምስ ተኪኤ ዛፉ እየ ዝሰረሕ ንሱ ኣብ ዘካይዶ ዘሎ ፅንዓት ማለት እውን ኣብ ናይ ኣዶታት መፅንሒ ክፍሊ ምጥቃም ኣብ ኣዶን ህፃንን ጥዕና ውፅእት ዝህልዎ ተፅዕኖ ዝካየድ ፅንዓት ኮይኑ እዚ ድማ ንዕዑ ንናይ ካልኣይ ድግሪ ብ ኢፒዲሞሎጂን ባዮስታስቲክስ ኣብ ኣድስ ኣበባ ዩኒቨሪሲቲ ፣ጥዕና ሳይንስ ፣ ኮሌጅ ሕ/ሰብ ጥዕና ት/ቲ ክፍሊ ንመመረቕታ መመላእታ ዝውዕል ፅንዓት እዩ። ስለዚ ኣነ ሕጂ ብጣዕሚ ግላዊ ዝኮኑ መረዳእታታት ናይ ኣዶን ህፃንን ካብ ዝተፈላለዩ ሬጅስትሬሽናት ናይዚ ሆስፒታል ክእክብ እየ። ብተወሳኺ ውፅኢት ናይዚ መፅናዕቲ ንመላእ ማሕበረሰብ ፣ ንስለኽለኻ መባእታዊ ሆስፒታል፣ ንወረዳ ጥዕና ቤትፅሕፈትን ንመንግስትን ኣብ ምስፍሕፋሕን ምጥንኻሪን ናይ ኣዶታት ምፅንሒ ክፍሊ ከምኡ እውን ናይ ኣዶን ህፃንን ጥዕና ኣብ ዝለዓለ ብርኪ ንክበፅሕ ዝትፈላለዩ ትልሚታትን ስለቲታትን ንምንዳፍ ኣብ ጥቅሚ ከም ዝውዕል ክግነዘቡ ይግባእ፡፡ ከምኡ እውን ኒዞም ኣብዚ ፅንዓት ንዝሳተፉ ወገናት ቀጥታዊ ዝኮነ ምንም ዓይነት ጥቕሚ ከም ዘይህልዎምን ኣብ ሓፅር ይኩን ድሕሪ ነዊሕ ጊዜ ምንም ዓይነት ጉድኣት ከም ዘይህልዎ ከነ ረጋግፀልኩም ንፈቱ። ነዚ መረዳእታ ንምእካብ እንተ በዝሑ 30 ደቒቓ ከም ዝኮነ ፤ ከምኡ እውን ምንም ዓይነት ሽም ናይ ተሳተፍቲ ኣካላት ከም ዘይፃሓፍ እንዳሓበርና ፤ ምስጥራውነት ናይዚ ዝተኣከበ መረዳእታ ብዘይካ ኣብዚ ፅንዓት ዝተሳተፉ ኣካላትን ፍቃድ ናይ ናይዚ ሆስፒታልን ዝተሓለወ ከምዝኾነ ከነ ረጋግፀልኩም ንደሊ። ብሙሉእ ይኹን ብከፊል መረዳእታ ከይእከብ ወይካኣ ክቋረፅ እንተደልኩም ሙሉእ መሰል ከም ዘለኩም ክግነዘቡ ይግባእ፡፡ ኮይኑ ግና ፍቓድኩም ኮይኑ ሙሉእ መረዳእታ ከእክብ ኣብትፈቅዱልና ምስጋናና ዝለዓል እዩ። ኣብመወዳእታ ዝኮነ ይኩን ሕቶ ኣብዝህልወኩም በዚ ኣብ ታሕቲ ተፃሕፉ ዘሎ ኣድራሻ ክተሓቱ ከም እትኽእሉ ክንሕብረኩም ንፈቱ።

ነመስግን!

ሰለዚ ሕጂ መረዳእታ ምእካብ ክጅምር ዶ?

1. እወ እንተኮይኑ ኣመስግንኩም ቀፅሉ
2. ኣይፋሉን እንተኮይኑ ኣመስግንኩም መክንያት ሓትተኩም ናብ ካልእ ቀፅሉ

ሽም መረዳእታ ኣካቢ --------------------------------------- ፊርማ ------------------ ዕለት------------------

ሽም ሱፐረቫይዘር --- ፊርማ ---------------- ዕለት ------------------

ኣድራሻ ናይ ተመራማሪ

ሽም <u>ተኪኤ ዛፉ ገ/መሰቀል</u>

ስልኪ ቁፅሪ <u>+251920256201/ +251914876055</u>

እሜል tekish2014@gmail.com

11.5. Data extraction tool

S. N.	Question	Response category	Response	Remark
1.	**Maternal waiting home utilization (Exposure status)**	1. Exposed 2. Non exposed		
2.	**Socio-demographic characteristics of the mothers**			
201.	Maternal age in completed years.			
202.	Residence	1. Urban 2. Rural 3. Unknown		
203.	Occupational status	1. Farmer 2. Housewife 3. Governmental work 4. Unknown		
204.	Educational status	1. Can't read and write 2. Elementary 3. High school 4. College and above 5. Unknown		
205.	Religion	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other (specify)		
3.	**Maternal health-related questions**			
301.	Date of admission			
302.	Time of admission (in 24 hours)			
303.	Parity of the mother			
304.	Did the mother receive antenatal care during her pregnancy at any health facility?	1. Yes 2. No		If No (Skip to Q. 308)
305.	Where did she receive ANC for this pregnancy?	1. Health center 2. Primary hospital 3. Health post 4. Private clinic 5. Other specify		
306.	Number of ANC visits in the health facility during pregnancy			
307	What health services did she receive when she		1. Yes	

.	visited the clinic during her current pregnancy? (Multiple responses)		2. No	
		1. Physical examination (including weight, blood pressure, heart rate)		
		2. Gynecological examination		
		3. Ultrasound		
		4. HIV/STD testing		
		5. Blood tests		
		6. Nutritional supplements		
		7. Tetanus vaccine		
308.	Did she have a history of C/S in her previous pregnancies?	1. Yes 2. No		If No skip to Q 310
309.	Number of C/S in the previous pregnancy			
310.	During this pregnancy does she had any of the following diseases?		1. Yes 2. No	
		1. Diabetes Mellitus		
		2. Cancer		
		3. Tuberculosis		
		4. HIV		
311.	Mother taken/buy any iron tablets or iron syrup during this pregnancy	1. Yes 2. No		If no skip to Q. 313
312.	During the whole pregnancy, for how many days did she take the tablets or syrup?			
313.	Primary attendant of the delivery	1. Doctor 2. Health officer 3. Nurse 4. Midwife 5. Emergency surgeon 6. Unknown		
314.	Mode of delivery	1. SVD 2. Instrumental 3. C/S 4. Unknown		
315.	Type of birth the mother gave	1. Singleton 2. Twin 3. Triplet 4. Unknown		
316	Were any complications detected during her pregnancy, delivery or after delivery?	1. Yes 2. No		If no skip to Q. 322
317.	If yes, the type of complication/s the mother experienced. (Multiple responses)		1. Yes 2. No	
		1. Sepsis		
		2. Uterine rupture		

		3. PPH		
		4. APH		
		5. Obstructed labour		
		6. Preeclampsia		
		7. Eclampsia		
		8. Other (specify________)		
318.	Date of complication developed			
319.	Time of complication developed (in 24 hours)			
320.	Has she received any treatment for that complication/s?	1. Yes		If No skip to Q. 322
		2. No		
321.	Time between development of complication and treatment received (in completed hours)			
322.	What is the outcome of the mother?	1. Discharge Alive		If discharge alive or referred skip to Q. 324
		2. Referred alive		
		3. Dead		
		4. Unknown		
323.	If dead what was the possible cause of the death?	1. Sepsis		
		2. Uterine rupture		
		3. PPH		
		4. APH		
		5. Obstructed labour		
		6. Preeclampsia		
		7. Eclampsia		
		8. Other specify		
324.	Date of discharge			
325.	Time of discharge (in 24 hours)			
4.	**Perinatal health related questions**			
401.	Did the fetus have any complication during intrapartum period?	1. Yes		If no skip to Q. 403
		2. No		
402.	What was the main detected complication of the fetus?	Specify it		
403.	Sex of the newborn	1. Male		
		2. Female		
404.	Was the newborn weighted at birth?	1. Yes		If no skip to Q. 405
		2. No		
405.	How much did he/she weighted in gram?			
406.	Did the neonate experience any complication/s?	1. Yes		If no skip to Q. 409
		2. No		

407.	Which one of the following complications did the neonate experienced? (Multiple responses are possible)		1. Yes 2. No	
		1. Neonatal sepsis		
		2. Asphyxia		
		3. Other specify		
408.	Date of complication developed.			
409.	Time of complication developed (in 24 hours)			
410.	Was the neonate received any management for his/her complication?	1. Yes 2. No		
411.	What was the outcome of the newborn?	1. Alive at discharge 2. Stillbirth 3. Early neonatal death 4. Referred 5. Unknown		If alive or referred skip to Q. 501
412.	If dead/stillbirth what was the possible cause?	1. Asphyxia 2. Neonatal sepsis 3. Other specify		
5.	**Maternal waiting home service questions**			
501.	Was the mother admitted to MWH?	1. Yes 2. No		If No skip to Q. 504
502.	How long had she been in the MWH? (Fill in completed days.			
503.	What were health services given? (Multiple responses are possible)		1. Yes 2. No	
		1. Health educations		
		2. Food		
		3. Physical examinations (vital signs)		
		4. Laboratory tests (PICHT, VDRL, Hgb, blood group, RH factor)		
		5. Tetanus vaccine		
		6. Iron tablet		
		7. Antibiotics		
		8. Other specify		
504.	How long does it take her to travel to the Selekleka primary hospital? (in hours)			