RESEARCH ARTICLE

Study on the Causes of Maternal Mortality between 2018 and 2021 in Ahiazu Mbaise Local Government Area, Imo State Nigeria

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Abstract

The aim of the research was to ascertain the maternal mortality ratio within Ahiazu Mbaise Local Government Area of Nigeria, the effect of antenatal care, age, parity, and educational level on maternal mortality. This is a retrospective analysis between 2018 and 2021. Data were collected using a semi-structured and validated data collection tool that contained data relevant to the study, utilising a comprehensive sampling method, the study was conducted across health institutions within the local government area. The sample size was 1,613, with 1,600 live births and 13 maternal deaths during the period of the study. The hypotheses were tested at an Alpha-value of 0.001 level of significance using a t-test. The results show the following, the maternal mortality ratio of Ahiazu Mbaise LGA, during the period of study was 813/100,000 live births. The major causes of maternal deaths in the local government area were post-partum haemorrhage, 23%, obstructed labour/ uterine rupture,23% hypertensive disorders 15% unsafe abortions 15%, indirect 15%, and puerperal sepsis 9%. Most of the patients who died in this study did not attend antenatal clinics. Based on the findings, it was recommended that every pregnant woman should attend the antenatal clinic and should deliver in a hospital.

Keywords: Maternal, Mortality, Maternal Mortality, Ahiazu, Imo state, Nigeria.

1. Introduction

Maternal mortality is a tragic and unnecessary event, every day about 800 women die from complications related to pregnancy and childbirth. 99% of these maternal deaths occur in developing countries and these developing countries, maternal mortality is higher in women living in rural areas and among poorer communities. Young adolescents are more at risk of dying from abortion-related complications.

In 2017, over 295,000 women died away before, during, and after giving birth (WHO, 2019). The bulk of these deaths take place in environments with limited resources, even if many of them might have been avoided. In 2017, Southern Asia and Sub-Saharan Africa were predicted to be responsible for 84% of all maternal fatalities worldwide. Nigeria continues to have the second-highest rate of maternal fatalities worldwide.

The global concern regarding maternal mortality requires urgent and immediate attention.it is estimated that every two minutes a female dies due to pregnancy-related causes. Roughly half of these fatalities occur within Sub-Saharan Africa, placing women in this area at a heightened risk of maternal death during childbirth. Nigeria maintains its second position worldwide in terms of maternal deaths, with a maternal mortality ratio estimated at around 814 per

100,000 live births. (NPC, & NDHS, 2009). This tends to be higher in rural areas like my area of study where a large proportion of women are in the reproductive age group. This is unacceptable when compared with the maternal mortality ratio of developed countries like Sweden with a maternal mortality as low as 5/100,000 live births.

Annually, an estimated twenty million women who survive childbirth endure various chronic conditions, leading to maternal morbidities.(WHO, 2010). The World Health Organization fact sheet, in the year 2010 shows that 287,000 women died while they were pregnant or during the process of childbirth. Most of these deaths were reported in low-resource settings and they could have been prevented if they had had a chance to be supported by a good infrastructure and health services(WHO & UNICEF, 2010).

As per the most recent assessment by UNICEF and the World Health Organisation, 529,000 women still die annually due to complications during pregnancy and childbirth, with nearly 90% of these deaths occurring in Asia and Sub-Saharan Africa (WHO & UNICEF, 2010). The World Health Organisation (2017) reports that Nigeria accounted for 14% of all maternal fatalities worldwide in 2010 and had the second-highest yearly rate of maternal mortality worldwide. In Nigeria, as per 2015 NPC & NDHS (2016), the maternal mortality ratio stood at approximately 814 deaths per 100,000 live births.

Postulated causes of this problem globally can be categorized into Reproductive, Obstetrics, Health services and contributory factors. These problems have been rendered ineffective in developed countries through the utilization of quality antenatal and intra-natal care. In developing countries, the risk associated with childbirth is further exacerbated by factors such as high fertility rates, pervasive poverty, social disparities, lack of awareness, and insufficient access to healthcare services.(WHO, 2010).

Maternal mortality reported in developing countries like Nigeria shows a clear gap between the privileged and underprivileged. Nigeria faces challenges due to its large population of over 160 million, geography, high rate of population growth, poverty, and cultural and religious diversity.Maternal mortality ratio (MMR) statistics vary across different geo-political zones within Nigeria, with South Western Nigeria boasting one of the lowest rates of preventable maternal and perinatal deaths. (NPC&NDHS, 2008) A significant portion of maternal deaths in this

country are concentrated in rural regions, including the area under examination, characterized by dense populations, widespread poverty, illiteracy, myths, religious beliefs and proliferation of unskilled traditional birth attendants.

This study was a retrospective study aimed at determining the causation of maternal death in Ahiazu Mbaise, determining the maternal mortality ratio and the effect of antenatal care on maternal mortality in this local government area. Permission was obtained from both the government and private hospitals within the local government area including the maternal and traditional birth attendants to release information that is necessary for the study.Records of individuals who passed away during pregnancy, childbirth, and the postpartum period were reviewed to gather relevant data pertaining to the circumstances of their deaths. Furthermore, the complete tally of live births that took place throughout the research duration was appropriately recorded.

From the patient's case record, information was obtained as regards the cause of death, booking status, parity of patient, age of patient and educational level of the patient. The study aims to determine the causation of maternal death in Ahiazu Mbaise LGA between January 1st 2018toDecember 31st 2021, to determine the MMRatio (maternal mortality ratio) in Ahiazu Mbaise LGA; determine the effect of age on maternal mortality in AhiazuMbaise LGA; determine the effect of antenatal care on maternal mortality on maternal mortality in Ahiazu Mbaise LGA; determine the effect of educational level on maternal mortality in Ahiazu Mbaise LGA; and determine the effect of parity on maternal mortality in Ahiazu Mbaise LGA.

2. Literature Review

2.1 Maternal Mortality

Every expecting mother wants to give birth safely and healthily as pregnancy and delivery are natural physiological processes. Sadly, most underdeveloped nations do not operate like this. Globally, there were around 287,000 maternal fatalities in 2010 (WHO, UNICEF, 2019 & Hogan et al., 2010). Almost 99% of maternal deaths were documented in developing nations, primarily concentrated in South Asia and Sub-Saharan Africa, which collectively contributed to 85% of global maternal mortality. As of 2010, Sub-Saharan Africa faced a maternal mortality lifetime risk of 1 in 39 adults., while Southern Asia reported a ratio of 1 in 160. Comparatively, industrialized

nations displayed a significantly reduced lifetime risk of 1 in 3800.

The 10th revision of the International Statistical Classification of Diseases (ICD-10) and Related Health Problems of the World Health Organisation (WHO) defined maternal mortality as the death of a woman from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes, while she was pregnant, during childbirth, or within 42 days of the pregnancy's termination, regardless of the length of the pregnancy or its site.

The MMRatio (maternal mortality ratio) varies among nations, with rural regions having a higher ratio than developed ones. The ratio is greater in poor countries than in industrialised countries (WHO, 2017). The main causes of the problem include poverty, illiteracy, and places with poor access to medical care, particularly maternity care. WHO (2014) reports that around 800 maternal fatalities occur each day, with poor nations accounting for 99% of these deaths. According to UNDP (2000), there are an estimated 529,000 maternal fatalities worldwide, with 95% of those deaths occurring in Asia and Africa. The lack of adequate maternal healthcare facilities and poverty in developing nations were blamed for 827,000 fatalities worldwide in 2010, according to WHO statistics. Global maternal mortality rates were reported to have reached 289,000 in 2013 (WHO, 2013).

Sub-Saharan Africa records the majority of maternal deaths worldwide, with a rate of 179 death for every 100,000 live births, followed by South Asia with 69 deaths for every 100,000 live births. Research has shown that maternal mortality ratios in developing nations are greater than in industrialised nations, where the ratio is 16 per 100,000. In developing nations, the ratio is 240 per 100,000. These differences also exist across individuals from various socioeconomic backgrounds and within a nation. In most developing countries, various factors such as socioeconomic status, social dynamics, religious beliefs, and cultural practices collectively influence maternal mortality rates. Additionally, there's an observation that these rates tend to be elevated in rural areas compared to urban ones.(WHO, 2014, UNICEF & UNFPA, 2012).

Nigeria has a very high maternal mortality ratio, which is one of the nation's health issues. From 704 out of 100,000 live births in 1999 to 800 out of 100,000 live births in 2004, the situation deteriorated.

Between the six geopolitical zones, there is a great deal of variation. With a greater prevalence in rural regions, it varies from around 165 out of 100,000 live births in the Southwestern portion of the nation to over 1,500 out of 100,000 live births in the North Eastern section. Despite all of the government's and non-governmental organisations' attempts to lower it, maternal mortality has fluctuated throughout time, according to Harrison (2000).

The maternal mortality ratio is almost insignificant in developed countries due to improved living standards and appropriate and easily available healthcare facilities. Developed countries have significantly reduced their maternal mortality rates, initially through the utilization of trained professionals during childbirth and subsequently through advancements in obstetric care, including procedures like Caesarean section, medical interventions such as penicillin and blood transfusion, hospital deliveries, and prenatal care (Hogberg & Joelson, 1985).

Maternal mortality falls under the Millennium Developed Goals (MDGs), specifically within objective 5, garnering significant attention globally. In some countries, these initiatives have led to a reduction in maternal mortality by up to 50%.The World Health Organization (WHO, 2019) ranked the elimination of maternal mortality as the third Sustainable Development Goal (SDG), building upon prior achievements of the MDGs (Millennium Development Goals).

Without a comprehensive registry of fatalities and the underlying causes of death, accurately assessing maternal mortality is often unfeasible. In addition, appropriate tools and accurate measurements required for the determination of maternal mortality are lacking in developing countries due to cultural, social, economic, and political factors (Pison, 2001). These factors make measuring maternal mortality difficult and include uncertainty about the precise time when pregnant women are at higher risk of adverse health effects, Lack of insight into deaths indirectly attributable to the pregnancy, and underreporting of pregnancy as a cause of death.

Maternal mortality is expressed using two interchangeable performance metrics. The MMRatio, or maternal mortality ratio, and the MMRate, or maternal mortality rate. Maternal mortality rate is the number of maternal deaths per 1000 women in the reproductive age group during that period, whereas maternal mortality ratio is the number of maternal deaths per 100,000 live births.

2.2 Causes of Maternal Mortality

Addressing the high maternal mortality ratio requires a thorough understanding of its underlying causes. Frequently, challenges arising during pregnancy and childbirth lead to women's deaths. The primary contributors to maternal fatalities include complications such as haemorrhage (25%), infections (15%), unsafe abortions (13%), high BP (blood pressure) during pregnancy (preeclampsia/eclampsia) (12%), and obstructed labour (8%).

In Asia (30.8%) and Africa (33.9%), haemorrhage emerged as a predominant factor leading to maternal fatalities, as indicated by a Lancet review of maternal death causes (Khan et al, 2006). In affluent nations, issues associated with anaesthesia and Caesarean sections represented the predominant cause of fatalities (21.3%). Conversely, in Latin America and the Caribbean, hypertensive disorders contributed to 25.7% of all maternal fatalities. However, in Asia and Africa, they accounted for 9.1% of maternal deaths.

Significantly higher rates of infection were seen in the Caribbean and Latin America (7.7%), Asia (11.6%), and Africa (9.7%). According to Khan et al. (2006), the percentage of mortality attributable to abortion was greater in industrialised nations (8.2%) and the Caribbean and Latin America (12%) than in Africa (3.9%) and Asia (5.7%). Underreporting and incorrect categorization may be the reason for the lower proportion of abortion-related fatalities to the total cause-specific mortality estimates in Asia and Africa.

Less than 1% of maternal mortality in underdeveloped nations and over 5% in developed nations were attributed to ectopic pregnancy; this disparity is likely a result of the high prevalence of pelvic inflammatory illness in these regions. About 6% of fatalities in Africa were due to HIV/AIDS, whereas one-tenth of deaths in Asia were caused by anaemia (12.8%) and obstructed labour (9.4%) combined (Khan et al.,2006).

2.3 Factors Affecting Maternal Mortality

Despite all the efforts made by WHO and other related bodies, maternal mortality remains a major issue in developing countries. Eliminating maternal mortality requires knowing the causes. Several factors have been mentioned in the literature as affecting maternal mortality specifically in less developed nations. These causes are broadly categorized into social, cultural, and economic factors (Gholampour et.al.,

2018). Improvement in the resolution of these factors can lead towards improvement in the reduction of maternal deaths.

2.3.1 Social Factors

Within socioeconomic contexts, various factors contribute to the elevated rates of maternal death in impoverished countries. In Africa, several potential socioeconomic variables influence maternal death. These include the attitudes of healthcare providers, economic inequalities, transportation challenges, political instability, age, education levels, gender disparities, and the availability of both material and human resources(Adjiwaonuet.al., 2018; Azuh et.al, 2015; Cardenas-Cardenas &Cotess-Cantillo, 2015; Rokicki et al., 2014).

2.3.2 Cultural Factors

High rates of maternal mortality are also significantly influenced by a nation's cultural characteristics. Certain cultures hurt pregnant women's health in impoverished nations. Compared to urban regions, cultural obstacles were more pronounced in rural parts of developing nations, leading to a considerable rise in maternal death rates. Yet, cultural obstacles were also discovered in urban slums, where residents maintain their customs and traditions just as they do in rural regions. As a result, significant rates of maternal death have been reported in urban slums (Adika et al., 2017).

Women's behaviour during the perinatal period is significantly shaped by specific cultural norms, customs, beliefs, and values. The way pregnant women navigate these challenges during pregnancy increases the risk of mortality during childbirth. Cultural factors affect maternal mortality through direct harm, lack of action, healthcare utilization, and societal status. Each of these factors is associated with increased maternal mortality rates in developing countries. (Nour, 2008; Azuh et al., 2015).

2.3.3 Economic Factors

Economic factors significantly impact maternal mortality rates, especially in developing countries. Research indicates that due to limited economic opportunities in these nations, the quality of life for their inhabitants is generally lower. Reduced income levels are common due to lower earnings. This situation is particularly challenging in rural areas where employment opportunities, especially for women, are limited. Consequently, maternal mortality

rates in these regions increase due to constrained access to healthcare and insufficient income levels, both of which directly and adversely affect women's health and well-being.

The economic status of each family also significantly influences maternal mortality rates. Families with higher economic means can access healthcare services, whether from private or public hospitals, ensuring they receive necessary medical attention during pregnancy and delivery. Conversely, families with lower economic status encounter challenges in accessing healthcare services, contributing to elevated maternal mortality rates within these households. (Gholampour et al., 2018; Fawole& Adeoye,2015).

2.3.4 Religion

It has been consistently noted that there is some level of religious factor in health care utilization. Studies have consistently maintained that religion is associated with healthcare utilization and improved health outcomes (Giyamah et al., 2006).Religion stands as a prominent social institution that molds both individual and community health behaviours by impacting lifestyles, motivations,and worldviews. (Benjamin, 2005).

Faith healing and strict adherence to church doctrine and practices are stressed in religious teachings, which can occasionally obstruct modern healthcare seeking. One extreme conservative Apostolic group in Zimbabwe is one example of how different religious group's view health care and health-related issues (Maguranyanga, 2001). Because of their belief that certain biblical passages prohibit blood transfusion, the Jehovah's Witnesses, another Christian group, strongly counsel their followers against accepting transfusions of whole blood, white blood cells, red blood cells, plasma or platelets. (Loma Linda University, 2014). This is particularly depressing because a large number of women in this group have died from postpartum haemorrhage, which is completely curable with blood transfusion.

2.3.5 Theoretical Framework

The theoretical framework serves to introduce and elucidate the theory that elucidates the existence of the research problem being studied. It provides the structural support for the theory of a research study, demonstrating an understanding of relevant theories and concepts pertinent to the research topic. Various theories, such as the three-delay model by Thaddeus and Maine, the theory of planned behaviour, gender equity theory, the theory of reasoned action, and the Gather theory, can be employed to expound upon maternal mortality. Despite the relevance of these theories to maternal mortality, this study is grounded in the three-delay model proposed by Thaddeus and Maine.

2.3.6 The Three-Delay Model

Thaddeus and Maine (1980) acknowledged the importance of timely and sufficient treatment in averting maternal fatalities. They employed a three-phase framework to identify gaps in access to managing obstetric emergencies. The three-delay model suggests that most pregnancy-related deaths result from delays in deciding to seek proper medical assistance for an obstetric emergency, reaching an appropriate obstetric facility, and receiving adequate care upon reaching the facility.

Phase 1: Deciding to Seek Care

Phase one illustrates a hesitation in making the decision to seek care by the woman and/or her family. Efficient emergency care hinges on the patient's or caregiver's capacity to acknowledge the presence of an abnormal condition and recognize its severity, necessitating immediate care that is assumed to be accessible. Any reluctance or tardiness in seeking suitable care could have catastrophic consequences for the patient. (Thaddeus Maine, 1994)

Salient points in phase 1 are the onset of the acute problem, recognition of the cause and severity of the problem, economic and education status of the patient or the caregivers, perception of care of the facility, the perceived accessibility, distance, cost of care, transportation and weather. The mentioned factors greatly have a bearing on the ability of the patient or relative to seek care on time.

Many challenges encountered by females in developing nations stem from the diminished status of women, possibly attributed to cultural norms or limited education, as well as reliance on their husbands to make health-related decisions. Additionally, inadequate awareness of pregnancy complications and risk factors, along with a delayed recognition of when to seek medical assistance, contribute to late presentations at healthcare facilities. Past adverse experiences with obstetric complications may discourage women from seeking aid when confronted with similar issues, while financial constraints can impede their access to medical care for obstetric complications..

These delays can be prevented by equipping communities with knowledge about pregnancy, childbirth, and newborn care so they are aware of when to seek healthcare facilities. Empowering women through adequate education and income-generating activities will foster independence, enabling them to make informed decisions regarding their reproductive well-being.

Phase 2: Reaching Care

The delay in identifying and reaching a medical facility is dependent on many factors including the availability of transportation services, good roads, accessibility of the hospital, geography of the hospital location example mountainous terrain, rivers etc, ability to mobilize and transport the patient to the nearest hospital services, transit time, outcome in transit, weather and seasonal considerations (Mould-Milman& Naidoo, 2014).

Delays in this phase can be mitigated by enhancing access to healthcare, including establishing health centres in rural and remote areas and deploying outreach healthcare workers to provide services in villages. Constructing waiting houses near healthcare centres for expectant mothers from remote areas to stay in before their due dates can ensure that assistance is readily available when they go into labour. Additionally, providing ambulances can be beneficial for those requiring urgent medical attention.

Phase 3: Receiving Care

The delay in receiving appropriate care upon the patient's arrival at the health facility can be categorized into three parts: the delay in providing appropriate care at the initial facility, the delay in transferring the patient for further care, if necessary, and the delay in providing necessary care at the second facility. Any delay at these junctures could have catastrophic consequences for the patient.

Important points that may help in the reduction of maternal mortality at this phase include the availability of health facilities and manpower, the availability of life-saving drugs and blood transfusion services at the health facilities, the ability of the health professional to diagnose, initiate appropriate resuscitative measures and institute definitive measures after resuscitation. Additionally, factors such as the need for transfer vehicles (Ambulance services) in case of referral, the presence of critical care specialists such as surgeons, intensivists, and obstetricians, staff availability, and competency are also important considerations.

Moreover, the training of midwives who will continue serving in rural areas after qualification can contribute to reducing maternal mortality due to phase 3 delay. (Ifenne et al., 1997)

The three delays, which involve postponing early prenatal care, accessing medical facilities during pregnancy, and receiving prompt and adequate emergency treatment from management, contribute significantly to maternal mortality.(Nwagha et al., 2012) This third delay, which is a major problem for the Nigerian health system and is mostly caused by the government's indifference to the suffering of its employees, also involves health personnel arriving late to work and showing a lack of empathy (Igwegbe et al., 2012).

3. Methods

This retrospective study involved an epidemiological examination of maternal deaths extracted from the records of health facilities in Ahiazu Mbaise from January 1st, 2018, to December 31st, 2021. A well-prepared questionnaire containing pertinent information for the study was distributed to hospitals and healthcare facilities in the area. Relevant data included live deliveries and maternal deaths due to complications of pregnancy, delivery, and the postpartum period within the study period, as well as maternal mortality resulting from preexisting maternal conditions exacerbated by pregnancy, labour, delivery, or the postpartum period.

Other necessary information obtained included the cause of death, booking status, age, parity, place of delivery, academic level and occupation of the woman. The questionnaires were distributed to the research assistants for data gathering after educating them on the methodology. A written note was given to the assistants to give to the management of the health facilities intimating them about the study, and its importance and soliciting their help to release relevant data necessary for the study.

At consenting health facilities, the records of patients who died within the period of study from complications related to the pregnancy records were obtained and information necessary for the study was collected from their record books and compiled in a textbook made available for the study. This process was repeated for all the health facilities that consented to participate in the study.
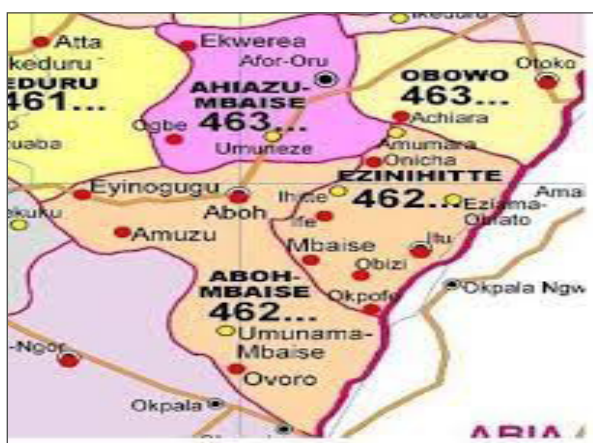
After data collection, it was analysed to identify the causes of maternal mortality and maternal mortality

ratio in the local government area, and other factors associated with maternal mortality in the local government area.

3.1 Study Area

This was conducted in Ahiazu Mbaisein Imo State, South Eastern Nigeria with an estimated population of about 235,200 people, it has an area of 114 km² and a population density of about 2,063/km²(Google).

Map of Imo State, highlighting the geographic location of Ahiazu Mbaise LGA
source: *Google*
Bounded: *Ahiazu North*
Bounded: *Obowo East*
Bounded: *Aboh Mbaise South*
Bounded: *Ikeduru West*

3.2 Study Population

This encompasses all instances of live deliveries and maternal deaths recorded in Ahiazu Mbaise between 2018 and 2021 due to complications related to pregnancy, labour, delivery, and the postpartum period. Also included are fatalities resulting from preexisting medical conditions exacerbated by pregnancy, labour, delivery, or the postpartum period. The study population consists of 1,613 patients.

3.3 Sampling Technique

Questionnaires that were pretested, semi-structured and validated were employed for data collection. Relevant data for the study, including cause of death, patient's age, marital status, educational level, parity, antenatal booking status, occupation of the deceased, husband's occupation, and total live deliveries in the hospital during the study period (from 2018 to 2021), were gathered..

3.4 Sources of Data Collection

Records from hospitals, clinics, maternities, traditional birth attendants, and health centers in the local government area were utilized for data collection.

The people are mostly subsistence farmers. There are large numbers of women of reproductive age and an abundance of grand multiparous women (women that have delivered more than 4 children) in the area, most of the deliveries take place in health centres and the percentage of traditional birth attendants and home deliveries is significant and in most cases patients are referred from these sources to health facilities when it is already too late.

Information regarding the total live births within the study period, fatalities due to pregnancy, delivery, and puerperium-related causes, as well as their booking status, parity, marital status, age, and educational level, were all documented.

3.5 Data Analysis

Following data collection, statistical analysis was conducted utilizing SPSS software version 20.0 The study identified the causes and factors influencing maternal mortality and the maternal mortality ratio in the local government area..

4. Results

Data were collected from thirty-three health facilities in Ahiazu Mbaise, including ten primary health centers, twelve private hospitals, one general hospital, and ten traditional birth homes in the Local Government Area. Over the period of 2018 to 2021, a total of 1,613 deliveries were documented in these health institutions. Among them, 1,600 were live births, while 13 resulted in maternal deaths. This equates to a ratio of 813 maternal deaths per 100,000 live births.
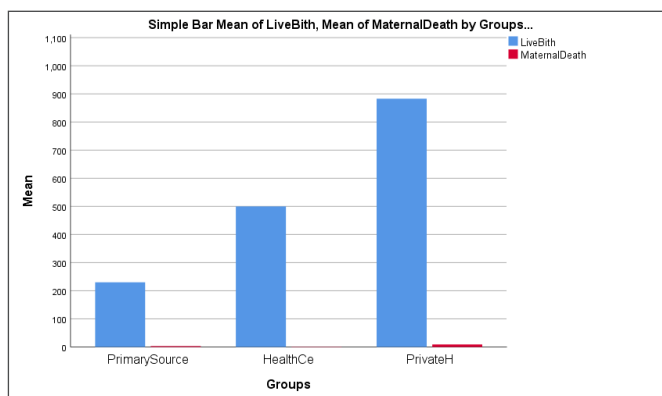
TBAS   Health Centres Private Hospitals

Figure 1. *This is a bar chart presentation of live births and deaths from sources*

The data analysis revealed that the ten health centres accounted for 30% of deliveries and 15% of maternal deaths. Similarly, the ten traditional birth homes contributed to 19% of deliveries and 15% of maternal mortality. One general hospital in the local government area contributed to 3% of deliveries and 8% of maternal deaths. On the other hand, twelve private hospitals in the local government contributed to 47% of total deliveries and 62% of maternal mortality. The distribution is visually represented in the bar chart above..
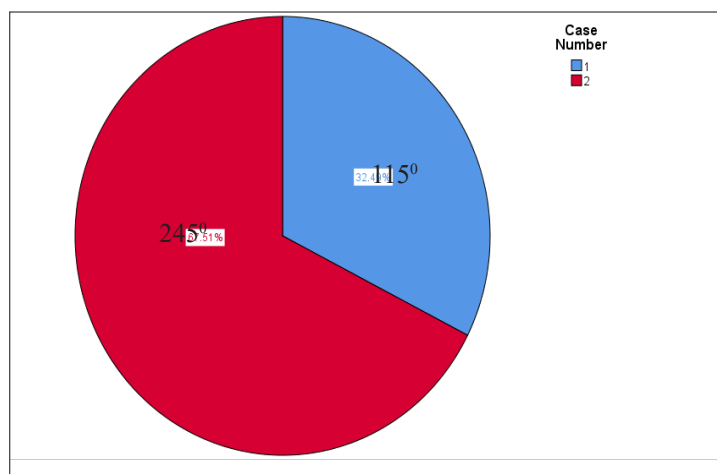
Figure 2. *Pie chart presentation of women who had antenatal care and those who did not have antenatal care*

The total number of women that did not register for antenatal care among the patients is 245^0 in the pie chart while 115^0 in the pie chart represent those that registered for antenatal care.
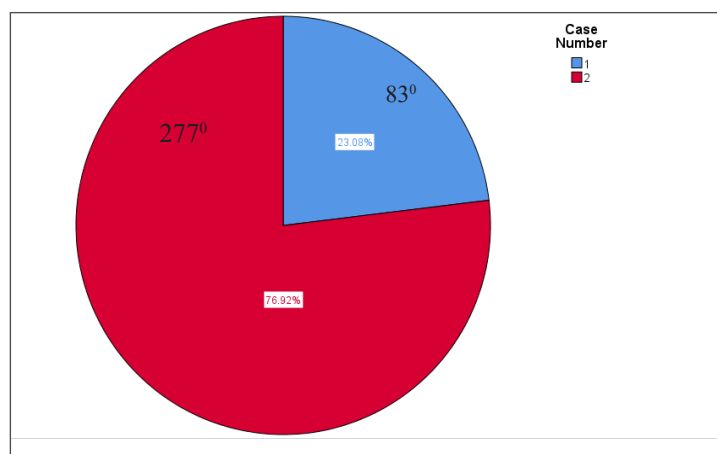
Figure 3. *This is a pie chart presentation of maternal mortality based on booking status*

The pie chart above depicts that out of 277° fatalities, individuals who passed away did not avail antenatal care, while 83° individuals who passed away received antenatal care..

Table 1. *Demographic representation of total deliveries based on age*

Age in years	Number of patients	%
≤19	100	6
20-34	1,424	89
≥35	89	5
TOTAL	1,613	100

Source: *Field survey (2021)*

From the table above it can be seen that 895 women aged between 20-34 years which is 89% of women that delivered during the period of study. One hundred women aged 19 years or less which is 6% of the total delivered in the health institutions during this period and women aged 35 years or more had the least number of deliveries which is 5% of the total.

Table 2. *Demographic presentation of maternal age based on booking parameters*

Age(years)	Booked	%	Unbooked	%	Total
≤ 19	80	80	20	20	100
20-34	424	30	1000	70	1424
≥35	20	22	69	78	89

Source: *Field survey (2021)*

From Table 2, it is apparent that 80% of patients aged less than 19 years who delivered during the study period were booked, while 20% were unbooked. Among patients aged 20-34 years, 31% were booked, whereas 69% were unbooked. For patients aged 35 years or older, 22% were booked, while 78% were unbooked. Thus, the majority of deliveries during the period were made by women aged between 20-34 years.

Table 3. *Distribution of maternal deaths based on booking status*

Age	Number of pxs (%)	Booked (%)	Unbooked (%)
≤19	2(15)	1(50)	1(50)
20-34	8(62)	2(25)	6(75)
≥35	3(23)	1(23)	2(67)

Table 4. *Demographic representation of total deliveries based on parity*

Parity	Number of patients	%
0	100	6
1	300	19
2-4	974	60
≥5	239	15
Total	1,613	100

Source: *Field survey (2021)*

Table 4 indicates that the majority of deliveries during this period involved women with between 2 and 4 children, accounting for 60% of total deliveries. Only 6% of patients were experiencing their first pregnancy, while 15% had 5 or more children. Therefore, parity 2-4 comprised the largest proportion of patients during the study period.

Table 5. *Demographic representation of the parity of maternal mortality based on booking status*

Parity	Booked	%	Unbooked	%	Total
0	1	50	1	50	2
1	1	33	2	67	3
2-4	1	`17	5	83	6
≥5	0	0	2	100	2

Source: *Field survey (2021)*

From Table 5, it is evident that 15% of deaths occurred during the first pregnancy, with one woman being booked for antenatal care while the other did not register. Parity 2-4 accounted for the highest percentage of deaths related to childbirth, totalling 46%, of which only one woman was booked. Grand multiparous women (parity ≥5) who died did not attend antenatal care and comprised 15% of the total. Among all deaths during the study period, only 23% had registered for antenatal care.

Table 6. *Demographic breakdown of causes of maternal deaths*

Cause of death	Number of deaths	%
Haemorrhage	3	23
Puerperal Sepsis	1	9
Obstructed Labour	3	23
Hypertensive Disorders	2	15
Unsafe Abortion	2	15
Indirect Causes	2	15

Source: *Field survey (2021)*

Table 6 shows that the commonest causes of maternal deaths were obstetric haemorrhage, and obstructed labour each contributing to 23% of maternal deaths, followed by indirect causes, hypertensive disorders and unsafe abortions each contributing 15% of maternal deaths. In this study, puerperal sepsis contributed to the lowest percentage of deaths which is 9%.
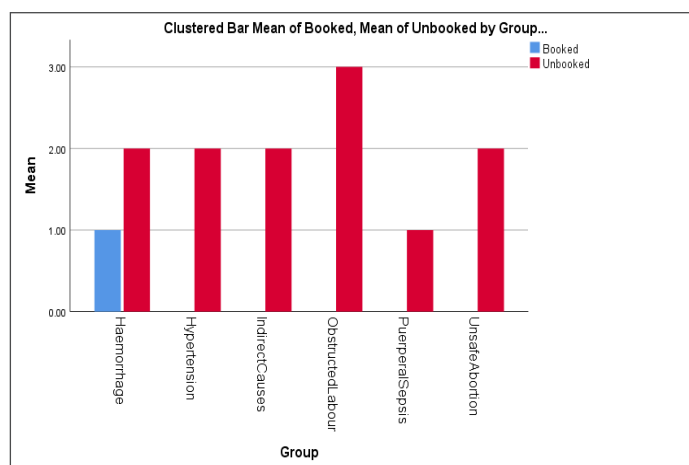
Figure 4. *This is a bar chart presentation of the causes of maternal mortality of both booked and unbooked women.*

From the figure above, obstructed labour accounted for the most maternal mortality among unbooked patients, followed by obstetric haemorrhage, hypertensive disorders, unsafe abortions, and indirect causes. Puerperal sepsis resulted in the fewest deaths.

Table 7. *Demographic representation of causes of maternal mortality based on booking status*

Causes	Booked	%	Unbooked	%	Total
Haemorrhage	1	23	2	67	3
Puerperal sepsis	0	0	1	100	2
Obstructed labour	0	0	3	100	3
Hypertension	0	0	2	100	2
Unsafe abortion	0	0	2	100	2
Indirect causes	0	0	2	100	1

Source: *Field survey (2021)*

From the analysis above, out of the 3 fatalities due to Postpartum haemorrhage, 67% were unbooked while 23% were booked. Similarly, all pregnancy fatalities resulting from obstructed labour, hypertension, unsafe abortions, and indirect causes involved unbooked individuals..

Table 8. *Demographic Distribution of maternal deaths based on the period of death*

Period of death	Number of deaths	%
Antepartum	3	23
Intrapartum	3	23
Postpartum	6	46
POSTNATAL(After 24hours Of Delivery)	1	8

Source: *Field survey (2021)*

Table 8 indicates that the majority of deaths took place during the immediate postpartum period, accounting for 46% of all maternal fatalities. Approximately 23% of women passed away before labor due to incidental causes, unsafe abortion, and hypertensive disorders.

Only 8% of women died from puerperal sepsis more than 24 hours after delivery. Women who died during childbirth comprised 23% of the total percentage of fatalities.

Table 9. *Demographic distribution of the above deaths based on booking status*

Period of death	Booked	%	Un-booked	%	Total
Antepartum	0	0	3	100	3
Intrapartum	1	33	2	67	3
Postpartum	2	23	4	67	6
Postnatal	0	0	1	100	1

Source: *Field survey (2021)*

From Table 9, no booked patient died during the antepartum period, the women that died during this period were un-booked thus contributing 100% of women that died during the antepartum period. Of the women that died during the immediate postpartum period, of these 67% were un-booked. Only one woman died after 24 hours of delivery and she was un-booked. Of the women that died during delivery 67% were un-booked, while 23% were booked.

Table 10. *Demographic distribution of duration of hospital stays before death*

Duration	Number of deaths	%
≤1 Hour	5	38
1 hour –1day	7	54
1 day-1 week	1	8
1week-4weeks	0	0
4weeks-6weeks	0	0

Source: *Field survey (2021)*

Table 10 indicates that the majority of patients passed away either on the day of admission, accounting for 54% of total deaths, or within less than an hour after admission, representing 38% of total deaths. Only 8% of patients succumbed within one day of admission. There were no reported deaths beyond one week post-admission.

Table 11. *Demographic distribution of duration of hospital stay based on booking status*

Duration of hospital stay	Booked	%	Unbooked	%	Total
<I hour	1	20	4	80	5
1hr – 1 day	2	29	5	71	7
>1day-1week	0	0	1	100	1
>1week-4weeks	0	0	0	0	0
>4weeks-6weeks	0	0	0	0	0

Source: *Field survey (2021)*

From Table 11, the percentage of booked patients that died less than one hour after admission is 20%, while 80% of un-booked patients died during the same period. Of the total percentage of patients that died within 1 to 24 hours of delivery, 71% are un-booked, while 20% of the patients are booked. The only woman who died after the first day of admission was un-booked.

Table 12. *Distribution of maternal mortality based on the level of education*

Level of education	Number of deaths	%
No Formal Education	6	46
Primary Education	4	31
Secondary Education Not Completed	2	15
Secondary Education Completed	1	8
Tertiary Education	0	0

Source: *Field survey (2021)*

Table 12 illustrates that the majority of deaths occurred among individuals with minimal or no educational attainment, ranging from those with no formal education to those who did not complete secondary education, collectively accounting for 92% of the total number of deaths. Those with education, that is those who completed secondary education and tertiary education contributed only 8% of the total maternal deaths.

Table 13. *Demographic distribution of level of education based on booking status*

Level of education	Booked	%	Un-booked	%	Total
No education	0	0	6	100	6
Primary education	1	25	3	75	4
Secondary education not completed	1	0	1	100	2
Secondary education completed	1	0	0	100	1
Tertiary education	0	0	0	0	0

Source: *Field survey (2021)*

From the above table, the highest percentage of deaths was recorded from people with no formal education which is 46% of the total and all the patients were un-booked, this was followed by patients with primary education which contributed 31% of the total, 75% of them were un-booked while only 25% patients in this category were booked. Two people with secondary education not completed died during the period of study, one was booked while the other did not register for antenatal care. The only patient who has completed her secondary education was booked. No patient with tertiary education was lost during the period of study.

5. Discussion

The findings made in the course of this research work can be discussed as follows:

This study showed that the MMRatio (maternal mortality ratio) of AhiazuMbaise is 813/100,000 live births and is almost at par with the MMRatio of Nigeria which is 814/100,000 live births (WHO 2020). The elevated maternal death rate observed in the local government is indicative of the situation prevailing in other local government areas across the country, a study conducted in Kebbi state showed a maternal mortality of 890/100,000 live births (Olatunji et al.,2018). This is higher than the maternal mortality ratio in my study.

Intra-country level, the result obtained from my study is in disagreement with the results obtained from similar studies in the northern parts of Nigeria, Galadanci et.al (2008) in their study in Kano showed a maternal mortality ratio of 1600/100,000 live births which is almost double the MMRatio (maternal mortality ratio) of Nigeria.A similar study done in Zamfara state showed similar results with a MMRatio of 1049/100,000 live births (Olatunji et al., 2012). Fawole et al(2012) in their study across 21 health institutions in three states, Katsina, Lagos and the Federal capital territory noted a high maternal mortality ratio of 927/100,000, this value is higher than the value from my study but lower than the values obtained by other researchers in their studies in the Northern part of Nigeria. Studies done in the southwestern part of the country showed lower values, study done in Ogun state showed a MMRatio of 179/100,000 live births (Sageer & Kongnyuv, 2019).

The reason for this high maternal mortality ratio obtained from my study is probably due to a lack of antenatal care registration, most of the women who died during the period of study did not have antenatal care. The intra-country variation is due to the difference in socio-cultural, religious and educational factors in these regions, with the women in the South Western part of the country being more educated and

economically advantaged than those from the Northern part of the country and thus utilising antenatal care services and hospital delivery.

The study showed that the majority of maternal deaths resulted from direct complications during pregnancy, delivery and the postpartum period. Direct causes contributed to 86% of the total maternal deaths. The commonest cause of death was postpartum haemorrhage (23%). This was in agreement with the study done by other authors, Orhue et al., (1999) 31%, Okaro et.al (2000) 21% and with a global estimate of 24.8% (WHO, 1999). However, this was in disagreement with the findings of the study done in IMSUTH Orlu by Ezem &Okeudo (2011) in which the commonest cause of maternal mortality was puerperal sepsis. Reason for this includes the non-correction of anaemia during pregnancy, home deliveries, the inability of the TBAS to handle post-partum haemorrhage and the absence of blood for transfusion in most health facilities in the local government. Obstructed labour and ruptured uterus contributed to 23% of maternal deaths in this study the major reason is that these women who did not have antenatal care were managed by traditional birth attendants who allowed them to try vaginal deliveries even when there did not meet the criteria for that.

Other causes of maternal mortality in this study are hypertensive disorders which contributed to 15% which is higher than the global estimate of 2-8% (WHO 2004) but similar to the national estimate of 15-30% (Singh et al., 2004), unsafe abortions and indirect causes each contributed 15% while puerperal sepsis contributed 9%.

The age group most affected in this study is the age range of 20-34 years which contributed 89% of the total. This is not surprising because this age group represents the prime reproductive age, but when the number of deaths per the number of women in the different age groups is analysed, the two extreme age groups contributed more than those in the age group 20-34. This is in agreement with the findings of the study by Cond-Aguedo et al (2004) in which it stated that the risks of maternal mortality are highest in adolescent girls because of increased incidence of pre-eclampsia, cephalopelvic disproportion and uterine inertia while Dutta (2004) noted in his study that the mentioned risks are 2-4 times higher in women aged 35 years and above.

The study also reviewed the relationship between parity and maternal mortality and showed that para

2-4 contributed to the highest number of patients in this study (60%) and also contributed to 46% of maternal deaths but when analysed number of deaths per number of patients in that parity group, those in para 0 contributed the highest number of maternal deaths followed by those in para ≥5.

The relationship between the level of education and maternal mortality showed that those with less than secondary education contributed to the majority of maternal deaths (92%) while those who finished their secondary education contributed (8%). This finding is in agreement with other studies that women's literacy and educational level improved their health outcomes and decreased maternal mortality, as educated women sought professional healthcare services (Egmong et al., 2004).

The study also reviewed the relationship between the period of death and maternal mortality, it showed that most of the deaths occur during the postpartum period which is the period most of the complications occur. This period contributed to 54% of maternal mortality in this study, this value is higher than that recorded by a similar study conducted by Li et.al (1996) in which the value was 45%. Thus, the postpartum period represents the danger period and thus warrants close monitoring to prevent most of these complications.

The study also reviewed the effect of antenatal care on maternal mortality, it was observed that 68% of the patients in the study population did not register for antenatal care and only 32% of the patients registered for antenatal care during the period of study. Of the 13 maternal deaths, 78% of the women did not register for antenatal care while only 22% registered. This is in agreement with the findings by Pandit (1992) in his study, "The Role of antenatal care on maternal mortality" in which there was a marked reduction of maternal mortality in the women who attended antenatal care during their pregnancy from 1920/100,000 live births to 82/100,000 live births over 8 years. These findings underline the importance of antenatal care in the reduction of maternal mortality ratio globally.

6. Conclusion

The conclusions were made based on the research findings and concerning the statistical analysis used.

The major causes of maternal mortality in the local government area include direct factors like postpartum haemorrhage which contributed 23%, obstructed labour/uterine rupture contributed 30%, hypertensive

disorders (pre-eclampsia/eclampsia) 15%, unsafe abortions 15%, puerperal sepsis 9%, and indirect factors like malaria and HIV/AIDS15%, Table 6.

The maternal mortality ratio of the Ahiazu Mbaise local government area is 813/100,000 live births and the maternal mortality ratio is very high when compared with the maternal mortality ratios of some areas from South Western Nigeria or with international values.

Statistical analysis using the t-test showed that extremes of age, high parity and lack of education(independent variables) all have positive effects on maternal mortality. Most of the patients that died in this study died during the postpartum period showing that period is a dangerous period

The findings have implications for reducing the maternal mortality ratio in the Ahiazu Mbaise local government area. The results from this study revealed the various factors responsible for the high maternal mortality ratio in the local government. It also revealed the maternal mortality ratio of the local government area during the period of study which was previously unknown.

The study also revealed the various factors which contributed to the high maternal mortality ratio in the local government making it easier to tackle this scourge by addressing the various causative and contributory factors. Thus, addressing the issue of high parity, illiteracy and contraceptive use will decrease maternal mortality in the local government area.

Another important finding from the study is the effect of antenatal care on maternal mortality. This study showed that most of the women who died during the period of study did not utilize antenatal care during pregnancy. Thus, sensitizing pregnant women on the importance and utilization of antenatal care will drastically reduce maternal mortality in the local government area.

7. Recommendations

The following recommendations were suggested based on the findings and conclusion from this study:

1. The public health practitioner should help to create awareness among women in the local government about the need for antenatal care registration and the importance of delivering in a hospital capable of handling obstetric emergencies. This can be achieved through public health education, announcements in the churches and communities

2. There should be training and retraining of all cadres of health personnel so that they will be able to handle obstetric emergencies. The concept of traditional birth attendants should be systematically phased out and replaced by trained local or rural midwives since most rural women feel more comfortable delivering with them than in hospitals because of costs. The health practitioner should be vigilant during the first 24 hours after delivery because this is the period most of the complications occur.

3. The local government authorities should encourage their women to register for antenatal clinics and utilize the services offered in the clinics, the local government authorities should also encourage their women to deliver in health facilities with the capacity to handle obstetric emergencies. The communities should equally be encouraged to educate their female children and also discard certain harmful beliefs and practices that are harmful to pregnant women and women in general.

4. All strata of government should be encouraged to play a central role in the reduction of maternal mortality in this local government. The goals of millennium development and sustainable development goals should be practised in the local government so that the maternal mortality ratio in this local government area should compare favourably with those of developed countries.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The author declares that there is no competing interest.

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