



Exploring factors associated with maternal deaths in the University of Port Harcourt Teaching Hospital: the health workers' perspective

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Abstract

Pregnancy or delivery-related maternal deaths occur every 10 minutes in Nigeria. This amounts to a whopping 53,000 maternal deaths every year and for every woman who dies, 30-50 more women suffer childbirth-related injuries, infections, or diseases. This research was conducted to explore the factors associated with maternal deaths from the perspectives of health workers in the University of Port Harcourt Teaching Hospital, Rivers State, Nigeria. A mixed method approach involving the extraction of data from medical folders associated with maternal deaths from January 2013 - December 2017 and qualitative interviews with health workers. The majority of maternal deaths at the study occurred in those aged 30 – 39 years, unbooked and these deaths were mostly due to hypertensive disorders (24%). The commonest clinical presentation was seizures (13.5%) and the common reported cause of death was organ failure (29.2%). Maternal mortality is still common although there have been decrease over the years. Recommendations included increasing public enlightenment campaigns and education of the communities especially the rural ones on the importance of antenatal care and delivery taken in health facilities by trained attendants. Social health insurance should also be strengthened to improve access to preventative care and reduce the burden of catastrophic health expenditures among households with pregnant women. The need for proper management of patients' health records was also advocated.

Keywords: Maternal, deaths, mortality records, related factors, causes.

Introduction

The World Health Organization [WHO] defines maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental cause^[1]. In different countries globally maternal mortality

remains a major cause of death among women of child-bearing age and remains an issue of serious public health concern in developing countries^[2]. The health of mothers is pivotal as it has a bearing on the health of every member of the household, particularly that of children and aged persons. Despite the positive and fulfilling aspects of being a mother, it is still often associated with adverse events such as disabilities, death etc.^[3]. When death

occurs, the children of the dead face higher risks of death as well. The consequent death of children is due to reasons such as poor nutritional status, unfulfilled educational attainments, emotional and mental troubles etc. The negative impacts of maternal deaths are also felt by other members of the nuclear and extended family^[4,5].

There is still a wide discrepancy in maternal mortality across countries. This is evidenced by the fact that while 25% of females of reproductive age lived in developed countries, they contribute only 1% to global maternal deaths^[6]. The remaining 99 % of all maternal deaths occur in developing countries with as much as half of these deaths occurring in Sub-Saharan Africa (SSA) and about a third occurring in South Asia^[7]. Similarly, The World Health Organization reports that approximately 536,000 maternal deaths occur annually, and 98% of these deaths occur in sub-Saharan Africa and Asia. Nigeria is a major contributor to the number of maternal deaths occurring within the African continent^[6,8] with a high maternal mortality ratio of 1,100 per 100,000 live births compared to the average of 900 maternal deaths per 100,000 live births in sub-Saharan Africa and an average of 400 per 100,000 live births globally^[2]. Available evidence shows that, 1500 women die from largely preventable pregnancy or pregnancy-related complications every day^[9]. Nigeria has one of the highest maternal mortality rates and is second only to India whose population is eight times larger than that of Nigeria^[10]. In actual terms, Nigeria contributes 2% of world's population but accounts for 10% of the world's maternal death. The lifetime risk of maternal death in Nigeria from childbirth is 1 in 18 which is higher than the average of 1 in 22 in sub-Saharan Africa and the global average of 1 in 92^[2].

For a clearer perspective, pregnancy or delivery-related maternal deaths occur every 10 minutes in Nigeria, amounting to a whopping 58,000 maternal deaths every year in Nigeria. Put differently, at least 800 women die in every 100,000 live births^[7]. Globally an estimated 289, 000 maternal deaths and maternal mortality ratio (MMR) of 210 maternal

deaths per 100, 000 live births occurred in 2013 with Nigeria accounting for 13% of all maternal deaths that occurred in that same year^[11]. “Every single day, Nigeria loses about 2,300 under-five year old and 145 women of childbearing age”. This makes the country the second largest contributor to the under-five mortality rate and maternal mortality ratio in the world^[12]. These figures may even be underestimated due to imperfect data collection attributable to Nigeria’s passive system of births and deaths registration^[13].

For every woman who dies, 30-50 more women suffer childbirth-related injuries, infections, or diseases^[14]. According to a 2010 report by Engender, an estimated 400,000 Nigerian women and girls suffer from fistula and approximately 12,000 new cases occur annually. Women living in poverty and in rural areas, and women belonging to ethnic minorities or indigenous populations, are among those particularly at risk. Complications arising as a result of pregnancy and childbirth are major causes of death for 15-19 year old women and adolescent girls in developing countries^[15].

Causes of maternal mortality are multifactorial. Traditionally, the causes have been classified as direct and indirect, each contributing about 70–80% and 20–30% of the total maternal deaths, respectively. The main reason for classification into direct and indirect deaths is to target focused interventions^[16,17]. The tenth revision of the International Classification of Diseases (ICD) ascribed maternal mortality to deaths during pregnancy, childbirth, and the puerperium. It divides maternal deaths into direct obstetric deaths, indirect obstetric deaths, coincidental and late maternal deaths. The majority of these fatal obstetric complications occur during labor and immediately after birth. The aim of the study was to explore the factors associated with maternal deaths from the perspectives of health workers in the University of Port Harcourt Teaching Hospital, Rivers State Nigeria.

Materials and Methods

Study Location

The study was carried out in the Department of Obstetrics and Gynaecology (O & G) in the University of Port Harcourt Teaching Hospital (UPTH) which is concerned with caring for the health needs of women. UPTH is one of the two tertiary health care institutions in Port Harcourt, the capital of Rivers State, south-south Nigeria. It was founded in 1980 and was officially commissioned by the federal government in 1985. UPTH is located along the East-West Road, Port Harcourt but its catchment area extends beyond Rivers State, to include much of the Niger delta region; a catchment

population that can be conservatively put at ten million people^[18]. The hospital started as a 60-bed hospital at a temporary site and only relocated to its permanent site in 2006. The hospital's capacity is now expanded to 500 beds and nearly 200,000 patients are seen annually in both outpatient and inpatient settings. It carries out an average of 8.42 surgical operations every day, and an average of 9.24 deliveries each day. Besides offering medical services, the hospital also provides clinical education and training to students, nurses, resident doctors and other healthcare professionals.

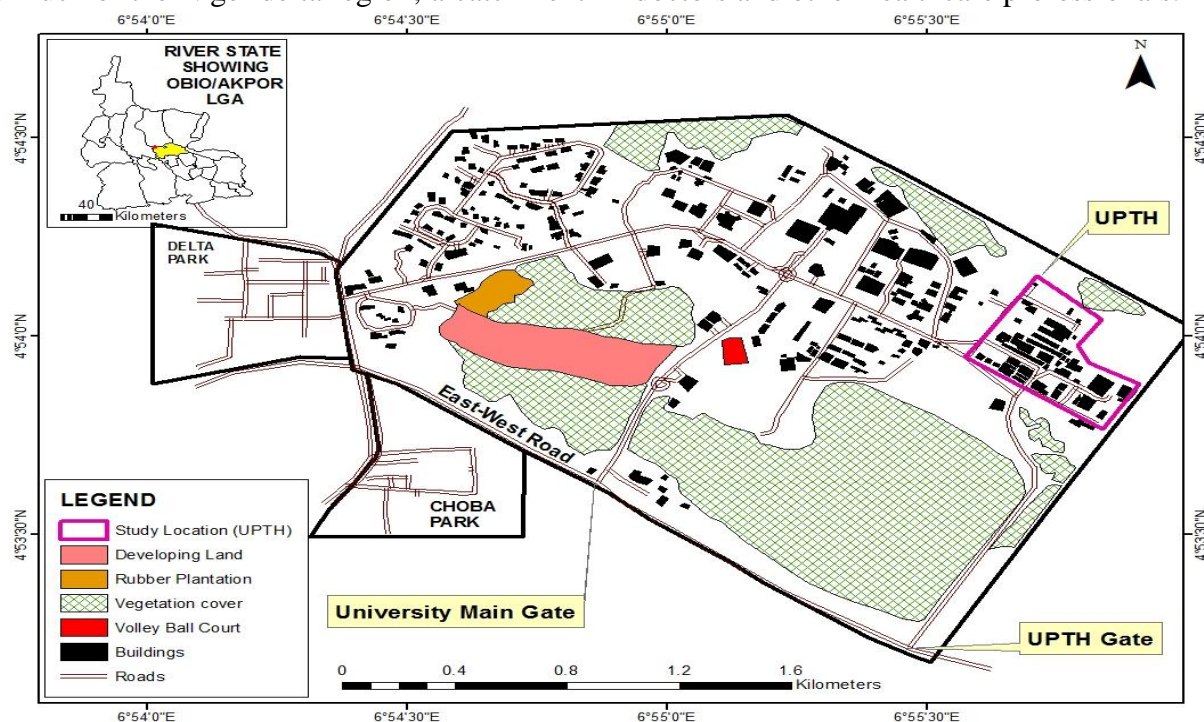


Figure 1.1 Study Location (UPTH) and its environs, with insert of Rivers State map showing Obio/Akpor LGA (Google Earth Imagery, 2018).

Study Design

This research utilized a mixed methods design using quantitative and qualitative data collection methods. Quantitatively, a descriptive cross sectional study was done where individual records of all maternal deaths occurring in the hospital during the past 5 years from 2013 to 2017 were retrieved and studied after obtaining permission from the authorities of the hospital. The socio-economic profile of the victims as well as the documented causes of death and the factors which led to death in each case were extracted from the records and analyzed. The qualitative aspect of the

study involved a phenomenological approach involving in-depth face to face interview with selected health workers comprising medical consultants, registrars, nurses of the O & G department of the University of Port Harcourt Teaching Hospital (UPTH). The aim of the qualitative interview was to uncover the circumstances around maternal deaths seen in the hospital.

Study Population

The qualitative aspect comprised of health workers in the O& G department of UPTH while the quantitative aspect was the review of all the

medical records of mothers who died within the past five years.

Inclusion Criteria

1. Frontline health care workers (doctors and nurses) in the O& G Department of UPTH.
2. Medical folders involving maternal deaths in UPTH of pregnancy or puerperium-related causes within the past five years (January 2013 to December 2017).

Exclusion Criteria

1. Health workers in the O& G department of UPTH who are absent or decline consent to participate in the interview.
2. Medical folders of maternal deaths which are defective in contents and with lots of missing data.
3. Medical folders of death of female in reproductive age not related to pregnancy or puerperium.

Sample Size Determination

It is critical to determine the minimum sample size for a study even before the commencement of data collection. This mixed methods study utilized different research paradigms in line with the qualitative and quantitative methodologies which were triangulated to provide a comprehensive and fully rounded analysis of the subject. Since the aim of the quantitative approach is to test pre-determined hypotheses and produce generalizable results^[19], the minimum sample size was calculated using the Fisher's formula: $n = Z_{\alpha}^2 p(1-p)/d^2$ ^[20].

Where: n = minimum sample size; $Z_{\alpha} = 1.96$ (standard normal deviate); d = degree of accuracy desired (0.02); p = working prevalence (576/100,000= 0.00576). The above data provided the estimate of the minimum sample size required for this study as 55. However, all the available medical folders which fell into the stipulated time (January 2013- December 2017) were used for this study.

The qualitative studies provided deeper illumination and understanding of complex associated issues necessary to answer the questions of 'why?' and 'how?' The review of five hundred

and sixty doctoral thesis that applied qualitative approaches found that the mean sample size needed to achieve data saturation was 31^[21]. The sample size for the qualitative aspect of this study was thus based on the number of interviewees needed to achieve data saturation or information redundancy.

Sampling Method

For the qualitative aspect of the research, maximum variation sampling variant was used to recruit twenty-two (22) widespread interviewees. This was sufficient to provide adequate information necessary on the subject.

Study Instrument

The semi-structured qualitative interviews were conducted with a pre-tested interview guide. All interviews were recorded using an encryptable audio recorder and verbal and non-verbal proceedings of the interview noted. The areas covered by the interview included:

- Opinions concerning risk factors and causes of death.
- Attitudes to use of formal health care.
- Challenges they face in receiving health care.
- Challenges the health workers face in administering health care.
- Suggestions for prevention of future deaths.

The quantitative data was gathered via the use of a data extraction sheet to ensure consistency and completeness in carrying out a task. The data extraction sheet was structured into sections: Section I comprised of the socio-demographic data which consisted of the ages, marital status, occupation, level of education, religion and maternal obstetric characteristics of the mothers that died. Section II consisted of the various clinical presentations of the mothers before their death. Section III included the ailments the mothers were diagnosed with (clinical diagnosis) prior to their death. Section IV was the duration of stay i.e. the length of time they stayed in the hospital before their death. Section V was the diagnosis recorded in the folders as the cause of their death. Section

VI was the booking status; to ascertain whether they were booked or unbooked patients.

Study procedure/data collection process

All data was collected by the researcher. The aim of the research was first explained to and read by the respondent. Written informed consent were taken and the consent form signed by them. All efforts were put in to collect the right information.

Validity of Instrument

Since the medical records were written by a doctor and compiled by qualified health personnel, they were considered valid. However, the accuracy of the findings of this study is predicated on the completeness and accuracy of the data extracted from the patients' record. Repeated checks were undertaken by other experts to ensure that the data retrieved from the folders were complete and accurate.

Ethical Consideration

Request for ethics approval was tendered to the Research and Ethics Committee of the University of Port Harcourt, Nigeria and was granted. Permission was obtained from the authorities of the hospital (UPTH) for the quantitative aspect of the research i.e. access to the patients records. An introductory letter was given to the Head of Department of O& G to grant access to the nurses' registers in the wards and to interview the health workers in the department. Informed consent was also obtained from the health workers to participate in the interview. Anti-plagiarism test was done to ensure originality of the study.

Study Limitation

Many folders could not be found and some of those that were found had lots of missing data. The specific denomination of those that were Christians were not capture in the folders; various sects have certain tenets they hold very dearly such as home births, refusal to take blood etc. This would have helped to know if the deaths were from those sects. There was also unwillingness of some health workers to participate in the interview due to their very busy schedule.

Data Analysis

Quantitative data obtained from the medical records was summarized using descriptive summary measures including mean, standard deviation, range, frequency distribution, percentage, tables and charts. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0 computer Software. Qualitative data obtained during the interview sessions was transcribed verbatim and analyzed after the coding using thematic content analysis.

Results

After data cleaning, it was found that out of the 167 folders reviewed, 156 had complete data necessary for carrying out this study giving a percentage of 93%. The number of interviewees were twenty-two (22) after which data saturation was attained.

Table 1: Socio-demographic data of cases that died of pregnancy-related causes

Characteristics	Frequency (n=156)	Percentage (%)
Age		
≤19	6	3.9
20-29	70	44.9
30-39	74	47.4
40-49	5	3.2
≥50	1	0.6
Mean	29.55 ± 5.75years	
Marital Status (n=63)		
Married	60	95.2
Unmarried	3	4.8
Level of Education (n=15)		
Primary	2	13.3
Secondary	8	53.3
Tertiary	5	33.3
Occupation (n=63)		
Trading/Business	31	49.2
Housewife	18	28.6
Student	6	9.5
Civil servant	6	9.5
Business	2	3.2
Religion (n=63)		
Christianity	63	100

From Table 1, the mean age of cases was 29.55 ±5.75yearswhile cases within the category of 30-39 years constituted 74 (47.4%) and those within 20-29 years of age constituted 70 (44.9%). There were 60 (95.2%) married and 3 (4.8%) unmarried cases.

Secondary and tertiary levels of education constituted 53.3% and 33.3% respectively. Trading/business was the popular occupation among cases accruing 49.2% and 63 (100.0%) of the cases were Christians. (Table 2)

Table 2 Socio-demographic Characteristics of Respondents

Variables	Frequency (n=22)	Percentage (%)
Sex		
Male	13	59.1
Female	9	40.9
Marital status		
Married	15	68.2
Unmarried	7	31.8
Work experience (years)		
0-10	17	77.3
11-20	3	13.6
21-30	1	4.5
31-40	1	4.5
Designation		
Nurses	5	22.7
Junior registrars	8	36.4
Senior registrars	6	27.3
Consultants	3	13.6

A total of twenty-two health workers (13 males and 9 females) in O & G department participated in the qualitative interview aspect of this study. Most of them were married and included consultants, senior

and junior registrars, and nurses of different cadres who have been working in the department for some time ranging from 1 to 35 years.

Table 3: Maternal Characteristics

Characteristics	Frequency n=156	Percentage (%)
Gravida (n=36)		
1-2	16	44.4
3-4	10	27.8
>4	10	27.8
Parity (n=109)		
Zero	24	22.0
1-2	49	45.0
3-4	28	25.7
> 4	8	7.3
Alive (n=60)		
None	20	33.3
1-2	27	45.0
3-4	12	20.0
>4	1	1.7
Duration of Hospital Stay (n=59)		
1-2	26	44.1
3-4	15	25.4
5-6	6	10.2
>6	12	20.3
Mean	4.32 ± 3.98 days	
Booking Status (n=141)		
Booked	3	2.1
Un-booked	138	97.9

The mean number of pregnancy (gravida) among respondents was 3.17 ± 1.82 , and the mean parity 1.87 ± 1.64 . The table shows that respondents who

stayed in the hospital for at most 2 days were more (44.7%) and 98% of the women were unbooked (Table 3)

Table 4: Clinical Diagnosis

Diagnosis (Multiple Response)	Frequency n=300	Percentage (%)
Hypertensive disorders	72	24.0
Haemorrhage	51	17.0
Sepsis	50	16.7
Anaemia	18	6.0
Pulmonary edema/ embolism	18	6.0
Ruptured uterus	14	4.7
Obstructed labour	13	4.3
CVD	9	3.0
HIV/AIDS	8	2.7
Abortion	4	1.3
Sickle cell disease (SCD)	4	1.3
Malaria in pregnancy	4	1.3
Ectopic pregnancy	1	0.3
Others	34	11.5

The various diagnosis made on the patients are commoner diagnosis among patients (Table 4). shown in this table, revealing Eclampsia, puerperal These corroborate with the responses obtained from sepsis/shock, Postpartum haemorrhage (PPH), the interviewees as the most frequently identified pulmonary edema/embolism and anaemia as the medical causes of maternal deaths were Eclampsia,

post-partum haemorrhage (PPH) obstructed labour and puerperal sepsis.

Table 5: Recorded Causes of Death

Characteristics	Frequency n=24	Percentage (%)
Organ failure	7	29.2
Cardio-respiratory arrest	5	20.8
Hypovolemic shock	4	16.7
Septicemia	4	16.7
CVA	2	8.3
DIC	1	4.2
Pulmonary edema	1	4.2

The cause of death was clearly stated in some folders. Among all the causes of death listed in the table, organ failure was more common and cardio-respiratory arrest seconds it; Hypovolemic shock

was also listed as one of the causes of death, responsible for 4 (16.7%) causes of death (Table 5).

Table 6: Clinical Presentations of Maternal Mortality

Characteristics	Frequency n=118	Percentage (%)
Seizure	16	13.5
Unconscious	13	10.9
Haemorrhage	11	9.2
Weakness	11	9.2
Fever	10	8.4
Breathlessness	8	6.7
Labour pain	8	6.7
Pain	6	5.0
Drainage of liquor	5	4.2
Cough	4	3.4
Restlessness	4	3.4
Prolonged labour	4	3.4
Headache	3	2.5
Irrational behavior	3	2.5
Offensive discharge	3	2.5
Others	8	8.4

Table 6 shows the clinical presentations of the patients. Seizure (13.5%) and unconsciousness (10.9%) had the greater frequency than other conditions. Those with fever, haemorrhage and weakness, constituted 10 (8.4%), 11 (9.2%) and 11 (9.2%), respectively.

The qualitative aspect involved the interview of twenty two health workers (13 males and 9 females) in O & G department which included consultants, senior and junior registrars, and nurses of different cadres who have been working in the department for some time ranging from 1 to 35 years. Three major themes emerged following the content analyses and these were:

- The common causes of maternal deaths

- The factors associated with maternal deaths
- Recommendations to improve maternal survival rates

Theme 1: The health workers laid claims to five major diseases commonly associated with maternal deaths which included pre-eclampsia, eclampsia, post-partum haemorrhage, obstructed labour and puerperal sepsis which disproportionately affected the unbooked patients. A respondent had this to say: *“First of all, among the booked patients, we rarely have deaths. That tells you that booking for antenatal care is of immense benefit but occasionally, we have deaths from situations that are difficult to manage for example, eclampsia; that is one of the more difficult aspects, more painfully,*

we sometimes encounter deaths from haemorrhage which could be prevented by adequate blood transfusion (Male, consultant obstetrician)

Theme 2: Respondents had various opinions on the factors associated with maternal mortality. Some respondents classified them based on the three levels of delay. They identified the first level of delay as the delay in deciding to seek care in a hospital and attributed it mainly to lack of awareness (ignorance), socio-cultural and religious beliefs, the socio-economic status of the individual and lack of education (illiteracy). The second level of delay was said to be the delay in presenting at the hospital after the decision is made and attributed it to bad roads, financial constraint, lack of means of transportation etc. while the third level of delay was said to be the delay in administering care when they finally get to the hospital and attributed it mainly due to lack of resources e.g. emergency drugs, consumables, oxygen, blood, requirements for surgery, manpower or hospital's policies on patient treatment such as making payments at the point of access to essential care. The most notable delay associated with maternal deaths from the health workers' perspectives was the third level as a respondent described: *"Because it's a very big hospital, the bureaucracy of getting those materials paid for from the pharmacy is challenging and so, most times, you have to stress yourself as a staff to run around for patients to make sure those materials are gotten [obtained] for urgent intervention; so to me, that's the most stressful aspect of the work, the lack of materials is a key issue here"* (Male, resident doctor)

Other causes such as lack of knowledge or skill, poor attitude to work, poor referral system and sub-optimal lower levels of health care and poor government policies were also mentioned.

Theme 3: Many recommendations on how to improve maternal survival rates were made by the respondents which could be grouped into three subthemes: education, clinical intervention, government intervention. On Education, most of them recommended the need for creating awareness through public enlightenment campaigns in

churches, mosques, markets, rural communities; stressing the need for early registration and strict compliance with antenatal care; health education of the public, education of the girl-child and training of TBAs to know the danger signals so they can refer on time before complications set in while some differed by recommending that the TBAs should be eradicated.

A respondent said:

"Also the TBAs should work hand in hand with medical doctors and other health personnel to refer these patients and not keep them for too long when they see that the case is above what they can manage. The government should actually help to curtail some of these maternal deaths". (Female resident doctor)

Another staff put it this way:

"Public enlightenment campaigns, the girl-child education are very important. When you enlighten the women by giving health talks, they would understand why antenatal care is very important so they would always value antenatal care; whenever they are pregnant, they would present to the hospital for [attend] antenatal care because most of these problems in obstetrics are picked up right from antenatal care, so if they are picked at the antenatal level, I think we could tackle about 80% preventable causes of maternal mortality" (Male, resident doctor)

On Clinical intervention, the most recurring recommendation was to make resources needed for care of patients readily available, others included proactive measures, training and re-training of health workers, better attitude to work and they stressed the need for a labour ward blood bank and pharmacy headed by a haematologist and pharmacist respectively.

On Government intervention, the recommendations offered by the respondents included; poverty alleviation, improving infrastructure in the tertiary centres, enforcing penalties for quackery, more investment in the health sector, free emergency/maternity services especially for indigent patients, improved policies on health, health insurance, provision of basic amenities

including security and governmental campaigns through the media.

Discussion

Maternal mortality continues to be of crucial public health concern in many parts of the world including Nigeria and understanding the factors associated with it is important in addressing the challenge of its persisting high rates. This was a five-year retrospective study of recorded causes of maternal deaths that occurred between January 1st, 2013 and December 31, 2017 at University of Port-Harcourt Teaching Hospital, Rivers State, Nigeria.

On socio-demographic characteristics, the findings showed that out of 156 maternal deaths reviewed, majority 74 (47.44%) of the women that died were within the age category of 30-39 years, mostly married 60 (95.23%) with secondary level of education (53.33%). Their major occupation was trading/business (49.21%) and all of them were religious.

On the maternal obstetric characteristics, for parity it was noticed that majority (67%) had parity of ≤ 2 while about 33% had a parity of >2 and nearly all the maternal deaths were unbooked patients (97.87%).

The findings on age revealed that 47.4% of the maternal deaths were within the ages of 30-39. This suggests a peak age for child-bearing in this setting and greater tendencies for women within this age bracket to visit formal health care facilities howbeit late. This finding corresponds with a similar retrospective survey of all deaths in women aged 15-49 years that occurred from January 1, 2013 to December 31, 2015 at the University of Port Harcourt Teaching Hospital^[22]. The majority (45.6%) of the women in this previous study were aged 30-39 years^[22]. This demographic picture is also in line with the findings of another study which reported a preponderance (63.3%) of deaths in mothers occurring within the age bracket of 20-34 years^[23].

A curious finding from this study was that only 3.9% of maternal deaths were attributed to teenagers. This low percentage was all corroborated by previous studies. For example, the previous review in UPTH recorded only 15 (4.4%) teenage deaths^[22] like another study by which found a low adolescent maternal mortality ratio compared with women older than 30 years^[24]. Although these negates the report by that women aged 15-19 are two times more likely to die from pregnancy or childbirth as women over 20 years of age^[11], it is likely that hospital-based studies showed such low proportionate death of teenage mothers because most of them may not have been able to access formal care as the older women^[25].

Most of the women were married 60 (95.23%) which agrees with a previous study which reported more than half (223 [65.5%]) of maternal deaths to women who were married^[22], but these two studies are a contrast to findings from other studies which reported increased mortality in lone mothers^[26-27]. A global survey on maternal and perinatal health reported women who are not married or cohabiting had almost twice the risk of pregnancy-related death than others^[28].

About half of the cases were traders/business persons. This was closely followed by housewives and only a few were students and civil servants. Although all these women fall in the low to middle socio-economic status, it is pertinent to note that most of them are engaged in revenue generating ventures. This is similar to what was reported in an earlier study which showed that only a few women (7.6%) were unemployed^[22].

There is an established relationship between the socio-economic status of a woman, her healthcare seeking behavior and utilization of health care services. While education was reported as the only variable that was a consistent significant predictor of service utilization at the individual-level, socio-economic status in general remained a consistent significant predictor of service utilization at the household level^[29]. Although socio-economic factors like lack of money to pay for health care and cost of transportation were major barriers to service

utilization in an earlier report^[30], distance to a healthcare facility was also identified as an important barrier^[31]. Understandably, more of the existing studies are focused on pre-hospital factors that constitute barrier to utilization of service. But clear insights to what institutional factors would also be relevant but most health records reviewed in this study did not contain the actual time of arrival of patients to the facility as well as the time of their deaths. This should be an important consideration of future audit of maternal and child healthcare services in this setting as it would provide the required information for system redesign.

Most of the women had secondary level of education (53.33%), which is in line with the conclusion that better service utilization is often associated with a higher educational status^[29]. This was also the same finding from a large cross-sectional study involving 287,035 inpatients giving birth in 373 health care institutions in 24 countries in Africa, Asia and Latin America^[28]. It was found that women with no education had 2.7 times risk of dying while those with 1 - 6 years of education had twice the risk of maternal mortality of women compared with those that had more than 12 years of education.

On the maternal obstetric characteristics, majority (67%) of the deceased had parity of ≤ 2 while about 33% had a parity of > 2 . This suggests higher risk of maternal deaths among women with lower parity as also reported in a previous study^[32]. It is pertinent to highlight the contrast of this curious finding with existing literature establishing direct relationship between high parity and maternal and child mortality^[33]. While the multipara may be more knowledgeable in identifying dangers signs in pregnancy, there are also tendencies that higher parity could be associated with poorer utilization of health care services and higher patronage of TBAs and maternity homes; fewer ANC visits and late ANC registration^[34].

This finding that nearly all the maternal deaths (97.87%) were from unbooked patients is not surprising. This is often attributed to poor socio-economic status, holding tenaciously to the words of

religious leaders, poor health seeking behavior, poor attitude of health personnel, cultural practices and aversion to caesarean section which encourages the use of maternity homes and TBAs^[35-36]. When the influence of pre-hospital care is removed, it is found that among the recorded deaths, those involving patients referred from other facilities or brought straight from home were almost fifty times more compared to those previously booked patients in the referral facility. This finding is double what was reported in a previous study in Nigeria^[37] and about ten times the report from south India^[36]. This dismal disparity in deaths could be an indictment of current policies in referral hospital concerning unbooked obstetric cases. While this is great need to strengthen advocacy, community mobilization for improved utilization of ANC services, it is also critically important to give adequate attention to the nature of pre-hospital care and patients' reception at referral hospitals.

The leading clinical diagnosis of the maternal deaths as shown from this study was hypertensive disorders (24%) which included post-partum hypertension, pre-eclampsia and eclampsia that independently accounted for 2%, 7% and 15% respectively. Eclampsia had the highest prevalence of all the hypertensive disorders. Haemorrhage (17%) was the next leading cause which was closely followed by sepsis which accounted for 16.7%. Other direct causes of maternal deaths were obstructed labour and abortion accounted for 4.3% and 1.3% respectively. Indirect causes such as anaemia and HIV accounted for lower percentages of 6% and 2.7% respectively. The findings from the qualitative interviews provided similar findings and also provided insights into some of their root causes. These indicated that poor utilization of antenatal care services, ignorance of the danger signs and it could be due to the three stages of delays which include indecision on where to go for care, lack of transportation, long waiting time, insufficient or absence of blood transfusion and emergency services, shortage of skilled health personnel and system failure. These findings were in line with the responses of the health workers who

affirmed that eclampsia, puerperal sepsis and hemorrhage were the leading medical causes of maternal deaths.

These findings align with several studies which revealed the preponderance of direct maternal deaths with the highest contributors being hypertensive disorders of pregnancy. The indirect causes accounted for a paltry proportion of maternal deaths^[21,35,37,38]. Other studies have however, reported higher contribution of obstetric haemorrhage as the leading cause of direct maternal deaths^[23,39-40]. Some of the risk factors associated with these leading causes of deaths are weaved around ignorance of danger signs, complicated deliveries in TBAs, maternity homes and resource poor settings; late presentations, unequipped health facilities etc.^[41]

The qualitative interviews with the frontline health workers revealed many medical and non-medical factors that contributed to maternal deaths in this setting. The medical causes such as eclampsia, haemorrhage, puerperal sepsis, tallied with those obtained from the quantitative data and the social causes included; the three levels of delay, poor awareness, cultural and religious beliefs, lack of prenatal care, patronization of quacks (TBAs), illiteracy, inadequate manpower, lack of resources to work, poor referral system, lack of health insurance, insecurity and poor government policies on health etc. This implies that the factors affecting the death of a pregnant woman is all encompassing and requires a holistic approach to tackle the menace.

There is a need for further investigation into the causes of delays in seeking appropriate care in the Nigerian setting. Although general delays have been reported in 53.8% of cases^[41], further classification of these delays shows that those related to user factors were observed in 10.2% of cases while 34.6% of delays were related to health service accessibility and 25.7% were related to quality of medical care^[41,42]. The existence of any of these levels of delay is associated with increasing severity of maternal outcomes and thus, each level of delay

should be adequately investigated with a view to finding lasting solutions.

Clearly, the barrage of local factors that reinforces delay before getting to a formal health facility include poor ability to recognize signs, symptoms, and severity of the situation, dependence on TBA services; low female literacy level; delayed access to transport; hardship of long distance and physical terrain^[41,42]. Similarly, the plethora of causes of delays within the hospital include long waiting hours before receiving treatment at a healthcare facility, delays at the time of admission, poor usage of treatment protocols, insufficient equipment, shortage of drugs, non-availability and incompetence of health staff^[42, 43]. Neglecting to address these patients and facility-associated causes of maternal mortality are probably responsible for the unyielding high rates of maternal deaths in the hospitals.

Health workers recommendations were in line with earlier suggestions which include: creating awareness through public enlightenment campaigns in churches, mosques, markets, rural communities, stressing the need for early registration and strict compliance with antenatal care visits, health education of the community and the girl-child, training of TBAs to recognize the danger signs and refer promptly, redesigning ANC services to be more culturally acceptable as measured needed to stem the high maternal mortality rates. Other recommendations include critical investments like blood bank services, well-stocked pharmacy, and availability of consumables, adequate and well-trained staff, implementation of universal health coverage for all, improving the socio-economic status of citizens and investing more in the health sector by the Government and other stakeholders to ensure quality services are provided^[44 - 46].

Conclusion

Maternal mortality is indeed a major public health concern. More of the identified cases were in those between the ages of 30 and 39, parity less than 2, unbooked and with hypertensive disorders. Most of the identified factors are preventable but not entirely

within the remit of the health system. A well-coordinated strategy and robust partnership is needed to reverse the high maternal mortality rate in Nigeria.

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