بسم الله الرحمن الرحيم

University of Shendi

Risk factors for Maternal Mortality in Khartoum State public Hospitals , 2015

Atheists required for phD degree in public health

By : Fatima Elshikh Mohammed Elhadi

M.Sc 2010 and B . sc honors 2005

Supervisor : prof . Abdel Ghaffar Ali Adam

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بسم الله الرحمن الرحيم

قال تعالي

والله خلق لكم مما خلق ظلالاً وجعل لكم من الجبال اكناناً وجعل لكم سرابيل تقيكم الحر وسرابيل تقيكم بأسكم كذلك يتم نعمته عليكم لعلكم تسلمون.

صدق الله العظيم

الاية (81) من سورة النحل.

Dedication

To The kind persons who gave me the gift of love, motivated me to go forward; my parents, my husband, everybody from whom I learned something, my dear friends who were beside me with their support, and my beloved country

Acknowledgement

All Praise to Allah

I would like to express my sincere gratitude to my supervisor Prof . Abdel Ghaffar Ali Adam who encouraged me to continue on digging and for his special effort in this study.

Special thank to Dr. Shadma Iffat for her sincere support.

مستخلص الدراسة

أجريت هذه الدراسة فى مستشفيات ولاية الخرطوم العامة لغرض دراسة عوامل خطر وفيات الامهات و تحديد نسبة وفيات الامهات و كذلك تحديد الاسباب المباشرة و الغير مباشرة لوفيات الامهات فى مستشفيات ولاية الخرطوم العامة و معرفة عوامل الخطر بالعلاقة مع الخدمات الصحية المقدمة و العوامل الاقتصادية و الاجتماعية و السكن .

تم استخدام الدراسة الوصفية التتبعية بالمستشفيات لكل الوفيات التى حدثت فى مستشفيات ولاية الخرطوم فى الفترة من يونيو 2014 الى يونيو 2015 المعلومات الخاصة بالامهات المتوفيات تم الحصول عليها من الاقارب استنادا على استبيان وفيات الامهات اللفظى لمنظمة الصحة العالمية لسنة 2012 وكذلك تم استخدام مجموعات المناقشة مع الحوامل و مقابلة الزائرات الصحيات فى وحدات الصحة الانجابية.

المعلومات الخاصة بعوامل الخطر تم الحصول عليها من 120 حالة وفاة لكل 110662ولادة حية و تم تقييميها وتحليليها بواسطة نسبة عامل الخطر و الانحدار اللوجستى الثنائى .

نسبة وفيات الامهات فى مستشفيات ولاية الخرطوم 108 لكل 100000 ولادة حية

الاسباب الرئيسة المباشرة للوفاة كانت كلاتى النزيف ,(23.3%) ثم العدوى (14.2%) ثم تسمم الحمل (12.5%) امااالاسباب الرئيسية الغير مباشرة هى الملاريا (15%)و الانيميا (8.3%).

اغلب الوفيات كانت فى عمر 30-34 و 49% من المتوفيات تمت ولادتهم بواسطة عملية و 43.3% ولادة طبيعية و 7.5% اجهاض . و 42.5% توفوا خلال 24 ساعة من الولادة .

التاخير فى الوصول للرعاية الصحية (p. value =0.009,OR = 2.8) و التاخير فى البحث عن الرعاية الصحية ([p. value = 0.023, OR =8.4) بالعلاقة مع مكان اقامة المتوفية نجد انها لها دلالة خطر و تنبؤه احصائى حيث ان النساء المقيمين فى الريف اكثر عرضة لخطر الوفاة

التطعيم ضد التتانوس (p. value= 0.028, OR = 3.7) , والرعاية و المتابعة اثناء الحمل (p value = 0.007 OR = 2.3) لهما دلالة خطر احصائية و تنبوة احصائى فى العلاقة مع مستوى التعليم حيث ان النساء الغير متعلمات اقل استخداما مرتان و

ثلاثـة مرات علـى التوالى لخدمات الرعايـة الصـحية الاوليـة واكثر عرضـة لخطـر الوفـاة التاخير فى البحث عن الخدمة الصحية لها دلالة احصائيةو خطر تنبؤ بالعلاقة مع المستوى الاقتصادى و الاجتماعى للمتوفية (p value =.025 , OR of 6.8)

اهم عوامل خطر وفيات الامهات التى ذكرت بواسطة النساء الحوامل و الزائرات الصـحيات هـى سـؤء خدمـات الصـحة الانجابيـة و بعد المسـافة من اقرب مستشفى و سؤء التغذية و الفقر و الزواج المبكر و العادات الضارة .

لذلك فان الدراسة توصى بالاتي:

- الالتزام السياسى لدعم جهود تقليل وفيات الامهات.

- تحسين خدمات صحة الامومة فى القرى و الارياف.

- تحريك المجتمع لزيادة استخدام خدمات الصحة الانجابية

- تشجيع مشاريع زيادة الدخل للامهات للقضاء على الفقر والامية.

Abstract

   The study of the risk factors for maternal mortality in Khartoum State public hospitals was carried out during 2013 to 2015. The aim of the study is to explore the risk factors for maternal mortality in Khartoum State public hospitals , to determine maternal mortality ratio in Khartoum state public hospitals, and to identify the direct and indirect causes, associated with maternal mortality.

   A descriptive prospective hospital-based study was used for all maternal deaths, occurred in public hospitals, in Khartoum state, between June 2014 and June 2015. Information on deceased will be collected immediately from relatives by using Adapted verbal autopsy questionnaire 2012, interviewing with the health visitors working in reproductive health unit, and focus group discussions with the pregnant women.

The information of risk factors was obtained form 120 died women out of 110662 live births, the odds ratio and binary logistic regression was used to assess the risk factors associated with maternal deaths.

Maternal mortality ratios in public hospitals in Khartoum state was 108/100000 live births. The main direct causes of deaths were Haemorrhage (23.3%), followed by sepsis(14.2%) and Eclampsia (12.5%). The main indirect causes of   deaths are Malaria (15%) and Anaemia (8.3%). Most of women died during the age 30-34. In addition, 49.2% of women who died were delivered by caesarean section, while 43.3% were normally delivered 7.5 % were abortions.   The 42.5 % of women died within 24 hours after delivery, while 56.7% of women died after 24 hours of delivery. Delayed for reaching health care (p. value =0.009,OR = 2.8),   and delayed for seeking health care (p. value = 0.023, OR =8.4]) were   significant predictors in association with

residence place which indicates that women living in rural area are more likely to die.

Vaccination against tetanus, (p. value= 0.028, OR = 3.7) and antenatal care (p. value = 0.007 OR = 2.3) were significant predictors in association with educational level of deceased, indicated that women with no education and primary education are 3.7 time and 2.3 time respectively less likely to use vaccination against tetanus and antenatal care and then increased risk to die.

Delayed for seeking health care (p value =.025, OR of 6.8) was significant predictors for maternal death in relationship with the socio economic status for deceased. Poor antenatal care service, living at far distance from nearby hospital, poor nutrition, poverty, early marriage, and harmful habits were main risk factors mentioned by health visitors and pregnant women.

In conclusions, the low socio-economic status as well as rural and low education level of women is at high risk of maternal death in Khartoum State public hospitals. Therefore the main recommendations are:

- Political commitment to decreasing maternal mortality are required, improving maternity service in rural hospitals, and community mobilization to support utilization of maternal health services and women empowerment program and income generation project should be establish to solve non-health service problem like poverty , female education, and Scio economic status.

Table of Contents

List of tables

List of figures

List of Abbreviations

MDG   =   Millennium Development Goals

FGD   =   Focus Group Discussion

MMR   = Maternal Mortality Ratio

ANC   = Antenatal Care

SHHS   =   Sudan Household Survey

WHO   =   World Health Organization

UN   =   United Nation

HIV   =   Human Immunodeficiency Virus

NFPA   =   United Nations Population Fund

UNICEF   =   United Nations Children's Fund

WRA   =   Women in Reproductive Age

ICD   =   International Classification of Disease

LB   =   Live Birth

MD   =   Maternal Death

Chapter (1)

Introduction

Problem statement

Rational

Objectives

1- Introduction

The WHO defines maternal death as the "Maternal death is 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 causes, {1}.

Improving maternal health is one of the eight Millennium Development Goals adopted by the international community at the United Nations Millennium Summit in 2000. In Millennium Development Goal 5 (MDG5), countries have committed to reducing the maternal mortality ratio by three quarters between 1990 and 2015,{2}.

Maternal mortality is unacceptably high. About 800 women die from pregnancy- or childbirth-related complications around the world every day. In 2013, 289 000 women died during and following pregnancy and childbirth. Almost all of these deaths occurred in low-resource settings, and most could have been prevented,{3}.

In the Eastern Mediterranean Region, around 53,000 women of childbearing age die every year as a result of pregnancy related complications. In fact, the Region comes only second to the African Region with regard to the number of maternal deaths. This problem occurs in a context where several countries in the Region suffer from lack of national policies, political instability, inadequate financial and human resources, restrictive regulations, poor socioeconomic conditions and gender-based discrimination, reduced access and utilization of safe motherhood services, including family planning, and scarcity of health-related data and information necessary to monitor and evaluate maternal health needs and the provided health services,{4}.++

In Sudan Progress towards achieving goal 5 is assessed through examining three indicators: The maternal mortality ratio (MMR), the contraceptive prevalence rate and the proportion of births assisted by skilled birth attendant. Between 1990 and 1999, the MMR reduced from 552 to 509 maternal deaths per 100,000 live births, a decline of 7.8% which is not that significant. There are also wide disparities and inequalities, both between states and within localities{5}. The household survey SHHS 2006 revealed MMR 623 /100000 for northern Sudan and last household survey revealed MMR was 216 /100000LB in SHHS 2010,{6} .

Women die from a wide range of complications in pregnancy, childbirth or the postpartum period. Most of these complications develop because of their pregnant status and some because pregnancy aggravated an existing disease. The four major killers are: severe bleeding (mostly postpartum bleeding), infections (also mostly soon after delivery), hypertensive disorders in pregnancy (eclampsia) and obstructed labor. Complications after unsafe abortion cause 13% of maternal deaths. Globally about 80% of maternal deaths are due to these causes. Among the indirect causes (20%) of maternal death are diseases that complicate pregnancy or are aggravated by pregnancy, such as malaria, anemia and HIV ,{7}. Women also die because of poor health at conception and a lack of adequate care needed for the healthy outcome of the pregnancy for themselves and their babies ,{2}.

1.2-Problem statement:

Maternal mortality is considered one of the major global health concerns especially in developing countries. Maternal death is considered the 3rd common cause of death among women in Africa. It is also one of the top 5 causes of deaths in general population as it contributes to 14% of total deaths,{8}. It affects not only women but also their families and communities. The risk of an infant dying increases significantly with the mother's death.

The death of a woman of reproductive age brings significant economic losses and setbacks to community development, {9}.

Maternal mortality is unlike other public health problems in several ways. First, although mortality is an ever-present threat, most women wish to be pregnant and to deliver a child at least once in their lives. Thus, although primary prevention is not entirely relevant, the prevention of unwanted pregnancy is not simply crucial, it is the single most important preventive intervention. Second, maternal mortality has multiple clinical causes{10}. Globally, there were an estimated 289 000 maternal deaths in 2013, a decline of 45% from 1990. The sub-Saharan Africa region alone accounted for 62% (179 000) of global deaths followed by Southern Asia at 24% (69 000). At country level, the two countries that accounted for one third of all global maternal deaths are India at 17% (50 000) and Nigeria

at 14% (40 000). The global MMR in 2013 was 210 maternal deaths per 100 000 live births, down from 380 maternal deaths per 100 000 live births in 1990,{11}.

Sub-Saharan Africa also had the largest proportion of maternal deaths attributed to HIV, at 10 percent, Of the 19,000 worldwide deaths formally referred to as "AIDS- related indirect maternal deaths", 17,000 (91 per cent) were in sub-Saharan Africa,{12}.

In many low income countries, deaths from maternal causes represent the leading cause of death among women of reproductive age. Since child survival is related to breast feeding, maternal deaths are a disadvantage to child survival and have an impact that rebounds across generations. A number of middle income countries such as Sri Lanka and Honduras have reduced maternal deaths. Nevertheless maternal mortality levels remain unacceptably high especially in sub-Saharan Africa and Asia. The United Nations (5th Millennium Development Goal) report asserts that in sub-Saharan Africa, the risk of a woman dying from such complications in the course of her lifetime is 1 in 16 compared to 1 in 3 800 in the developed world. This ultimately means that 99% of maternal deaths occur in the low income countries,{13}.

The most recent survey (SHHS 2010) estimated maternal mortality rate in Sudan (216/100.000LB). Delivery by trained personnel in Sudan stood at 72% (89% urban & 66 rural) in 2010 compared with 57% in 2006 .

The most recent maternal death review in Sudan (2010- 2012) estimated MMR in Khartoum state in 2010 (184/100000LB) , in 2011(149 /100000 LB) , in 2012 (165/100000 LB){6}. However; the results of SHHS2 showed a marked reduction in MMR from 638 in 2006 to 216 deaths per 100000 live births in 2010 {14}. Although not fully explained by the health authorities, this reduction might be attributed partially to the recent health policies and the other health interventions implemented by the government,{15}. Separation of South Sudan which has the highest maternal mortality in the world might also contribute to this reduction. Nevertheless; the difference in the Methodology and the geographical coverage between the two rounds of survey makes it difficult to compare the results or even to follow the mortality trends over time, {16}.

1.3 Rationale:

Maternal mortality remains a major challenge to health systems worldwide. Reliable information about risk factors, causes, trend, of maternal mortality is essential for resource mobilization, and for planning and assessment of progress towards Millennium Development Goal-5 (MDG 5),{7}.

Maternal mortality in Sudan is still high which increases the challenges to keep pace with the MDG target with 2015,{17}. However; the country is still far from achieving MDG5 targets. Due to lack of accurate information on which effective interventions and strategies can be based ,{13}.

Because there is no accurate vital registration system in Sudan, maternal mortality estimates in Sudan were based on indirect and direct sisterhood estimates as in the demographic surveys conducted in the past four decades

The Sudan household health survey and most research showed only the maternal mortality indicator and causes, trend, without considering risk factors.

Estimated risk factors of maternal mortality over time are critical in that they help in planning of reproductive health programs to reduce mortality. The prospective descriptive studies about risks factors for maternal mortality in Khartoum state hospitals is rare

1.4 Objectives:

4-1 General Objective:

To Study the risk factors for maternal mortality in Khartoum State public hospitals, Sudan, 2013 to 2015.

4-2 Specific objectives:

1. To determine maternal mortality ratio in Khartoum state public hospitals

2. To identify the direct and indirect causes associated with maternal mortality

3. To compare maternal mortality distribution and risk factors between rural and urban area.

4. To identify risk factors in the association between health services and illness factors in relation to:

   - Socio-demographic variables: Age, residence (rural/urban), ethnicity, family income, education and occupation

Chapter (2)

Literature Review

2.1 Definitions

Definitions related to maternal death

2.1.1 Maternal death: 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 causes,{11}.

2.1.2 Pregnancy-related death: The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death.,{18}.

Late maternal death: The death of a woman from direct or indirect obstetric causes, more than 42 days, but less than 1 year after termination of pregnancy,{18}.

2.1.3 Direct obstetric deaths are those resulting from obstetric complications of the pregnant state (pregnancy, labour and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.,{19}.

2**.1.4 Indirect obstetric deaths** are those resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but was aggravated by physiologic effects of pregnancy ,{19}.

2.2 Statistical measures of maternal mortality:-

2.2.1 Maternal mortality ratio (MMR): The number of maternal deaths per 100,000 live births in a given time period. This MMR expresses obstetric risk, or a woman's chances of dying from a given

pregnancy. This is the most commonly used indicator of maternal health.

2.2.2 Maternal mortality rate: The number of maternal deaths per 1,000 women of reproductive age (usually 15–49 years).This is an indicator of the risk of maternal death among women of reproductive age and provides an indication of the burden of maternal death in the adult female population,{2}.

2.2.3 The lifetime risk of maternal death is the risk a woman has of dying during her reproductive years, given current rates of fertility and the risk of maternal mortality. Given the length of the reproductive period (about 35 years), the lifetime risk is calculated as [1 − (1 − maternal mortality rate)35],{20}.

2.3 Data source of maternal mortality

Estimation of maternal mortality indicators is difficult and subject to error because the data on which estimates are based are frequently inaccurate. These estimates produced jointly by the WHO and UNICEF and UNFPA countries, are classified into one of the following four categories :

Countries with the complete civil registration and good cause of death attribution

Those with complete or nearly complete civil registration of number of births and deaths but with the poor cause of death attribution.

Those without reliable system of civil registration , where maternal death like other vital events, unrecorded.

Those with estimate maternal mortality based on household surveys used direct or indirect sisterhood method,{20}.

2.3.1 Civil registration systems

In developed countries, information about maternal mortality derives from the system of vital registration of deaths by cause. Even where coverage is complete and all deaths medically certified, in the absence of active case-finding, maternal deaths are frequently missed or misclassified.5,6,7,8,9 In many countries, periodic confidential enquiries or surveillance are used to assess the extent of misclassification and underreporting. Few developing countries have a vital registration system of sufficient coverage and quality to enable it to serve as the basis for the assessment of levels and trends in cause-specific mortality including maternal mortality,{19}.

2.3.2 Household surveys:

Where civil registration data are not available, household surveys provide an alternative. Limitations of household surveys include the following:

The survey identifies pregnancy-related deaths (not maternal deaths); Because maternal deaths are rare events in epidemiological terms, surveys to measure their levels require large sample sizes to provide statistically reliable estimates and therefore they are expensive.

Even with large sample sizes, the obtained estimates are still subject to uncertainty (wide confidence intervals), making it difficult to monitor changes over time,{18}.

2.3.3 Sisterhood methods

Sisterhood methods obtain information by interviewing a representative sample of respondents about the survival of all their adult sisters,{18}.

The sisterhood method has several disadvantages. Because it typically ascertains deaths during the past 5 or 10 years, it provides historical, rather than current information about maternal deaths. Furthermore, the sisterhood requires the expense and effort of a survey. It is limited by the accuracy of the respondent's understanding of the decedent's cause of death,{20}.

2.3.4 Reproductive-age mortality studies (RAMOS):

This approach involves identifying and investigating the causes of all deaths of women of reproductive age in a defined area population by using multiple sources of data (e.g. interviews of family members, vital registrations, health facility records, burial records, traditional birth attendants),{21}.

2.3.5 Verbal autopsy

Verbal autopsy is a method used to ascertain the cause of a death based on an interview with next of kin or other caregivers. This is done using a standardized questionnaire that elicits, information on signs, symptoms, medical history and circumstances preceding death. The cause of death, or the sequence of causes that led to death, are assigned based on the data collected by a questionnaire and any other available information. Rules and guidelines, algorithms or computer programs, may assist in evaluating the information to determine the cause of death. The main objective of VA is to describe the causes of death at the community level or population level where civil registration and death certification

systems are weak and where most people die at home without having had contact with the health system,{22}.

2.3.6 Census

A national census, with the addition of a limited number of questions, could produce estimates of maternal mortality; this approach eliminates sampling errors (because the entire population is covered) and hence allows a more detailed breakdown of the results, including time trends, geographic subdivisions, and social strata.

This approach allows identification of deaths in the household in a relatively short reference period (1–2 years), thereby providing recent maternal mortality estimates, but is conducted at 10-year intervals and therefore limits monitoring of maternal mortality.

The training of enumerators is crucial, since census activities collect information on a range of other topics which are unrelated to maternal deaths,{18}.

2.4 Maternal mortality world wide

Globally, the maternal mortality ratio (MMR) has fallen by 45% between 1990 and 2013. All MDG regions of the world have experienced considerable reductions in maternal mortality. There were an estimated 289 000 maternal deaths in 2013, (13) Most of them died because they had no access to skilled routine and emergency care. Since 1990, some countries in Asia and Northern Africa have more than halved maternal mortality,{23}.

According to WHO reports, all regions experienced a decline of 37% or more in MMR between 1990 and 2013. The highest reduction in the 23-year period was in Eastern Asia (65%) followed by Southern Asia (64%), Northern Africa (57%), South-eastern Asia (57%), Oceania

(51%), sub-Saharan Africa (49%), Caucasus and Central Asia (44%), Western Asia (43%), and Latin America and the Caribbean (40%). Eastern Asia experienced the highest average annual decline between 2005 and 2013 at 5.2% while Latin America and the Caribbean experienced the least decline in the same period, at 1.1%. When interpreting change in MMR, consideration must be given to the relative ease of reducing MMR while comparing the high level to low level.(13) For WHO, UNICEF, UNFPA, World Bank and UNPD regions, despite an initial increase in maternal mortality in regions highly affected by HIV (Southern Africa) between 1990 and 2005,{9}.

At the close of the last century, Sub-Saharan Africa still had high maternal morbidity and mortality rates, with the goals of safe motherhood eluding many governments. The Programme of Action of the International Conference on Population and Development of 1994 and the Fourth World Conference on Women of 1995 were created in an attempt to tackle these issues and drew unprecedented attention to reproductive health and rights as well as to gender equity and equality.. Demographic events of the last decade are a sharp contrast to those in the 1980s, when decreasing infant, child, and adult mortality rates, and maternal mortality ratios (MMRs) were leading to steadily increasing life expectancy and improved health status for women in the region,{20}.

2.5 Maternal mortality in Developing countries

Almost all maternal deaths (99%) occur in developing countries. More than half of these deaths occur in sub-Saharan Africa and almost one third occur in South Asia. The maternal mortality ratio in developing countries in 2013 is 230 per 100 000 live births versus 16 per 100 000 live births in developed countries, {3}.

The adult lifetime risk of maternal mortality in women from sub-Saharan Africa was the highest at 1 in 38, in sharp contrast to 1 in 3700 among women in developed countries. Two countries accounted for one third of all global maternal deaths: India at 17% (50,000) and Nigeria at 14% (40,000). Of the 40 countries with the highest MMR in 2013, Sierra Leone is estimated to have the highest, with an MMR of 1100. Only two countries outside the sub-Saharan African region had high MMR: Afghanistan (400) and Haiti (380). In contrast, Cabo Verde and Mauritius were the only two sub-Saharan African countries that had low MMR, at 53 and 73 maternal deaths per 100,000 live births, respectively,{11}.

2.6 Maternal mortality in Sudan

Sudan is one of eleven countries that are responsible for 65% of global maternal deaths according to a recent World Health Organization (WHO) estimate,{14}. The last results of SHHS2 2010 showed a marked reduction in MMR from 638 in 2006 to 216 deaths per 100,000 live births in 2010,{24}.

The average annual reduction rate of maternal mortality was 3% between 1990 and 2010 which has led to 60% reduction. However, given the challenges facing maternal health, MDG5 might not be easy to attain. The average annual percentage change in maternal mortality is -1.6% between 1990 and 2010. With the current pace of reduction of maternal deaths, Sudan is most unlikely to achieve MDG5,{25}.

For every woman who dies, approximately 20 more suffer long-lasting injuries, or disabilities such as obstetric fistula, uterine prolapse, infertility and depression,{24}

2.7 Causes of maternal mortality worldwide

The major causes of maternal deaths worldwide are severe bleeding (25%), infections (15%), eclampsia seizures/fits often following a pregnancy-related rise in blood pressure, (12%), obstructed labour - when the neck of the womb is fully open but the baby will not come out (8%), unsafe abortion (13%), other direct causes (8%) and indirect causes (20%), including AIDS, malaria and pulmonary embolus – a blood clot in the lungs or ectopic pregnancy, where a pregnancy occurs outside the womb. Sever anemia contributes to the risk of death in cases of haemorrage. Maternal anemia affects globally about half of all pregnant women, {26}.

A related WHO study of causes of more than 60,000 maternal deaths in 115 countries shows that pre-existing medical conditions exacerbated by pregnancy (such as diabetes, malaria, HIV, obesity) caused 28% of the deaths. "The new data show a changing profile in the conditions that cause maternal deaths; reflecting the increasing burden of noncommunicable diseases in women throughout the world. Ending preventable maternal deaths will require both continued efforts to reduce complications directly related to pregnancy, and more of a focus on noncommunicable diseases and their effect in pregnancy. Integrated care for women with conditions like diabetes and obesity will reduce deaths and prevent long-lasting health problems,{27}.

2.8 Causes of maternal mortality in Sudan

Direct maternal death were (64.5%), mainly due to; haemorrhage (30.9%), eclampsia (13.4%) and sepsis (11.2%). Indirect MDs were malaria (35.5%), (12.7%) due to hepatitis and (6.9%) due to anemia. Notified deaths from obstetric haemorrhage were (30.9%), post-partum haemorrhage (PPH) was (66.2%), rupture uterus (16.8%), ante-partum haemorrhage (APH) (12.1%) and (4.9%) due to abortion. Uterine atonia was the main cause of PPH; (48.4%), followed by; retained placenta (24.3%), birth canal injuries (24.0%)and blood disorders (3.3%) ,{6} .

2.9 Risk factors for maternal mortality

The risks of maternal mortality and morbidity can be assigned to two major categories: maternal, or "host," characteristics, including age, parity, stature, and underlying or concurrent disease; {2} and community characteristics, primary location and isolation, whose main effects have to do with the availability and quality of health care,{28}.

Another risk factors, such as, Household and community characteristics (behavior, cultural-religious values, and income poverty); Biological-demographic variables and risk factors; Malnutrition-infection syndrome (including protein-energy malnutrition [PEM], micronutrient deficiencies, anemia, malaria, and HIV/AIDS); Health systems; and national policies and related investments (health and non health) also contribute in maternal mortality rate,{20}.

2.9.1 Household and Community Characteristics

Pregnancy outcome and maternal survival have strong correlations with household behavior and decision making. Low status of women in the household and society as a whole, as exemplified by inequality in education, employment, property ownership, participation, and decision

making, is another important correlate. Gender-based violence is common in situations in which the status of women is low and legal protection inadequate, and in turn it is correlated with high rates of maternal mortality.

Harmful traditional practices and religious beliefs also adversely affect maternal health from the sexual or genitally linked ones, such as female genital cutting, to feeding and nutritional practices, {20}.

2.9.2 Household poverty

There is emerging evidence of the link between poverty and maternal deaths in low and middle-income countries. In Peru, for example, there is a six fold difference between the MMR among the richest and poorest income quintiles (800/100,000 vs. 130/100,000). In Indonesia, the risk of maternal death is around three to four times greater in the poorest than the richest group. An analysis across 10 developing countries reveals that the proportion of women dying of maternal causes increases consistently with increasing poverty,{29}.

There are many ways in which poverty might lead to high MMM. For example, extreme poverty is often associated with limited access to necessary antenatal medical care as well as appropriate medical resources during and after delivery. The poor may not have access to fresh water, and may live in sub-standard dwellings and be at greater risk of contracting malaria or parasitic infections that compromise a woman's immunity during pregnancy,{30}.

Poverty remains widespread in Sudan with 46.5% of the population who lives below the poverty line according to the national definition of poverty (US$ 1.5 per person/day). Those who are most affected by

poverty are the rural dwellers, particularly, women and internally displaced people,{25} .

2.9.3 Age and Parity

For women, who are too old, too young, or have had too many pregnancies are at higher risk of obstetric complications; birth interval is an additional and confounding factor. The definitions of "old," "young" and "many" are, of course, debated. Regardless of the precise definitions, adolescents (< 16), older women (> 40), primiparae (P = 0), and grand multiparae (P > 4) are all more likely to experience a complication during pregnancy or delivery, and their infants are more likely to die before, during, or soon after birth. Very young women, whose pelvic bone growth is still not completed, are more likely to have a narrow birth canal, the leading cause of difficult deliveries that prolong labor and increase the risk of obstetric fistulae. Young women and primiparae are more likely to develop hypertension and eclampsia. Both young unmarried women and older mothers with several children are more likely to seek abortions because of unwanted pregnancies, {28}.

2.9. 4 Anemia and Maternal Mortality

The recent Lancet series on maternal and child under-nutrition estimated that 20% of maternal deaths are due to maternal iron-deficiency anemia and stunting in women. Maternal anemia control programs are the primary maternal nutrition program worldwide, yet they lack adequate funding and have, therefore, failed to significantly reduce maternal anaemia in developing countries,{31} .

Study conducted   in Eastern Sudan shows, severe anaemia is the major cause of indirect maternal death and accounts for 20.3% of cases {32}.

2.9. 5 Malaria and Maternal Mortality

Malaria remains a major killer of women in pregnancy and a leading indirect cause of maternal mortality,{20}.Twenty-five million pregnant women are currently at risk for malaria, and, according to the World Health Organization (WHO), malaria accounts for over 10,000 maternal deaths per year,{33}.

In Sudan, falcipruam malaria is main causes of maternal mortality, and pregnant women experience variety of adverse consequences from malaria infection, such as malaria anaemia, weight and prenatal mortality,{34}.

2.9.6 HIV and Maternal Mortality

An estimated 17 million women globally are living with HIV. The majority of these women live in Sub-Saharan Africa and are of reproductive age (15–49 years). Estimates of maternal death due to HIV-related causes vary widely. In 2011, HIV-related causes contributed to between 19,000 and 56,000 maternal deaths. HIV-infected pregnant women have two to 10 times the risk of dying during pregnancy and the postpartum period compared with uninfected pregnant women, {35}.

2.9.7 Health Systems

Poorly financed and unaccountable health systems, including weak referral systems, are a key determinant of maternal outcome. Another determinant is poor access to quality maternal health care services because of geographical terrain and poor roads. Maternal health care services are deemed to be of poor quality if, for example, they lack skilled health providers, the providers have negative attitudes, treatment guidelines and protocols are inappropriate, and they lack essential drugs,

equipment, and supplies. A low health personnel-to-population ratio is a chronic issue in Sub-Saharan Africa. Given that skilled birth attendants working within a supportive health system are the most important factor in keeping women healthy and safe in pregnancy, inadequate numbers and distribution of human resources are major underlying causes of maternal mortality in Sub-Saharan Africa,{20}.

Health services in Sudan are provided by the public sector, private and traditional sector. Within the public sector, service delivery is organized at primary, secondary and tertiary levels,{25}.

Study conducted in seven states by UNICEF and ministry of health, about maternal and neonatal heath service in Sudan, revealed uneven distribution of reproductive health staff across the seven states, with Khartoum having the highest concentration of reproductive health staff (an average of 28 per facility) and Kassala having the lowest concentration.

Three-quarters of maternal deaths occur during delivery and the immediate postpartum period. Thus the availability of a skilled health worker with midwifery skills (along with commodities, drugs, equipment), as well as adequate transportation for referral in case of an emergency, are crucial for saving maternal and neonatal lives. According to results of the SHHS, only half of all births in Sudan are delivered by skilled personnel,{9}.

2.9. 8Antenatal care:

 Only half of women worldwide receive the recommended amount of care during pregnancy. Regular contact with a doctor, nurse or midwife during pregnancy allows women to receive services vital to their health and that of their future children. The World Health Organization (WHO)

recommends a minimum of four antenatal care visits. However, global estimates indicate that only about half of pregnant women receive this recommended amount of care, {36}.

Antenatal care has been downplayed in recent years as an intervention for reducing maternal mortality. This has arisen in large part as a result of improved understanding of the causal pathways that lead to maternal deaths,{37}.

In Sudan, according to the Annual Report of the NRHP 2008, antenatal care (ANC) services were being provided by 45 % of facilities, the proportion of mothers receiving at least one antenatal care visit has stayed almost static, not increasing beyond 75 % through the 1990s to 2010 (SHHS). Antenatal care coverage was higher in urban areas (84.3 %) than in rural areas (70.4 %), and both the women's educational level and economic level of the household seem to influence the proportion of pregnant women,{38}.

2.9.9 Three Delays of Maternal Mortality

Maternal mortality in resource-poor nations has been attributed to the "3 delays": delay in deciding to seek care, delay in reaching care in time, and delay in receiving adequate treatment. The first delay is on the part of the mother, family, or community not recognizing a life-threatening condition. Most births occur at home with unskilled attendants, and it takes skill to predict or prevent bad outcomes and medical knowledge to diagnose and immediately act on complications.

The second delay is in reaching a health-care facility, and may be due to road conditions, lack of transportation, or location. Many villages do not have access to paved roads and many families do not have access to vehicles. Public   transportation   (or   animals)   may   be   the   main

transportation method. This means it may take hours or days to reach a health-care facility. Women with life-threatening conditions often do not make it to the facility in time.

The third delay occurs at the healthcare facility. Upon arrival, women receive inadequate care or inefficient treatment. Resource-poor nations with fragile health-care facilities may not have the technology or services necessary to provide critical care to hemorrhaging, infected, or seizing patients. Omissions in treatment, incorrect treatment, and a lack of supplies contribute to maternal mortality,{39}.

2.10 Maternal Death Surveillance and Response

Maternal Death Surveillance and Response (MDSR) is a form of continuous surveillance linking the health information system and quality improvement processes from local to national levels. It includes the routine identification, notification, quantification, and determination of causes and avoidability of all maternal deaths, as well as the use of this information to respond with actions that will prevent future deaths. Elimination of preventable maternal mortality is the goal of MDSR, {40}.

Maternal death surveillance and response systems have the potential to deliver real-time, frequent monitoring of maternal mortality levels, trends and causes, provided investments are made to assess the completeness of reporting and data accuracy as part of the system. If successful, such systems would be a major step forward in the measurement of maternal mortality. Moreover, they would serve as the basis for a longer-term advancement, namely, strengthening the civil registration and vital statistics system, {41}.

2.11 Strategies to Reduce Maternal Mortality

The strategies that have been promoted as potentially effective ways to overcome the high rates of maternal mortality, have been multiple, and substantial changes have occurred in recent decades. Initial efforts since the 1950s have focused on antenatal clinics and maternal education, followed by an emphasis on family planning. In the 1970s, training and promotion of traditional birth attendants (TBAs) were introduced, while the 1990s were dominated by an emphasis on increased access to and quality of obstetric care. Relatively, few of the strategies, proposed in this recent time period, have involved the medical profession directly as interventions such as family planning or antenatal care were thought to be deliverable by community health workers,{42}.

2.11.1 Intrapartum and Postpartum Period

Interventions focused on the intrapartum period have been implemented. For example, efforts to address or treat postpartum hemorrhage and infection facilities have been made by providing oxytocics and antibiotics, manual removal of the placenta, blood transfusion, and if needed, hysterectomy. Instrumented vaginal deliveries are encouraged and basic surgical equipment for cesarean deliveries is required. As most women in developing nations deliver at home, organizations such as the World Health Organization, Institute of Medicine, World Bank, and the Lancet's Maternal Survival Steering Group prioritize professional skilled birth attendance at delivery. Studies have determined a direct relationship between having skilled birth attendants during labor and decreased maternal mortality ratios. Programs designed for home-based deliveries recommend skilled birth attendants carry emergency first aid kits, and easy access to health facilities if labor becomes dysfunctional ,{39} .

2.11.2 WHO key working areas to reducing maternal mortality

Strengthening health systems and promoting interventions, and focusing on policies and strategies that work, are pro-poor and cost-effective.

Monitoring and evaluating the burden of maternal and newborn ill-health and its impact on societies and their socio-economic development.

Building effective partnerships in order to make best use of scarce resources and minimize duplication in efforts to improve maternal and newborn health

Advocating for investment in maternal and newborn health by highlighting the social and economic benefits and by emphasizing maternal mortality as human rights and equity issue.

Coordinating research, with wide-scale application, that focuses on improving maternal health in pregnancy and during and after childbirth,{7}.

In Sudan maternal and neonatal mortality can be reduced by ensuring access to voluntary family planning to space births, provision of adequate antenatal care, ensuring skilled attendance at delivery, backed by emergency obstetric care when needed,{14}.

The United Nations recommends the four pillars of safe motherhood ___Family planning (FP); antenatal care (ANC); skilled birth attendance (skilled health personnel, commodities, drugs, and equipment); and emergency obstetric and neonatal care. Moreover, it is crucial to overcome the three main delays in accessing health services: 1) delay in recognizing danger signs and in making the decision to seek medical

care; 2) delay in arrival at a health facility; and 3) delay in the provision of adequate care at the health facility, {14}.

2.12 Similar studies:

 A prospective, descriptive, hospital-based study conducted in Khartoum, 2007 & 2008 to determine maternal mortality ratio – MMR, with regard to obstetric haemorrhage & associated risk factors ,{43}. it Showed 130 maternal deaths reported out of 105210 live births ,maternal mortality ratio is 124/100000 live birth, 107 cases (82.3%) due to direct obstetric causes, while 23 cases (17.7%) were indirect. Obstetric hemorrhage was the main direct cause 29.2%, mostly due to post partum hemorrhage – PPH, 76.3%, it affects low risk groups, only 21% were grand-multipara blood transfusion. Most of patients, 68.4% died within first 24 hour& most of maternal deaths (68.8%) had no significant abnormal obstetric history in current pregnancy or in the past, 42.1% did not present with hemorrhage, & 39.5% had from admission,{43}.

  And the study showed that, home delivery, late presentation, suboptimal intra-partum or intra-operative care & late intervention, unavailability of blood or blood substances & poor referral system, are the main factors behind maternal deaths, {43}.

  A research   conducted in Sudan about factors contributing to maternal mortality 2013,{44} the findings tell that multiple interacting factors contribute to maternal mortality in the country. These factors are closely linked to socio-cultural, economic, geographical, and organizational barriers. Rural women seem to be significantly disadvantaged. This is due to the obvious urban-rural inequalities in education, income, and health as well. The marked gender inequity and low woman's decision-making autonomy aggravate the overall situation and put negative

impacts on women's health. To add to the problem; health services related barriers were found to be an essential component of each phase of delay. They might act as explicit barriers to utilization of maternal services,{44}.

The study carried out in different region of Sudan in 2010 about epidemiology of Maternal mortality {45}, showed that maternal mortality ranged from 442 (146/33034) to 640 (63/9841) / 100000 birth in the different regions of Sudan, most of these were due to communicable diseases. The main findings of this study showed the high rates of maternal mortality and poor prenatal outcomes all over the investigated regions including the capital Khartoum. Almost similar causes were behind this high maternal mortality, in which septicemia, haemorrhage, hypertension, malaria and anaemia were the identified causes, {45}.

Another study carried out in Kassala State - Eastern Sudan about Maternal mortality. This community-based study using Reproductive age mortality survey over a period of three-years (2004-2006),{32} showed that Maternal mortality rates and ratios were 80.6 per 100,000 women reproductive age and 713.6 per 100,000 live births (LB), respectively, and wide discrepancy between urban and rural maternal mortality ratios (369 and 872\100,000 LB, respectively). Direct obstetric causes were responsible for 58.4% of deaths. Severe anemia (20.3%) and acute febrile illness (9.4%) were the major indirect causes of maternal death whereas obstetric hemorrhage (15.6%), obstructed labor (14.1%) and puerperal sepsis (10.9%) were the major obstetric causes. As for the contributing factors, we found delay of referral in 73.4% of cases in spite of a high problem recognition rate (75%). 67.2% of deaths occurred at home, indicating under utilization of health facilities, and

transportation problems were found in 54.7% of deaths. . There was a high illiteracy rate among the deceased and their husbands (62.5% and 48.4%, respectively), {32}.

A retrospective study carried out at the Medani Teaching Hospital, Medani City, Sudan 1999, about maternal mortality {46} finding that out of the total number of deliveries in that period (N=44,605), 877 women died with a rate of 1,966 per 100,000. This rate showed a decline each year, being 2,661 per 100,000 during the period 1985-1989. The mortality rate during 1990-1994 was 2,021 per 100,000 and 1,363 per 100,000 during the last period of 1995-1999. Sepsis was the cause of deaths in almost one third of the cases, while malaria accounted for 37.2%. The number of preventable deaths had decreased steadily. The study highlighted the existence of a serious and preventable obstetrical problem. Sepsis, malaria, hemorrhage and hypertensive disorders are the main contributory factors. Poor antenatal care and poor provision of health services add more to the problem ,{46}.

Study carried out in rural Tanzania in 2010 about assessment of risk factors associated with the maternal mortality (47) found that Two significant risk factors for maternal mortality have been identified and this can play a role in identifying women at higher risk of a maternal death. Increasing maternal age and marital status were the factors that were found to be associated with increased risk of maternal death. This was driven by high rates of haemorrhage and eclampsia in this region which indicates an urgent need for better antenatal and obstetric care for women over thirty years. Indirect causes of maternal death such as HIV/AIDS, TB, malaria and anaemia also contributed to a significant proportion of deaths, highlighting the need for effective interventions ,{47}.

A case control study conducted in Kenya about Risk factors for maternal mortality in a Tertiary Hospital from January 2004 to March 2011{48} showed that factors significantly associated with maternal mortality included: having no education relative to secondary education, history of underlying medical conditions, doctor's attendance at birth (OR 4.6, 95% CI), having no antenatal visits being admitted with eclampsia ,being admitted with comorbidities, having an elevated pulse on admission ,{48}.

Study carried out in Senegal in Dakar hospitals (1997) about Risk factors for maternal mortality{49} showed the risk factors associated with health system failures: medical equipment failure, lack of antenatal visit, and lack of available personnel at time of admission. Various indicators of maternal status at time of admission (complications, blood pressure, temperature, oedema, haemoglobin level) and of health history prior to admission (previous complications, previous C-section, lack of treatment) were also strong predictors of survival. Lastly, socio-demographic factors also appeared as correlates of maternal mortality, in particular: first pregnancy, pregnancy of high birth order, rainy season, being unmarried and low level of education, {49}.

The 2007 Community Survey conducted in South Africa included questions on maternal deaths in the previous 12 months (pregnancy-related deaths). The Maternal Mortality Ratio (MMR) was estimated at 702 per 100,000 live births, some 30% more than at the 2001 census. This high level ratio occurred despite a low proportion of maternal deaths (4.3%) among deaths of women aged 15-49 years, which is even lower than the proportion of time spent in the maternal risk period (7.6%). The high level of MMR was due to the astonishingly high level of adult mortality, which increased by 46% since 2001. The main

reasons for this exceeding level were HIV/AIDS and external causes of death (accidents and violence), {50}.

Study in Nigeria about Predictors of maternal mortality in institutional deliveries 2010(51) showed that . About one-fifth (20.5%) of women had no antenatal care while 79.5% had at least one antenatal visit during pregnancy. Four-fifths (80.5%) of all deliveries were normal deliveries. Elective and emergency caesarean section rates were 3.1% and 11.5% respectively. There were 79 maternal deaths and 8 526 live births, giving a maternal mortality ratio of 927 maternal deaths per 100 000 live births. No antenatal care, parity, level of education, and mode of delivery were significantly associated with maternal mortality. Low maternal education, high parity, emergency caesarean delivery, and high risk patients risk independently predicted maternal mortality,{51}.

Study in west Iran about risk factors of maternal mortality 2014 {52} showed The majority of cases were aged 20-34 years, died in hospital, and lived in urban areas. The most common causes of death were bleeding, systemic disease, infection, and pre-eclampsia. The OR estimate of maternal death was 8.48 (95% CI=1.26-56.99) for advanced maternal age (≥35 years); 2.10 (95% CI=0.07-65.43) for underweight and 10.99 (95% CI=1.65-73.22) for overweight or obese women compared to those with normal weight; 1.56 (95% CI=1.08-2.25) for every unit increase in gravidity compared to those with one gravidity; 1.73 (95% CI=0.34-8.88) for preterm labors compared to term labors; and 17.54 (95% CI= 2.71-113.42) for women with systemic diseases. Study. Conclude maternal age, abnormal body mass index, multiple gravidity, preterm labor, and systemic disease were the main risk factors for maternal death. However, more evidence based on large cohort studies in different settings is required to confirm our results,{52}.

Chapter (3)

Methodology

3- Methodology:

3.1 Study design: Prospective descriptive hospital-based study of all maternal death at public hospitals in Khartoum state during **2013-2015**

3.2 Study area:

Khartoum state is the capital of Sudan; it is the political and commercial centre of Sudan. Its lies between latitudes 15 to 16 degrees north and longitudes 31 to 34 degrees east. It is about 28000 square km. , is located in centre of Sudan and it has boarders with 7 states.

Total population is 6649564, pregnant women are 224090(est 2012) and women in child bearing age are 15,46727 according to central census unit. . Khartoum state is divided to 7 localities. Bahry , Khartoum   , Omdurman , Umbada , SharqAlneel , karrary, jabelawlia

In Khartoum state there were 22 governmental hospitals, 137 health centers and 183 dispensaries that covered all states.   The total health visitors were 41 and Assistant health visitors were 110 and midwives are 1527. The total deliveries were93801 live births in hospitals in 2013 according to reproductive health unit report , about 31% of deliveries attended by Omdurman maternity hospital ,{53}.

3.3 Study population:

1. All women who died in maternity department of public hospitals in Khartoum state from June 2014 to June 2015)

2. Health visitors and assistant health visitors in primary health care centers and hospitals in Khartoum state

3. Pregnant women in Khartoum state hospitals

3-4. Sampling

3.4. 1 Sample Size

1. Total coverage of all maternal death occurred in maternity department from June 2014to June 2015 in Khartoum public hospitals which were 120 deaths .

2. All health visitors (41 health visitors) in primary health care centers and hospitals

3. Pregnant women who accepted to participate (48 pregnant women) from three different maternity hospitals

3.4.2 Inclusion criteria

1. All family members of deceased women
2. Heath visitors who accepted to be involved in the study
3. Pregnant women who accepted to be involved in the study

3.4.3 Exclusion criteria

Only family members of deceased women and health visitors and pregnant women who refuse to participate in the study .

3.5 *Method of data collection:*

Information about risk factors will be collected by using

I. Information of deceased will be collected immediately from relatives , after informing the consent from relatives and hospital directors by using Adapted verbal autopsy questionnaire 2012 (Standard World Health Organization) by trained data collectors . Verbal autopsy method is an epidemiological tools used to identify maternal deaths and their probable causes. The questionnaire of contributing factors were constructed including socio-demographic,

causes , antenatal visit, health service used for the final illness , cost of illness (Appendix 1)

II. Structured interview with the health visitors working in reproductive health unit included issues on, period of experience, knowledge and role in providing antenatal service (Appendix 2).

III. Focus group discussions with the pregnant women will be conducted in three different maternity hospital , selected randomly by drown.

In each hospital (two group , 8 participants in each group) , the selection of these personnel by convenience sampling and all participants should complete a consent to Participate in Focus group discussion The discussion will be carried in separate office and take approximately 30 minutes and the researcher introduce the topic of the discussion to participant , then initiate the discussion and kept silent to record the opinions in note book . (Appendix 3)

3.6   Data analysis :

The quantitative data will be analyzed by using SPSS version 20   the results are presented by

Descriptive statistical analysis :

Using frequency and proportion (tables and figures, graph)   Maternal mortality ratio was estimated by dividing the number of maternal deaths in public hospital in Khartoum state during study period and total live births in public hospital in Khartoum state during that period

Inferential statistical analysis:

- All data about risk factors were categorical first , coding to 0 , 1 and analyzed using contingency table and chi-square tests to find risk factor associated with deceased women . An odds ratio (OR) is used to determine whether a particular exposure is a risk factor for maternal mortality. Odds ratio are most commonly used in case-control studies, however they can also be used in cross-sectional and cohort study designs as well with some modifications and/or assumptions), {54} . The Odds ratios (ORs) 95% confidence intervals and p-values are reported for three group of risk factors (residence place , socio-economic status , educational level association with health services, illness risk factors)

  Socio economic measured based on three variable occupation ,education, family income, and factors score was calculated according to from 5 to 29 from 5 -15 is lower, from 16-29 is high according to Kuppuswamy's scale in India 2012. (Appendix 4) Anew variable was derived low and high socio economic status {55}.

- Binary logistic regression is also undertaken to determine which risk factors predict was strongly associated with maternal death and impact of overall factors of relationship among the independent variables : (health services factors , illness factors) and dependent variable (residence place, deceased educational level. socio -economic status) Predictors entered into regression models included all factors and significant predictors and odd ratio are reported for each group .

- The qualitative data were analyzed manually.

3.7 Study variables

Variable risk factors include:

 i. **Socio-demographic characteristics:** age, socio-economic status, educational status of mothers;

 ii. **The information on causes and risk factors associated with maternal mortality** which include the following:
    a. Antenatal coverage,
    b. Distance
    c. Vaccination against tetanus
    d. Infectious disease.
    e. Usual residence
    f. Health system
    g. Chronic diseases
    h. Delayed for health care

3.8 Piloting Study: One hospital will be used for piloting study, to test the data collection tools, to make necessary amendment and proper training for data collectors (22 data collectors).

3.9 Ethical consideration:

1. The proposal of study was passed by University of Shendi post graduate studies (research committee)

2. The consent and permission will be obtained from health authority of Khartoum state

3. Explanation of the study purpose and the benefits of it . will be given for every participant when asking her to participate in the study to gain her consent

3. Confidentiality of data and privacy will be rigorously protected. Research team will be trained adequately in this aspect. Access to the confidential data will be limited to researcher.

Chapter (4)

(Results)

Table (1): distribution of maternal deaths among the Khartoum state public hospitals during the study period (2014-2015)

Number	Hospitals	Frequency	Percent
1-	Omdurman maternity	68	56.7
2-	Bahri hospital	16	13.3
3-	Alsuadi maternity hospital	7	5.8
4-	Bashair	7	5.8
5-	academic hospital	4	3.3
6-	Saad abu alla hospital	4	3.3
7-	Alturky hospital	4	3.3
8-	Ali adelfattah hospital	2	1.7
9-	Al bangadded hospital	2	1.7
10-	Abudelak hospital	2	1.7
11-	Jabal awleia hospital	2	1.7
12-	Chinese friendship hospital	2	1.7
	Total	**120**	**100.0**

N= 120

Table4 shows nearly more than half deaths (56.7%) occurred in Omdurman maternity hospital, due to load of work.

Table (2): *Age distribution of maternal deaths in Khartoum state public hospitals during study period (2014-2015)*

Variable	Frequency	Percent
less than 20years	6	5.0
20-24year	28	23.3
25-29years	33	27.5
30-34years	43	35.8
35-40 years	6	5.0
above 40 years	4	3.3
Total	**120**	**100.0**

N =120

The above Table shows the age distribution of women who died. Most of them died during the age 30-34years (35.8%), 27.5 died aged 25 to 29 years , 23.3% died aged 20 to 24years , 3.3% died aged above 40 years, and 5.0% died in the age that is less than 20 years as well as aged 35 to 40 years.
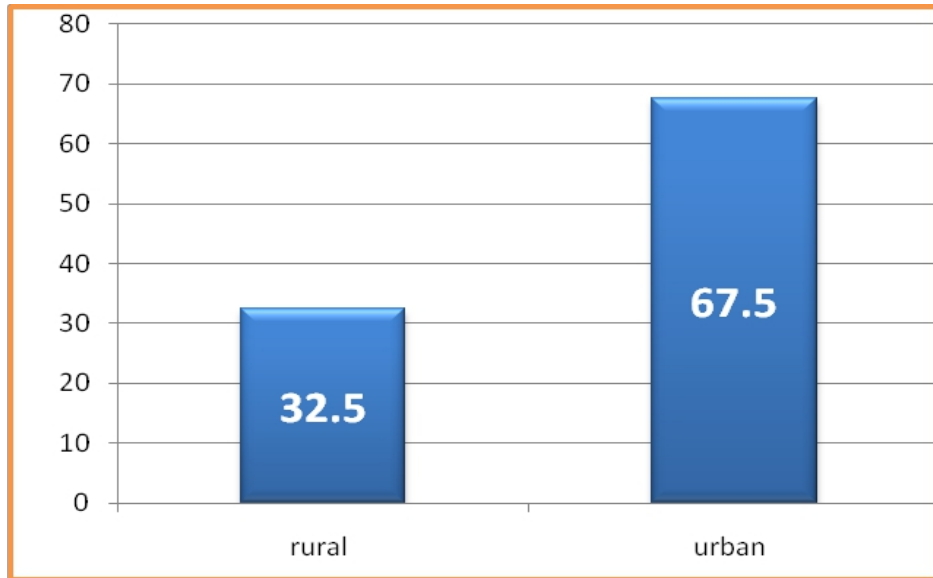
N =120

Figure (1): *Residence of the maternal deaths in Khartoum state public hospitals during study period (2014-2015)*

show nearly more than half of women who died were residing in urban areas (67.5%) while 32.5% were residing in rural area.
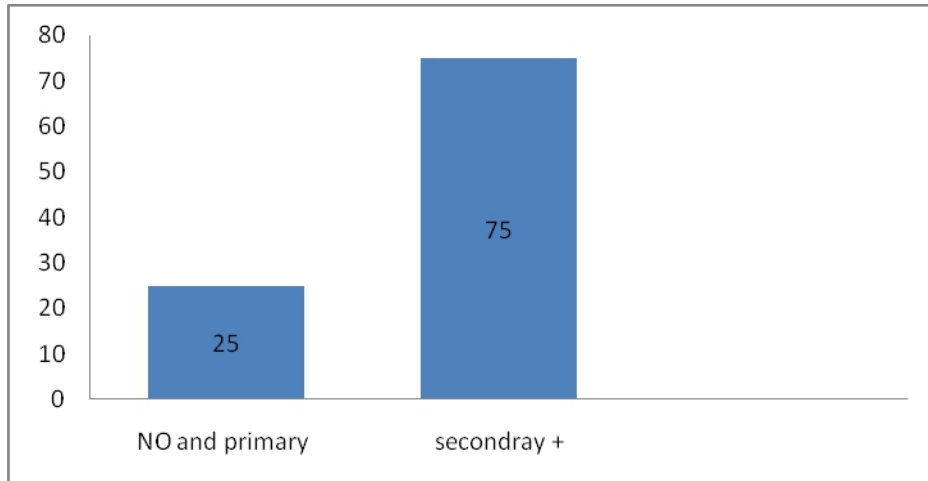
N =120

Figure (2): *Educational level of maternal death in Khartoum state public hospitals during study period (2014-2015).*

It shows the most of women who died (75%) were secondary school and above education and (25%) were of no formal and primary school education .
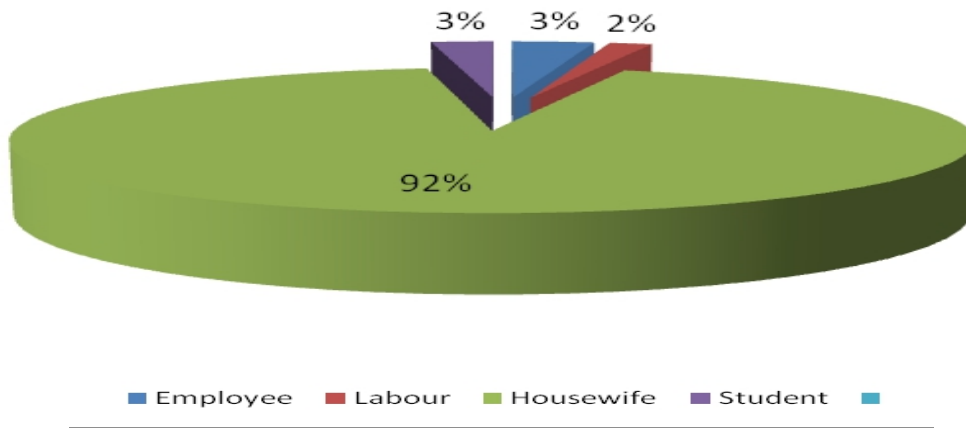
N =120

__Figure (3):__ The occupation of the deceased prior to death in Khartoum state public hospitals during study period (2014-2015).

The figure shows that 92% of women who died are housewives, 3.% are employee and student and 2% labour.

N =120

Figure (4) Show occupation of deceased Husband in Khartoum state public hospitals in study period   . The majority of husbands occupation are semi skilled worker (44.2%), skilled worker (36.7%), Unemployed and proficient (6.7%),   while other occupations contributed with small proportion.

41
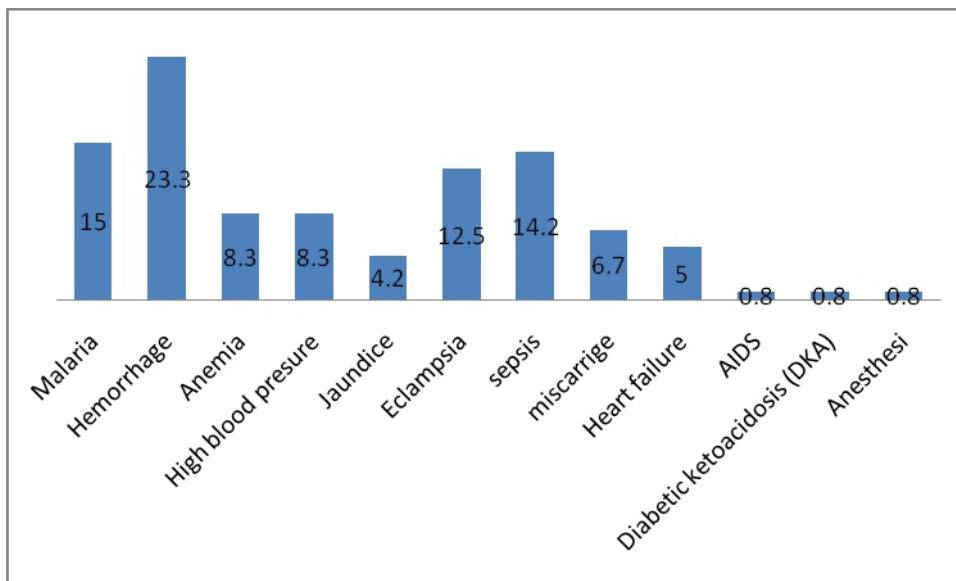
N =120

Figure (5):   The Causes of maternity deaths in Khartoum state public hospitals during study period (2014-2015)   .

The figure shows that the direct causes of   death are Hemorrhage (23.3%), followed by   sepsis(14.2%), Eclampsia (12.5%)   and miscarriage (6.7%). The indirect causes of death are Malaria (15%) followed by Anemia   and High blood pressure (8.3%). Other indirect causes such as Jaundic, Heart failure, AIDS contributed only with small proportion.

Normal   c-section   not applicable
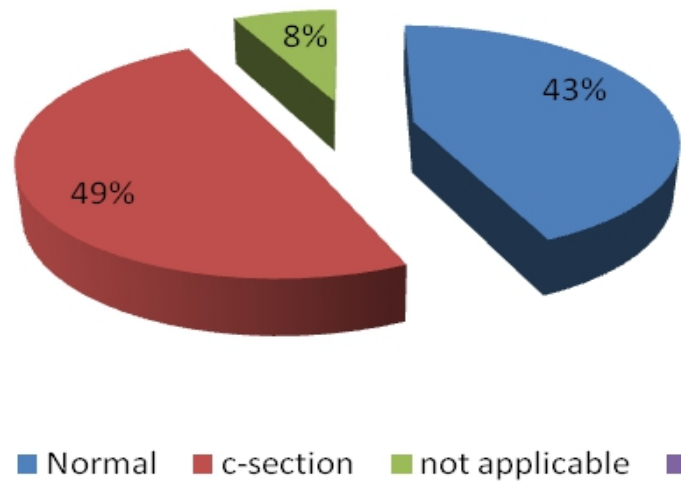
N =120

Figure (6): The mode of delivery among the women who died in Khartoum state public hospitals during study period

The figure shows that 49.2% of women who died were delivered by cesarean section, while 43.3% were normally delivered

Table (3): The women who died within 24 hours after delivery in Khartoum state public hospitals during study period (2014-2015).

Variable	Frequency	Percent
Yes	51	42.5
NO	68	56.7
don't know	1	.8
Total	**120**	**100.0**

The above Table indicates that 42.5 % of women died within 24 hours after delivery, while 56.7% of women died after 24 hours of delivery.

Table (4) : *distribution of deceased whether they were pregnant or not pregnant during the time of death in Khartoum state public hospitals in study period (2014-2015)*

	Frequency	**Percent**
Pregnant	10	8.3
Not pregnant	110	91.7
Total	**120**	**100.0**

The result shows that most of women were not pregnant at time of her death (91.7%), whereas only (8.3 %) of women who died were pregnant at time of death.
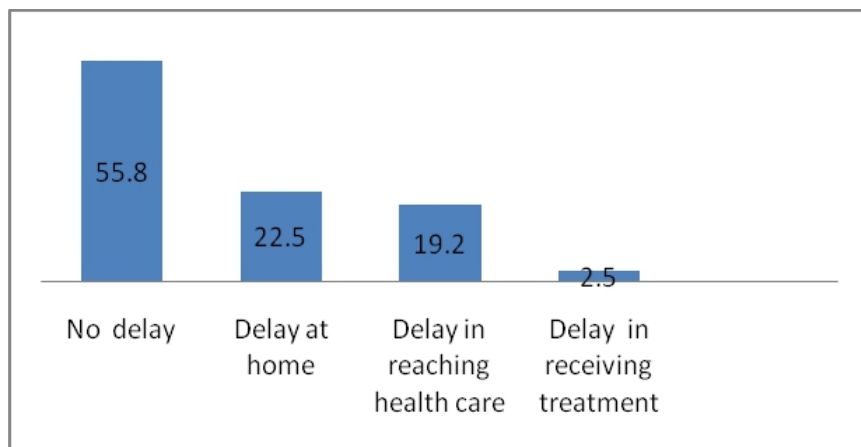
Figure (7): *The state of delay in heath care among the deceased in Khartoum state public hospitals in study period (2014-2015) .*

About half of women (55.8%) who died have no delay for health care, while 22.5 % of women who died were delayed at home or in seeking health care , 19.2% in reaching health care, and 2.5 % in receiving treatment .
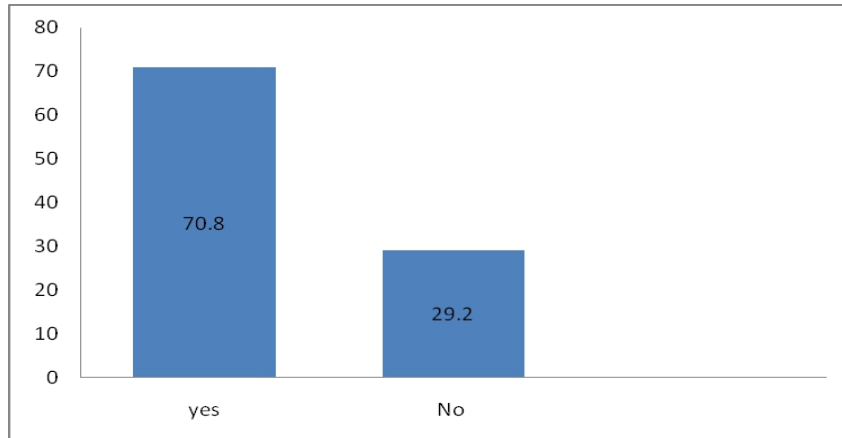
Figure (8): *Vaccination given against tetanus to the deceased in Khartoum state public hospitals during study period (2014-2015).*

According to the responses of the relatives of the deceased, it was observed that 70.8% of women who died were vaccinated against tetanus and 29.2% of them were not vaccinated
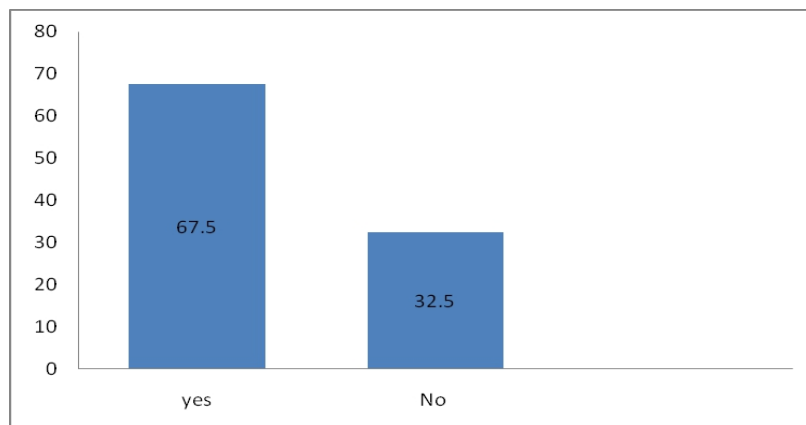
Figure (9): The attendance of antenatal care during pregnancy among study population in Khartoum state public hospitals in study period.

The above figure reveals that more than half of women who died (67.5%) went to reproductive clinic or Health Visitors, during pregnancy for antenatal care while 32.5 of them didn't.

Table (5) *Association between deceased residence and health service and illness risk factors in Khartoum state public hospitals during study period*

Risk factors		Urban		Rural		Odd ratio	Confidence interval CI	P value
		Freq.	%	Freq.	%			
Antenatal care visit	Yes	61	75.3%	20	24.7%	2.898	(1.29-6.48)	008
	NO	20	%51%	19	48.7			
Vaccinated against tetanus	Yes	65	80.2%	16	19.8%	3.859	(1.67-8.87)	001
	No	20	51.3%	19	48.7%			
Delay in reaching near hospitals	Yes	13	16%	68	84%	1.85	(.034- .209)	*.000*
	No	27	69.2%	12	30.8%			
Delayed for seeking health care	No delay	58	71.6%	23	23.1%	8.406	(3.460 -20.42)	.000
	Delay	9	28.4%	30	76.9%			
Delayed in receiving care	Yes	22	27.2%	27	69.2%	1.6	(.272 -.383)	.000
	NO	59	72.8%	12	30.8%			
Malaria	Yes	9	11.1%	72	88.9%	1	(.315 - 3.799)	.888
	No	4	10.3%	35	89.7%			
High blood pressure	Yes	15	18.5%	66	81.5%	1.	(. .246 - 6.45)	. .246
	No	4	10.3%	35	89.9			
Anemia	Yes	4	4.9%	77	95.1%	.455	(.107-1.923)	.274
	No	4	10.3%	35	89.9%			

The table showed odd ratio and p value for chi square of deceased residence associated with health service and illness factors . Table found all health services (antenatal care visit (OR = 2.898 , P value = .008), vaccinated against tetanus (OR = 3.859 ,P value = .001) , delayed for seeking health care (OR = 8.406 , P value = .000) ,

Delay in reaching hospitals   (OR = 1.85 ,P value = .000) , Delayed in receiving care(OR = 1.6 ,P value = .000)) were significantly associated with deceased residence and posed higher risk to maternal deaths. Other illness risk factor associated with deceased in resident place   such as malaria (OR = 1   ,P value = .888) ,   anemia , (OR = .455 ,P value = .274), high blood pressure (OR = 1 .9 ,P value = .246) were not significant and lower risk to maternal death except high blood pressure and malaria with no risk to maternal death .

Table (6)   *Association between deceased educational status and health services , illness risk factors in Khartoum state public hospitals during study period*

Risk factors	Secondary			No and primary		Odd ratio	Confidence interval CI	P value
		Freq.	%	Freq.	%			
Antenatal care visit	Yes	69	67.7%	12	40%	4.929	(2.047-11.86)	.000
	NO	21	23.3%	18	60%			
Vaccinated against tetanus	Yes	73	81.1%	12	%40	6.441	(2.616-15.86)	.000
	No	17	18.9%	18	60%			
Delay in reaching near hospitals	Yes	27	30%	12	40%	.643	.272 - 1.517	.311
	No	63	70%	18	60%			
Delayed for Seeking health care	No delay	55	61.1%	12	40%	2.357	(1.013- 5.484)	. .044
	Delay	35	38.9%	18	60%			
Delayed in receiving care	Yes	33	36.7%	16	53.3%	.507	(.220- 1.168)	.108
	No	57	73.3%	14	46.7%			
Malaria	Yes	8	8.9%	5	16.7%	.488	.(.146- .1.62)	.235
	No	82	91.1%	25	83.3%			
High blood pressure	Yes	15	16.7	4	13.3%	1.00	(.396- 4.272)	.665
	No	75	83.3	26	86.7%			
Anemia	Yes	6	6.7%	2	6.7%	1.000	(.191-5.241)	1.000
	No	84	93.3%	28	93.3%			

The above table shows antenatal care visits, vaccinations against tetanus, those who were not delayed for health care were high in secondary education + than no education and primary.

Antenatal care visit (OR = 4.929P value = .000), vaccinated against tetanus (OR = 6.441P value = .000) , delayed for seeking health care (OR = 2.357P value = .044) are significant association and higher risk to maternal deaths. Other factors such as, those who Delayed in receiving care (OR = .643 P value = .311), malaria(OR = .488 P value = .235) high blood pressures(OR = 1.3P value = .665) , anemia (OR = 1.00 value = 1.000) are not significant in association with the educational level and pose lower risk to maternal death except high blood pressures and malaria with no risk

Table (7): *Association between deceased socio- economical status versus health service and illness risk factors for deceased in Khartoum state public hospitals during study period*

Risk factors	Lower			Higher		Odd ratio	Confidence interval CI	P value
		Freq.	%	Freq.	%			
Antenatal care visit	Yes	41	66.4%	40	100%	.641	(.294-.1.593)	.261
	NO	24	33.6%	15	0			
Vaccinated against tetanus	Yes	44	76.3%	21	74.5%	.715	(.322-.1.591)	.411
	No	21	32.7%	14	25.5%			
Delay in reaching near hospitals	Yes	27	41.5%	12	21.8%	3.546	(1.135-.5.712)	.022
	No	38	58.5%	47	78.2%			
Delayed seeking health care	No delay	40	61.5%	13	23.6%	5.167	(2.328-11.480)	.000
	Delay	25	38.5%	42	76.4%			
Delayed in receiving care	yes	6	11.3%	7	10.4%	1.0	(.345-3.474)	.879
	No	47	88.7%	60	86.6%			
Malaria	Yes	5	7.7	8	14.5%	.490	(.271-.947)	.229
	No	60	92.3	47	85.5%			
High blood pressure	Yes	9	13.8	10	18.2%	.723	(.271-.1.931)	.517
	No	56	86.2	45	81.8%			
Anemia	Yes	4	6.2	4	7.3%	.836	(.199-.3.519)	.807
	No	61	93.8	51	92.7%			

The above table shows delayed for seeking health care (OR = 5.16 , P value = .000) Delay in reaching near hospitals   (OR = 3.4 , P value = .022), are significant association and high risks to maternal death . Antenatal care visit (OR = .641,P value = .261), vaccinated against

tetanus (OR = .715,P value = .411) , malaria(OR = .490, P value = .229) , high blood pressures(OR = .723, P value = .517) , anemia (OR = 836p value = .807) are not significant and have lower risks to maternal deaths.

Binary logistic regression result:

Table (8) : Show Significant predictors of binary logistics regression model for residence of deceased women versus health services and illness factor in Khartoum state public hospitals during study period

In the full model which combination all predictors factors has statistical significance (.000) of the model chi-square 44.970. The overall percentage of cases that correctly predicted accuracy rate computed by SPSS is increased from 67.5% for the null model to 79.3 for full model. The model overall explained between 30.1% (Cox and Snell R square) and 42.0% (Nagelkerke R square) of the proportion of variance and correctly classified 79.3% of the cases.

Significant predictors for risk factors

Model	Variable	B	S.E.	Wald	Df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	Malaria	1.106	.893	1.536	1	.215	3.023	.526	17.391
	High blood pressures	.534	.701	.579	1	.447	1.705	.431	6.737
	Anemia	-1.234	1.082	1.301	1	.254	.291	.035	2.428
	Delayed for reaching hospital	-1.572	.599	6.882	1	.009	2.8	.064	.672
	Delayed for receiving health care	.828	.967	.732	1	.392	2.288	.344	15.223
	Delayed for seeking health care	-2.102	.924	5.173	1	.023	8.4	.020	.748
	Vaccination against tetanus	.836	.667	1.572	1	.210	2.308	.624	8.530
	Antenatal care visits	.675	.692	.951	1	.329	1.964	.506	7.625
	Constant	.030	1.423	.000	1	.983	1.030		

N =120

The table shows the logistics analysis combining all factors in the models. The Statistically significant predictors of risk factors model for residence of deceased women included two variable, i.e., delayed for

reaching health care (p. value =0.009, **with the odd ratio [OR = 2.8),** and delayed for seeking health care (p. value = 0.023, **with the odd ratio [OR = 8.4])** . The strongest predictor for delayed seeking health care indicate that women who live in rural area were 8.4 time more likely to die from delayed for seeking health care As for other variables, (malaria, high blood pressures ,anemia ,Vaccination against tetanus, Antenatal care visit) is not significance Predictors and less likely to risk for deceased women .

Table (9) : Shows Significant predictors of binary logistics regression model for educational status of deceased women and health services and illness risk factor in Khartoum state public hospitals during study period.

The full model containing all predictors variables is statistically significance (.006) of the model chi-square 21.420. The overall percentage of cases that correctly predicted accuracy rate computed by SPSS is increased from 75% for the null model to 75.8 for full model . The model as a whole explained between 30.1% (Cox and Snell R square) and 42.0% (Nagelkerke R square) of the proportion of variance and correctly classified 68.8% of cases

Significant predictors for risk factors

	Variable	B	S.E.	Wald	Df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1ª	Malaria	.113	.747	.023	1	.880	1.119	.259	4.838
	High blood pressures	.063	.716	.008	1	.930	1.065	.262	4.332
	Anemia	.260	.976	.071	1	.789	1.298	.192	8.781
	Delay for reaching near hospitals	.451	.652	.480	1	.488	1.571	.438	5.633
	Delayed for receiving health care	.368	.953	.149	1	.700	1.444	.223	9.350
	Delayed for seeking health care	-1.147	.906	1.601	1	.206	.318	.054	1.876
	Vaccination against tetanus	1.335	.606	4.848	1	.028	3.799	1.158	12.461
	Antenatal care visits	.833	.615	1.833	1	.007	2.300	.689	7.679
	Constant	-2.258	1.343	2.827	1	.093	.105		

N = 120

The table shows two   variable are Statistically significant predictors (vaccination against tetanus, (p. value= 0.028, **with the odd ratio (OR = 3.7) and antenatal care** is (p. value = 0.007 **with the odd ratio (OR**

= **2.3)** . This two variable indicated that women with No education and primary education were 3.7 time and 2.3 time respectively less likely to use vaccination against tetanus and antenatal care and then increased risk to die . While other variables (malaria, high blood pressures, anemia, delayed for health care ,delayed for reaching , delayed for receiving health care) are not significance predictors and lower risk to maternal death .

Table (10) : Show model Significant predictors of binary logistics for socio economical status of deceased women and health services and illness risk factor in Khartoum state public hospitals during study period.

The full model containing all predictors variables is statistically significance (.024) of the model chi-square 21.420. The overall percentage of cases that correctly predicted is increased from 55.8 % for the null model to 68.8for full model .

The model overall explained between 13% (Cox and Snell R square) and 18.7% (Nagelkerke R square) of the proportion of variance and correctly classified 68.8.0% of the cases.

Significant predictors of risk   factors

Model	Variable	B	S.E.	Wald	Df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Malaria	-.181	.688	.069	1	.793	.835	.217	3.212
	High blood pressures	.640	.568	1.268	1	.260	1.896	.623	5.770
	Anemia	.341	.788	.188	1	.665	1.407	.300	6.596
	Delay for reaching near hospitals	-.194	.545	.127	1	.721	.824	.283	2.394
	Delayed for receiving health care	-.282	.902	.098	1	.755	.754	.129	4.422
	Delayed for seeking health care	1.924	.860	5.012	1	.025	6.849	1.271	36.919
	Vaccination against tetanus	-.072	.582	.015	1	.901	.930	.297	2.912
	Antenatal care visits	.096	.574	.028	1	.867	1.101	.357	3.390
	Constant	-1.220	1.109	1.211	1	.271	.295		

N=120

The above table shows the logistics analysis combining all factors in the models.   Only one independence variable is Statistically significant predictors contribution to the model . that is, delayed for seeking health

care (p.value =.025 with the odd ratio of 6.8). The deceased women who delayed for seeking health care are 6 times more likely to death than those who did not delay.

All other variables are above the level of significance .05 and does not Statistically significant predictors to maternal death

Qualitative results from focus group discussion for pregnant women at maternity hospitals analysis 2015

All of the pregnant women aged 25-40 years, resident in both urban and rural areas, were represented in this study. Most of pregnant women were aware about importance of their health during pregnancy

Most of them know about antenatal care during pregnancy . They said that the antenatal care means regular follow up during pregnancy by medical , nursing and mid wife care. Few of them did not understand the antenatal care . They also observed that antenatal care is good as well as nutrition is important.

They said that there is no disadvantage of antenatal care visit but regular visit is important to detect any problem so as to be avoided.

All women in group discussion showed their awareness about maternal mortality as a death of a woman while pregnant or after delivering a baby.

Most of them preferred hospitals for providing ANC, though few of them preferred primary health care centers, they said hospital is good for health care and the presence of specialists.

Most of pregnant women said that one of the causes of maternal mortality is bleeding, while the remaining group of women stated that it due to medical mistakes and lack of information provided,

About relationship between the economic situation of the mother and her death during childbirth or after birth, all of them answered with 'yes', and they said that the follow up needs good economic status and poor economic status that lead to malaria , anemia, typhoid and also to death. Few of them observed that sometime there is no relationship between the economic situation of the mother and death.

Asking about the recommend solutions to avoid maternal mortality, all of women recommended the followings: increasing health education for women, Regular follow up during pregnancy, activating role of government to solve problem, increasing health insurance coverage for poor families, Provision of efficient health cader in hospitals, sufficient availability of blood in blood banks.

Qualitative results from interview with health visitors in Khartoum localities:

About fifteen health visitors working in reproductive health unit in PHC from all localities in Khartoum state were interviewed. I found the role of health visitors in PHC is significant and they play a crucial role in caring and supporting child bearing women and their babies during antenatal period .

Most of the health visitors have secondary education while few of them have primary education.

Most of health visitors in primary health care centers have long experience with more than ten years where as few of them have less than 5 years .

Asking them about their roles in care of maternity, it is found that all of them are aware of antenatal care provision for women during pregnancy, according to ministry of health guide in pregnancy care.

About preventive measures provisions for pregnancy, health visitors informed us that all the (measures are taken to give iron tablet, folic acid, tetanus vaccine , except giving advice related to preventive measures for malaria and providing impregnated mosquito nets(as not available in primary health centers).

About information provided during the counseling, most of them are well aware of this, but few of them don't have any.

When they were asked about facing any problem while providing antenatal care service , most of them agreed with the main problems such as the shortage in antenatal care equipments, shortage of health visitors staff, lack of essential drugs, and inappropriate work

environment, e.g., office. Few of them expressed that the main problems is the lack of transport to access a health unit.

When they were asked about their opinions on the causes for maternal deaths in hospitals, most of them replied with the main causes as hemorrhage, sepsis, and obstructed labor while few of them believed that the malaria infection is the main problem.

Asking health visitors about risk factors for maternal deaths in hospitals, most of them said that the main factors are poor antenatal care services, far distance from nearby hospital, poor nutrition , poverty and economic status of family, but only a little number of health visitors stated , the early marriage, harmful habits , medical and family history are the risk factors.

Their comments on women's utilization of the antenatal services

All those interviewed agreed on the statement that there is increase in women's utilization of the antenatal services but they suggest some improvement in work environment in ANC in PHC as well as opening a health visitors school to solve staff shortage, all that leading to women's better utilization of ANC, safe delivery and reducing maternal deaths.

Chapter (5)

Discussion

5. Discussion

5.1 Maternal Mortality Ratio

In 12 public hospitals out of 17 hospitals in Khartoum state during the period from June 2014 to June 2015, a total number of maternal death was 120 out of 110662 LB, according to maternal mortality definition by WHO. The maternal mortality ratio was calculated as (108/100000 live birth) is considered very high as compared with the annual report for statistical department in Khartoum ministry of health which is 11/100000livebirth in these hospitals as compared with the maternal death surveillance report in Khartoum state which is 72/100000 live birth in the same hospitals during the same period.

They show big difference in MMR report between this study and other health sectors in the same period. Sudan has problems in statistical registration like other developing countries without reliable system of registration in maternal death {20}. Unawareness of definition of maternal death in hospital leads to misreporting by health providers, and there is no link between statistical department in hospital and maternity department, as file of women who died is always lost. In some hospitals there are some deaths occurring during pregnancy and whose information is lost specially for those women who immediately died resulting from illegal pregnancy.

The MMR in this study is lower when we compared it with a study conducted in hospitals in Khartoum state during 2007 & 2008 with MMR 124/100000 live births, because this study did not include all public hospitals as the directors of the two Khartoum university hospitals namely Soba and Ibrahim Malak hospital refused to allow collecting our data.

5.2 Socioeconomic information for deceased

In this study, the majority of women died while in the age group of 30-34 because those are the ages at which women are most likely to give birth, so if the efforts directed at this group of age would most effectively reduce the number of deaths. Deaths in the Asian and sub-Saharan African countries are concentrated on ages between 25-29 followed by ages 30-35 ,{56} .

According to literature on maternal mortality, the advocacy for risk is among adolescent women and women who are too old.

More than half of women who died were residents in urban area. And nearly all of women (92%) who died are housewives which indicate that certain sections of the society are more prone to maternal mortality .

In this study three quarters of deceased were secondary education and above and one quarter were without education and primary education . In Sudan total literacy rate for adult males is 73%, it is estimated at only 52% for females,{57}. In this study 44.2% of women who died were in low socio economic status and (55.8%) were high . According to findings of the Sudan National Baseline Survey, 53% of the households reported receiving no income during the year preceding the survey ,{14}. Where these results are considered a big problem especially among women and affect their health

5.3 Causes of maternal mortality

The main direct cause of maternal mortality in Khartoum state public hospital was hemorrhage followed by sepsis and eclampsia. The World health organization report 2014 as well as the maternal death report in Sudan 2013 presented the same direct causes ,{44}.

The main indirect causes in this study were malaria, anemia , and high blood pressure , whereas HIV , jaundice and heart failure contributed to small a proportion. Globally, malaria , anemia and ectopic pregnancy are considered the main indirect causes of maternal death,(26).   When compared with other   studies conducted in Khartoum state hospitals 2010 , Medani teaching hospital 1999   showed anemia , malaria and hypertensive disorder that were the major causes of indirect maternal deaths. {31, 45} . Other studies in Tanzania 2010   and   Kenya 2011, Senegal   1999, showed   HIV and tuberculosis as indirect causes of death {47, 48, 49, 50} because in these countries, HIV and tuberculosis are major   public health problem .

5.4 Health services used before death

Our study revealed that nearly half of women who died were delivered by caesarean section, while   other women   who   died were normally delivered . In this   study the   death in   women   who   delivered   by caesarean section were high   compared   with   the   women   who delivered   normally . In an another   study conducted in sudan 2010 showed   planned caesarean section may reduce the risk of perinatal death by approximately 75% compared with attempting vaginal birth ,{58} . Another   study in Nigeria 2010 concluded that the mode of delivery was significantly associated with maternal mortality,{51}. Other study in West Iran   about risk factors for maternal mortality concluded   that cesarean section increased the risk of maternal mortality by nearly two-fold,{52}.

Maternal death review in Sudan 2012   showed that half of deceased (49.7%) died within the first 24 hours from admission or delivery ,{6 } . This study showed that 42.5% of deceased died within 24 hours after delivery while 56.7% of women died after 24 hours after delivery. In

developing countries, about 60 percent of the maternal deaths occur during childbirth and 50 percent of these deaths occurring within the first 24 hours of delivery. Inadequate postnatal care may contribute to mortality in women,{20}.

The majority of deceased cases that occurred during this study period were not pregnant at the time of their death , only 8.3% of deceased were pregnant at the time of their death. Death in Sudan during pregnancy is not high as compared with the south Sudan, according to annual report of health data from south Sudan 2014 by WHO. Most of the deaths occurred during pregnancy are due to miscarriage and ectopic pregnancy, however, maternal mortality by abortion is not recorded in statistics because maternal death's definition is not clear for health providers and statisticians. In hospitals it was observed that most nurses and statisticians believe that the death during pregnancy does not belong to maternal mortality.

The Delay Model is a conceptual framework that has been used to assess factors contributing to maternal mortality in developing countries. In Sudan, two thirds of maternal death cases reviewed, indicate delay in women's decision to seek care and delay in identifying and reaching medical facility. One third of deaths were due to not receiving adequate care once hospitalized,{25}.

Similarly, this study proved that 22.5 % of women, who died, were delayed in seeking health care, 19.2% in reaching health care, and 2.5 % in receiving treatment. The study conducted in Kalssala showed more than half of women delayed for seeking health care, due to distance, bad roads, lack of transport and the rainy season, were reported as important disincentives for seeking care in more than 50% of the maternal deaths in Kassala state,{32}.

This study observed 70.8% of deceased women were vaccinated against tetanus, which is a similar percentage with the study conducted in Sudan 2013 on neonatal mortality that showed 70% of pregnant women received tetanus vaccine,{58} .

Worldwide tetanus kills an estimated 180 000 neonates deaths and 30 000 women,{59}.

Of all mothers who died (67.5%) had attended antenatal care, Global Health Observatory (GHO) data of WHO which observed that the proportion of women receiving antenatal care at least once during pregnancy was 83% for the period 2007–2014, {60}.

In Sudan, 75% of pregnant women receive at least one antenatal care visit and 47% of them receive four visits,{9} .This proportion is considered a problem to maternal health and there are many factors that influence the utilization of antenatal care .

For this study, we conducted interviews with health visitors in primary health care units to identify problems of provision of antenatal care. The health visitors are main providers of antenatal care and specialist in caring and supporting child bearing women and their babies during antenatal period. After interviewing, we found acute shortage of health visitors in primary health care in Khartoum state, therefore, Khartoum state needs health visitors now more than ever to meet MDG5 target and most maternal death are due to pregnancy complication that can be preventable by antenatal care . Other problems are shortage of antenatal care equipments, lack of essential drugs, and inappropriate work environment.

5.5 Risk factors for deceased women:

The odd ratio and binary logistic regression model were used for each of three groups. The dependence risk factors are 1)residence place group 2)educational status group 3) socio-economical status group versus independent variable i.e., health services and illness risk factors (delayed for seeking health care , delayed for reaching health care, delayed for receiving health care , vaccination against tetanus , antenatal care visit , malaria , high blood pressures and anemia).

5.5 1 Residential place (urban – rural) association with health service and illness factors

The chi square and odd ratio used in this study revealed all health services risk factors(such as, delayed for seeking health care , delayed for reaching health care, delayed for receiving health care or treatment , vaccination against tetanus and antenatal care visit) were showing significant effect on deceased residence and increased risk to maternal death . Comparing this with the study conducted in Sudan 201, about factors contributing to maternal mortality, found delays factors and accessibility factors , antenatal care visit were risk factors for maternal death . Another study in Kenya about risk factors showed antenatal care visit factor is significantly increased risk to maternal death, {48}.

It was observed that women in rural areas were less likely to use and obtain maternal health services and these showed increased risk to die , than those in urban area.

The result revealed that the difference between rural and urban area in use of antenatal care services and vaccination against tetanus is due to accessibility and availability of health service in theses area. This study showed three delayed had significantly increased risks to

maternal deaths in association with the residence. According to study conducted in Sudan 2013, lack of awareness about danger signs among pregnant women , traditional beliefs and geographical barriers in rural areas lead to delay in seeking health care, delayed in reaching near hospital due to long distance and travel time and delay in receiving health care due to lack of drugs and cost of health care.

Binary logistic regression model was performed to identify the most stronger predictors in the model of association between dependent variable (residence place) and independence variables (health services , illness risk factors). This study revealed only two variables from all variables entered into model; 1) delayed in reaching hospital and 2)delay in seeking health care; remained significant predictors. Women who live in rural areas were 8.4 times more likely to die from delay in seeking health care and were 2 times more likely to be delayed in reaching healthcare and thus prone to increased risk for maternal deaths.

It was observed that maternity unit in rural hospitals did not work effectively due to shortage in staff and equipment. Most pregnant women going to main maternity hospital lead to delayed for seeking and reaching health care. This is clear from this study, as maternal death was not reported from rural hospital because rural hospital is refer all danger cases to urban hospitals.

This study found that the illness factors had not significantly increased risk for maternal death in association with residence factors.

5.5.2 Educational status association with health services and illness factors

From chi square and odd ratio of educational status of deceased versus health services and illness risk factors . The significant and increased odds are found in three factors, such as, delay in seeking health care, antenatal care visit, vaccinated against tetanus. Women with no education and women with primary education were found more likely to die from these risk factors than women with secondary education and above . Delay in seeking health care was related to educational status because women not educated or poorly educated did not recognize illness and danger signs to seek health care when needed. In addition, antenatal care and vaccination against tetanus are at higher risk to maternal deaths in association with the maternal education.

Binary logistic regression model showed vaccination against tetanus and antenatal care are most strong significant predictors. Women with secondary education were three times more likely to be vaccinated against tetanus and two times more likely to use antenatal care than women with no education and with primary education. That proves women with no education and primary education were more likely to have increased risk for maternal death.

This was in line with other findings from SHHS2 which revealed an association between Antenatal care visit use and the woman's education level and the association between maternal mortality and illiteracy was found to be significant in two studies in Sudan ,{44,32}.

In this study (illness factors) there is no significant increased risk association between maternal death and educational status

5.5. 3 .Socio-economical status association with health services and illness factors

The chi square and odd ratio for association between socio-economical status of deceased and health services and illness risk factors, that showed delayed for seeking health care and delayed in reaching hospitals, are significantly associated with socio economical status and increased risks for maternal death.

The study conducted in Sudan 2013, showed that transportation cost in Khartoum State was one of the factors, having negative impacts on seeking facility based delivery,{44}.

The binary logistic regression model for socio- economical status that found only one independent variable from all variables, has strong significant predictors, that is, delay in seeking health care.

The study conducted in Sudan, 2013, showed women suffering from delay in seeking health care is due to their low socio-economic status,{44}.

One study from India, 2013, found that the deceased were poor and non-literate, and housewives were significant association with high risks to maternal deaths,{61}.

This study found that the delay in seeking health care is a strong increased risk for maternal deaths in three groups of logistic model.

Delayed in seeking care refers to factors of residential place, socio economical and educational status. As observed, the illness factors

(malaria , anemia and hypertension) were not having significantly increased risk for maternal mortality in all of the three groups.

This study found that other risk factors in the result of qualitative approach, mentioned by health visitors and pregnant women, including early marriage, harmful habits , far distance from hospital, poor nutrition , and type of delivery .

5.6 Limitation of study:

- Firstly, this study included only deaths that occurred among the hospital admission and therefore the risk factors identified here were specifically associated with in-hospital mortality. Pregnancy related mortality that occurred outside hospital may have other risk factors that were not identified here.

- Secondly, bias may have resulted from the misclassification of causes of death data and missing information in some hospitals because turnover of data collectors. Also recall bias by relative of deceased for question before death may exist due to long period

- Thirdly There are other risk factors which were not present in our study and could not be examined which include risk factors found in the literature to be predictors of maternal mortality, including parity, , type of delivery, type of birth, birth order and delivery assistant, age

- Fourthly Two hospital of Khartoum university namely Soba and Ibrahim malak hospitals were not included in this study because mangers of these hospital refused to allow us to collect the data

Chapter 6

Conclusions

Recommendation

6 .1 Conclusions:

This study highlights risk factors for maternal mortality at public hospitals in Khartoum state during 2013-2015 with the following conclusions:-

- Maternal mortality ratio in public hospitals in Khartoum state was 108/100000 live birth. It was high, with a wide variation in different sectors of health, during the same period in the same hospitals. These variations in maternal mortality ratio were due to misreporting and poor registration of maternal data in hospitals.

- The direct causes of maternal mortality were hemorrhage sepsis and eclampsia and the indirect causes were anemia, malaria and hypertension.

- Delay in reaching hospital and delay in seeking health care were found to be significant predictors risk factors for maternal death in association with deceased residence.

- Antenatal care visits and vaccination against tetanus were found significant predictors risk to maternal death in association with educational level.

- Delay in seeking health care is found to be significant predictors to maternal death in relationship with the socio economic status of the deceased.

- Illness factors (such as malaria , anemia and hypertension)were not significantly causing increased risk for maternal mortality.

- Most of women died during the age of 30-34 years .

- 92% of women who died were housewives and 3% were employee and student

- 49.2% of women who died were delivered by cesarean section, while 43.3% were normally delivered .

- 42.5 % of women died within 24 hours after delivery, while 56.7% of women died after 24 hours of delivery.

- Most of pregnant women in group discussion preferred hospitals for providing antenatal care

- Most of health visitors were aware of antenatal care provision for women during pregnancy.

- Shortage in antenatal care equipment, shortage of health visitors staff, lack of essential drugs, were main problems faced by health visitors during provision of antenatal care service.

6.2 . Recommendation

To reduce risk factors of maternal mortality the following are recommend:

- Health authorities are to strengthen maternal health information system, by moving from paper based system to electronic maternal information system in hospitals , training health providers about importance of maternal death registration and reporting . These actions can help decision making in planning , monitoring the progress toward the targets, and assessing the feasibility of various strategies.

- Ministry of health is to improve antenatal care service in PHCc by improving work environment , infrastructures , provision of equipments, and solve staff shortage .

- Ministry of health is to upgrade maternity service in rural hospitals by the provision of equipment, medical qualified staff and ambulances .

- Ministry of health to increase coverage by antenatal, postnatal and emergency obstetric care for all pregnant women to discover and manage timely any complication leading to maternal death .

- Improving women's knowledge through effective health education.

- Public health authorities are to strengthen maternal death surveillance and response system that includes maternal death identification, reporting, reviewing, and response to provide the information and guide actions to prevent future maternal deaths.

- Political commitment to decreasing maternal mortality is vital to the success of programs. Governments that have made the fifth Millennium Development Goal a priority by providing leadership through human and financial resources.

- Strengthen community mobilization to support utilization of maternal health services.

- Women empowerment program and income generation project are to be established to solve non-health service problems, like poverty , female education, and socio-economic status.

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Annexes (1)

Questionnaire: Risk factors for maternal mortality in Khartoum state updated Verbal autopsy standards:The 2012 WHO verbal autopsy instrument

Date: …. /……. / 2014

1- Basic information about interview and respondent

1. Name of hospital …………………………………………………….

2. What is your relationship to the deceased?

   a. Father   b. Mother   c. Spouse   d. Sibling   e. sister

   f. Other relative (SPECIFY) …………   g. No relation

SECTION 2 . INFORMATION ON THE DECEASED AND DATE OF DEATH

3. How old was the deceased when she died?

   a. less than 19 year (   )   **b. 20-29year** (   )   **c. 30—35 years** (   )

   d. Above 35years (   )

4. What was her place of usual residence?

   a. Urban ( )   b. Rural ( )

5. What was her place of normal residence 1 to 5 years before death?

   a. Urban( )

   b. Rural ( )

6. What was the age of marriage

a. Less than 18 year ( )   b. 19-25year ( )   c. 26—35 years ( )

b.   d. above 35years ( )

7. What was her   highest level of schooling?

a. NO formal education ( )   b. Primary ( )

c. Secondary ( )   d. graduate ( )   e. postgraduate ( )

 f. Don't know ( )

8. What was her economical activity status in year prior to death?

a.   Employer ( )

b. Labour ( )

c. Home maker ( )

d. Student ( )

 C. Other (specify)……….

 D. Don't know( )

9- **What was her husband occupation, that is, what kind of work did she mainly**

Do

 A. Proficient ( )

 B. Famer - shopowener

 C. skilled worker ( )

 D. Semi skilled worker ( )

 E. Un skilled worker ( )

 F. Unemployed ( )

G. 0ther (specify)…….

H. Don't know(   )

Family income per month

a. More 2000   b.1000-1999   c.750-999   d. 500-749   c. 300-499   d.299-101   e. less than 100

SECTION 3. RESPONDENT'S ACCOUNT OF ILLNESS/EVENTS LEADING TO DEATH

10. Could you tell me about the illness/events that led to her death?

a. Hemorrhage (   )   b.   Infection malaria   (   )   c. High blood pressure (   )

 d. unsafe abortion and obstructed labour (   )   e. Anesthesia   (   )

f. abortion (hemorrhage, sepsis)   (   )

g. anemia related condition   (   )

I. malaria (   )

h. Jaundice   (   )

j. ruptured uterus (obest lab) (   )

k. Other (specify) ……………..   (   )

SECTION 5. CONTEXT AND HISTORY OF PREVIOUSLY KNOWN MEDICAL CONDITIONS

I would like to ask you some questions concerning the contexts and previously known medical conditions the deceased had; injuries and accidents that the deceased suffered; and signs and symptoms that the deceased had/showed . When she was ill. Some of these questions may not appear to be directly related to his/her death.

Please bear with me and answer all the questions. They will help us to get a clear picture of all possible symptoms that the deceased had.

11. Did she have a recent positive test for Malaria?

   a. YES ( )   b. NO ( )

12. Did she have diagnosis of diabetes?

   a. YES ( )   b .NO ( )

13. **Was there any diagnosis of High Blood Pressure?**

a. YES ( )   b. NO ( )

14. **Was there any diagnosis of Heart Disease?**

  a. YES ( )   b. NO ( )

SECTION 4 . SYMPTOMS AND SIGNS ASSOCIATED WITH PREGNANCY AND DELIVERY

15. **Did she die within 24 hours after delivery?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

16. **Did she die during labour, but undelivered?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

17**. How many births, including stillbirths, did she have+ before this baby?**

a. One baby ( )   b. 2-3 baby ( )   c. 4-6 baby ( )   d. More than 6 ( )

18. **Did she have any previous C-section?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

19 . **Did she die during or after a multiple pregnancy?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

20**. Did she give birth to a live, healthy baby within 6 weeks of death?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

21**. Was there any vaginal bleeding during pregnancy or + after delivery?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

22**. Was there excessive vaginal bleeding during labour?**

  a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

23 **.Was there excessive vaginal bleeding after delivering the baby?**

  a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

24**. Was the placenta not completely delivered?**

  a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

25**. Did she deliver or try to deliver an abnormally positioned baby?**

  a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

26**. Was she in labour for unusually long (more than 24 hours)?**

  a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

  27**. Did she receive professional assistance for the delivery?**

  a. YES   b. NO   c. DON'T KNOW

28**. Did she have an operation to remove her uterus shortly + before death?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

29**. Did she have a normal vaginal delivery?**

a. YES ( )   b. NO ( )   c. DON'T KNOW( )

30. **Did she have an assisted delivery, with forceps/vacuum?**

 a. YES   ( )   b. NO ( )   c. DON'T KNOW ( )

31. **Was it a delivery with caesarean section?**

 a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

32. **Was the baby born less than nine month early?**

 a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

SECTION 5. TREATMENT AND HEALTH SERVICE USE FOR THE FINAL ILLNESS

33. **Was she adequately vaccinated?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

34. **Did she go to reproductive clinic or health visitors during pregnancy (antenatal visit)**

 . YES ( )   b. NO ( )   c. DON'T KNOW ( )

35**. If answer yes how many visit**

a. One visit ( )   b. 2- 3 visit ( )   c   more than 4visit ( )

36. **ANC provider**

   a. consultant

   b. registrar

   c. medical officer

   d. health   visitors

   e. mid wife

   f. No ANC

37. Health care provider attending maternal death

   a. specialist

   b. registrar

   c. medical officer

   d. house officer

   e. anesthetist

   f. mid wife

38. Did she receive any treatment for the illness that led to death?

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

39. Did she receive (or needed) a blood transfusion?

a. YES ( )   b. NO ( )   c. DON'T KNOW( )

SECTION 6.   BACKGROUND,   RISK FACTORS

40. **+ Did she use motorised transport to get to the hospital or +
health facility**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

41. **Were there any problems during admission to the hospital or +
health facility?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

42. **Were there any problems with the way she was treated (medical
treatment**

**+ procedures, inter-personal attitudes, respect, dignity) in the +
hospital or health facility?**

a. YES ( )   b. NO ( )   c. DON'T KNOW ( )

43**. Does it take more than 2 hours to get to the nearest hospital or health facility from the deceased's household?**

a. YES ( )   b. NO ( )   c. DON'T KNOW (   )

44. Women and Family Factors,   Area   of delay

   a. no delay

   b. delay at home

   c. delay in reaching   hospital

   d. delay in receiving treatment   at hospital

45. **Over the course of illness, did the total costs of care and treatment prohibit other household payments?**

a. YES   (   )   b. NO   (   )   c. DON'T KNOW (   )

Health Workers Interview for paramedical

Risk factors behind   maternal mortality Khartoum state 2014-2015)

1-Date of interview: …………………………

2-Name of hospital…………………………

Instructions: tick in the appropriate box for type of health worker being interviewed [√]

a.   Health visitors

b.   Trained Midwife

c.   Nursing

d.   Medical Assistant (MA)

A: Demographic data

3- **Sex of person being interviewed**

 Female [ ] male [ ]

4- **Age in years**

   a. Less than 20 years   b. 21- 30 years   c. 30 -40   d. more than 40

5-- **Level of Education**

(a) No education [   ]

(b) Primary education [   ]

 (d) Secondary education form [   ]

(f) University/ college/tertiary [   ]

B: Period of Experience

6- For how long have you been working in antenatal care?

    a. Less than one years [   ]

    b. 1-5 years [   ]

    c. 5-10 years

    d. above 10 years   [   ]

7- How long ago did you receive training?

    a. Less than one month [   ]

    b. 2-4 month [   ]

    c. 6-oneyears [   ]

    d. above two years   [   ]

C: Health workers Role in ANC

8- What role do you play in the care of maternity

a. Taking history (personal, family, social, medical, obstetric, and the date of the current   pregnancy) [   ]

b. Physical examination to identify potential problems [   ]

c. Laboratory examination [   ]

d. Explain the risks of pregnancy [   ]

e. Take appropriate action based on what it obtained the information [   ]

f. Provide advice and guidance [   ]

g. Registration information and provided treatment in pregnant Card   [ ]

9- **What history do you take from antenatal mother who come to your clinic. Probe for the following;**

  (a) Personal history [   ]

  (b)Social History   [   ]

  (c)Family history   [   ]

  (d) Medical history [   ]

  (e) Surgical history [   ]

  (f) Obstetric history [   ]

  (g) History of current pregnancy [   ]

  (h) Breast feeding

10-**What do you check when doing physical examination? Probe for;**

  (a) Blood pressure [   ]

  (b) Weight [   ]

  (c) Edema [   ]

  (e) Breast   [   ]

  (f) Fundal height [   ]

  (g) Fetal presentation [   ]

  (h) Listen to fetal heart sound[   ]

  (i)sign   of anemia [   ]

11- **What laboratory investigation do you carry out? Probe for**

(a) Hemoglobin [   ]

(C)Groping and cross matching [   ]

d) Malaria testing [   ]

(f) Urine for: protein [   ]

Sugar

12. **What prophylactic drugs and preventive measure do you give?**

    (a) Iron tablets [   ]

    (b) Folic acid   [   ]

    (c) TTV   [   ]

    (d) Impregnated mosquito nets   [   ]

13- **What information do you provide during education and counseling**?

(a) Process of pregnancy and its complication [   ]

(b) Diet   [   ]

(c) Personal hygiene [   ]

(d) Danger signs in pregnancy [   ]

(e) Exclusive breast feeding   [   ]

(f) Harmful habits e.g. drug abuse, smoking, taking   [   ]

traditional medicine

(g) Plans for delivery [   ]

(f) Schedule for next visit [   ]

(g) Plan for postpartum [   ]

(h) Effects of STI [   ]

14. **What problems do you encounter in assisting maternity**

Clients or when providing ANC ? Probe for

(a) Equipment   [   ]

(b) Lack of transport [   ]

(c) communication [   ]

(d) Shortage of professional staff [   ]

(e) Lack of essential drugs [   ]

(f) other specify [   ]

16 . In your opinion causes of maternal death in hospital is

a. Hemorrhage [   ]

 b. Infection malaria[   ]

 c. High blood pressure [   ]

 d. Unsafe abortion, and obstructed labour. [   ]

h.   anemia [   ]

j. Anesthesia   [   ]

 e. other _____

16 . In your opinion risk factors of maternal death   is

(a) Geography, eg, long-distance transfer   [   ]

(b) Utilization of Antenatal care   [   ]

(c) Poor nutrition [   ]

(d) History of pregnancy [   ]

(e)poor economic status of women (poverty) [   ]

(f) Other specify [   ]

17. **What is your comment on women's utilization of the antenatal services?**

_____

_____

_____

18. **Do you have any questions/comments?**

_____

_____

_____

Risk factors for maternal mortality Khartoum state 2014.

Focus group discussion question with women in child bearing age

Name of hospital _____

Name of moderator _____

Consent to Participate in Focus Group

The purpose of the group is to try and understand risk factors for maternal mortality in Khartoum state hospitals .

You can choose whether or not to participate in the focus group and stop at any

time. Although the focus group will be tape recorded, your responses will remain

anonymous and no names will be mentioned in the report.

There are no right or wrong answers to the focus group questions. We want to hear

many different viewpoints and would like to hear from everyone. We hope you can

be honest even when your responses may not be in agreement with the rest of the

group. In respect for each other, we ask that only one individual speak at a time in

the group and that responses made by all participants be kept confidential.

I understand this information and agree to participate fully under the conditions

stated above:

Signed:_____

Date:_____

WELCOME

Thanks for agreeing to be part of the focus group. We appreciate your willingness to Participate

We are working on a project concerned with risk factors of maternal mortality in Khartoum state

we are having these focus groups is to find out the risk factors for maternal mortality in Khartoum state hospitals

We need your input and want you to share your honest and open thoughts with us.

The interview will take about 15-30 minutes

Introduction

The objective of question set is gathering information on four level

a. Understanding the women health as perceived by the group being interviewed

b. Identification of problem facing maternal health according to each of group being interviewed

c. Identification the causes and risk factors of maternal mortality in maternity department in hospital according to each of group being interviewed

d. Recommendation to reduce or avoid maternal death as suggested by group

Focus group guiding Question

A. Understanding the women health

1. What do you know about women health?

_____

_____

_____

_____

2. What do you know about antenatal care for women?

a) Regular medical and nursing, mid wife care, recommended for women during pregnancy

b) Regular check-ups that allow doctors or midwives to treat and prevent potential health problems

c) The availability of routine prenatal care that played a part in reducing maternal death rates

3. What do you think about antenatal care visit?

   a) Monthly visits to the doctors during the first two trimesters (from week 1–28)

   b) Fortnightly visits to doctor from 28th week to 36th week of pregnancy

   c) Weekly visits to doctor after 36th week till delivery(delivery at week 38–40)

   d) Assessment of parental needs and family dynamic

Probes

"Can you talk about that more?"

"Help me understand what you mean"

"Can you give an example?"

4. Do you   prefer   primary health care or hospital in providing ANC ? advantage and disadvantage

    Probes

"Can you talk about that more?"

"Help me understand what you mean"

"Can you give an example?"

B. Problem facing   maternal health

5. In your opinion, what are the problem facing maternal health during pregnancy ?

Probes

"Can you talk about that more?"

"Help me understand what you mean"

"Can you give an example?"

6. What do you know about maternal mortality?

    Probes

"Can you talk about that more?"

"Help me understand what you mean"

"Can you give an example?"

C. Risk factors of maternal mortality

7. What are the causes of maternal mortality?

   Probes

   "Can you talk about that more?"

   "Help me understand what you mean"

   "Can you give an example?"

8. What do you think the delivery requires _ Obstetricians and Gynaecologists or midwives?

   Probes

   "Can you talk about that more?"

   "Help me understand what you mean"

   "Can you give an example?"

9. In your opinion, is there a relationship between the economic situation of the mother and her death during childbirth or after birth?

   Probes

   "Can you talk about that more?"

   "Help me understand what you mean"

   "Can you give an example?"

D. Recommendation and solutions

10. Would you recommend solutions to avoid maternal mortality?

Annexes (4)

Original Kuppuswamy's socioeconomic status scale

A	Education	Score
	Proficient	7
	postgraduate	6
	Graduate	5
	Diploma	4
	High school certificate	3
	Primary school certificate	2
	Illiterate	1
B	**Occupation**	**Score**
	Proficient	10
	Semi proficient	6
	Famer - shopowener	5
	skilled worker	4
	Semi skilled worker	3
	Un skilled worker	2
	Unemployed	1
C	Income per month	Score
	More 2000	12
	1999-1000	10
	750-999	6
	749-500	4
	499-300	3
	299-101	2
	=100	1
	Total	**Socioeconomic status**
	16-29 5-15	Higher Lower