

INTEGRATED STUDIES ADDRESSING THE INCIDENCE OF SEVERE MATERNAL  
MORBIDITY (SMM) IN KILOMBERO DISTRICT, TANZANIA

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## Abstract

Severe maternal morbidities (SMM) are a diverse range of serious complications which occur during pregnancy, childbirth and the post-natal period (six weeks after childbirth). They can affect any of the body organ systems, and their severity means that if untreated, or wrongly treated, maternal death is likely to result. Therefore prevention of maternal death requires better understanding of the epidemiology and outcome of the various forms of SMM. Tanzania is among developing countries in the world having a high maternal mortality ratio (454 per 100,000 live births), but there are few published evidence addressing all major forms of SMM in Tanzania. Not all pregnant Tanzanian women use health facilities for antenatal care or delivery, not even for treatment in the event of a complication. Therefore ascertaining the level of SMM in health facilities will not give a true estimation of the incidence among all pregnant women. While ascertaining SMM in the community would therefore seem to be a preferable approach, there are considerable practical barriers to executing such research in rural areas of developing countries. Furthermore previous studies have raised concerns about the reliability and validity of women's self report of obstetric complications, especially when such report is retrospective.

This PhD research has therefore taken two complementary approaches: (1) At St Francis Referral Hospital, Kilombero, Tanzania, using hospital routine data with case note review of all admissions experiencing complications, it has ascertained over the course of a full calendar year, the incidence and outcome of SMM, and associated risk factors (N= 5500 total admissions, n=1723 with case note review); (2) By undertaking a community interview survey in that hospital's rural catchment area, to determine the incidence of SMM via women's self reporting of symptoms. This survey attempted to interview all women in selected villages that are subject to the Ifakara Centre Demographic Surveillance System (IC-DSS), and who were recorded by IC-DSS as having given birth over the same time-frame (690 were interviewed, while 663 had given birth during study period). Validation of self-reporting of SMM was undertaken using interview response data of the subset of 173 interviewees who had attended St Francis hospital for obstetric delivery/treatment during the study interval, and for whom hospital diagnosis made at that time were therefore also available.

In the hospital study, the incidence of both intra partum (IP) and postpartum (PP) SMM (among all women delivering there or admitted postpartum) was 19.2%, with a case fatality rate of 1.7%. The incidence of solely intra partum SMM was 17.2%, the rate being higher among primigravida than among multigravid (28% v 8%,  $p < 0.001$ ), among teenagers than older women (23% v 14%,  $p < 0.001$ ) and single women than among other women (68.1% v 48.7%,  $p < 0.001$ ). Among 909 intra partum SMM, the three commonest conditions were obstructed labour (69%), eclampsia (14%) and severe preeclampsia (9%) while in the 258 postpartum SMM; the three commonest conditions were postpartum eclampsia (26%), puerperal sepsis (24%) and postpartum haemorrhage (23%). Neonatal death was more common among women with intra partum SMM than among other deliveries (4.7% v 1.1%,  $p < 0.001$ ). There were no intra partum maternal deaths, but across all antenatal, intra partum and postpartum admissions, maternal mortality was four-fold greater among women admitted in critical condition than among other women (2.1% v 0.5%,  $p = 0.006$ ). The majority of the women who became maternal deaths were admitted in critical condition (11/17).

Among Ifakara IC-DSS women interviewed, the majority had used health facilities at some level for obstetric care (64.7%), and affirmed prior birth and emergency complication readiness plans (97.6% & 81.5%). The incidence of any SMM (antenatal to postnatal, derived from self reported symptoms by interviewees) was 16.7%; while for both intra partum and postpartum SMM, the incidence was 15.4%, lower than that of the hospital study (19.2%). Considering solely intra partum (interview-ascertained) SMM, the rate was 8.1% ( $n = 54$ ), lower than the corresponding estimate of 17.2% from the hospital study. Validation interview-ascertained intra partum SMM classification could be undertaken in the subset of 173 who had delivered in St Francis hospital. Of these, 48 could be matched with the list of names of hospital admissions subjected to case note-review (i.e. all deliveries with any evidence of complications), while the remainder had no hospital-ascertained complication even (and hence must be presumed to be 'normal deliveries'). In this group, interview-ascertained IP SMM rate was 21.4%, and the sensitivity and specificity for interview-ascertained IP SMM were 59.3% (16/27) and 85.6% (125/146) respectively.

This is the first study in Tanzania to address the incidence of all intra partum and postpartum severe morbidities, using both retrospective review of referral hospital data/records and an interview survey in the surrounding rural community. The research findings have described the relative frequency of various subtypes of SMM, and the relationship of SMM to socio

demographic and obstetric factors and to maternal-foetal outcome. Such information will be helpful for clinicians and maternity staff to understand the pattern of SMM and how the hospital is performing in treating SMM cases. The finding that maternal death is so strongly associated with admission in critical condition emphasises the importance of addressing factors that delay admission of pregnancies that develop complications.

In the thesis the findings from the research studies will be elaborated and the challenges of such research will be discussed. While the sample size for validation of intra partum SMM was too small to be able to make conclusive remarks, the finding of borderline sensitivity will be discussed in relation to specific morbidities and the reliability of the hospital data 'gold standard' comparator.

With a pragmatic approach one can undertake research on SMM that enhances understanding of the complexities of SMM and its measurement, while also imparting knowledge on the epidemiology of the condition and potential actions that could be considered to improve outcome for SMM.

## Declaration

I hereby declare that I composed this thesis and that I was fully engaged in the whole research process i.e. proposal writing, field work, analysis and writing the thesis. Whenever there was a contribution made by other colleagues, I would fully acknowledge them in the text. This work has not been submitted for any other degree or professional qualification.

Signature:

Date:

13/10/2011



## Dedication

*This thesis is dedicated to my husband Michael and children Chedi and Jessie*

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## Abbreviations & Acronyms

AIDS: Acquired Immune Deficiency Syndrome

AMDD: Averting Maternal Death and Disability

ANC: Antenatal care

AP SMM: Ante partum severe maternal morbidity

BEmOC: Basic emergency obstetric care

CEmOC: Comprehensive emergency obstetric care

CI: confidence interval

Chi sq: Pearson's chi square value

df: degrees of freedom

EmOC: Emergency Obstetric Care

HELLP: **H**aemolytic anaemia **E**levated **L**iver enzymes and **L**ow **P**latelet counts.

HIV: Human Immunodeficiency Virus

ICU: Intensive Care Unit

Impact: Initiative for Maternity Mortality Programme Assessment

IP SMM: Intra partum severe maternal morbidity

KCMC: Kilimanjaro Christian Medical Centre

MM: Maternal mortality

MNCH: Maternal Newborn and Child Health

NGOs: Non Governmental Organizations

NM: Near miss

TDHS: Tanzania Demographic and Health Survey

TRACE: Tracing adverse and favourable events in pregnancy care

PP SMM: postpartum severe maternal morbidity

# 1 Introduction

## 1.1 Background to the study

Severe maternal morbidities are complications of pregnancy and childbirth which if not detected early and treated promptly, are highly likely to lead to maternal death. Among those who experience Severe Maternal Morbidity (SMM), but escape death, there are many women who get long standing debilitating conditions such as obstetric fistula. Such conditions have adverse social and economic consequences to the woman, her family and the community as a whole.

There have been few community studies on the incidence of SMM, largely because of the complexities of this set of conditions which can affect any of the body organ-systems and furthermore, there are profound methodological challenges in ascertaining SMM.

In Tanzania, studies have been conducted mainly on maternal *mortality*, with only few studies on the broad scope of SMM.

## 1.2 Structure of this thesis

The remainder of the thesis chapters comprise of a review of maternal health issues in **Chapter 2**, and the specific issues on Severe Maternal Morbidity (SMM) in **Chapter 3**.

**Chapter 4** outlines the research aims and methods for this PhD research. However, for ease of understanding of the two studies, the methods specific to each study will be detailed in the relevant chapter. The results are split into three chapters: **Chapter 5** describes the hospital based study of incidence and outcome of SMM, while **Chapter 6** describes about the community incidence interview study. **Chapter 7** describes a validation analysis of information which was obtained from the community survey in the form of intra partum SMM classification

The thesis concludes with **Chapter 8**, giving a general discussion drawing together findings of the two main studies, including the validation analysis. This discussion draws on some preliminary findings of the in-depth interviews with maternal health stakeholder. The chapter ends with conclusions drawn from the study findings and reflection on the discussion and recommendations.

## 2 Maternal Health

### 2.1 Introduction

Any pregnancy that is wanted is an important event in a woman's lifetime, and the ideal would be that she experiences a healthy state throughout, and the outcome is a healthy baby. Unfortunately, this is not always the case. As can be seen in **Figure 2-1**, a woman may experience a complication during pregnancy and the complication can be so severe as to become life-threatening. In extreme cases, the woman dies.

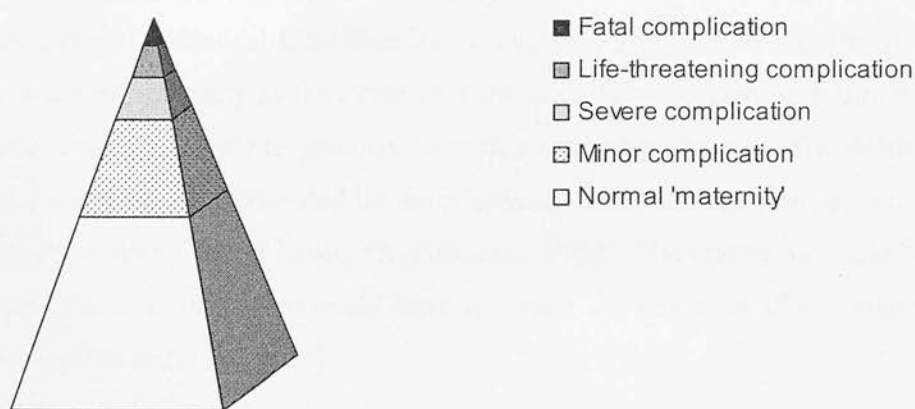


Figure 2-1: A diagrammatic representation of 'maternity', of the continuum from normal healthy maternity to maternal death (not to scale)

In this chapter, I shall review the topic of maternal health and focus on maternal mortality globally and in Tanzania. In addition, I shall discuss the different initiatives implemented to reduce maternal mortality. Lastly, I shall mention how the focus of this thesis relates to maternal mortality.

## **2.2 Reflection on Maternal Mortality**

### **2.2.1 Global burden of maternal mortality**

In 2008, the World Health Organization estimated 358,000 maternal deaths in the world, of which 99% occurred in developing countries; sub-Saharan Africa region having 57% of all deaths (i.e. 204,000), followed by South Asia whose estimate was 30% of all deaths (i.e. 109,000). Maternal mortality continues to be a challenge in developing countries (Filippi et al., 2006, Ronsmans et al., 2006).

### **2.2.2 Definition of maternal mortality**

The International Statistical Classification of Diseases and Related Health Problems (ICD 10), defines maternal mortality as the death of a woman while pregnant or within 42 days of end of pregnancy irrespective of the duration, as well as site of pregnancy. The deaths may be due to any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (World Health Organization, 1992). The reason for excluding accidental or incidental causes is that these could have occurred anyway even if the woman had not been pregnant (Lewis and Berg, 2004).

### **2.2.3 Pathological causes of maternal mortality**

The new World Health Organization (2009) classification categorises the causes of maternal deaths into three groups, which are:

- i. 'Direct maternal deaths resulting from obstetric complication of a pregnancy state (pregnancy, child birth or postpartum) such as major obstetric haemorrhage, obstructed labour and puerperal sepsis. In addition suicide in pregnancy, death from puerperal psychosis and postpartum depression are now categorised under this group.
- ii. Indirect maternal deaths resulting from previous existing disease or disease that developed during pregnancy and which was aggravated by the physiologic effects of pregnancy, for instance cardiac disease and diabetes mellitus.
- iii. 'Unanticipated complications of management' such as those related to caesarean section.'

The third classification is a recent addition in response to recognition that in some cases, maternal death could result from adverse complications of the management instituted. This

addition makes it possible to track trends in iatrogenic adverse outcomes such as those related to caesarean section (Pattinson et al., 2009).

The predominant causes of maternal mortality vary across the globe. A systematic review conducted by Khan and co authors (2006) showed that haemorrhage was the leading cause of death in Africa (point estimate 33.9%, range 13.3%-43.6%; 8 data sets, 4508 deaths) and in Asia (30.8%, 5.9%-48.5%; 11 data sets, 16,089 deaths). In contrast, in Latin America and the Caribbean, hypertensive disorders were most often the cause of death (25.7%, 7.9%-52.4%; 10 data sets, 11,777 deaths). The leading causes of maternal deaths in developed countries were other direct causes such as the ones related to anaesthetic accident or caesarean section (21.3%, 0.0-33.9%, 5 data sets, 2823 deaths). Considering other specific causes, deaths due to sepsis when compared between developed and developing countries, showed a higher proportion in developing countries- Africa [odds ratio 2.71 (95%CI 1.49-4.91)], Asia [odds ratio 1.91 (95%CI 1.07-3.40)], and Latin America and the Caribbean [odds ratio 2.06 (95%CI 1.17-3.62)] (Khan et al., 2006). In developing countries several factors such as absence of blood transfusion services, late detection and poor monitoring of hypertension, as well as lack of antibiotics for prophylaxis in prolonged/ obstructed labour, may contribute towards a poor outcome for obstetric complications (Bates et al., 2008, National Bureau of Statistics [Tanzania], 2007).

Data on maternal deaths due to abortion do not always distinguish between induced and spontaneous abortion. In many countries, induced abortion is illegal, or is illegal unless the life of the mother is at risk. In such countries, induced abortions are likely to be clandestine and unsafe (Paxman et al., 1993, Guillaume and Lerner, 2008). The proportion of maternal deaths due to abortion (unspecified whether induced or spontaneous) was found to be the highest in Latin America and the Caribbean (point estimate 12%, range 0.0%-32.9%; 10 data sets, 1,777 deaths) (Khan et al., 2006). It is of note that these countries have a very restrictive legislation on abortion practices (Paxman et al., 1993, Guillaume and Lerner, 2008).

#### **2.2.4 Contributory factors to maternal mortality**

In the previous section the pathological causes of maternal mortality have been described. Some of these are difficult to predict or prevent in clinical practice- for example abruptio placentae, in many cases. However, in most cases complications that are detected early and treated promptly,

longer term morbidities could be avoided and, more importantly, maternal deaths prevented (World Health Organization, 2008).

Therefore, if maternal mortality is to be reduced, then once one of these pathological causes of mortality begins to manifest, there must be minimal delay to clinical management. The timing of delays that arise has been classified by Thaddeus and Maine (1994) into three main phases, which are:

- Delay in seeking care ('Phase I'). This can arise from failure of a woman and her family to recognise complications and for various factors delaying decision to seek professional care. The latter might be due to some cultural beliefs and myths discouraging them from using health care services. The cost involved in accessing and use of health facilities may also be a factor. Moreover, a woman may be reluctant because of her previous bad experience of child birth which took place at a health facility.
- Delay in physically reaching a health facility ('Phase II'). This may be due to several factors impeding access to health care services such as poor roads, unreliable transport services, and long distance to health facility and lack of money for transport. Such type of delay happens in many developing countries such as Tanzania, the situation being worse in rural areas.
- Delay in receiving appropriate care at a health facility ('Phase III'). The reasons for such a delay might be organizational/ administrative, shortage of qualified staff, lack of essential drugs/ supplies/equipment, and/or erroneous clinical management. In Tanzania, on average, only one third of health care posts are filled, therefore staff shortage at health care facilities is acute and delay is often inevitable (Ministry of Health and Social Welfare -Tanzania, 2008). This situation is especially common in the lower level health facilities, where dispensaries are filled by 41% and health centres by 31% of the recommended staffing level *ibid*.

For a particular woman delays can occur at one, two or all three phases, so that total delay to management can accumulate, to be substantial.

Figure 2-2 shows a diagram of ‘Three delays model’ conceptualised by Thaddeus and Maine (1994). The diagram shows the three phases of delay on the right, and also shows, on the left, a classification of sets of factors which can influence delay: socio-cultural, health facility accessibility, and the quality of care.

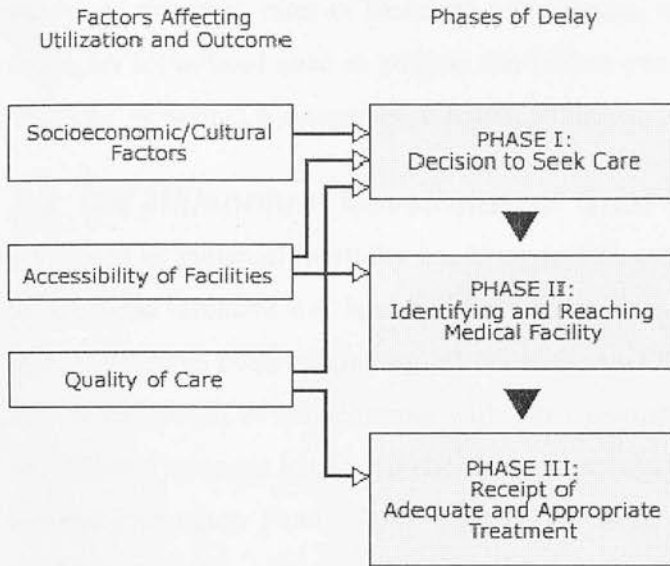


Figure 2-1: The three delays model of maternal mortality (Thaddeus and Maine, 1994).

It can be seen that phase I delay i.e. delay in making a decision to seek care, can be influenced by all three sets of factors. For example a woman may delay seeking care because of lack of money (socio-economic), absence of transport (accessibility to facilities), and because she has a negative perception of the quality of care at the health facility. Conversely phase II and III are each considered to be influenced by only one set of factors.

The developed countries have made fairly good progress with respect to early detection and prompt treatment of maternal complications. However the developing countries are still faced with multiple socio-economic and demographic factors such as those classified in the Thaddeus (1994) model as factors causing delay to seeking obstetric care.

It should be noted that in this model ‘delay’ is not always a simple matter of time. Even if a woman with obstetric complication has arrived in a health facility in time, and is seen by a clinician, that clinician might make and implement *inappropriate* clinical management, or might not be able to implement the correctly-determined management because of lack of essential resources (e.g. drugs). In such a case the extent of delay is ‘hypothetical’ and unbounded, since



appropriate clinical action was never taken. In this way the Thaddeus model acknowledges the vital importance of having skilled personnel at the health facility, and that the facility is well equipped.

It is clear therefore that since delay to receipt of adequate and appropriate care is a major reason for continuing high rates of maternal and neonatal morbidities and mortalities, any prevention strategies formulated need to address the factors exacerbating delays, but including availability of skilled personnel and supplies at health facilities.

### **2.3 UN Millennium Development Goal 5 of improving maternal health**

Reduction of maternal mortality has been an international goal ever since 1987, when the Safe Motherhood Initiative was launched in Nairobi, Kenya (Family Care International, 2007). Since then, there have been continuing efforts made by UN agencies (i.e. WHO, UNICEF, UNFPA, The World Bank) in collaboration with other international development agencies, and regional and national maternal health stakeholders, to improve maternal health (Maine et al., 1997, United Nations Population Fund, 2008). That is, the focus has become broader than solely maternal mortality.

In 2000, world leaders of 189 countries adopted the United Nations Millennium Declaration, thereby committing themselves to achieving the eight UN Millennium Development Goals (MDGs) (United Nations, 2000). Implementation of these goals aimed to bring improvement to the lives of poor people worldwide. The targets were to be achieved between 1990 and 2015 (see **Appendix IB** for a list of MDGs).

The world leaders met again in September 2010, to review the progress made towards achieving the MDGs (United Nations, 2010). The conclusion of the review meeting was that although some progress had been made regarding some of the goals in some countries, there was still slow progress in most of the sub-Saharan countries. The MDG report considered the challenges still faced in implementing the MDGs *ibid*. During the meeting, the UN Secretary General, along with heads of state and governments, private sector, foundations, international organizations, civil societies and research organizations pledged \$40 billion as a commitment to scale up women and children's health services worldwide. The UN Secretary General also launched the Global Strategy for Women's and Children's Health, designed to speed up the implementation of MD Goal number 4, which targets child mortality, and Goal number 5 which targets maternal

mortality as described below. As a follow up to ensure the \$ 40 billion pledges are delivered to developing countries and that they are spent in the most effective way to save lives, a commission on Information and Accountability for Women's and Children's Health was formed by the UN Secretary. The commission through in-depth discussions with high-level group of global leaders has come up with recommendations which will assist in the implementation of the accountability (World Health Organization, 2011).

The Millennium Development Goal number 5 aims at improving maternal health (United Nations, 2008). The goal is sub-divided into two targets, each with related indicators for monitoring progress.

- i. Target 5a, aims at reducing the maternal mortality ratio by 75% between 1990 and 2015. Its indicators are:
  - o Maternal mortality ratio
  - o Proportion of births attended by skilled health personnel
- ii. Target 5b, aims at achieving universal access to reproductive health during the same time. Its indicators are:
  - o Contraceptive prevalence rate
  - o Adolescent birth rate
  - o Antenatal coverage (at least one visit and at least four visits)
  - o Unmet need for family planning

It would be expected that progress in achieving target 5b would have a positive impact also on the goal of target 5a, reduction of maternal mortality. High coverage of contraceptive services will prevent unwanted pregnancies and unsafe abortions (World Health Organization, 2008). Reduction of unwanted adolescent pregnancies will also avoid the unnecessary adverse health risks associated with early childbearing (Kurth et al., 2010). High coverage of quality antenatal clinics across the region, and use of them by local women will enable proper monitoring of pregnancies for any risks and complications, so that measures can be taken in a timely manner (World Health Organization, 2009).

## **2.3.1 Target 5a- Maternal mortality**

### **2.3.1.1 Maternal mortality ratio**

The statistic generally used by the World Health Organization to quantify maternal mortality is the maternal mortality ratio (MMR), defined as the number of maternal deaths per 100,000 live births at specified time in a given area (World Health Organization, 2011). To calculate MMR, the number of live births and maternal deaths will need to be obtained, and it is suggested that this can be achieved via vital statistics and health facility records and surveys *ibid*. However, while vital statistics might record female deaths, they will not always record reliably whether the woman was or had recently been pregnant, so the exact number of maternal deaths is often unclear. Furthermore, in developing countries not all women deliver in a health facility, so health facility records cannot be expected to count all live births. Finally, in many developing countries, there are problems with quality and completeness of national vital statistics and health activity data. Therefore there are major difficulties in obtaining reliable estimates of MMR, most especially in developing countries which are unfortunately, the countries which have the highest rates of maternal deaths. For these reasons, the UN agencies (1997) adopted a set of process indicators which had been designed by the Columbia University to provide information on availability, use and quality of the services needed to treat the major complications of pregnancy, causing maternal mortality. More details of the UN process indicators will be given in 2.4.2.

### **2.3.1.2 Skilled attendance during pregnancy**

The term *Skilled attendant* has been defined by WHO (2004) as ‘an accredited health professional- such as a midwife, doctor or nurse- who has been educated and trained in proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and immediate postnatal period, and in identification, management and referral of complications in women and newborns’.

Skilled attendants are crucial in implementation of safe motherhood, since they have important roles at every stage of pregnancy. During pregnancy, their role is to monitor the progress of the pregnancy regularly and screening for diseases. They also explain to the woman the need for a birth plan, danger signs and measures to take in case of emergency. Preventive measures and counselling are also provided to the woman regarding conditions such as malaria and HIV infection (World Health Organization, 2004).

During delivery and in the postnatal period, the skilled attendant monitors closely the progress of labour and delivery to ensure a safe delivery and to detect early any complication that develops. In case of a complication, with respect to the mother or the newborn, the skilled attendant should take prompt measures for treatment, or if she is unable to manage the complication, make referral to higher level facility *ibid*.

In developing countries, up until recently, it was considered that traditional birth attendants could perform the role of skilled attendants if they were provided with some training. However, evidence is accumulating to show that training of traditional birth attendants has not contributed to reduction in maternal mortality *ibid*. This is because the traditional birth attendants are isolated from the health system. They do not have access to essential drugs and equipment and, historically, they have not been linked into the hierarchical system of referral in place, although in recent years attempts have been made to remedy this *ibid*. That is, the WHO recommends that traditional birth attendants, who generally live within or close to the rural communities, should be urged to encourage pregnant women to use health facilities provided for antenatal, delivery and postnatal care, so that complications can be detected and treated at the facilities *ibid*.

However, there has been a shortage, globally, of skilled attendants, especially in developing countries. The lowest levels are in Eastern Africa, where Tanzania is located, where only 33.6% of posts created have been filled, South-Central Asia (37.5%) and Western Africa (39.6%). The situation is different from developed countries where the average rate is above 90% (World Health Organization, 2004).

Some developing countries such as Malaysia and Sri Lanka have made a substantial reduction in maternal mortality, by increasing the number of midwives being trained (World Health Organization, 2005).

It is clear that shortage of skilled attendants especially at rural areas continues to be a major challenge. To address the problem, the Governments needs to increase relocation of funding in order to train more skilled attendants as well as increase the incentive package for those working in rural areas and improve the working conditions .

## **2.4 Measuring progress towards reduction of maternal mortality**

As briefly mentioned in 2.3.1.1, the UN has adopted some process indicators that could be used as a substitute for MMR. as an indication of maternal services in place that are likely to improve maternal mortality ratios and hence will be expected to improve MM by different safe motherhood programmes, ministries of health and international agencies to monitor the availability, use and quality of life saving emergency obstetric services which are provided at country or sub national level (Maine et al., 1997). It is appreciated that one way of reducing maternal mortality is by improving the availability, accessibility, quality and use of services for treatment of complications that arise during pregnancy and childbirth. Therefore since it has been challenging to monitor the maternal mortality ratio due to difficulties in ascertaining maternal deaths (ref 2.3.1.1), the process indicators were considered equally useful in informing how much the deaths have been avoided through provision of the life saving obstetric services. The services are collectively known as Emergency Obstetric Services (EmOC) whose operational definition is described below.

### **2.4.1 Definition of Emergency Obstetric Care (EmOC)**

Emergency obstetric care is defined as a set of lifesaving services that need to be available in health facilities to respond to emergencies that arise during pregnancy, delivery or postpartum (Maine et al., 1997). These life saving services, which are also referred to as ‘signal functions’, are many and diverse. The UN working group (1997) therefore decided to limit the definition to a short list of essential signal functions which are used to treat the direct obstetric complications that cause the vast majority of maternal deaths worldwide. The working group defined a *Basic* Emergency Obstetric Care (BEmOC) facility as one that provides the following signal functions:

- i. Parenteral antibiotics
- ii. Parenteral oxytocin
- iii. Parenteral anticonvulsants for pre eclampsia and eclampsia
- iv. Manual removal of placenta
- v. Removal of retained products of conception
- vi. Assisted vaginal delivery ( e.g. vacuum extraction)

After the review of the UN process indicators in 2006, the World Health Organization (2009) added another signal function of ‘Performance of neonatal resuscitation’ since it is a necessary intervention to any newborn showing signs of distress.

The working group also defined a *Comprehensive* Emergency Obstetric Care (CEmOC) facility as one that provides all the signal functions listed for *Basic* Emergency Obstetric Care (BEmOC), *plus* surgical services such as caesarean section and blood transfusion services.

*Basic* Emergency Obstetric Care services (BEmOC) are usually provided at both health centre and hospital level, whereas generally, *Comprehensive* Emergency Obstetric Care (CEmOC) services are provided at hospital level only *ibid*.

#### **2.4.2 UN process indicators of EmOC**

Once EmOC was defined, the UN process indicators of EmOC were chosen to address the following questions:

1. Are the facilities providing EmOC adequately distributed per population?
2. Are the facilities geographically distributed?
3. Are pregnant women using the facilities?
4. Are women with pregnancy and childbirth complications using the facilities?
5. Are sufficient critical services (ie CEmOC) being provided?
6. Is the quality of health care services adequate?

The process indicators had their corresponding acceptable threshold levels, however it was suggested that countries could also set their own threshold levels depending on what works best for them in order to bring improvement for the services.

**Table 2-1: The UN process indicators for EmOC (World Health Organization, 2009)**

Indicator	Threshold level for indicators to be met
1. Availability of EmOC: basic and comprehensive care facilities	At least 5 EmOC facilities (including at least 1 comprehensive facility) for every 500,000 population of all ages
2. Geographical distribution of EmOC facilities	All sub national areas have at least 5 EmOC facilities (including at least 1 comprehensive facility) for every 500,000 population of all ages
3. Proportion of all births in EmOC facilities	( minimum level to be set 'locally')
4. Met need for EmOC i.e. proportion of women with major direct obstetric complications who are treated in such facilities	100% of women judged to have had major direct obstetric complications are treated in emergency obstetric care facilities
5. Caesarean sections as a proportion of all births	The estimated proportion of births by C-section in the population is between 5% and 15%
6. <i>Direct</i> obstetric case fatality rate among women with direct obstetric complications in EmOC facilities	Case fatality rate less than 1% for direct obstetric complications (see 2.2.3)

In addition, two indicators were added during the revision of UN guidelines for monitoring emergency obstetric care in 2006 (World Health Organization, 2009) as seen in **Table 2-2**.

**Table 2-2: New UN process indicators for EmOC**

Indicator	Threshold level for indicators to be met
1. Intra partum and very early neonatal Death rate	Standards to be determined
2. Indirect causes in emergency obstetric Care facilities	No standard set by WHO, can be set by countries

Adapted from (World Health Organization, 2009)

It is intended that the process indicators listed above will enable a programme either to assess the health care needs or monitor the availability, accessibility, quality and use of EmOC services in a particular area. The World Health Organization has set thresholds for some indicators while it has left a few for each country to set its own according to the practicalities and relevance to enable improvement of EmOC services. Regarding EmOC facilities, they should be fully functional in the sense that they provide all the signal functions according to the type of facility. For such facilities to be counted in any monitoring of current situation, the facilities should have performed all the signal functions in a three month period before assessment *ibid*.

The proportion of women who deliver in EmOC facilities is the number of births in EmOC facilities per all live births expected in the area. The (minimum) threshold rate was initially set by the World Health Organization as 15%, on the assumption that 15% of births are likely to develop a complication needing EmOC care *ibid*. However, of late many countries are making efforts to ensure that more women deliver in health facilities. Therefore the WHO now recommends a target to be set locally *ibid*.

In EmOC terms ‘met need’ is calculated as the number of women treated for direct obstetric complications at EmOC facilities in a given time, divided by the expected number of women who would have major obstetric complications (such as those labelled as direct causes of maternal mortality mentioned in 2.2.3.i ). These direct obstetric complications are estimated to be 15% of expected births *ibid*.

Caesarean section is one of the major obstetric interventions to avert maternal and neonatal deaths and complications such as obstetric fistula. However rate of caesarean section that is either too low (for the prevalence of such complications), or too high, could lead to harm.



Therefore for caesarean section rate a pragmatic approach has been taken, with an interval 'threshold' *ibid*. Since the caesarean rate is calculated by counting the number of caesarean sections only in facilities that provide EmOC, as per the definition, some caesareans might be missed due to those facilities being excluded on account of not qualifying as EmOC facilities (perhaps due to absence of some signal functions). Therefore, it is recommended that the caesarean rate should be calculated including caesareans undertaken in other facilities in the region, so as to give a complete picture for the area. It is commented that there is a need for caution when interpreting caesarean section rates since the tendency to focus caesarean expertise and facilities in one high-level hospital (and refer most cases there) will mean diversity in caesarean rates across all facilities in the region.

The direct obstetric case fatality rate is the proportion of death before discharge among women admitted in EmOC facility with direct obstetric complications only, or who develop such complications after admission. The rate gives a crude estimate of the quality of care provided, in that facility or region, to women with complications.

Apart from case fatality rate due to direct obstetric complications, there are women who die due to indirect non obstetric complications, and the rate of such deaths can be high in countries where there is high prevalence of malaria and /or HIV. The WHO therefore recommends that each country monitors the indirect case fatality rate *ibid*. Thus is important in developing countries such as Tanzania where pre existing diseases are pandemic such as HIV/AIDS Maternal health in Tanzania (National Bureau of Statistics [Tanzania], 2007).

### **2.4.3 Overview of maternal health from published surveys**

Two large surveys of maternal health have been undertaken in Tanzania (National Bureau of Statistics [Tanzania], 2005). I will review the findings for maternal health and service delivery in this section and focus on maternal mortality in Tanzania in the next section.

#### **2.4.3.1 Tanzania Demographic Health Survey 2005**

The Tanzania Demographic and Health Survey (TDHS) (2005) is one of the national surveys conducted to measure levels, patterns, and trends in demographic and health indicators, maternal health being one of them.

**Table 2-3** outlines key indicators of use of maternal health services as reported by the women who had a live birth in their last pregnancy during the five-year period before the survey.

**Table 2-3: Summary of maternal health service indicators as reported by TDHS (2005)**

Indicator	%
<b>Antenatal care (N=5772)</b>	
Received ANC from a health professional at least once	94
Received ANC from a health professional at least four times	62
Was provided with information about signs of pregnancy complication	47
Blood pressure measurement taken	66
Blood sample taken	54
Measurement of weight done	94
<b>Delivery care (N = 8725)</b>	
Women who delivered at health facility	47
Women assisted by health professionals	46
Caesarean section proportion	3
<b>Post partum care* (N=2873)</b>	13

\* Post natal care for mothers delivering outside health facilities

Antenatal coverage has not been adequate since only 62% attained the recommended four visits. The World Health Organization recommends that pregnant women should attend clinic before the 16<sup>th</sup> week of gestation for general baseline assessment and regular follow up including screening of infectious diseases such as syphilis, HIV/AIDS as well as immunization of tetanus toxoid (United States Agency for International Development and ACCESS program, 2007). If the pregnancy is uncomplicated, then it is advised that the woman should have at least four visits in their entire pregnancy, but more frequent visits are advised for those with complications (World Health Organization, 2009). Attending fewer than four times could be explained in some cases by women commencing antenatal clinic late in the pregnancy, so that the baby is born prior to the recommended number of antenatal visits being completed. The same survey showed that at their first visit, women's median number of months pregnant is 5.4 (National Bureau of Statistics

[Tanzania], 2005). Barriers to accessing ANC could be distance and lack of reliable transport. This is supported by findings from the same survey which showed that educated women, those living in urban areas and those in the highest wealth quintile were more likely to attend antenatal clinic. Furthermore, these factors tend to be inter-correlated.

Another potential explanation for low frequency of attendance is that the quality of ante natal care, especially in rural areas, has been shown to be inadequate. For instance, in the survey, only two thirds of women reported their blood pressure having been measured, while only just over half who said a blood sample was taken from them. Such findings are consistent with those of Urassa and co authors who conducted two studies in a rural district in Tanzania (Urassa et al., 2002, Urassa et al., 2003). They found inadequate quality of antenatal care regarding screening and management of hypertension and anaemia. The health workers could detect only four out of twelve women with elevated blood pressure. This could be due to the findings such that the health workers generally recorded lower blood pressure levels than the observers. The other possibility which could not be assessed in the study was whether all health workers recorded blood pressure at the same Korotkoff sounds as the observers. Antenatal screening for obstetric complications such as hypertension and anaemia in pregnancy is crucial since these conditions if not detected and treated in a timely manner, will lead into maternal and neonatal morbidity and mortality (Almerie et al., 2010).

Regarding weight measurements in the survey, almost all women had reported having their weight checked which is encouraging.

The survey also enquired whether women had been warned of 'danger signs', such as severe headache, which could occur during pregnancy. Only less than half of the women reported to have been warned of the danger signs. The survey's recommendation however is that such women's reporting on service use and information of danger signs of pregnancy should be interpreted with caution since there could be other factors influencing the responses given by the women such as recall of events and their understanding of questions during the interviews. Nonetheless, the survey gave insight to the quality of ante natal care Tanzanian women receive during pregnancy *ibid*.

For intra partum care, the survey showed that only 47% of all births in Tanzania occur in health facilities. Over half of the women deliver their babies outside health facilities, of which their

responses as to who attended them during delivery were relatives (58%), traditional birth attendants (56%) and alone (6%) *ibid*. As discussed in 2.3.1.2 that the presence of a skilled birth attendant during delivery is of vital importance so as to detect and manage obstetric complications or refer promptly women to higher health facility (World Health Organization, 2004, World Health Organization, 2008). However, even among those who use health facilities particularly for example a rural dispensary, not all benefit from truly skilled attendance at their births. The issue of skilled attendance remains a challenge in Tanzania especially in rural areas.

Postnatal care for mothers who had delivered outside the health care facilities was very uncommon (13%). This is regrettable since the first two days after delivery are a high risk time of complications leading to maternal and neonatal deaths (World Health Organization et al., 2007)

#### **2.4.3.2 Emergency Obstetric Care in Tanzania as reported by the Tanzania Service Provision Assessment Survey (TSPA) 2006**

The Tanzania Service Provision Assessment Survey was conducted in a sample of 72 health facilities (selected across regions) to provide detailed information on the availability and quality services for maternal health, amongst many other aspects of health services (National Bureau of Statistics [Tanzania], 2007). The results of the survey were then presented by geographical zones to allow for the analysis of differences by geographical region.

The surveyed facilities were investigated with respect to Emergency Obstetric Care (EmOC) performance/functioning over a period of three months prior to survey. The survey found that EmOC services in Tanzania were less than satisfactory. Nationally, the coverage rate for Basic Emergency Obstetric Care (BEmOC) is 0.55 facilities per 500,000 people *ibid*. This rate is only one ninth of the recommended UN level (World Health Organization, 2009a). Furthermore, there were variations by geographical zone, the worst scenario being in the western zone with 0.05 facilities per 500,000 people, less than one ninetieth of recommended provision (National Bureau of Statistics [Tanzania], 2007). Looking in depth at the BEmOC services, the survey revealed that such services are very rarely provided at the lowest level i.e. dispensary. **Table 2-4** shows the survey results, for health centres and hospitals which have provided signal functions (life-saving services) in the last 3 months. Comparison of percentage for hospital and health centres shows very clearly the difference of all services except for parenteral antibiotics. The survey then

showed that provision of BEmOC is inadequate at health centre level. It is particularly alarming that only 3% had parenteral anticonvulsants available in the facilities. The disparity between health centres and hospitals is even more stark where overall provision of the range of functions is unsatisfactory. No health centre had provided Comprehensive Emergency Obstetric Care services (CEmOC), which is understandable because this requires performance of caesarean section and blood transfusion services. But also no health centre had provided all types of BEmOC. Only 20% of the hospitals managed to provide a full list of the components of BEmOC.

**Table 2-4: Provision of 'signal functions' in the last 3 months, as reported in health centres and hospital, separately and overall. (N=72 health facilities).**

Signal function (Life-saving services)	<i>Basic</i> Emergency Obstetric Care (BEmOC)		<i>Comprehensive</i> Emergency Obstetric Care (CEmOC)		Health centres %	Hospitals %
Parenteral antibiotics		✓		✓	57	65
Parenteral oxytocin		✓		✓	11	77
Parenteral anticonvulsants		✓		✓	3	57
Manual removal of placenta		✓		✓	42	74
Removal of retained products		✓		✓	31	77
Assisted vaginal delivery		✓		✓	11	49
Caesarean section		-		✓	12	94
Blood transfusion		-		✓	9	90
<b>Provision of all BEmOC</b>					0	20
<b>Provision of all CEmOC</b>					0	18

Regarding CEmOC, the national estimate is 0.55 facilities per 500,000 people *ibid*, which is about half the level of 1 per 500,000 people recommended by the UN (World Health Organization, 2009). The survey revealed that only two zones; i.e. the Northern zone, with 1.3 facilities per 500,000 people, and the Eastern zone, with 2.1 facilities per 500,000 people, meet the UN recommended coverage for comprehensive EmOC. The two zones might have produced better results as they comprise of the largest commercial city and societies which are economically better off compared to other regions. It is also alarming to note that only 18% of the hospitals were able to provide full range of CEmOC services.

The findings in these two national surveys show that the availability and use of maternal health services is unsatisfactory especially in rural areas. A substantial number of women attend antenatal clinic once, but do not manage to pay subsequent visits. At the clinic, the quality of antenatal care is still questionable as has been evidenced by poor services. During delivery, few women are privileged to be attended by skilled personnel. This implies that not all complications developing during delivery will be detected, treated and or referred to a higher level facility. Moreover, emergency obstetric care services are insufficient even at the health centre level. Therefore women have to travel longer distance to a hospital so as to receive services which should have been offered at a health centre level. Even at the hospital, there are insufficient emergency obstetric services as evidenced in the second survey. Improving maternal health in Tanzania continues to be a challenge due to multiple constraints at different levels of health care.

#### **2.4.4 Maternal mortality in Tanzania;**

Among eleven countries in sub-Saharan Africa which together contribute 65% of world's maternal mortality, Tanzania is ranked the seventh highest (World Health Organization, 2010). Recently, Kweka (2010) reported some preliminary findings of Tanzania Demographic and Health Survey, which showed a maternal mortality ratio of 454 maternal deaths per 100,000 live births. Albeit the ratio is too high, it has decreased by 21% from a ratio of 578 maternal deaths per 100,000 live births, as reported by the previous Tanzania Demographic and Health Survey (2005).

As is often the case with overall national statistics, there are disparities in estimates in different settings/studies. **Table 2-5** reports estimates calculated by various studies in Tanzania,

undertaken between 1971 and 2005. Where one study reports separate estimates for different settings, these are presented separately in the table.

**Table 2-5: Maternal mortality ratio of hospitals and communities in Tanzania (studies published between 1971 and 2005)**

Authors	Population	Year of study	MMR	95%CI
Armon (1979)	KCMC referral hospital, Kilimanjaro	1971- 1977	180	(130-250)
Mbaruku (1995)	Kigoma regional hospital	1984	933	(620-1350)
		and 1991	186	(80-360)
Font (2000)	Kilombero district	1995	448	(363-534)
Mswia (2003)	Dar-es-salaam urban	1993- 1999	591	(489-714)
	Morogoro poor rural district	1992- 1999	1099	(964-1253)
	Hai wealthier rural district	1992-1999	348	(289-420)
Kazaura (2006)	Muhimbili national hospital, Dar-es-salaam	1999-2005	512	(465-559)

**Table 2-5** shows that the MMR varies across studies from 180 to 1099, over five-fold. The studies vary in size, so varying precision of estimation is one issue to bear in mind. Variation over and above this could be due to factors such as when the data were collected, or type of population (community or referral hospital). For example, the MMR was high in Kazaura's study, where an explanation could be the nature of the hospital, which is the national referral hospital receiving mostly women with severe complications, some of them arriving in critical conditions because of various delays that can accumulate as has been discussed in 2.2.4. However, Armon's study was also undertaken in a referral hospital (KCMC), but it reports the lowest MMR. Perhaps this is because at the time it was conducted, in the 70's, there were

relatively fewer critical cases referred to the hospital. Another issue to bear in mind is the possibility that bias of some sort has distorted study findings. If documentation of maternal death cases was less reliable in the 1970s, then this could bias Armon's estimate downwards, due to under-ascertainment.

The pattern of conditions causing maternal deaths may also differ in different areas of Tanzania. Mswia et al (2003) obtained the causes of maternal deaths through verbal autopsy. In Dar-as-salaam urban, of all 72 maternal deaths, the top three common conditions were postpartum haemorrhage (14%), hypertensive disorders of pregnancy (14%) and puerperal sepsis (14%). Furthermore in Hai district, of 87 maternal deaths, the common conditions were induced abortion (22.7%), postpartum haemorrhage (13.6%) and hypertensive disorders (10%). Morogoro rural district's top conditions were postpartum haemorrhage (29%), spontaneous unspecified abortion (15.2%) and complications of labour and delivery (13.8%), out of 197 maternal deaths. In Mswia's study (2003), induced abortion made a remarkable contribution to maternal deaths in Hai district, as opposed to the other two areas studied (by the same team). Induced abortion is illegal in Tanzania, so socio-cultural issues are highly pertinent, and fear of stigma may prevent women from giving a true account of the abortion event. This is one of the reasons many abortions are 'unclassified' (as induced or spontaneous) because a woman might have died before revealing the full facts.

#### **2.4.4.1 Initiatives for prevention of maternal mortality in Tanzania**

Since the launch of Safe motherhood initiatives in 1987, the government of Tanzania has been fully engaged with the challenges and has adopted various strategies to reduce maternal mortality. Various national policies give guidance so that relevant activities are implemented from national to community level. Such policies include the National Health Policy (Ministry of Health and Social Welfare - The United Republic of Tanzania, 2003), the Health Sector Reforms and the Health Sector Strategic Plan (2003-2007) (The United Republic of Tanzania Ministry of Health and Social Welfare, 2008). Since maternal mortality reduction does not only involve the health sector but other social economic sectors, it is also a major priority area in the National Strategy for Growth and Poverty Reduction (NSGPR/MKUKUTA) 2005-2010. The goals for MKUKUTA strategy are to improve the survival, health and well being of all children and



women, especially vulnerable groups (The United Republic of Tanzania Vice President's office, 2005).

Furthermore, in 2005, there was a development of the Maternal, Newborn and Child Health (MNCH) strategic plan to accelerate reduction of maternal, newborn and child deaths. This was a response to the New Delhi Declaration (April 2005) which urged all countries to develop strategies to reducing the persistently high rate of maternal, newborn and child deaths in order to reach the UN millennium development goals number 4 and 5 (Ministry of Health and Social Welfare - The United Republic of Tanzania, 2008). One of the MNCH strategic plan is to strengthen the health system at all levels of health care ensuring quality services are delivered at all level of health care. Moreover, it seeks to ensure community participation in planning and implementing actions to improve the health services. The plan also promotes partnership of the government with donors, NGOs, the private sector and other stakeholders in improvement of maternal, newborn and child welfare *ibid*.

There has been much action-oriented research and the many interventional programmes in Tanzania have made a positive change towards reducing maternal mortality. A few examples of the successful stories can be cited; Mbaruku and Bergstrom (1995) launched an intervention programme to reduce maternal mortality, in the regional hospital in Kigoma. This followed a retrospective study to investigate the actual issues needing to be addressed to improve the services. Some of the interventions instituted were the introduction of regular audit meetings, on-the-job training, and the supply of essential drugs, repair of the operating theatre, maintenance of equipment and the establishment of a small infusion production unit. Following these interventions, the maternal mortality ratio in the regional hospital was reported to have fallen from 933 to 186 per 100,000 live births between 1984 and 1991.

Kayongo et al (2006), through the auspices of CARE and AMDD program in Mwanza region, introduced some measures in four hospitals to improve the emergency obstetric care facilities. Some of the major interventions included renovating and upgrading the hospitals to a comprehensive EmOC status, providing essential supplies and equipments, reviewing and developing of EmOC protocols and guidelines and training and placement of key staff.

Evaluation of the interventions during the 5 year period improved the UN process indicators as follows:

- Proportion of all births in EmOC facilities increased from 13.1% to 17.9%
- Met need for EmOC increased from 9.1% to 19.3%
- Caesarean section rate increased from 1.2% to 1.8%
- Case fatality rate dropped from 3% to 1.9%

Olsen and co-authors (2009) demonstrated a hospital based programme at a rural hospital situated in northern Tanzania. This was a comprehensive programme involving all aspects of reproductive and child health services, HIV/AIDS care, 24 hour comprehensive emergency obstetric care, ambulance, radio and transport services. The impressive part of the story is that each village had a contract with the hospital to maintain the roads by the efforts of the local community. The hospital supplied the machinery needed while the villages supplied the manpower. If a village did not repair the roads, then it would not receive ambulance or maternal child health services. Evaluation on these interventions has not been documented to see its impact on maternal mortality.

While there are heartening examples, the relatively small population involved mean that the three combined efforts might have scant impact on the national MMR. Similar work will have to be scaled up to many more locations, before a substantial further improvement will be seen in the overall national MMR

## **2.5 Chapter summary**

Review of maternal mortality globally and in Tanzania, shows that it persists as too high, especially in developing countries, due to both social cultural and provision of quality health care. More efforts are needed for all maternal health stakeholders to work closely, in collaboration with other sectors such as infrastructure ministries to ensure implementation of safe motherhood. This thesis focuses on one of the determinants of maternal mortality which is Severe Maternal Morbidity (SMM). The next chapter therefore, reviews severe maternal morbidity, the key precursor of maternal mortality.

### 3 Severe Maternal Morbidity

The focus of this thesis is on severe maternal morbidity, a key precursor of the outcome maternal mortality, which has been reviewed in the previous chapter. This chapter therefore presents a background and definition for severe maternal morbidity. Different ways of identifying cases will be discussed as well as the methodological challenges of case-ascertainment. Lastly incidence of severe maternal morbidity is presented globally and for Tanzania.

#### 3.1 Background to severe maternal morbidity

Morbidity, as defined by Last (2001), is a broad term indicating any departure, subjective or objective, from state of physiological or psychological well-being. Considering, specifically, *obstetric (maternal)* morbidity, this has been defined by the World Health Organization (1989), and documented in Pattinson (2003) and Paruk's (2001) publications, as any morbidity (regardless of the site or duration of pregnancy), from any cause, related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. This is illustrated in **Figure 3-1**, which shows a population pyramid where the majority have absence of even mild complications, through to: occurrence of minor conditions (such as backache); severe complications (such as profuse uterine bleeding); life threatening complications (such as shock); and the worst-case scenario, which is maternal death. Note that the definition includes morbidities that result from a specific intervention. For example, abdominal wound dehiscence following caesarean section.

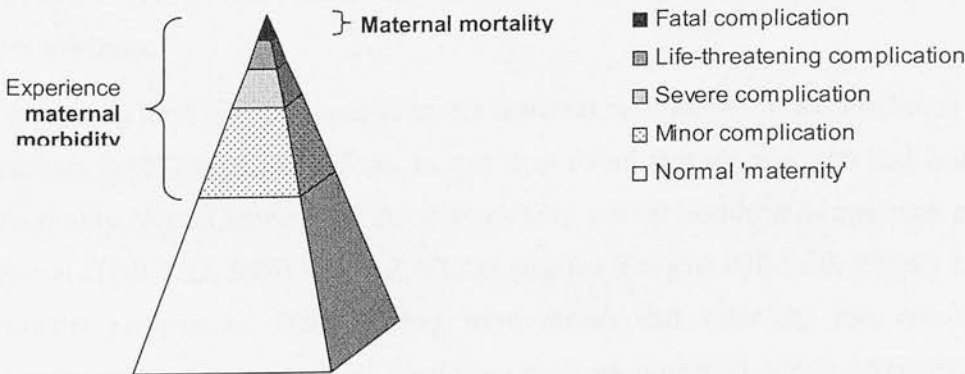


Figure 3-1: A pyramid diagram showing the continuum of maternal morbidity from non-occurrence through to maternal mortality (not to scale)

### 3.1.1 The impact of severe maternal morbidity

Many pregnancies are affected by some degree of morbidity, albeit this is very unlikely ever to be life-threatening e.g. backache/ morning sickness. Where obstetricians and population health specialists wish to make improvements is in detection and intervention in the case of potentially life-threatening maternal morbidities. A convention has therefore developed of focussing academic research and writing on *severe* maternal morbidity, rather than the full spectrum of all maternal morbidities indicated on **Figure 3-1**.

A clear and serious consequence of severe morbidity is maternal mortality. However, even where the woman survives, she may be afflicted with longstanding after effects such as obstetric fistula. This condition can occur if a woman has sustained a prolonged obstructed labour which has not been relieved by a timely caesarean section (Orji et al., 2007). The baby's head thus remains pressed against tissues surrounding the birth canal for a prolonged period of time (i.e. bladder and sometimes even rectal tissues). As a result blood flow to the compressed area is cut off, resulting in sloughing of the tissues, this in turn leaves a channel (fistula) (Kelly, 1992). The fistula may develop either between the bladder and vagina and/ or between the rectum and vagina. This means there is vaginal leakage of urine and or faeces *ibid*. This can lead to medical after effects such as chronic vulva excoriation, cervical damage and cessation of menses (Orji et al., 2007), but the woman often suffers social and economic consequences as well, because the uncontrollable leaking of urine and/ or faeces from the vagina, may lead to the woman being shunned by society and abandoned and even divorced by her husband (The INFO project, 2004),(Bangser et al., 2010). Moreover, such a condition may restrict the woman from earning income which could affect the wider family, especially critical where she is the sole breadwinner.

Other long term consequences of severe maternal morbidities have been shown by Filippi and co authors (2007) in Burkina Faso, in that they found that women who had had severe maternal morbidity had an increased risk of developing mental health problems such as depression and anxiety (OR 1.82, 95%CI 1.18-2.80) and suicidal thoughts (OR 2.27, 95%CI 1.33-3.89) at three months postpartum. Other studies have shown that infertility can occur as a result of inappropriate management of conditions such as puerperal sepsis (AbouhZahr et al., 1998, AbouhZahr and Rodeck, 2003) and this can be devastating in many cultures.

Severe maternal morbidity may also have consequences for the unborn child, such that it dies, or suffers severe birth asphyxia as can occur if there is prolonged and neglected obstructed labour (McClure et al., 2009). Severe asphyxia has a high risk of causing long term handicap (Kulak et al., 2010).

Severe maternal morbidity has also been found to be associated with low birth weight, which in turn increases the risk of infant mortality; for example, in the case of severe anaemia in pregnancy the risk is quadrupled or trebled (Kidanto et al (2009) and Marchant et al (2004) respectively).

### **3.1.2 Defining Severe Maternal Morbidity**

While there has not been a standard published definition of severe maternal morbidity, there is an implicit understanding that it is any potentially life threatening complication occurring during any stage of pregnancy from antenatal to postpartum period. It is this that we will use as our definition of Severe Maternal Morbidity (SMM). [From here on lower case 'severe maternal morbidity' will be used in a general descriptive sense, while 'Severe Maternal Morbidity' (or SMM) will refer to the set of potentially life-threatening conditions defined as above.] Since a proportion of those with SMM will die of their condition, sometimes even despite best care, there is the further implication that counts of cases will include those who have died.

#### **3.1.2.1 The concept of maternal 'near miss'**

Over the last two decades, increasing attention has been paid to a subset of severe maternal morbidity cases - maternal 'near miss' cases. These are the women who experience maternal morbidity at the severe end of the morbidity spectrum (i.e. an obstetric condition that is judged actually, not just potentially, life threatening), but who survive (Ronsmans and Filippi, 2004, Bullough and Graham, 2004).

The switch to a focus on maternal near miss cases, as opposed to maternal deaths, resulted from a recognition that maternal deaths were becoming rare in developed countries, hence could not be available for monitoring the quality of obstetric care *ibid*. Fortunately modern obstetric knowledge means that only a proportion of women with life-threatening conditions die, so there are considerably more maternal near miss cases than deaths. It was therefore realised that review

of these near miss cases would enable more robust conclusions to be drawn concerning risk factors for maternal deaths *ibid*.

### **3.1.2.2 Definition of maternal ‘near miss’**

In the published literature, there have been three main definitions which have been used in near miss (Pattinson and Hall, 2003). The definitions are:

1. ‘A severe life threatening obstetric complication necessitating an urgent medical intervention in order to prevent the likely death of the mother’ (Filippi et al., 2000).
2. ‘Any pregnant or recently delivered woman, in whom immediate survival is threatened and who survives by chance or because of the hospital care she received’ (Prual et al., 2000).
3. ‘A very ill woman who would have died had it not been that luck and good care was on her side’ (Mantel et al., 1998).

The definitions have similarities in the sense that they all address acute illness requiring a medical intervention to save life. Furthermore, the last two definitions incorporate the possibility of a chance of survival of these women even in the absence of medical intervention.

Recently, the WHO working group on Maternal Mortality and Morbidity classifications, created a consolidated definition for a maternal near miss case: *‘A woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy’*.

### **3.1.2.3 Application of the maternal ‘near miss’ concept**

The main application of the maternal near miss case classification has been to monitor and evaluate the quality of obstetric care in health facilities. This has been achieved through case reviews, clinical audits and confidential enquiries. An example of a case review is when a treatment care plan for a woman experiencing a near miss condition, is assessed. The health providers within the maternity wards are involved in the review process and areas of weaknesses are identified and discussed. Recommendations are given on how to correct the areas of weaknesses so that they do not happen again (Ronsmans C and Filippi, 2004, Bullough and Graham, 2004).

With regard to clinical audit of near miss cases, this is a quality improvement process where health care providers agree on a specific topic to be audited. The investigation may either focus on the outcome, clinical care or availability of structural factors such as drugs and supplies. There are agreed criteria and standards to be used as a benchmark before the audit. Data is then collected and analysis done to see if the standards and criteria were being met. Depending on the outcome, recommendations are made as a team so that actions are taken. After an agreed period, evaluation is done to see if actions were taken. Depending on the results and recommendations, another clinical audit may be conducted (Bullough and Graham, 2004).

The Scottish Confidential Audit of Severe Maternal Morbidity has been conducted annually in all consultant led maternity units (Lennox and Marr, 2010). All cases of severe maternal morbidity are reported on monthly basis by the clinical risk management team in each unit to the Scottish Programme for Clinical Effectiveness in Reproductive Health (SPCERH). The hospital team undertake detailed assessment of cases of major obstetric haemorrhage and eclampsia by filling a structured national Case Ascertainment Proforma. By filling in the proforma, one can assess if the case management followed the national guidelines. The quality of patient's care can also be known as well as the contributing factors towards the morbidity. Lessons learnt and action points are also outlined and finally the SPCERH can draw the learning points relevant to the national context so that further recommendations are made to bring improvement in clinical practice *ibid*.

In addition, the near miss cases can be analysed to find any positive circumstances that appear to have improved outcome over what seemed clinically likely at the time. For example in the case of an extremely severe obstetric morbidity where there was very little chance of survival, or a high chance of adverse sequelae, to look for factors that might have contributed to the woman's recovery, or prevented the most adverse effects which is death. This method is called *Tracing adverse and a favourable event in pregnancy care (TRACE)* and has been applied in Ghana and Indonesia by researchers from the University of Aberdeen (Impact University of Aberdeen, 2007). In Ghana, a panel of experts focussed on the clinical quality of care being provided by health professionals in health facilities. In Indonesia the focus was on evaluation of community midwife's practice through in-depth interviewing of lay people as well as health professionals on their perspectives of the practice of community midwives. The findings were collated and used

to generate conclusions on the standard of care provided while focussing on positive and negative aspects *ibid.*

Many other developing countries, besides South Africa where the concept of maternal near miss was first piloted by Mantel and co authors (1998), have now adopted the concept for auditing purposes (van den Akker et al., 2011, Okong et al., 2006) and for ascertaining the prevalence (Kaye et al., 2003) and long term consequences of near miss conditions (Filippi et al., 2007). The near miss cases have also been interviewed regarding their views on the health care which was provided to them and barriers which they had to overcome before receiving treatment (Filippi et al., 2009). The estimation of how many number of near miss cases accessing life saving obstetric surgery have also been used to evaluate safe motherhood programmes (Filippi, 2010).

The UK Obstetric Surveillance System (UKOSS) studies rare disorders of pregnancy on a national basis including maternal near miss morbidities (Lewis, 2007). The surveillance is very useful since it provides information on the disease incidences, the prevalence of factors associated with the near miss morbidity, risk factors for the near miss and auditing of specific aspects of care against the national guidelines. Such information is useful in complementing the National Confidential Enquiries into Maternal Deaths. The findings are also useful to bring to light any urgent public health need. The UKOSS model is now being adapted by several countries such as Australia and Nordic countries (The Australian Maternity Outcome Surveillance System (AMOSS), 2009, NOSS-Nordic Obstetric Surveillance Study, 2009).

### **3.1.3 Which concept to use – Severe Maternal Morbidity or ‘near miss’?**

Over the years research in this area has been confusing in its uses of the term severe maternal morbidity and many other terms such as maternal near miss, severe acute maternal morbidity, life threatening obstetric complications and severe obstetric morbidity (Geller et al., 2002, Mantel et al., 1998, Waterstone et al., 2001.). This situation has been commented in the two systematic reviews of severe maternal morbidity which were conducted, between 1998 and 2003 [Minkauskiene et al (2004)] and from 1997 to 2004 [Say et al (2004), Gulmezoglu et al (2004)].

There are two main conceptual differences between SMM and Near Miss (NM), the clearest being that NM counts will not include deaths resulting from the acute maternal morbidity that has occurred. It is clear that in their review Say et al (2004) aimed to estimate the prevalence of near miss cases only, albeit reporting maternal deaths as well. Therefore, for Prual’s study



(2000c), which reported direct obstetric morbidities among six West African countries, including fatal cases, Say and co-authors have noted that they had to re-calculate the count of 'near miss' cases (NM), by subtracting the deaths (Say et al (2004). The inclusion or not, of deaths means that epidemiologically NM and SMM summary statistics cannot be used interchangeably, certainly not in countries where a relatively large proportion of SMM cases die. [For a 'near miss'-based measure that addresses the extreme range of maternal morbidities *including* deaths, Say et al (2009) have defined a measure labelled 'Women with Life-Threatening Condition' (WLTC), which is defined as the number of near misses plus number of maternal deaths].

The other conceptual difference is that SMM has a less stringent lower limit for case ascertainment, since it includes cases with severe complications (ie *potentially* life threatening conditions), in addition to the truly life-threatening complications considered to be 'near misses'. These differences are illustrated in **Figure 3-2** below.

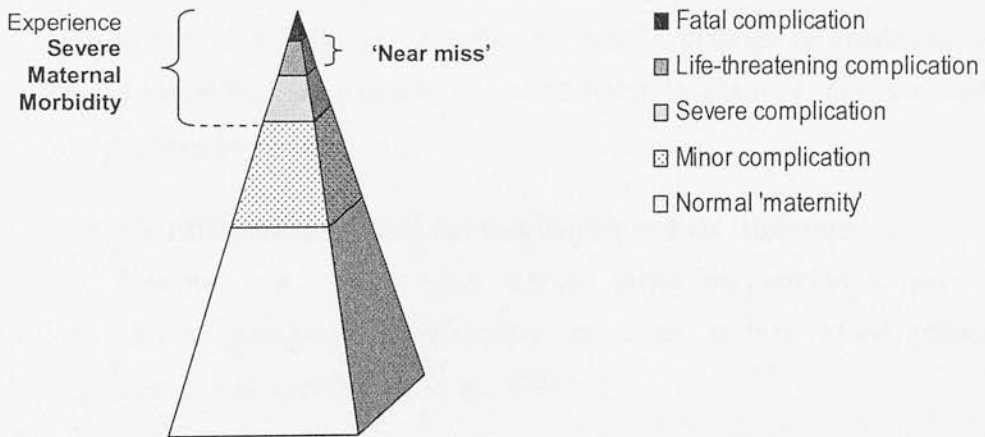


Figure 3-2: A pyramid diagram comparing SMM and 'near miss' definitions (not to scale)

### 3.2 Identification of cases of severe maternal morbidity

The challenge presented by case identification is very similar for SMM and NM, the only difference between them being in the stringency of the threshold set to distinguish case from non-case, in that near miss cases must have (had) a complication that is (was) *actually* life-threatening, whereas for SMM cases it might be only *potentially* life-threatening. For both SMM and NM the particular challenge is the diversity of complications for which thresholds need to be

set, including complications that differ in the timing of onset (antenatally, intrapartum or up to 42 days postpartum), and in their nature, given that they can involve markedly different disease processes and any of the organ systems of the body.

There have been three main approaches to SMM case-identification, as summarised by Say et al (2004) in their systematic review on the prevalence of maternal near miss. Broadly, the methods are based on:

1. Specific Diseases (Waterstone et al., 2001c), (Khosla et al., 2000), (Prual et al., 2000), (Filippi et al., 1998).
2. Type of management or intervention (Mantel et al., 1998), (Filippi et al., 2000), (Brace et al, 2004).
3. Organ dysfunction and or failure (Mantel et al., 1998), (Brace et al., 2004),

### **3.2.1 Case-identification based on disease**

In this method, cases are identified according to specific diseases or conditions which may include severe haemorrhage (ante partum and postpartum), hypertensive disorders and sepsis, as applied by Waterstone et al (2001).

### **3.2.2 Case-identification based on management or intervention**

This system identifies cases which have required major intervention to save life. Such interventions include emergency hysterectomy, caesarean section, blood transfusion and admission to intensive care unit (Mantel et al., 1998).

### **3.2.3 Case-identification based on organ dysfunction or failure**

This approach is based on the concept that, at any stage of pregnancy, there could be an insult causing morbidity somewhere on the continuum between the extremes of normal health and death (Ronsmans and Filippi, 2004). An example of such a complication is obstetric haemorrhage, which if not managed promptly may become '*life-threatening*' which will be manifested as organ dysfunction/or failure, affecting one or more organs such as kidney, liver, brain or heart. **Table 3.1**, shows a '*potentially life threatening*' condition, obstetric haemorrhage, some of the organ dysfunction/failures that can result, and the markers indicating each organ dysfunction / failure status, and which could be used to ascertain the life-threatening morbidity.

To keep the table succinct only one SMM is shown and only two associated organ failures, but clearly the table would have to be much longer if it were comprehensive for all possible complications, organ failures and associated indicators.

**Table 3-1: Two of the life threatening organ dysfunction resulting from SMM (obstetric haemorrhage), and markers for these**

Potentially threatening condition	life	Life-threatening condition	Identifiers for organ dysfunction
Obstetric haemorrhage e.g. <i>abruptio placentae</i>		i. Vascular dysfunction/ failure	<ul style="list-style-type: none"> <li>○ <i>clinical criteria</i> – shock i.e. persistent systolic blood pressure of &lt; 90mmHg for ≥ 60 minutes with pulse rate ≥ 120 despite aggressive fluid replacement of &gt;2 litres</li> <li>○ <i>laboratory criteria</i> – oxygen saturation &lt;90% for ≥ 60 minutes</li> <li>○ <i>management criteria</i> – blood transfusion of ≥5 units</li> </ul>
		ii. Renal dysfunction/ failure	<ul style="list-style-type: none"> <li>○ <i>clinical criteria</i> – decreased urine output of &lt;30 ml/hr for 4 hours of &lt; 400ml/24hr</li> <li>○ <i>laboratory criteria</i> – creatinine ≥ 300µmol/l or ≥ 3.5mg/dl</li> <li>○ <i>management criteria</i> – dialysis for acute renal failure</li> </ul>

Adapted from (Say et al., 2009)

### 3.2.4 WHO consensus regarding ‘near miss’ case identification

Recently a group of maternal health experts considering the methods of identification of near miss cases came to a consensus that cases should be identified using the organ based dysfunction criteria (Say, 2009). The disease specific criteria were considered to comprise too low a threshold to qualify as near miss cases, in particular if wishing to identify a small enough set of ‘near miss’ cases for review and discussion for quality improvement of health services. The management-based criteria were considered simple to apply but could be influenced by availability of resources such as blood transfusion services and availability of beds in the intensive care unit.

However, for many practical purposes of measurement especially in resource constrained setting, it will be difficult to use the organ based dysfunction criteria, therefore any retrospective or community research would probably need to use a disease- based criteria.

### **3.3 Methodological issues in case ascertainment**

#### **3.3.1 The validity of reported symptoms suggestive of severe maternal morbidity**

In areas having poor utilization of health facilities then even a disease based approach to SMM case-ascertainment will be difficult, since there will have been no adequately qualified health professional present to make a diagnosis. An alternative could be to use women's reporting of symptoms suggestive of obstetric complications to make a diagnostic classification. However, there have been many concerns expressed about the validity of symptom reporting by women, and doubts as to whether these could be used to measure the incidence of SMM. One of the main reasons for this has been doubts as to the ability of a woman to recall the incident accurately, still more so as to a woman's ability to make an apt judgement of the clinical situation at the time. However, it had been suggested that a woman should be able to recall a particularly distressing event like severe maternal morbidity (Ronsmans and Filippi, 2004, Ronsmans et al., 1997).

The problem for methodological development of community-based research into SMM is that there is by definition no gold standard measure available, against which to assess a woman's reporting of her condition. To achieve this one would need 24 hour cover by health personnel in the community, to verify any problem.

Among the common statistical measures which have been used to assess the level of accuracy on women's reporting is 'sensitivity', which measures the proportion of actual positives which are correctly identified as positives and 'specificity', which measures the proportion of negatives which are correctly identified as negatives. Theoretically, the aim would be achieving 100% sensitivity and 100% specificity. However this is not always the case, hence some acceptable levels will be set according to the aim of the test.

There has been inconsistency of study findings with regard to the accuracy of women's reporting of the symptoms. For instance Stewart and co author in the Philippines (1995a) showed a better sensitivity and specificity, respectively, in conditions such as haemorrhage (0.70 and 0.78), dystocia (0.69 and 0.97) and sepsis (0.89 and 0.83) while that of eclampsia being (0.44 and 0.96). Although eclampsia showed the worst sensitivity, the cases were too few to make conclusive remarks. In Bolivia, Seone and co authors (1998) found mismatching of women's reports with medical diagnosis. The highest agreement was obtained for reporting eclampsia with

sensitivity of 50 (95%CI 28.2-71.8) and specificity of 98.6 (95%CI 97.5-99.7). In another study done in South Benin, Filippi and co authors (2000) found a better sensitivity and specificity, respectively, for severe cases of eclampsia (88.2, 99.7) and abnormal bleeding in the third trimester for a recall period of at least three to four years (83.9, 81). Questions on dystocia and infections of the genital tract revealed poor results except when information on treatment was included. On the other hand Souza with co authors in Brazil (2010) found that women who had obstetric complications could recall and report accurately the treatment they had received rather than the actual obstetric complication. For example, the sensitivity of women reporting on bleeding during pregnancy and an increased bleeding during delivery or postpartum was 81% (95% CI 68.7-89.4) with specificity of 69.7% (95% CI 65.2-73.9) while the sensitivity of women reporting on hysterectomy was 100% (95% CI 85.4-100) and specificity 99.6% (95% CI 98.3-99.9).

The findings of different studies cannot be amalgamated since each author has used a different set of questions for each morbid condition. The majority have focussed on the common conditions causing maternal mortality such as dystocia, severe haemorrhage, sepsis and eclampsia. Souza and co-authors (2008) conducted a systematic review of studies which were done in developing countries, in order to assess the capacity, of questionnaires applied to laywomen, to identify accurately those who had suffered complications during pregnancy, childbirth and puerperium. Using Ronsman's (1997) criteria of the best sensitivity of at least 50% and specificity of 95%, Souza and co authors (Souza et al., 2008) were able to compile questions which had achieved the targeted level for each four main conditions commonly causing maternal deaths. Four studies achieved the target level in questions addressing eclampsia and hypertensive conditions (Filippi et al., 2000, Ronsmans et al., 1997, Seoane et al., 1998, Sou et al., 2006). The other two studies' questions achieved the target in addressing dystocia and infection while only Filippi's study (2000) achieved the target in questions addressing haemorrhage. Filippi's study (2000) among all the studies managed to achieve the targeted sensitivity and specificity in questions addressing all the four conditions. In addition, Souza and co authors were able to estimate how close the calculated prevalence of self reported morbidity was close to the actual prevalence of morbidity using the sensitivities and specificities. They found that the prevalence of morbidity was overestimated in 22.2% of the simulations (12:54),

and the possibility of the prevalence of self reported morbidity being overestimated was thrice greater when the actual prevalence was  $\leq 5\%$  (OR=4, 95% CI=1.06-15.08).

The findings of validation studies regarding accuracy of women's self reporting of SMM still poses challenges with regard to estimation of prevalence of SMM in the community. Although, the task force meeting on validation of women's reporting of obstetric complications concluded that 'estimation of the population prevalence of obstetric complications based on interview data collected in national surveys are not likely to be valid or reliable' (Ronsmans C and Filippi, 2004); it is evident also that there is a desperate need for information obtained from the community, to provide some insight to the incidence of maternal morbid conditions, and health seeking behaviour in relation to the severity of condition. It would also be helpful to have better understanding of barriers to accessing maternal health care services, routinely and in the situation when complications occur unexpectedly.

### **3.3.2 Ascertainment of cases of severe maternal morbidity from hospital records**

#### **3.3.2.1 Under-ascertainment of SMM cases**

Under-ascertainment of cases is a common problem in retrospective review of hospital records, due to missing information in the case files. Considerable detail is often necessary to enable one to make or confirm a diagnosis. For instance, if a woman has bled profusely and the amount of blood loss is not documented, other clinical signs if documented could give a clue on the severity of bleeding.

Another contributing factor towards under-ascertainment of SMM cases could be lack of facilities to detect the problem, such as blood pressure machine, urine reagents for testing protein in urine and laboratory facilities to confirm diagnosis of HELLP syndrome. This problem is common in resource constraint countries as has been reported before in **Chapter 2** (Urassa et al., 2002, Urassa et al., 2003).

Other circumstances leading to under-reporting of useful information may happen when there is absence of useful charts such as a partograph during labour or if the health care providers are not familiar on how to use it. A partograph is a tool being used to monitor the progress of labour so that prompt actions are taken in case of warning signals of slow progress. The actions may either be referring a woman to a higher level facility or performing an intervention such as giving

oxytocin or doing a caesarean section. In addition, it enables the provider to monitor closely the condition of the woman and her foetus while in labour. Therefore in absence of a partograph, some useful events such as obstructed labour will not be recorded and not known when exactly the problem occurred.

### **3.3.2.2 Over-ascertainment of SMM cases**

In some instances, there may be over ascertainment of SMM cases. For example a woman may be diagnosed as having obstructed labour and undergo caesarean section before the labour has become truly obstructed. Usually in such a scenario a physician intervenes earlier rather than later, to keep himself on the safe side to avoid blame.

Obstructed labour commonly happens in women with cephalo pelvic disproportion (CPD) (Lawson, 1965). But not always, so diagnosis of CPD does not equate to obstructed labour. Furthermore, CPD is difficult to ascertain, as reported by Van Roosmalen (1995), and its diagnosis is dependent on subjective physician factors such as knowledge and experience. This was shown in the USA, in the 1980s, where it was found that there were six times more caesarean sections for CPD than in Ireland, among women with comparable risk status. The differences were believed to reflect cultural factors rather than the real differences in the epidemiology of CPD (Sheehan, 1987).

### **3.3.2.3 Erroneous ascertainment of SMM cases**

Misreporting of a proper diagnosis could occur due to negligence of the attending physician, or lack of knowledge and skills to diagnose the problem. This is very critical and in such cases, the problem could be detected if the facility conducts regular audits of either maternal deaths or SMM cases.

### **3.3.3 Overview reflection on concept, research setting and ascertainment**

The above consideration of methodological issues highlights the different ascertainment challenges that there are in different research settings. It has also been shown earlier that the concept of 'near miss' was originally developed as an extension of maternal *mortality*, to ensure a greater pool of cases for review/audit, and learning of lessons for obstetric care. However, because the near miss concept explicitly excludes the severest cases of maternal morbidity, those who die, it has limited use for the purposes of epidemiological summary of the magnitude of

maternal morbidity in a country or area. Therefore, despite case ascertainment based on indicators of organ dysfunction being the consensus ideal for near miss cases, this might not be true also for SMM. It is unfortunately a fact that even in hospitals that can and do make the organ function measurements (such as needed to ascertain 'near miss') at the time of caring for a specific patient, their methods of record-keeping and data storage will often prevent later recovery of this information for research, or at least make it very difficult. A further issue is that in many maternity hospitals in the world, in particular rural hospitals in developing countries, the equipment and laboratory infrastructure needed to make the organ function measurements, do not exist, or are only intermittently available for use. So even prospective (or near-in-time) epidemiological studies, that are to be based on organ function measurements, would not be possible in these settings, and would be even less likely in lower health facilities. Finally, for countries where many women deliver at home there will of course be no organ function measurements for home deliveries that develop catastrophic complications and so case ascertainment by organ function measurements will not be possible for the community studies that are needed.

Therefore, it will often be the case that research into severe maternal morbidities will need to use ascertainment methods other than the consensus organ-based criteria. Indeed, the WHO working group on maternal mortality and morbidity classification do recommend that researchers in low resource settings should 'supplement' the organ function markers with compatible clinical markers of organ– system dysfunction that are feasible for data collection (Say et al., 2009). Where no organ based ascertainment is possible it might be necessary to adopt a disease specific approach, as that illustrated by Waterstone and co authors (Waterstone et al., 2001). This method is considered simple and suitable for the retrospective designs of our study.

### ***3.4 Magnitude of severe maternal morbidity***

In this section, I shall draw on two global systematic reviews of 'near miss' published in 2004 (Minkauskiene et al., 2004, Say et al., 2004). Since then, there has only been one additional paper on systematic review of near miss maternal morbidity which was published by Souza and co authors (2006a), however the article is in Portuguese, hence could not be read.



### 3.4.1 Severe maternal morbidity occurrence globally

Both reviews claim in their methods to be reporting on 'near miss' (Minkauskiene et al., 2004, Say et al., 2004), but the Minkauskiene's review is *titled* as addressing 'severe maternal morbidity'. Furthermore, the studies included in both systematic reviews have used various terms, including SMM. There was also marked variation in methods of case ascertainment used in the papers included in the two reviews, such that the Say review has summarised studies (and associated morbidity estimates) grouped by method of case ascertainment. The Minkauskiene reviews 13 studies, mainly but not solely the disease-based studies reviewed by Say. Out of thirty studies of maternal 'near misses' reviewed by Say, only five studies had used WHO consensus-preferred organ based ascertainment. The inclusion criteria have also varied across studies, some including abortion cases while others excluding them. Moreover some have extended the postpartum period to 60 days or one year, while others have used the standard 42 days. Some studies have reported single morbid conditions while others have reported more than one condition. Apart from matter of terminology and ascertainment, there was also vagueness about statistical summaries reported. The systematic review conducted by Minkauskiene and co authors (2004) is titled as being a review of 'incidence and prevalence' of near miss cases, but reports all studies as 'prevalence', ranging from 0.07% to 8.23% (with denominators either deliveries or live births, as per each study design). It is therefore very difficult to amalgamate findings for a more precise and reliable estimate, even more so to make comparisons between studies.

**Table 3.2** below gives a summary of a few studies out of 30 which were reported by Say et al (2004) in the WHO systematic review of the prevalence of maternal near miss cases. The papers have been selected to represent each of the main groups of identification of cases. The prevalence in the reported studies was between 0.80% and 8.23% for the ones using disease specific criteria, 0.38% to 1.09% for organ system based criteria, and 0.01% to 2.99% for the management based criteria. The studies included in the systematic review showed a higher case fatality ratio among developing countries as opposed to developed countries (Say et al., 2004).

Table 3.-2: Summary of percentage of women experiencing SMM (per specified denominator)

Criteria of selection	Denominator	Country	Percentage %
<b>Disease specific</b>			
Pruhal (2000)	Live births	Multi country West Africa 1994-1996	6.17
Waterstone (2001)	Deliveries	UK 1997-98	1.21*
Oladapo (2005)	Deliveries	Nigeria 2002-04	17.0*
<b>Management based</b>			
Baskett (1998)	Deliveries	Canada 1980-93	0.07*
<b>Organ-system based</b>			
Mantel (1998)	Deliveries	South Africa 1996-98	1.31*
Kaye (2003)	Total number of referrals	Uganda 2000	10.61
Brace (2004)	Deliveries	Scotland 2001-02	0.39*
Okong (2006)	Live births	Uganda 1999-2000	1.71*
<b>Mixed method</b>			
Murphy (2009)	Deliveries	Ireland 2004-05	0.35*

\*Proportion re calculated after adding maternal deaths

In view of the fact that this thesis is addressing the SMM, which should include deaths, the percentages had to be recalculated in some cases to include maternal deaths (as indicated). However, the estimates for SMM may still be underestimated, since some studies reported on

'near misses', and so included only actually life-threatening condition, and so would not have included potentially life-threatening morbidities encompassed by SMM .

Comparison of the study findings is difficult due to various inclusion criteria and definitions which were used by authors, however the figures give an impression of higher proportion in developing countries as compared to developed countries. This corresponds with the case fatality ratios which are also higher in developing countries as shown in the WHO systematic review of maternal mortality and near miss (Say et al., 2004). Thus the results show a higher SMM and case fatality rate among developing countries. The reasons for such a difference may be due to multiple socio-economic and cultural factors, including poor health services, in developing countries, as discussed in 2.2.4.

Looking at the different identification criteria for SMM cases, the rates are low in organ based classification even in a study which was undertaken in a developing country by Okong (2006). As considered in 3.2.1, survival from organ dysfunction/ failure is fairly rare, depending as it does on luck or excellent treatment. Therefore SMM numbers ascertained by means of organ function criteria will be expected to be considerably fewer as compared to SMM cases that are not as severe as 'near miss'. Likewise the rate was lower for those women who were classified according to the type of management received, as shown by Baskett and co authors (1998). In such a case the rate could be lower partly due to under-ascertainment, if not all women who should have been were given the criterion for type of intervention, for instance use of ICU.

The studies have also used different denominators, which make it difficult for comparison. In a situation where the denominator is a selected subset of women, such as those with a specific circumstance, then the rate may be higher (or lower) because of that selection. This is likely to explain the findings of Kaye (2003), who reported near misses among women who had been *referred* on emergency basis to Mulago hospital, Uganda, and who were hence more likely to be in a perilous state. The percentage SMM in this study is notably high (10.61%) as compared to others, especially considering the ascertainment method is organ-based. Even in studies conducted within the same country, the rate was almost six times that reported by Okong et.al (2006) whose denominator was live births.

A study by Odelapo and co authors (2005) also shows a markedly high percentage for SMM. This could be explained by the fact that the study was conducted in Nigeria which is among

developing countries having the highest maternal mortality ratio globally i.e. 840 with 95% confidence intervals of 460 to 1500 (World Health Organization, 2003).

### **3.4.2 Severe maternal morbidity occurrence in Tanzania**

In Tanzania, there are no published studies addressing the magnitude of ‘comprehensive’ SMM (all the main conditions). However, studies have been conducted in some hospital settings to determine the occurrence of single obstetric morbidities (see **Table 3-3**). Other studies have measured the incidence/or prevalence of a single SMM within a population with specific disease. For instance Antelman (2000) reported the prevalence of 28% of severe anaemia in pregnancy among HIV positive pregnant women. This percentage might seem very high compared to the findings of Massawe (1996), but this is to be expected given the study population consisted of women with a chronic condition of HIV.

Maternal mortality studies such as those indicated in **Table 2-5** usually also report the SMMs considered to be the causes of maternal deaths observed. Hence such data cannot be used to determine the incidence of SMM in the corresponding population, since the various SMMs might have different mortality rates.

Knowledge of the incidence/or prevalence of SMM is useful in a hospital setting as well as the district, regional and even country level. The hospital manager would be able to allocate resources depending on the needs of different treatment options for the SMM. The health providers may also be able to assess themselves through case reviews or clinical audit. Where there seem to be a weakness in delivering appropriate care, the problem can be addressed with the other health providers. Furthermore the information at the district, region or national level will be useful for health programme planners and policy makers, to monitor how successfully the SMM cases are being managed and possibly see how best to direct new policies for further improvement. (Ronsmans and Filippi, 2004). For all these purposes it is numbers of SMM cases (life-threatening conditions) rather than ‘near miss’ cases (nearly died) that would be of greater utility.

**Table 3-3 Incidence of SMM in pregnant populations in Tanzania (studies published between 1991 and 2003).**

Authors	Type of SMM	Population	Year of study	Percentage (%)
Massawe (1996)	Severe anaemia in pregnancy	Maternal & child health clinics, Dar-es-salaam	1991-1992	4.0
Antelman (2000)	Severe anaemia in HIV positive pregnant women	Pregnant women enrolled in a clinical trial on the effect of vitamin supplementation in HIV infection, Dar-es-salaam	1995-1997	28.0
Urassa (2006)	Eclampsia in maternity women	Muhimbili national hospital, Dar-es-salaam	1999-2000	2.0
Stein (2008)	Uterine rupture in maternity women	Nyakahanga district hospital, Karagwe.	1985-1999	1.4
Kidanto (2009)	Severe anaemia in pregnancy	Muhimbili national hospital, Dar-es-salaam	2002-2003	5.8

### 3.5 Chapter summary

This chapter describes the complexities of SMM definition and has compared it to the currently more commonly used term ‘maternal near miss’. This has clarified that near miss cases are a subset of SMM cases excluding both fatalities and the less extreme conditions, those that are described by Say and co-authors (2009) as *potentially life-threatening conditions*.

The three main methods of SMM identification have been discussed and the various methodological challenges in ascertainment of SMM cases. In Tanzania, no published study was found addressing the occurrence of SMM as a broad state of the potentially life-threatening conditions. Therefore more work is needed regarding the occurrence of SMM in Tanzania and a better understanding of the determinants and outcome of various forms of SMM.

## **4 Research aims and overall methods**

In **Chapter 2 and 3**, I have reviewed Maternal Mortality (MM) and Severe Maternal Morbidity (SMM) conditions respectively, both globally and in Tanzania. These two conditions are related in the sense that severe maternal morbidity is a precursor of maternal mortality. In Tanzania, studies have been undertaken on maternal mortality as well as severe maternal morbidity described in the respective chapters. As far as SMM is concerned, the studies undertaken have shown the contribution of SMM to maternal mortality as described in **Chapter 2**, while others have addressed single morbidities (**Table 3-3**). However, to my knowledge, no study has addressed the incidence of all major subtypes of SMM in Tanzania.

This chapter therefore presents the research aims and the overall methods of the research studies which were conducted. More details concerning the methods of each study and other information such as the objectives, results and specific discussion will be presented in the respective **Chapters (i.e. 5, 6 & 7)**. Section 4.2 will describe the study area, while 4.3 will explain how I arrived at the method of undertaking my research studies. Section 4.4 outlines briefly the two main studies which I undertook in the district as well as the validation study and maternal health stakeholders' in-depth interviews. In 4.5, the term severe maternal morbidity will be defined generally as it has been used in this thesis. The general statistics methods will be presented briefly in 4.6 and lastly, the ethical issues will be mentioned in 4.7.

### **4.1 Research aims**

My aims therefore, were to *estimate the incidence of all major types of SMM, to assess women's utilisation of obstetric services in a rural district of Kilombero, in Tanzania, and to review their challenges faced in receiving such services.*

### **4.2 Study area- Tanzania**

The research studies were conducted in a rural district called Kilombero, which is in the south-eastern part of Tanzania. Among the three East African countries, Tanzania lies between longitudes 29<sup>0</sup> and 41<sup>0</sup> east and latitudes 1<sup>0</sup> and 12<sup>0</sup> south along the Indian Ocean. The first part of **Figure 4-1** shows the location of Tanzania in the African continent.

Important landmarks of Tanzania includes Mount Kilimanjaro the highest mountain in Africa, Ngorongoro Crater and the Great Rift Valley dotted with several lakes including Lake Tanganyika, the world's second deepest lake (The United Republic of Tanzania, 2001).

The 2010 projected population in Tanzania is 43 million (National Bureau of Statistics (NBS) [Tanzania] and ICF Macro, 2011), who mainly reside in the rural areas. The population is sparsely distributed in some geographical locations hence making some social services inaccessible. The country has 26 administrative regions with 130 administrative districts (The United Republic of Tanzania, 2001).

The economy of Tanzania is based mainly on agriculture which accounts for 44.4 % of gross domestic product (The United Republic of Tanzania Ministry of finance and economic affairs, 2009). However about 33.4% of the population live below the poverty line, their expenditure being less than \$0.5 per day (The Policy Forum, 2008)

#### 4.2.1 Study area- Kilombero district, Morogoro,

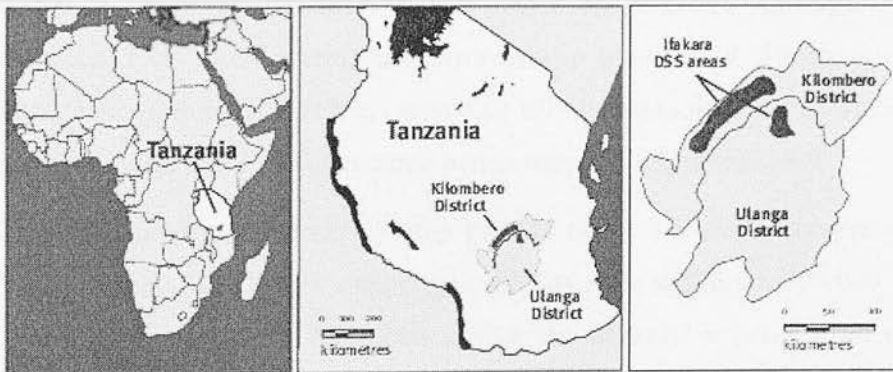


Figure 4-1: Map showing the location of Tanzania, Kilombero District and the Ifakara Demographic surveillance site (IC-DSS), Tanzania

Source: (Ifakara HDSS TANZANIA, 2009)

##### 4.2.1.1 General background of Kilombero district

Kilombero is one of the six districts in Morogoro region, in Tanzania as shown in the second part of **Figure 4-1**. The area is predominantly rural with the semi-urban district headquarters, Ifakara, being located about 420 kilometres south west of Dar- es-salaam, the biggest commercial city of Tanzania (Kilombero District Council, 2009).

The major features found in the Kilombero district are Kilombero River and Uzungwa Mountain which bring a lot of tourist's attraction *ibid*. The river separates Kilombero district from Ulanga district while forming a vast Kilombero valley floodplain. Large parts of this valley are flooded during rainy season, usually between November and May.

Kilombero district, which has an area of 14,915 km<sup>2</sup>, is divided into 5 divisions, 19 wards, 81 villages and 365 hamlets. The district has a total population of 416,401 with an annual growth rate of 3.9%. Women of reproductive age group comprise 15% of the population (Kilombero District Council, 2009).

There is a tarmac road which connects Kilombero district to other regions of Tanzania and a railway line (TAZARA) which goes as far as Zambia. However in some rural areas, the roads are in very poor condition, so that during the rainy season they may be impassable, leaving some areas being disconnected from the rest of the district *ibid*.

The economic activities done by the Kilombero people are mostly subsistence farming, fishing, animal husbandry, petty trade. A few people are employed in sugar cane factories, railway authority, local government, and hydropower plants *ibid*. However most people rely on subsistence farming. The farmers would usually move to their family sites which are remote for intensive cultivation. The cultivation period may last six months *ibid*.

Maternal mortality reduction is a top priority of the District's Comprehensive Council Health Plan. Currently the District's maternal mortality ratio is 386 per 100,000 live births (Kilombero District Council, 2009). The council receives financial support from the local government, ministry of health and some donors but some money is generated through cost sharing by the health facilities users, who pay a fixed amount of money for hospital services. A group of people are exempted from paying such services for example elderly people, children, pregnant women and patients with chronic illnesses.

The district is in the forefront in involving community with the districts' welfare including maternity health services. Due to high demand for ambulance services which are not always sufficient to meet the needs, the communities have been mobilized to start community health funds which would provide for transport charges to the hospital when a community member gets an emergency ill health condition. However, the progress regarding establishment of the community funds has been slow *ibid*.



#### 4.2.1.2 Health facilities in Kilombero district

##### Overview of Kilombero district health services in relation to the Health system

The health services in Kilombero district like any other district in Tanzania are integrated as one proceeding down the hierarchy from national to regional and district levels. The referral consultant hospitals receive cases from regional hospitals which in turn receive referral cases from district hospitals. The decentralization of the government has made the district level powerful in supervising all health services activities within the district under the District Health Management Team *ibid*. The district hospitals receive cases from health centres which in turn receive cases from dispensaries. Parallel to the public health referral system, there are private and faith based health facilities which provide services too. Some of the faith based health facilities have been designated to district hospitals as in the case of St Francis hospital in Kilombero district, which was a district designated hospital but has just been upgraded recently into a referral hospital (Association 'Doctors for Ifakara', 2007). More details of St Francis referral hospital are described below.

##### Health facilities

**Figure 4.2** below maps out the different health facilities in the Kilombero district and show how women are being referred up the health system in a hierarchical way. As can be seen in the figure, the district has two hospitals. These are St Francis referral Hospital and Illovo sugar company private hospital, which are 80 kilometres apart. St Francis referral hospital is the one catering for most patients with all types of complications including obstetric emergencies (Kilombero District Council, 2009). The two hospitals receive patients who are either referred from the four health centres which in turn are expected to receive patients from the thirty eight dispensaries. However, patients sometimes decide to bypass one level of health care for reasons such as poor perception on the quality of the health facility. In the district, all the health facilities shown in **Figure 4.2** are expected to be able to conduct a normal uncomplicated delivery. The *basic* Emergency Obstetric Care (BEmOC) services are expected to be provided at health centres and the hospitals while *comprehensive* Emergency Obstetric Care (CEmOC) at the hospitals.

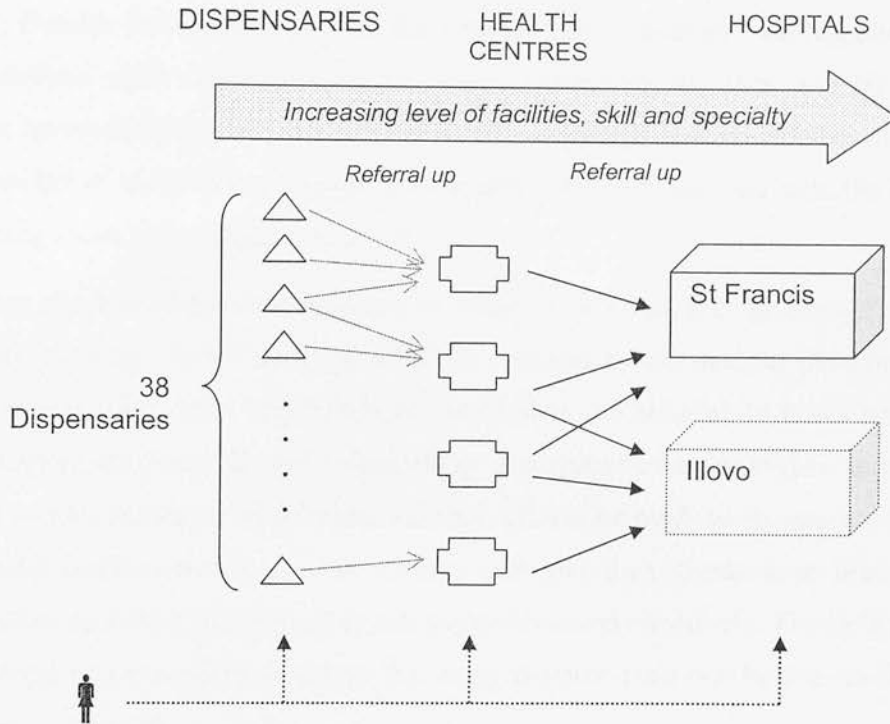


Fig 4.2: Kilombero obstetric care facilities, and arrangements for referral

### St Francis Referral Hospital

St Francis Hospital belongs to the Roman Catholic Diocese of Mahenge, Morogoro Region in Tanzania (Association 'Doctors for Ifakara', 2007). The hospital had been a Designated District hospital until the 28<sup>th</sup> June 2010, when the Minister for Health and Social Welfare announced in the National Assembly that it had been upgraded to a referral hospital *ibid*. The hospital has 371 beds and caters for about 600,000 people who are referred within the district's health system *ibid*). However a number of people from outside the catchment area use the hospital facility too without a formal referral. The hospital is co financed by the Tanzanian Government and the Diocese of Mahenge. Patients are charged a certain amount of money for hospital stays, treatments, examinations, operations and drugs. However pregnant women pay a flat rate of \$10

for delivery charges. Vulnerable groups such as children, very old and poor people are exempted from such charges.

The hospital has a well established Obstetrics and Gynaecology department where the maternity wards belong. Besides the maternity wards, the hospital has a maternity waiting home where women get admitted while waiting for labour. These women usually live very far from the hospital and or have a particular risk factor which needs prompt decision on delivery once labour sets in. The number of births in the hospital is estimated to be 5000 per year with the caesarean section rate being about 20% (Magoda A, 2009).

The hospital has also a small neonatal ward and an intensive care unit. It is the hospital routine to conduct a daily morning clinical meeting which is attended by all medical personnel in the hospital to discuss serious cases who had been admitted in the hospital 24 hours prior to the meeting. In addition, the Obstetrics and Gynaecology department conducts regular maternal and perinatal deaths audits meetings. At the audit meetings, efforts are made to incorporate staff from lower level health facilities if they were involved in managing the patients. In so doing, actions and recommendations following the meeting can be implemented effectively. The audit meetings are also conducted in a non punitive way so that every member feels comfortable in discussing the management of patients.

Like any other health facility in Tanzania, St Francis hospital is faced with challenges such as shortage of staff of all cadres especially the nurse midwives (Kilombero District Council, 2009). Other challenges faced by the hospital include unreliable drug supply from the government run 'Medical Department Store' and lack of medical equipments *ibid*.

#### **4.2.1.3 Ifakara Demographic Surveillance system (IC-DSS) site**

The Ifakara Demographic Surveillance System (IC-DSS) is a unit within the Ifakara Health Institute, Tanzania, which was started in 1996. The unit operates a demographic surveillance system in defined geographical areas of 25 villages in Kilombero and Ulanga Districts of Morogoro region (Ifakara Health Research and Development Centre, 2002), as shown in the last part of **Figure 4-1**. The population in the IC-DSS is estimated to be 80,000 (Alba et al., 2008), with a population density of 25 people per km<sup>2</sup> *ibid*.

The primary goal for the IC-DSS is to monitor regularly the demographic and vital events such as births, deaths and migration in the area, so that the information can be used by health planners to optimise the use of scarce resources for health care (Ifakara Health Research and Development Centre, 2002). The IC-DSS team consist of interviewers, supervisors, assistant field managers, data entry clerks, a filing clerk, a driver, a data manager and a field manager. This team works under the overall coordination of a demographer or epidemiologist. Furthermore at every sub village level, there are key informants chosen by the village leaders. They are usually paid a small allowance for every event they report.

At the villages, each household is visited by a DSS interviewer every four months, to collect information on pregnancies, births, deaths and migration using the household registration system (Ifakara Health Research and Development Centre, 2002).

In case of death of an individual, these deaths are followed up with a verbal autopsy obtained from an interview with family members of the deceased within 14 to 30 days after death. The interviews are conducted by the field supervisor and a team of three physicians assign the cause of death after review of relevant documents such as data collection form, a checklist of diagnosed conditions, health card and death certificate *ibid*.

The IC-DSS has enabled evidence based research activities to be conducted, which in turn has contributed substantially in policy formulations in Tanzania as for instance in the use of insecticide-treated nets to improve maternal and child health survival against malaria.

### **4.3 Why the research studies were conducted in Kilombero district**

My main interest was to conduct a research study in rural settings since that is where majority of people reside [Tanzania Demographic and Health Survey (2005)]. It was therefore anticipated that research findings in such areas would give a true representation of rural Tanzanian women who are the most marginalized. The Kilombero district was therefore selected as a study area since it is one of the rural districts of Tanzania.

In addition, some of the villages belonging to the Ifakara Demographic Surveillance System (IC-DSS) are located within the Kilombero district. The IC-DSS has a well established information system regarding births, deliveries and deaths of its population including maternal death as has been mentioned before. Furthermore, the verbal autopsies conducted on maternal deaths gives information on the causes of maternal deaths which are usually SMMs. Such information was

considered useful in estimating the true incidence of SMM as some rural areas do not have reliable information on maternal deaths and SMM which occurs in the community.

#### **4.4 Development of the research designs**

As mentioned above that the aim of our research was to measure the incidence of SMM in Kilombero district. However, I identified some limitations in carrying out the research which can be summarised as follows:

- i. The district like any other districts in Tanzania has a number of women who do not use health facilities for either childbirth or treatment of obstetric complications. This implies that a hospital based study although considered by Ronsmans (2004) to be appropriate for measuring SMM, would not give a true representation of the district's population.
- ii. Difficulties of interviewing women in the community who were diagnosed in hospital to have SMM since they might have moved to other places for employment, farming or even new marriage. Lack of official physical addresses and postal code is another limitation.
- iii. Controversies around the validity of women's reporting on obstetric complications as had been shown by Stewarts (1996), Ronsmans (1997) and Filippi (2000) in **Chapter 3**; the reason being a disagreement between woman's recall of her childbirth experience and medically diagnosed obstetric complication (Ronsmans and Filippi, 2004). In addition recently, Souza and colleagues in Brazil (2010) have reported a better validity among women who had SMM in reporting the type of treatment they received in eclampsia as compared to other types of morbidities. A longer length of time between delivery and interview was associated with poor recall.

In view of above limitations in conjunction with financial and time constraints, I decided to do two main studies which will collectively give an insight on the incidence of SMM. In addition there were two more studies whose findings were considered useful in complementing information which had been obtained in the two studies. The studies are outlined below, in 4.4.

Under ideal situation in absence of the constraints mentioned above, a prospective study could be done in the community to ascertain the incidence of SMM while at the same time having medical experts conducting physical and laboratory examinations to verify the complications reported

#### **4.5 Studies undertaken:**

This section outlines briefly the studies which were undertaken. More details of each study will be given in respective chapters as will be indicated. The first two studies were the main studies, to be followed by the other two studies. The studies are outlined as follows:

- i. Hospital study to determine the annual incidence of SMM at St Francis referral hospital with associated socio- demographic and obstetric factors and the outcome in terms of case fatality rate and conditions of both mother and baby. This is a hospital based study and as such lacks the true representation of the population. However it is the most specialised hospital in the district treating all forms of medical complications including SMM. I therefore anticipated that many women with SMM who had sought care within the health system would end up being managed in this referral hospital.
- ii. Community survey to estimate the annual incidence SMM at the hospital's rural catchment area, the Ifakara Demographic Surveillance Site (IC-DSS). More information on the study site has already been elaborated in 4.2.1.3.
- iii. A validation study on the community interview based SMM classification using the hospital based SMM classification as a gold standard, for those women who had used St Francis referral hospital for delivery. Although the validity of women' self reporting on SMM is questionable, the community study will give an insight on the perception of women on the problems they face during pregnancy, childbirth and postpartum and how they access obstetric care. More information will also be obtained on the barriers they face and the decisions to be made before seeking care, the birth plans and preparations in case of emergency obstetric complications.
- iv. An in-depth interview study on maternal health stakeholders' perspectives regarding the burden of SMM in the district, their perception about the danger signs of pregnancy, their role in women's birth and emergency complication readiness plans, their challenges and suggestions for possible solutions. However, since the study is in the analysis stage and that the data obtained from the first two main studies was considered adequate for this thesis, the study will not be discussed in this thesis. A few quotes which are obtained from the preliminary results will be incorporated in the discussion of the community incidence study in Chapter 6.

As mentioned earlier, more details regarding the objectives, methods and discussion relating to the first three studies will be given in their respective chapters (ie. 5, 6 and 7).

#### **4.6 Operational definition of severe maternal morbidity**

The term *severe maternal morbidity* in this thesis indicates an event suggestive of a potentially life threatening condition i.e. those which commonly causes maternal mortality in Tanzania. Such a condition may be severe obstetric haemorrhage (due to abruptio placenta), obstructed labour, uterine rupture, puerperal sepsis, eclampsia, severe pre eclampsia, AIDS manifestation, severe malaria and anaemia. (See **Appendix IA** for specific definitions of the conditions). However, the definition has been modified in each study to cater for the practicalities of the study as shall be indicated in respective chapters.

#### **4.7 General statistical methods**

##### **4.7.1 Overview of statistical methods**

The general statistical methods which have been used in the research studies are mainly descriptive and inferential statistics. The descriptive statistics was used to give explanation on both categorical and continuous variables in all the three studies. Inferential statistics was used to draw inferences on the sample regarding the population represented in all the three studies. This is in the form of describing the association, hypothesis testing and estimating numerical characteristics such as incidences. In addition, summary measures of agreement will be estimated for a community interview based SMM classification in the form of sensitivity (ie. number of true positive divided by a total of true positive and false negative cases) and specificity (ie the number of true negative divided by a total of true negative and false positive cases). The respective 95% confidence intervals were calculated using Java stat- Binomial and Poisson Confidence Intervals (Pezzulo, 2009). More details regarding the statistics will be given in the studies' respective chapters (ie **Chapters 5, 6 &7**).

With regard to the maternal health stakeholders' in-depth interviews, which were briefly mentioned in 4.4(iv), some of the preliminary findings will be incorporated into the discussion of community study where relevant.

#### **4.7.1.1 More information on the variables**

##### Missing data

For many variables, a small proportion of women had missing values. Where tables are presented, the total ('n') reported will be the one without the missing values and will be indicated by '#' sign.

##### The percentages of total values

In some cases the total percentage adds up to more than 100% because a woman had presented with more than one category of item. For instance, a woman may have more than one type of intra partum SMM condition such as obstructed labour and eclampsia.

##### Denominators used in calculating incidence rates of SMM:

In published studies of incidence/prevalence of SMM, the denominators commonly used have been the number of deliveries and number of live births (Say et al., 2004). In this thesis, both denominators have been reported, however the number of deliveries has been used frequently in hospital and community studies (**Chapter 5 & 6**).

#### **4.7.2 Statistical software programme**

For the three studies, the Statistical Package for the Social Sciences (SPSS version 14) has been used for data cleaning, coding and analysis.

#### **4.8 Ethical issues**

The research study protocol for the two main studies as well as the validation study and the maternal health stakeholders' in-depth interviews was approved by the Tanzania Commission for Science and Technology, the National Institute for Medical Research and the Ifakara Health Institutional Review Board as indicated in **Appendix VII**. Data collection commenced on 3<sup>rd</sup> August 2009 after the Kilombero District Executive Director had endorsed the research studies to be conducted in the district.



## **5 Hospital incidence study for Severe Maternal Morbidity**

### **5.1 Introduction**

In chapter two, I have reviewed the global initiatives to improve maternal health and reduce maternal mortality, and described what is known about maternal health in Tanzania. In chapter three, I focussed on reviewing Severe Maternal Morbidity (SMM), a clinical precursor to maternal death, and methodological issues in addressing this. In chapter four, I described the development of my PhD research designs addressing SMM in rural Tanzania (4.4). This chapter describes the first of these studies (4.5.i), which aimed to estimate the annual incidence of intra partum and postpartum SMM among maternity admissions to a rural Tanzanian hospital. Understanding of the epidemiology of SMM is important if one is to determine ways to reduce maternal mortality. The study was conducted at St Francis referral hospital in Kilombero district, Tanzania (4.2.1.2), covering the period July 2008 to June 2009.

### **5.2 Objectives**

The objectives for the study were:

- i. To estimate the incidence of intra partum and postpartum SMM.
- ii. To determine the socio-demographic and obstetric factors associated with intra partum and postpartum SMM.
- iii. To determine the case fatality rate among intra partum and postpartum SMM cases.

### **5.3 Methods**

#### **5.3.1 Study population, sample and design**

The study population comprised women admitted to maternity wards of a rural district, while the study sample comprised 5500 women who were admitted to St Francis referral hospital between July 2008 and June 2009. Out of these maternity admissions, there were 3777 women who were described in our study as having a '*transient admission*' since they attended for an expected routine delivery, had normal uncomplicated childbirth and were discharged home between 6 and 24 hours following childbirth. The remaining 1723 were described in our study as '*full*

admissions' as they were admitted with a pregnancy complication or had developed one in the course of childbirth.

The study design was a retrospective case series study whereby the hospital records of maternity cases were reviewed to ascertain intra partum and postpartum severe maternal morbidity. Maternal deaths were also recorded.

Figure 5-1 below illustrates the flow of maternity cases into, and within the St Francis hospital. Women might have arrived straight from home or they might have been referred from lower level health facilities.

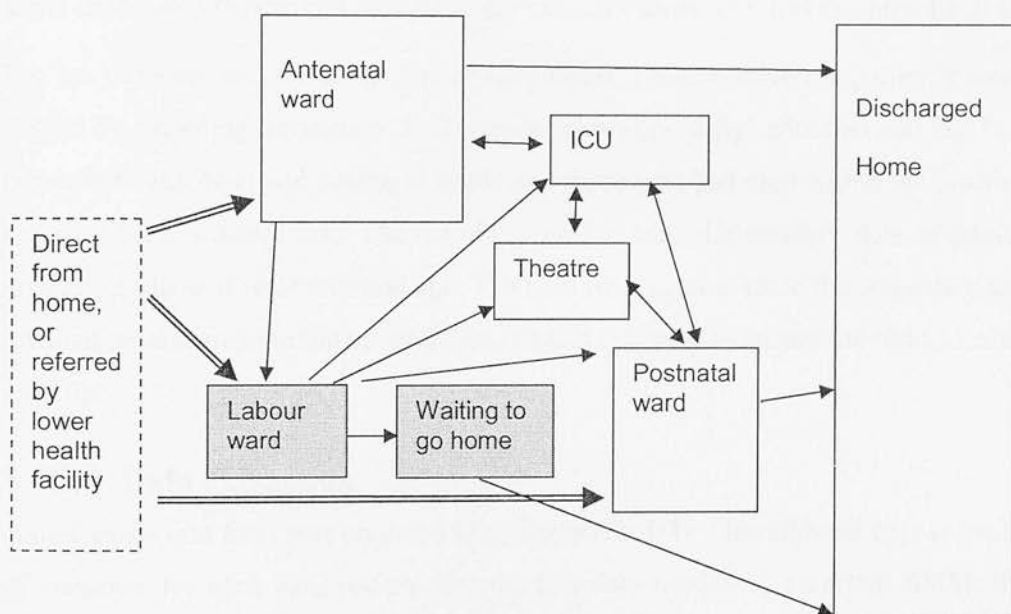


Figure 5-1: A diagrammatic representation (not to scale) showing the flow of maternity cases from admission to discharge

### 5.3.2 Data collection

Data collection was divided in two phases as reported below.

Phase 1 involved gathering of labour ward register books which recorded details of the 3777 women with 'transient admissions'. Data contained in these registers included identification number, data of admission and discharge, age, parity, antenatal clinic attendance, mode of delivery and outcome of the babies born. This data was then entered electronically into the computer program as will be explained in 5.3.4.

Phase 2 involved reviewing and extracting information from 1723 cases notes of 'full admissions'.

### 5.3.2.1 Case notes review

I reviewed 'full admissions' case files at the medical records department, with two record attendants assisting in retrieving the case notes. Each case note included notes written by the Doctor who attended the woman, in the form of history, physical examination findings, diagnosis, laboratory investigations undertaken, treatment received, progress made while in the wards and outcome. In addition the case notes contained partographs, nurses' treatment and vital signs charts, and theatre and intensive care notes for those who had used the facilities.

For the purposes and duration of reviewing notes, I had to have the patient's name. I therefore started by recording the names of all women who were 'fully' admitted and had been discharged home from antenatal and postnatal wards and those who had died within the hospital (these were recorded on a separate list). The list also included case file number, date of admission, date of discharge, place of residence and age. The lists were used to trace the respective case files in the medical records department using the particulars recorded to ensure the right identification of the case file.

### 5.3.2.2 Data extraction

A data extraction form was prepared (See Appendix III). This allowed easy recording of a range of variables for each case review. For the key data needed to ascertain SMM, the form listed conditions universally regarded as possibly a high risk of maternal death, and therefore classified as SMM.

The intra partum SMM conditions listed were:

- Severe haemorrhage
- Obstructed labour
- Eclampsia and severe pre eclampsia

The postpartum SMM conditions listed were: postpartum haemorrhage, sepsis and eclampsia.

However, I was also aware of other conditions in Tanzania, which commonly cause maternal deaths. Therefore a category of 'other obstetric SMM conditions' and 'other non obstetric SMM

conditions' was listed so that these conditions could also be recorded. The 'other obstetric 'SMM conditions would include conditions such as uterine rupture while other non obstetric SMM conditions will include severe malaria, severe anaemia, and AIDS.

The above conditions were ascertained pragmatically, based on relevant diagnosis recorded by the attending doctor in the case notes. In a few cases, where a diagnosis was not recorded, some additional sources of information were used to give a clue for the diagnosis. For instance, Theatre notes which were written by a surgeon, nurses ward report or round book, ICU report and nurses vital signs charts.

The operational definition for each condition commonly causing maternal death in Tanzania is shown in **Appendix I (a)**.

The form also allowed extraction of information in subsections such as:

- Personal information e.g. age, gravidity and marital status
- Referral diagnosis e.g. obstructed labour
- Antenatal factors e.g. antenatal clinic attendance
- Medical history
- General condition on admission
- Intra partum events e.g. mode of delivery
- Patient's outcome

I validated any case notes diagnosis (of common conditions causing maternal deaths such as eclampsia and obstructed labour) by cross-checking with other related sources of information (e.g. Theatre, and ICU registers as well as nurses' ward reports). Regarding maternal deaths diagnosis, these were validated using maternal deaths audit reports and nurses ward reports.

### **5.3.2.3 Difficulties encountered during data collection**

It was noted that some case notes for ante natal admissions lacked information on the actual management instituted at St Francis referral hospital. Some case notes had only information recorded from the antenatal card.

A number of case notes lacked sufficient socio-demographic information. I therefore had to trace the information in labour ward, where there was a special book which had recorded socio-demographic information of women being admitted in the labour ward.

### **5.3.3 Ethics and confidentiality**

For ‘transient admissions’, the information recorded from the labour ward register book was anonymised and could be identified by the register’s identification number.

With regard to ‘full admissions’, I made sure that all the lists of names I had used for identification of case notes were kept under strict confidentiality where no one else could access them. Once the case notes were identified, the extracted information was made anonymous using a unique identification number for every patient’s record.

### **5.3.4 Data entry**

Data entry was done separately in two phases as described below.

Phase 1 (‘transient admissions’) - Six clerks undertook data entry of information regarding women who had normal uncomplicated delivery into a purpose designed electronic database which was prepared by the Ifakara Health Institute Data Manager using Microsoft FoxPro software programme.

Phase 2 (‘full admissions’) - For those women who had been admitted in the maternity wards with complications, I entered into an electronic dataset the additional information which I extracted from case notes using the same Microsoft FoxPro software programme.

### **5.3.5 Preparations for analysis**

#### **5.3.5.1 Data cleaning**

Data cleaning was done after exporting both files of ‘transient admissions’ and ‘full admissions’ from the Microsoft FoxPro software programme to SPSS software version 14. The files were merged and a variable was created indicating the source of each record (i.e. transient or full admission). A new unique number was then created for each record since records belonging to ‘transient admissions’ had duplicate identification numbers. This was due to allocation of the same registry identification numbers in each month. For instance there would be an ID number of 002 in March 2008 and another ID number of 002 in April 2008. This indicates that two

different people were registered in the labour ward using the same ID number in two different months.

All records were scanned for any obvious errors. Where duplicate records were found, and confirmed to be definite duplicates, one of the pair was deleted. A total of 65 records were deleted. Frequency distribution tables were run for all variables to allow scanning for impossible values. Using a syntax command, records containing such problem values were selected and a list of records was produced. In this way, the records could be retrieved, checked against extraction forms and any error detected could be corrected in the dataset. The frequency tables were then re-run to confirm the tables were then correct.

Checks were also done for impossible lengths of stay indicating wrong dates. For example date of admission entered as 02/07/2008 and date of discharge as 06/06/2008. In such case the length of stay will be negative 25 days indicating wrong dates. A list of suspected wrong dates would then be produced using the syntax command; thus facilitating record retrieval for rectification.

Logical checks were undertaken by cross tabulating variables which were related, for instance '*detection of ante natal problem*' by '*type of ante natal problem*'. It is expected that a type of antenatal complication would be recorded only if there has been detection of antenatal problems. In case a type of antenatal complication had been recorded while the variable asking '*whether a problem had been detected antenatally*' was left blank, then it would be assumed that the problem had been detected, hence the space will be filled by a 'yes' option. If a record shows an antenatal problem had been detected but the type of problem not recorded, then in this case the blank record will be set to a missing value.

### **5.3.5.2 Data coding and recoding**

After thorough data cleaning, some variables were recoded to new revised variables such as 'age' to 'age group'. Furthermore, some string (text) variables such as '*other types of known medical illnesses*' were coded into categories. Some new variables were also created to indicate a broad category of a group of individual variables.

### **5.3.5.3 Classification of SMM types**

After cleaning and coding of data, the next step was to classify SMM with its subtypes since we did not have the variables in our data set. Using the information extracted from the forms, each

condition commonly causing maternal mortality was coded into a binary variable (i.e. 1= yes, 2=no). The conditions were obstructed labour, uterine rupture, severe obstetric haemorrhage, eclampsia, severe pre-eclampsia, puerperal sepsis, severe anaemia, cardiac failure, and severe malaria and AIDS.

I then created a new variable called intra partum SMM which indicated a broad category of individual obstetric and non obstetric intra partum conditions causing maternal deaths such as obstructed labour and severe anaemia respectively. Similarly I created another new variable called postpartum SMM which indicated a broad category of individual obstetric and non obstetric postpartum conditions causing maternal deaths such as postpartum haemorrhage and cardiac failure respectively. Once I had the intra partum and postpartum SMM variables, I needed to create a variable called 'any SMM', which indicated a broad category of intra partum and/ or postpartum SMM.

In view of the fact that some of case notes for antenatal admissions lacked sufficient information on the management instituted while in hospital, I decided not to classify antenatal SMM. Instead I left the variables as they were reported in the case files i.e. in the form of antenatal complication and not SMM.

**Figure 5-2** below illustrates the different obstetric and non obstetric conditions forming the broad categories of intra partum and postpartum SMM. Only a few conditions have been listed since the list is long. The diagram also illustrates the broad category of any intra partum and/or postpartum SMM which is derived from intra partum and postpartum SMM independently. As can be seen in the figure that the key variables created are: any intra partum/postpartum SMM, any intra partum SMM, any postpartum SMM, and any intra partum obstetric SMM, any intra partum non obstetric SMM, any postpartum obstetric SMM, and any postpartum non obstetric SMM.

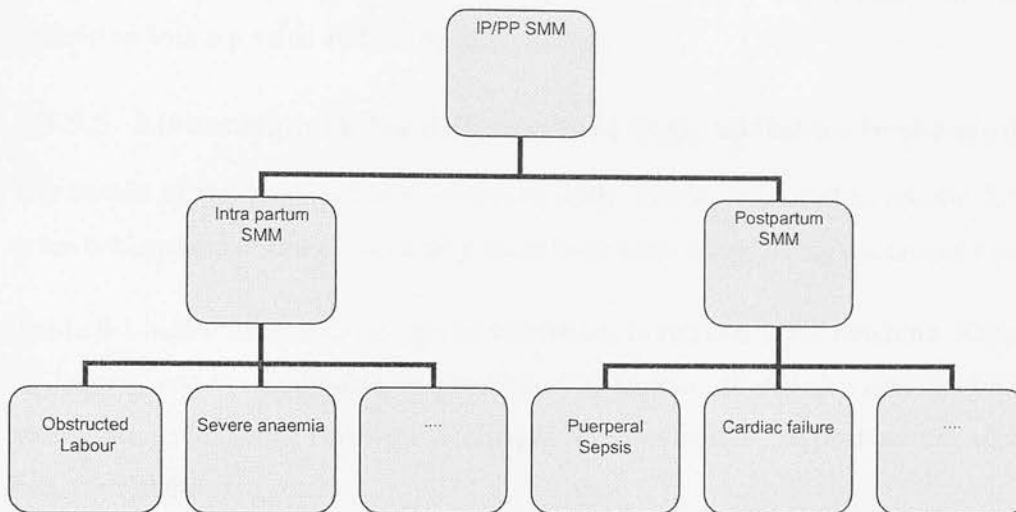


Figure 5-2: Flow diagram showing classification of SMM derived from obstetric and non obstetric complications extracted from case notes

Therefore with reference to **Figure 5-2**, I was able to calculate the incidence of intra partum and/or postpartum SMM, intra partum SMM only and postpartum SMM only.

#### 5.3.5.4 Statistical methods of analysis

Data analysis was grouped into two categories which included descriptive and inferential statistics.

Descriptive statistics- Data in the form of categorical variables was summarised and displayed in frequency distribution tables. The variables included socio-demographic characteristics, use of antenatal clinic, types of obstetric complications and severe maternal morbidity subtypes. The mean for the 'age' variable with standard deviation was also determined. A graph was used to show a comparison of age distribution between women involved in the hospital study and those within the reproductive age in Kilombero district.

Inferential statistics-. The incidence of intra partum and post partum SMM, were calculated and displayed with their confidence intervals. Different pairs of categorical variables were cross tabulated among themselves to ascertain if there was any association between the variables. Example of a pair of categorical variable is 'age' by '*intra partum SMM*'. Using Pearson's chi-square test, a '*p value*' of less than 5% was considered a statistically significant association. Furthermore a Mantel-Haenszel odds ratio was calculated to give a summary estimate of the association between women's critical condition on admission and the occurrence of maternal



death after adjusting for the different types of maternity admissions. The odds ratio was calculated with a p value and confidence intervals.

#### **5.3.5.5 Elaboration on the differences in some variables in the study data set**

The results of the hospital SMM incidence study will be displayed in section 5.4. This section gives background information on why some steps were taken during the analysis process.

**Table 5-1** below illustrates the type of admissions in relation to the outcome of care, the location of delivery and the study data set involved. The location of delivery may not be known for the ante partum admissions that were discharged home as well as the post partum admissions unless indicated in the case notes.

The information for all the women with complications was recorded under the ‘full admissions’ data set while those with uncomplicated childbirth were recorded in the ‘transient admissions’ data set. As previously discussed, these datasets were merged later. The ‘transient admissions’ dataset have only few variables compared to the ‘full admissions’ dataset. Therefore some analysis is only confined to the ‘full admissions’ data set due to absence of such variables in the ‘transient admissions’ data set. An example of variables lacking in ‘transient admissions’ data set are the socio-demographic characteristics such as marital and educational status.

**Table 5-1: Maternity admission types with respect to their outcome, location of delivery and study dataset type**

Type of Admission	Status of Maternity	Outcome of Care	Location of Delivery	Dataset involved
Antenatal	Antenatal Complication	Treated & discharged home while pregnant/ death	Not Known	'Full admissions'
		Remained in hospital until delivery	St Francis Hospital	'Full admissions'
Intra partum	Normal delivery/ intra partum complication	Normal delivery & discharged home	St Francis hospital	'Transient admissions'
		Complications & Treated/ death	St Francis hospital	'Full admissions'
Postpartum	Postpartum Complication	Treated & discharged home / death	Unrecorded, could be St Francis hospital or elsewhere	'Full admissions'

## 5.4 Results

### 5.4.1 Description of the study sample

During the study year, a total of 5500 women were admitted in the maternity wards. **Table 5.2** presents all admissions by timing (ante partum to postpartum), and it can be seen that the vast majority were intra partum admissions (92%). In **Table 5-2** intra partum admissions are subdivided according to whether they were '*transient*' uncomplicated admission for delivery, or whether intra partum complications were detected, necessitating full admission. Antenatal and postpartum admissions indicate complications since under ideal situation a woman only gets admitted during childbirth.

**Table 5-2: Distribution of types of maternity admission in the study year (2008/09)**

Type of admission	Frequency N = 5500	Percentage
Ante partum (AP)	361	6.56
Intra partum (IP)	5055	91.91
<i>Normal delivery ('transient')</i>	3777	68.67
<i>Delivery with intra partum complications ('full admissions')</i>	1278	23.24
Postpartum (PP)	84	1.53

**Table 5-3** shows the number of deliveries among women who were admitted in the maternity wards. By definition, all intra partum admissions would have culminated in a delivery in that same admission. In contrast, only 65% of antenatal admissions did so (235/361). This is mainly because many antenatal admissions will be checked and/or treated and then will be discharged home to await onset of labour. **Table 5-3** excludes postnatal admissions since these women might have delivered their babies at home, or at some other facility. Furthermore, if delivered at St Francis within the study year, and the delivery was later than approximately the first month of the study year, their delivery will anyway be recorded/included in the other antenatal/intra partum data presented in the table.

During the study period the number of live births was 5075, the intra partum admissions giving the higher proportion compared to ante partum admissions

**Table 5-3: Total number of deliveries by source of admission**

Source of admission	Number of deliveries N= 5290	Percentage
Ante partum (AP)	235	4.44
Intra partum (IP)	5055	95.56
<i>Normal delivery ('transient')</i>	3777	71.40
<i>Delivery with intra partum complications ('full admissions')</i>	1278	24.16

### Number of live births

The number of live births during the study period was 5075. **Table 5-4** shows the proportion of live births among women admitted during ante partum and intra partum period. The proportion of live births was higher among women who were admitted during the intra partum period compared to the ante partum period. For the intra partum admissions, women delivering with intra partum complications had a higher proportion of live births compared to those with uncomplicated delivery.

**Table 5-4: The proportion of live births by source of admission**

	Ante partum admission delivering in hospital N= 235		Normal delivery ( <i>'transient'</i> ) N= 3777		<i>Delivery with intrapartum complications (<i>'full admissions'</i>)</i>		Total
	n	%	n	%	n	%	
Live births	207	<b>88.1</b>	3613	<b>95.7</b>	1255	<b>98.2</b>	5075

### 5.4.1.1 Attendance at antenatal clinic

Antenatal care is an essential component in ensuring a safe pregnancy and its outcome. The number of women who attended antenatal clinic at least once was assessed. **Table 5-5** shows the antenatal clinic attendance across all maternity admissions. As can be seen in the table, the attendance was optimal in the sense that ante natal and post partum admissions were 100% while that of intra partum was 95.3%.

**Table 5-5: Antenatal clinic attendance at least once by type of admission**

Antenatal Clinic	Total		Type of admission					
	N = 5115	%	Ante partum		Intra partum		Post partum	
			N = 361	%	N = 4675	%	N = 79	%
Attended	4897	95.7	361	100.0	4457	95.3	79	100.0
Did not attend	218	4.3	-	-	218	4.7	-	-

### 5.4.1.2 Age & parity

The age of women respondents ranged from 14 to 49 years with a mean age of 25.1 years and standard deviation of 6.6 years. **Table 5-6** shows the age and parity distribution overall and across all types of admissions. As shown in the table, the majority of the women were less than 30 years of age. The same pattern was seen for ante partum and intra partum admissions, where postpartum admissions appeared to have an older age distribution.

Regarding the parity distribution, the same table shows that majority of the women had parity less than four. A similar pattern was observed across all admission types.

**Table 5-6: Age and parity distribution overall and by type of admission**

Variable	Overall N = 5500		Ante partum N = 361		Intra partum N = 5055		Postpartum N = 84	
	N	%	N	%	n	%	n	%
Age group	# 5080		# 354		# 4646		# 80	
Up to 19	1180	23.2	72	20.3	1094	23.5	14	17.5
20-24	1491	29.4	97	27.4	1378	29.7	16	20.0
25-29	1126	22.2	97	27.4	1004	21.6	25	31.3
30-34	707	13.9	44	12.4	646	13.9	17	21.3
≥ 35	576	11.3	44	12.4	524	11.3	8	10.0
Parity	# 5124		# 359		# 4681		# 84	
0	2040	39.8	170	47.4	1837	39.2	33	39.8
1-3	2373	46.3	154	42.9	2174	46.4	45	53.6
≥ 4	711	13.9	35	9.7	670	14.3	6	7.1

Figure 5-3 below shows a comparison of the age distribution of St Francis hospital maternity admissions to that of the Kilombero district's population of women of reproductive age. The age distribution between the two groups was similar as can be seen in the figure. Both groups showed a predominance of women who were between 20 and 24 years of age.

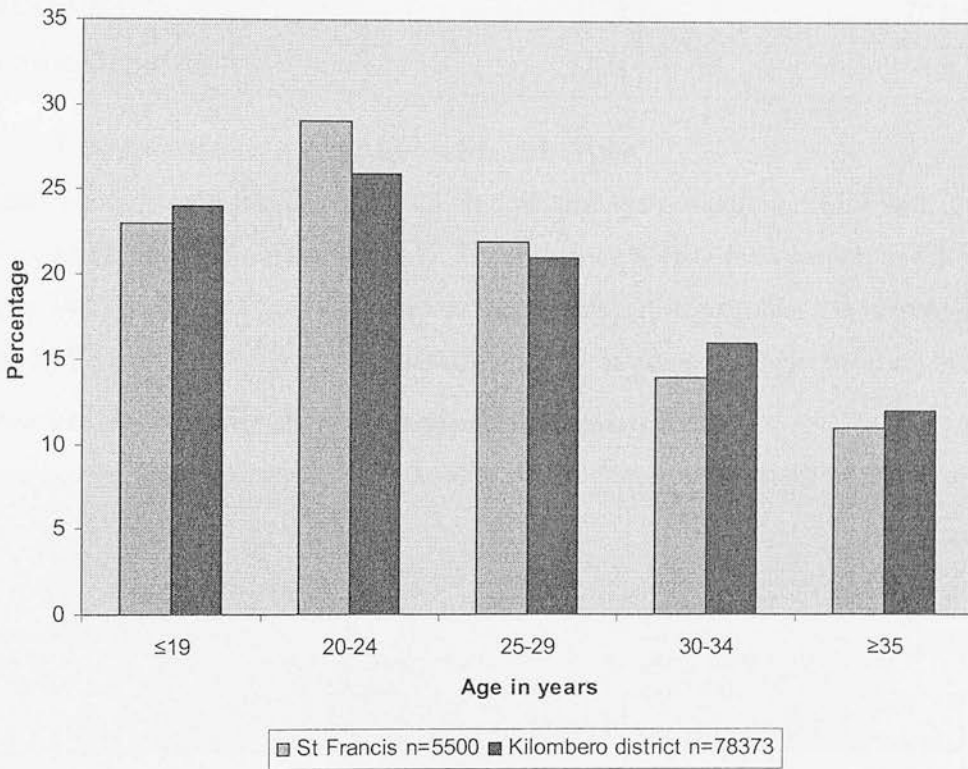


Figure 5-3: Comparison of age distribution between St Francis hospital study sample and Kilombero district's population of women of reproductive age

#### 5.4.2 'Full admissions'- i.e. women with complications

Table 5-7 shows the timing of admission for all cases admitted in maternity wards. As seen in the table, the commonest timing of admissions for obstetric complications was intra partum and ante partum. The hospital's maternity work load has been mainly on women coming for delivery and those with intra partum complications requiring a caesarean delivery. In the district, caesarean section service is available in St Francis referral hospital and another hospital which is 80 kilometres away.



**Table 5-7: Women experiencing complications; distribution by timing of admission**

Timing of admission	Frequency n = 1723	Percentage
Ante partum (AP)	361	21.0
Intra partum (IP)	1278	74.2
Postpartum (PP)	84	4.8

#### 5.4.2.1 Incidence of any SMM with subtypes

**Table 5-8** shows the incidence of both intra partum and postpartum SMM with its sub-types, i.e. intra partum only and postpartum only. The incidence of both intra partum and postpartum SMM cases was 19.2% out of all deliveries in the hospital. It is seen that the majority of the women with SMM had suffered from intra partum sub-type as compared to postpartum one.

**Table 5-8: The incidence of intra partum and/or postpartum SMM**

Type of SMM	Frequency	Incidence of Severe Maternal Morbidity (SMM)			
		% of all deliveries N = 5290	95% CI	Cases per 1000 live births N = 5075	95% CI
Both intrapartum and postpartum	1013	19.2	18-20	200	189- 211
Intra partum only	909	17.2	16-18	179	169- 190
Postpartum only	258	4.9	4-6	51	45 – 57

### 5.4.2.2 Clinical presentation of intra partum SMM cases

Table 5-9 shows a distribution of obstetric and non obstetric complications among intra partum SMM cases. In addition the proportions of the type of complications are calculated per delivery and 1000 live births. As seen in the table, obstetric complications contributed substantially to intra partum SMM as compared to non obstetric complications.

The types of obstetric complications are presented in Table 5-10 while the non obstetric complications are presented in Table 5-11.

Table 5-9: Obstetric and non obstetric complications among women with intra partum SMM cases, also expressed as percentage of all deliveries and cases per live births

Type of complication	n	% of IP SMM N = 909	% of all deliveries N = 5290	Cases per 1000 live births N = 5075
Obstetric	894	98.35	16.90	176.16
Non obstetric	19	2.10	0.36	3.74

**Table 5-10** shows the distribution of obstetric complications among intra partum SMM cases. Obstructed labour was the commonest complication comprising of diagnoses of cephalopelvic disproportion (35%), dystocia (25%), impending uterine rupture (2%) and prolonged labour (41%).

**Table 5-10: Distribution of obstetric complications among intra partum SMM cases, and in relation to live births**

Type of morbidity	n	% per IP SMM n = 909	Cases per 1000 live births N = 5075
Obstructed labour	625	68.76	123.15
Hypertensive disorders	203	22.33	40.00
<i>Eclampsia</i>	124	13.64	
<i>Severe pre eclampsia</i>	79	8.69	
<i>HELLP syndrome</i>	1	0.11	
Obstetric Haemorrhage	52	5.72	10.25
<i>Abruptio placentae</i>	20	2.20	
<i>Placenta praevia</i>	31	3.41	
<i>Unspecified</i>	1	0.11	
Uterine rupture	17	1.87	3.35
Other direct obstetric	8	0.88	1.58
<i>Intrauterine infection</i>	4	0.44	
<i>Cervical tear</i>	2	0.22	
<i>Pulmonary oedema</i>	1	0.11	
' <i>Maternal distress</i> '**	1	0.11	

\* Diagnosis written by attending Doctor, indicating clinical signs of dehydration and extreme exhaustion

**Table 5-11** presents the distribution of non obstetric complications of intra partum SMM. The three commonest conditions were severe anaemia, cardiac failure and AIDS

**Table 5-11: Distribution of non obstetric complications among intra partum SMM cases, and in relation to live births**

Type of morbidity	n	% per IP SMM N = 909	Cases per 1000 live births n = 5075
Severe anaemia	9	0.99	1.77
Cardiac failure	5	0.44	0.99
AIDS	4	0.44	0.79
Severe malaria	3	0.33	0.59
Others- Renal failure	1	0.22	0.20

### 5.4.2.3 Comparison of women with and without intra partum SMM in terms of age and gravidity

Intra partum SMM cases compared to all other women admitted for delivery.

Table 5-12 shows the association between intra partum SMM and age as well as gravidity by using a Pearson's chi square test. It can be seen that intra partum SMM was strongly associated with young age and low gravidity ( $P < 0.001$ ).

**Table 5-12: The association between intra partum SMM and age as well as gravidity among all other maternity admissions**

	Intra partum SMM (N=909)		No intra partum SMM (N=4381)		Total (N=5290)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
Age group	# 891		# 3988		# 4879	55.3	4	<0.001
Up to 19	265	29.7	877	22.0	1142			
20-24	254	28.5	1184	29.7	1438			
25-29	181	20.3	888	22.2	1069			
30-34	112	12.6	565	14.2	677			
≥ 35	79	8.9	474	11.9	553			
Gravidity	# 908		# 4008		# 4916	155.4	2	<0.001
1	527	58.0	1375	34.3	1902			
2-4	321	35.4	1965	49.0	2286			
≥ 5	60	6.6	668	16.7	728			

# Number of cases is less than total 'N' due to missing values

Intra partum SMM cases compared to other ‘full admissions’ without intra partum SMM.

A group of ‘full admissions’ was assessed by testing for any association of intra partum SMM with age as well as gravidity. **Table 5-13** shows the results after being tested by Pearson’s chi square test. The results, as seen indicate a statistically significant association of intra partum SMM with young age and low gravidity. The results are similar to that shown in **Table 5-12** whereby a comparison was done on intra partum SMM cases with all other maternity admissions.

**Table 5-13: The association of intra partum SMM with age and gravidity among ‘full admissions’.**

	Intrapartum SMM (N=909)		No intra partum SMM (N=814)		Total (N=1723)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
Age group	# 891		# 789		# 1680	57.0	4	<0.001
Up to 19	265	29.7	122	15.5	387			
20-24	254	28.5	218	27.6	472			
25-29	181	20.3	214	27.1	395			
30-34	112	12.6	142	18.0	254			
≥ 35	79	8.9	93	11.8	172			
Gravidity	# 908				# 1722	122.6	2	<0.001
1	527	58.0	261	32.1	788			
2-4	321	35.4	496	60.9	817			
≥ 5	60	6.6	57	7.0	117			

# Number of cases is less than total ‘N’ due to missing values

#### 5.4.2.4 Intra partum SMM cases with exclusion of obstructed labour

Referring to **Table 5-10**, one would observe that obstructed labour was predominant among intra partum obstetric SMM conditions. Further analysis was done while excluding Obstructed labour. **Table 5-14** below shows the testing of association of intra partum SMM with age and gravidity after exclusion of obstructed labour. The results are similar to the previous results in **Table 5-12 and 5-13** whereby there was a statistically significant association of intra partum SMM with young age and low gravidity.

**Table 5-14: The association of intra partum SMM (besides obstructed labour) and age as well as gravidity among 'full admissions'.**

	Intra partum SMM (N=284)		No intra partum SMM (N=814)		Total (N=1098)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
Age group	# 279		# 789		# 1068	24.3	4	<0.001
Up to 19	79	28.3	122	15.5	201			
20-24	69	24.7	218	27.6	287			
25-29	71	25.5	214	27.1	285			
30-34	34	12.2	142	18.0	176			
≥ 35	26	9.3	93	11.8	119			
Gravidity	# 283				# 1097	41.9	2	<0.001
1	150	53.0	261	32.1	411			
2-4	112	39.6	496	60.9	608			
≥ 5	21	7.4	57	7.0	78			

# Number of cases is less than total 'N' due to missing values

### 5.4.2.5 Association of intra partum SMM with Socio-demographic factors

Table 5-15 shows the testing of association of intra partum SMM with socio-demographic factors among 'full admissions'. The results show a statistically significant association of intra partum SMM with being single and having attained at least primary school education.

Table 5-15: The association of intra partum SMM with socio-demographic factors among 'full admissions'.

Variable	Intra partum SMM (N=909)		No intra partum SMM (N=814)		Total (N=1723)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
Marital status	# 904		#808		# 1712	43.2	1	<0.001
<i>Married</i>	658	72.8	693	85.8	1351			
<i>Single</i>	246	27.2	115	14.2	361			
Education	# 900		#808		# 1708	5.0	1	0.026
<i>At least primary</i>	769	85.4	658	80.4	1427			
<i>None</i>	131	14.6	150	18.6	281			
Occupation	# 895		#806		# 1701	3.3	1	0.070
<i>Earns income</i>	227	25.4	236	29.3	463			
<i>None</i>	668	74.6	570	70.7	1238			
From home to hospital in kms	# 649		# 629		# 1278	4.3	3	0.231
<i>Up to 20</i>	207	31.9	227	36.1	434			
<i>21-50</i>	237	36.5	229	36.4	466			
<i>&gt;50</i>	204	31.4	173	27.5	377			
<i>Other district</i>	1	0.2	0	0.0	1			

# Number of cases is less than total 'N' due to missing values



**Table 5-16** shows the association of intra partum SMM with different obstetric factors. The results show that there were a higher number of intra partum SMM cases among women who had been referred on emergency basis as well as those who had not been detected antenatally to have a complication. The association was statistically significant.

**Table 5-16: The association of intra partum SMM and obstetric factors among 'full admissions'**

Variable	Intra partum SMM (N=909)		No intra partum SMM (N=814)		Total (N=1723)	Pearson square test		Chi P value
	n	%	n	%		Chi sq	df	
Referred case			# 814			59.2	1	<0.001
Yes	266	29.3	113	13.9	379			
No	643	70.7	701	86.1	1344			
Known medical illness*	# 891		# 797		# 1688	0.5	1	0.974
Yes	12	1.4	10	1.3	22			
No	879	98.6	787	98.7	1666			
Antenatal problem detected	# 901		# 799		# 1700	21.1	1	<0.001
Yes	123	13.7	177	22.2	300			
No	778	86.3	622	77.8	1400			

# Number of cases is less than total 'N' due to missing values

\* Such as sickle cell and cardiac diseases

#### 5.4.2.6 Obstetric interventions for treating intra partum SMM

Table 5-17 shows the distribution of the treatment modalities for intra partum SMM cases. The three commonest types of treatment were caesarean section, magnesium sulphate and blood transfusion as seen in Table 5-17. Caesarean section and blood transfusion services comprise a comprehensive emergency obstetric care services while magnesium sulphate is a 'basic emergency obstetric care service' as explained in Chapter 2.

Table 5-17: Distribution of obstetric interventions administered for treating intra partum SMM cases

Type of intervention	Frequency n = 909	Percentage
Caesarean section	658	72
Magnesium sulphate	193	22
Blood transfusion	26	3
Emergency hysterectomy	17	2
Use of ICU	9	1

### 5.4.2.7 Maternal and foetal outcome among intra partum SMM cases

Table 5-18 shows the maternal and foetal outcome among women with intra partum SMM cases. The mean length of hospital stay was 6.35 days ranging from one day to 42 days. It can be seen that among intra partum SMM cases, 17% developed postpartum SMM. A few cases had had some adverse effects following the treatment given. The majority of the mothers had delivered live babies, and were discharged home alive. There were 10 maternal deaths.

Table 5-18: Maternal and foetal outcome among intra partum SMM cases

Maternal outcome	Frequency n = 909	Percentage
Development of postpartum SMM		
Yes	154	17
No	755	83
Development of IP treatment adverse effects*		
Yes	4	1
No	905	99
Ultimate outcome of mother		
Discharged home	899	99
Died	10	1
Outcome of baby		
Alive at birth	866	95.3
Died	43	4.7

\* Caesarean wound dehiscence and Niverapine induced drug reaction.

**Table 5-19** shows the association between intra partum SMM and neonatal death. As can be seen, neonatal deaths were more common among women with intra partum SMM than other women who were ‘fully admitted’ (4.7% v 1.1%,  $p < 0.001$ ). A possible explanation for such association could be that IP SMM conditions such as prolonged obstructed labour could result into severely asphyxiated baby who may end up dying as was discussed in chapter 3.

**Table 5-19: Association of Intra partum SMM with neonatal death among ‘full admissions’**

	Neonatal deaths (N=52)		No Neonatal death (N=1671)		Total (N=1723)	Pearson square test		Chi
	n	%	n	%		Chi sq	df	P value
<b>Intrapartum SMM</b>								
Yes	43	82.7	866	51.8	909	19.3	1	<0.001
No	9	17.3	805	48.2	814			

# Number of cases is less than total ‘N’ due to missing values

### 5.4.3 Clinical presentation of post partum SMM cases

**Table 5-20** shows a distribution of obstetric and non obstetric complications among post partum SMM cases and as well as their percentage out of all deliveries and live births. Most of the postpartum SMM cases were obstetric conditions.

**Table 5-20: Distribution of obstetric and non obstetric complications among post partum SMM cases, also expressed as percentage of all deliveries and live births**

Type of SMM	N	% of postpartum SMM N = 258*	% of all women who delivered N = 5290	% of live births N=5075
Obstetric cause	229	89	4.33	4.51
Non obstetric cause	31	12	0.59	0.61

\* The percentage adds to more than 100% since some women had more than one complication

Table 5-21 shows a distribution of obstetric conditions of postpartum SMM. The commonest conditions were eclampsia, puerperal sepsis and postpartum haemorrhage.

Table 5-21: Distribution of obstetric complications among post partum SMM cases, also expressed as percentage of all deliveries and live births

Type of complication	N	% of postpartum SMM n = 258	Cases per 1000 live births n = 5075
Hypertensive disorders	73	28	14.38
<i>Eclampsia</i>	68	26	
<i>Hypertension</i>	3	1	
<i>HELLP syndrome</i>	2	1	
Puerperal sepsis all types	61	24	12.00
<i>Foul smelling vaginal discharge</i>	58	23	
<i>Wound dehiscence</i>	4	2	
Postpartum haemorrhage	60	23	11.82
<i>Unspecified</i>	58	22	
<i>Uterine atony</i>	29	11	
<i>Cervical tear</i>	11	4	
<i>Retained placenta</i>	11	4	
Postpartum cardiomyopathy	11	4	2.17
Others*:	14	5	2.76

\* Sequelae of intra partum events (8), Puerperal psychosis (6)

**Table 5-22** shows the non obstetric conditions of postpartum SMM. As can be seen, severe anaemia and malaria were the commonest conditions.

**Table 5-22: Distribution of non obstetric complications among post partum SMM cases, also expressed as percentage of all deliveries and live births**

Type of morbidity	n	% per any postpartum SMM n = 258	Cases per 1000 live births n = 5075
Severe anaemia	22	9	4.33
Severe malaria	6	2	1.18
Cardiac failure	3	1	0.60
AIDS	1	0.4	0.20
Others- Pyrexia of unspecified cause	1	0.4	0.20

### 5.4.3.1 Association of postpartum SMM and Socio-demographic factors

Table 5-23 shows the association of postpartum SMM with age and parity among 'full admissions'. As can be seen, the rate of post partum SMM was almost equal across all age groups as well as the parity groups. Therefore no statistically significant association was found. However, it is recognized that the sample size was small, hence potential to miss differences due to chance.

**Table 5-23: The association of postpartum SMM with age as well as parity among 'full admissions'.**

Variable	Postpartum SMM (N=258)		No postpartum SMM (N=1465)		Total (N=1723)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
Age group	# 248		# 1432		# 1680	6.1	4	0.189
<i>Up to 19</i>	72	29.0	315	22.0	387			
20-24	59	23.8	413	28.8	472			
25-29	54	21.7	341	23.8	395			
30-34	39	15.7	215	15.1	254			
≥ 35	24	9.7	148	10.3	172			
Parity	# 258		# 1463		# 1721	5.8	2	0.056
0	135	52.3	657	44.9	792			
1-3	103	39.9	712	48.7	815			
≥4	20	7.8	94	6.4	114			

# Number of cases is less than total 'N' due to missing values

Table 5-24 shows the association between postpartum SMM and the socio-demographic factors among 'full admissions'. There were a higher number of postpartum SMM cases among unmarried women. The association was statistically significant. However it could be confounded by age.

Table 5-24: The association of postpartum SMM with socio-demographic factors among 'full admissions'.

Variable	Postpartum SMM (N=258)		No Postpartum SMM (N=1465)		Total (N=1723)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
Marital status	# 263		# 1449		# 1712	8.3	1	0.004
<i>Married</i>	190	72.2	1161	80.1	1351			
<i>Single</i>	73	27.8	288	19.9	361			
Education	# 261		# 1447		# 1708	0.3	1	0.594
<i>At least primary</i>	221	84.7	1206	83.3	1427			
<i>None</i>	40	15.3	241	16.7	281			
Occupation	# 258		# 1443		# 1701	2.9	1	0.088
<i>Earns an income</i>	59	22.9	404	28.0	463			
<i>None</i>	199	77.1	1039	72.0	1238			
Residence to hospital in kms	# 195		# 1082		# 1277	4.2	4	0.377
<5	2	1.0	35	3.2	37			
5-20	65	33.3	332	30.7	397			
21-50	73	37.4	393	36.3	466			
51-100	46	23.6	251	23.2	297			
>100	9	4.6	71	6.6	80			

# Number of cases is less than total 'N' due to missing values



### 5.4.3.2 Obstetric risk factors among postpartum SMM cases

Table 5-25 shows the association of post partum SMM with different obstetric factors among ‘full admissions’. The proportion of postpartum SMM cases were much higher among women who had been referred as emergency cases, as compared to non- referred cases. The difference was statistically significant ( $p < 0.001$ ) as seen in Table 5-25.

A higher proportion among the postpartum SMM cases gave no history of a detected problem during antenatal clinic attendance. This showed a statistically significant association ( $P < 0.001$ ), as shown in Table 5-25.

Table 5-25: The association of postpartum SMM with obstetric factors among ‘full admissions’.

Variable	Postpartum SMM (N=258)		No postpartum SMM (N=1465)		Total (N=1723)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
Referred case	# 267		# 1456			110.0	1	<0.001
Yes	124	46.4	255	17.5	379			
No	143	53.6	1201	82.5	1344			
Known medical illness*	# 256		# 1432		# 1688	2.5	1	0.111
Yes	6	2.3	16	1.1	22			
No	250	97.7	1416	98.9	1666			
Antenatal problem detected	# 257		# 1443		# 1700	13.1	1	<0.001
Yes	25	9.7	275	19.1	300			
No	232	90.3	1168	80.9	1400			

# Number of cases is less than total 'N' due to missing records

### 5.4.3.3 Obstetric interventions for treating post partum SMM

Table 5-26 shows the distribution of treatment interventions for postpartum SMM cases. The common obstetric interventions administered in treating postpartum SMM cases were blood transfusion, magnesium sulphate, intravenous antibiotics and use of intensive care unit.

Table 5-26: Distribution of obstetric interventions used in treating post partum SMM cases

Type of intervention	Frequency n = 258	Percentage*
Blood transfusion	76	30
Magnesium sulphate	69	27
Iv antibiotics	59	23
Use of ICU care	55	21
Uterine evacuation	12	5

\* Percentage adds up to more than 100% since some women received more than one intervention

### 5.4.3.4 Maternal and foetal outcome among postpartum SMM cases

The outcome is presented in terms of length of hospital stay and maternal and foetal wellbeing. The mean length of hospital stay among post partum SMM cases was 8.5 days (range 1-43 days). Table 5-27 shows the maternal and foetal outcome among postpartum SMM cases. It can be seen that most of the women were discharged home after treatment, and had their babies with them. There were ten maternal deaths.

Table 5-27: Maternal and foetal outcome among post partum SMM cases

Maternal outcome	Frequency n= 258	Percentage
Ultimate outcome of mother		
<i>Discharged home</i>	248	96
<i>Died</i>	10	4
Outcome of baby		
<i>Alive at birth</i>	230	89.1
<i>Died</i>	28	10.9

### 5.4.3.5 Maternal deaths

**Table 5-28** shows the distribution of maternal deaths during a study period of one year. There were 17 maternal deaths, 16 being obstetric in origin and one due to non obstetric cause. The deaths had occurred during ante partum and post partum period. As can be seen, there were no intra partum maternal deaths. The three commonest conditions causing maternal deaths were eclampsia, postpartum haemorrhage and postpartum cardiomyopathy.

**Table 5-28: Distribution of primary causes of maternal deaths**

Primary cause	Frequency
	n = 17
Eclampsia	9
<i>Ante partum</i>	6
<i>Postpartum</i>	3
Postpartum Haemorrhage	4
<i>Uterine atony</i>	1
<i>Extensive cervical tear</i>	1
<i>Unspecified</i>	2
Postpartum cardiomyopathy	2
AIDS	1
DIC following Intrauterine fetal death	1

**Table 5-29** shows the clinical condition of maternal deaths on arrival at the hospital and whether they received any treatment or not. As can be seen, most of the women who died were admitted in sick condition and majority received treatment of some kind. A few died upon arrival without receiving any treatment.

**Table 5-29: Distribution of clinical condition and treatment received among maternal deaths**

Variables	Frequency
	n = 17
Clinical condition on admission	
<i>Well</i>	6
<i>Sick</i>	11
Treatment status while in hospital	
<i>Received treatment</i>	13
<i>Died immediately after arrival before receiving treatment</i>	4

**Table 5-30** shows the association between patient's clinical conditions on admission with her outcome in terms of survival. It is seen that maternal mortality was four-fold greater among women admitted in critical condition than among other 'full admissions' (2.1% v 0.5%, p=0.006).

**Table 5-30: Association of clinical condition on admission to maternal outcome**

	Maternal death (N=17)		No maternal death (N=1706)		Total (N=1723)	Pearson Chi square test		
	n	%	n	%		Chi sq	df	P value
<b>Clinical condition</b>								
<i>Well</i>	6	35.3	1185	69.5	1191	9.2	1	0.006
<i>Sick</i>	11	64.7	521	30.5	532			

**Table 5-31** below shows the association of women’s critical condition on admission and the occurrence of maternal death. As can be seen, the Mantel- Haenszel odds ratio has been used , which gives a summary estimate of association between critical condition of the women at the time of admission and occurrence of maternal deaths after adjusting for the different types of maternity admissions. The women’s critical condition on admission increased the odds of occurrence of maternal death by seven fold as compared to a stable condition. This was supported by a P value which showed a statistically significant association of critical condition and maternal death, as well as the confidence intervals which did not include number one.

**Table 5-31: Association of critical condition on admission with maternal death after adjusting for the type of maternity admission (n = 5494)**

Factor	Occurrence of maternal death		
	Mantel- Haenszel Odds Ratio	P value	95%CI
Critical condition on admission	7.7	0.01	1.61- 36.65

Having shown the study findings, the next section presents the discussion, to be followed by a summary of this chapter

### **5.5 Discussion specific to this chapter**

This section discusses the findings of a study addressing the incidence of intra partum and postpartum SMM in a referral hospital in one of the rural districts of Tanzania. The discussion will begin by mentioning the salient findings of the study, to be followed by methodological concerns and lastly a discussion on the results.

#### **5.5.1 Salient findings of the study**

The incidence of intra partum and/or postpartum SMM was 19.2% with a case fatality ratio of 1.7%. The incidence of intra partum SMM only was 17.2% with its three commonest conditions being obstructed labour, eclampsia and severe pre-eclampsia. The incidence of postpartum SMM only was 4.9% with its three commonest conditions being eclampsia, puerperal sepsis and postpartum haemorrhage.

Intra partum SMM rate was higher among women who were primigravida, adolescents, unmarried, referred cases and those not being detected to have complications during antenatal clinic attendance. Neonatal death was more common among women with intra partum SMM than among other deliveries.

Regarding postpartum SMM, the rate was higher among unmarried women, referred cases, women having no complications during antenatal clinic attendance and those with intra partum SMM.

There were no intra partum maternal deaths, but across all admissions, maternal mortality was four-fold greater among women admitted in critical condition than among other women.

### **5.5.2 Methodological concerns**

This is the first study in Tanzania to address the incidence of intra partum and postpartum SMM in a referral hospital located within a semi-rural setting. As mentioned in **Chapter 3**, most of the published studies in Tanzania were based on single morbidity, or were addressing SMM as a cause of maternal mortality without estimating the incidence of SMM per se. This study, besides estimating the incidence of SMM with its subtypes, it assesses the socio-demographic and obstetric factors as well as the maternal and foetal outcomes. Knowledge of the epidemiology and clinical picture of SMM is a useful guidance when one aims at improving the outcome of SMM in terms of severe disabilities and maternal and neonatal deaths.

There has been a concern that hospital studies in developing countries like Tanzania do not give a true representation of the general population since relatively few people use health facilities for care. In our case, St Francis referral hospital is known to manage a substantial number of women with complications in the district, therefore the information generated from our study will reflect the level of care provided to a proportion of women attending health facilities. When one tries to quantify the actual representation of maternities having complications in the district, he/she may use the district's population parameters to estimate the number of maternities having a complication requiring a life threatening intervention. Using a formula shown in **Appendix II**, the number of births in the district during the study period would be estimated to 19,247. Therefore using the WHO (2004) estimate of 15% of pregnancies having a complication, the estimated number of women having complications in the district would be 2887. It is reassuring to know that during the study period about 60% of the estimated women with complications in

the district were managed at St Francis, given the fact that our study did not include early pregnancy complications, those being managed at Illovo hospital and the three district's health centres as well as those remaining at home.

The retrospective nature of the study design has its own drawback such as lack of information in the case notes due to poor quality of hospital records or under reporting by the attending Doctors. An effort was made to validate the reported diagnosis using other supplementary sources of records. A better alternative would have been a prospective study design as the one conducted by Prual and co authors (2000) in six West African countries where by they made a follow up of cases while pregnant until 60 days postpartum. However it was not possible in our circumstances due to cost and time constraints.

### **5.5.3 Main study findings**

#### **5.5.3.1 Incidence of intra partum and/ or postpartum SMM**

It is difficult to make a comparison of the SMM incidence with other previous authors' findings due to the diversity of their methods of identification of SMM cases (Brace et al., 2004). In our study, as mentioned in **Chapter 3**, that the SMM was based on specific diseases. Others have used management based criteria while some have used organ based dysfunction criteria (Mantel et al., 1998, Brace et al., 2004, Okong et al., 2006).

Even among authors using the disease specific criteria, there are many differences such as the gestational age at which the morbidities were identified. Some authors have included abortion (Khosla et al., 2000) while others have not (Waterstone et al., 2001, Prual et al., 2000). In our study we focussed on intra partum and post partum SMM conditions since these were feasible to be investigated and also were the commonest conditions contributing to maternal deaths (World Health Organization, 2005).

In any case when comparing the incidence reported from our study with the estimates reported by Minkauskiene (2004) and Say (2004) in both systematic reviews, the rate seems to be high. One of the possible explanations could be that our study incorporated all common conditions causing maternal deaths cases, unlike some studies which only identified the severest form of SMM (i.e. near miss). Moreover, the high incidence rate could also be contributed by the nature of the hospital where the study was conducted. Being a referral hospital, it receives women who

have obstetric complications from the district and a few from outside the district (Association 'Doctors for Ifakara', 2007). Our method of identification of cases has been challenged by Say and co authors (2004) in identifying near miss cases since it has too low a threshold which may overwhelm the case review process due to too many cases. However, since our intention was to describe the incidence of intra partum and postpartum SMM in St Francis referral hospital, we preferred to use this method which was applicable in such resource constrained setting as our hospital, unlike the management based criteria and organ based dysfunction which may require facilities which are not present in our setting. Our method of identification could also be used by other hospitals of similar settings in Tanzania.

### **5.5.3.2 Socio-demographic factors**

#### **Age:**

In our study, there seem to be a higher proportion of intra partum SMM cases among teenagers with no association among the postpartum SMM cases (**Table 5-12 & Table 5-23**). This is in contrary to Waterstone's et al (2001) in UK and Souza et al (2006) in Brazil who found SMM being highly associated with older women of 34 and 40 years and above respectively. In our study, the association with teenage pregnancies could have been contributed by a substantially higher number of obstructed labour and eclampsia which were found among intra partum SMM cases. These conditions are highly associated with young age as has been shown in several studies (Adeyinka et al., 2010, Rasheed et al., 2010). Obstructed labour commonly occurs in young women who are diagnosed to have cephalo-pelvic disproportion (CPD) due to their pelvis not attaining the maximum growth (Lawson, 1965). Studies on SMM, being conducted in developing countries have included obstructed labour since it is among the commonest conditions causing maternal deaths (Prual et al., 2000). However this is not the case in developed countries as can be seen in a study conducted by Waterstone and co authors (2001), whereby obstructed labour was not among the SMM cases.

The association of Intra partum SMM and young age as well as low gravidity remained the same despite exclusion of obstructed labour conditions (**Table 5-14**). As shown in **Table 5-10** that obstructed labour was predominant among all the intra partum SMM conditions. The subjectivity of conditions causing obstructed labour such as Cephalo-pelvic disproportion (CPD) have already been discussed in chapter 3 as reported by Ronsmans (2004), Van Roosmalen (1995) and



Sheehan (1987). Therefore a separate analysis without obstructed labour was performed to see if it could show any changes in the results, since a possibility of over reporting of the condition could not be ruled out due to the design of the study.

### **Marital status**

Women who were not married showed a statistically significant association with intra partum SMM (**Table 5-15**) as well as post partum SMM (**Table 5-24**). In view of the fact that this was a retrospective study, other useful information related to marital status could not be obtained. For instance, decision making processes, income status and if there was any financial assistance given by any family member. A possible explanation for such an association could be that single mothers are likely to have minimal financial support to access emergency facilities, hence end up having neglected morbidities such as obstructed labour. On the other hand one would expect single mothers to have the power to decide on their health related issues. This is not always the case since in the African societies other people have influence regarding a woman's decisions on health related matters. Such people include mothers, sisters, neighbours and traditional birth attendants.

### **Education, occupation and distance of women's residences to the hospital**

In the study, there was no evidence to show any association between intra partum or postpartum SMM and factors such as education, occupation, and distance of the women's residences to hospital (**Table 5-15 & Table 5-24**). However, it would be helpful if the socio demographic factors were investigated along with other parameters to give more informative indicators such as wealth quintiles (National Bureau of Statistics (NBS) [Tanzania] and ORC Macro, 2005). Unfortunately our study could not obtain the wealth quintile as this was a retrospective review of records, which lacked information such as type of house owned and other personal belongings.

#### **5.5.3.3 Obstetric factors**

##### **Gravidity:**

Low gravidity was found to be associated with intra partum SMM (**Tables 5-12 & 5-13**). A possible explanation could be, women of low gravidity are likely to be young hence prone to develop such obstetric complications as has been reported before. On the other hand the median

age at first birth in Tanzania is about 19.4, implying that some women might reach a high parity at a young age (National Bureau of Statistics (NBS) [Tanzania] and ORC Macro, 2005).

The association of age and gravidity was strong when comparison was made between intra partum SMM to all other maternity admissions not having intra partum SMM (**Table 5-12**) since the number was larger than when the comparison made to other full admissions without intra partum SMM (**Table 5-13**). For postpartum SMM cases, there was no evidence to suggest any association with factors such as age or parity. The findings are inconsistent with previous authors who found morbidities such as postpartum haemorrhage, being associated with high parity (Shechter et al., 2010, Jaleel and Khan, 2010).

#### **Emergency referred cases**

Women who were referred on emergency basis showed a statistically significant association with intra partum and postpartum SMM (**Table 5-16 & Table 5-25**). This is expected as it may imply that the cases being referred had extremely severe morbidities needing emergency obstetric intervention as have been observed in previous studies (Kaye et al., 2003, Almerie et al., 2010).

#### **Antenatal complications detected at clinic**

Regarding antenatal problems, women with undetected problems were highly associated with intra partum and postpartum SMM (**Table 5-16 & Table 5-25**). As mentioned previously that some complications are not predictable nor detected even during antenatal clinic. It is this fact which has prompted the WHO to give recommendations that all pregnancies be considered as risky (WHO, 2005). The other possibility for women with undetected antenatal problems having more morbidities is that some problems might have been missed because of lack of expertise or screening methods such as blood pressure machine as reported by Urassa and co authors (2003, Urassa et al., 2002).

### **5.5.4 The outcome of intra partum & postpartum SMM**

#### **Hospital length of stay**

The mean length of hospital stay was more or less the same among intra partum SMM and post partum SMM cases (6.35 v 8.5 days). This was longer compared to that reported by Joseph and co authors (2010) in Canada. In our study, women having longer hospital stay were the ones with more complications. For instance there was one woman who had stayed for 41 days after having had obstructed labour which was complicated into puerperal sepsis. In such case the baby is

likely also to have neonatal morbidity requiring even longer hospital stay. The hospital length of stay is useful information to the hospital management for budgeting purpose and resource allocation.

### **Intra partum SMM developing into postpartum SMM**

Regarding the intra partum SMM cases, about 17% went on developing postpartum SMM. This could be due to failure in controlling the primary problem which caused the intra partum condition. For instance uncontrolled intra partum eclampsia which may cause further postpartum eclamptic fits or other sequelae such as HELLP syndrome or pulmonary oedema. Furthermore a woman could be presenting with an intra partum SMM such as excessive vaginal bleeding due to abruptio placentae which may manifest during postpartum as severe anaemia. The intra partum period is very close to the postpartum period; therefore most of the conditions may occur almost at once unless a condition occurs several days later such as secondary post partum haemorrhage.

### **Occurrence of maternal deaths**

Regarding the outcome of the mother, it is encouraging to see that majority of the women were discharged home alive. It is unfortunate that a small percentage ended in a maternal death.

The case fatality rate in this study exceeds slightly the minimum acceptable threshold level by the World Health Organization (2009) which is based on direct obstetric complications. We compared with the WHO threshold level just to have an idea of how St Francis hospital was doing. However the WHO (*ibid*) recommends such a threshold to be compared after the case fatality ratio has been calculated for all health facilities which manage SMM cases in an area.

The case fatality ratio in this study is far greater compared to that reported of developed countries in the systematic reviews of SMM and other studies (Minkauskiene et al., 2004, Say et al., 2004, Joseph et al., 2010). The possibility for such a difference has already been mentioned in chapter 2. In the developed countries, SMM cases do occur but they are detected early and are treated promptly and adequately thus preventing maternal deaths from occurring. In developing countries, most of the SMM cases do not receive treatment in a timely manner due to multiple socio-economic and cultural factors. This is evident in our study whereby majority of the maternal deaths arrived late in such a critical condition that they died on arrival before receiving any treatment (**Table 5-30**). Furthermore the study showed that if a woman arrived in such a critical state, she is more likely to end up as a maternal death as shown in (**Table 5-31**). The

other reasons for women arriving in critical state could be delays occurring at the lower level facilities whereby they fail to detect the complication or delay in referring a woman to the hospital. The retrospective design of our study limited our ability to elicit any socio –economical, cultural and lower health facility related factors which could have caused the delays.

The pattern of the causes of maternal mortality is similar to many other developing countries except for post partum cardiomyopathy and DIC (WHO, 2005). Our study shows that there were no intra partum maternal deaths, meaning that none of the women died while in labour or delivering. It is difficult to be certain if none of the women had started slight labour pains before dying. This is due to the retrospective design of the study since some case notes did not have partographs which would indicate if a woman had started true labour. The numbers of maternal deaths were few; therefore we could not make any conclusive remarks.

### **Neonatal deaths**

Regarding the early neonatal outcome, as it has been mentioned that a poor neonatal outcome was associated with both intra partum and post partum SMM. Conditions contributing to intra partum SMM such as obstructed labour and eclampsia are highly associated with poor foetal and neonatal outcome as described in chapters 2 and 3. In our study, one would expect the outcome of the neonate not to be influenced by postpartum SMM since by then the baby had already been born. A possible explanation for such a relationship would be a strong link between intra partum and post partum SMM as has been demonstrated by majority of postpartum SMM cases having had intra partum SMM too.

## **5.6 Chapter summary**

This chapter has presented a hospital based retrospective study on the incidence of intra partum and postpartum SMM. The concern of this hospital study giving a true representation of its population has already been discussed earlier. This study therefore is complemented by a community study which was done in the rural catchment area of St Francis hospital to estimate the interview based SMM incidence. The community study is described in the next chapter.

## **6 Community interview survey of the incidence of SMM**

### **6.1 Introduction**

In the previous chapter, a hospital based study was described addressing the annual incidence of intra partum and postpartum Severe Maternal Morbidity (SMM) at St Francis referral hospital, Tanzania. It is well known that in developing countries, where not all who require hospital care achieve access to it, hospital studies do not give a true representation of the health outcomes for the general population. Therefore, a community survey within the hospital's rural catchment area to estimate the incidence of SMM was conducted to complement the hospital study findings.

### **6.2 Objectives**

The primary objective of this survey was to estimate the incidence of severe maternal morbidity among women in the community who had given birth within one year prior to the survey.

The secondary objective was to describe for women involved in the community survey, their antenatal and delivery health-care-seeking behaviour, as well as birth and emergency complication readiness plans.

### **6.3 Methods**

#### **6.3.1 Study population & setting**

The survey involved sampling of women who were part of the Ifakara Centre Demographic and Health Surveillance System (IC-DSS, described in 4.2.1.3), and who had given birth between May 2008 and April 2009. Although the IC-DSS is comprised of villages from Kilombero and Ulanga districts of Morogoro region, this study surveyed women residing at villages belonging to Kilombero district only.

Women whose pregnancies ended before 28 weeks were excluded from the survey. Thus all abortions and ectopic pregnancies will have been excluded. Reasons for excluding women whose most recent pregnancies ended earlier than 28 weeks were that in the IC-DSS office, records which are reliable are the ones related to the outcome of pregnancies beyond 28 weeks. This is partly because abortion is regarded as very much a private matter in African societies, and so women are not always ready to discuss it, especially if the abortion was induced, as had been

mentioned in 2.2.3. I recognise that abortion complications do cause SMM and maternal death, but estimation of the frequency of such events would have to be the subject of a separate study. However, it was considered feasible to approach women whose pregnancies lasted longer than 28 weeks, since they would be considered to have undergone childbirth.

### **6.3.2 Study design**

This was a community based interview survey of women who had given birth between May 2008 and April 2009, with interviews taking place in the woman's home.

### **6.3.3 Sample size**

Using the World Health Organization (2009) figure of 15% of pregnant women having SMM, as the likely true figure in rural Tanzania, and aiming for the 95% confidence interval around the study estimate to be no wider than  $\pm 3$  percentage points, the sample size calculated as required for the survey was 544. However, to allow for non-responses we increased the sample size by 10% to 600. Given village populations and numbers of pregnancies in the past year such a sample size would have been obtained from 5 villages.

However, it was learnt that during the rainy seasons, women together with men in the village move to their agricultural lands in remote areas for cultivation, so on advice the number of villages were increased to 8 in which women (who had given birth in the past year) would be recruited to participate in an interview.

### **6.3.4 Sampling procedure for villages**

A list of the 13 Kilombero villages in the Ifakara Centre Demographic and Health Surveillance System (IC-DSS) showed that the distance from the villages to Ifakara headquarters (and hence to the referral hospital) ranged between 20 and 95 kilometres, with an average of 63 kilometres. To select villages for the study a stratified random sampling technique was applied, whereby the 13 Kilombero district villages were classified into 4 strata by distance, from closest set, to medium close, medium distant, and very distant.

Simple random sampling was then applied to each stratum to select 2 villages, giving a total of 8 villages. The villages selected were: Lukolongo, Mngeta, Ikule, Mchombe, Idete, Miwangani, Igima and Namawala (82, 84, 95, 80, 20, 27, 62, 40. kilometres from the Ifakara headquarters respectively).

### 6.3.5 Operational definitions for the interview questionnaire

This symptoms reported by the respondents have been categorised and defined as presented below.

*Volunteered symptom*- any symptom reported by a respondent after being asked a non specific question.

*Prompted symptom*- any symptom reported by a respondent following an enquiry about that specific symptom.

*Maternal morbidity symptom* - any symptom a woman experienced during her last pregnancy from 7 months (28 weeks) until 42 days after childbirth and which she perceived by as being a deviation from normal pregnancy. The symptoms were subsequently categorised as clinically major or clinically minor.

*Major symptom* of maternal morbidity – is any symptom which is potentially of clinical importance, since it is suggestive of a condition commonly causing maternal mortality in Tanzania. Such a symptom may include convulsions/ fits, abnormal vaginal bleeding, abnormal vaginal discharge, prolonged labour and fever.

*Minor symptom* of maternal morbidity– any clinical symptom which under normal circumstances will not be likely to lead to a serious consequence such as critical illness or maternal death. Such symptoms include backache, pelvic pain, and joint pains.

'*Kanga*'- is a rectangular, standard –sized (100 cm x 155 cm) locally made African cotton fabric which has various purposes including being used by local women as a sanitary pad during delivery. Prata and co authors (2005) established that two fully blood soaked pieces of *kanga* give an estimate of slightly over 500mls of blood loss

### 6.3.6 Classification of SMM

This classification of SMM in the survey was derived from the major symptoms which have just been described, together with other information specific to the symptoms, such as treatment interventions. **Table 6-1** below displays the standard definitions for different SMM conditions used in literature with corresponding operational definitions used in the community survey.

**Table 6-1: Standard obstetric definitions with operations definitions for severe SMM conditions**

Obstetric diagnosis	Standard definitions by WHO (2000)	Operational definitions
Major obstetric haemorrhage	<p><b>AP-</b> any bleeding from 22nd week of pregnancy to the onset of labour pains</p> <p><b>IP-</b> Heavy bleeding during labour soaking at least one sanitary pad</p> <p><b>PP</b>—Blood loss of <math>\geq 500</math> mls following vaginal birth OR <math>\geq 1000</math> mls following caesarean birth until within 42 days of childbirth</p>	<p>Any bleeding :</p> <p><b>AP-</b> at all, between 28th week of pregnancy and before labour</p> <p><b>IP-</b> requiring use of <math>\geq 2</math> pieces of kanga which are fully soaked during labour and delivery</p> <p><b>PP-</b> requiring use of <math>\geq 2</math> pieces of kanga which are fully soaked following delivery until 42 days later.</p> <p><b>Or, at any stage</b> - Blood transfusion given</p>
Eclampsia*	<p>Convulsions at <b>any stage</b> with</p> <ul style="list-style-type: none"> <li>• Blood pressure <math>\geq 140/90</math> mmHg</li> <li>• Albuminuria <math>\geq ++</math></li> </ul> <p>Other accompanying features:</p> <ul style="list-style-type: none"> <li>• Severe headache, blurred vision and epigastric pain</li> </ul>	<p>Convulsions at <b>any stage</b></p> <p>AND</p> <p>there is no history of recurrent episodes of convulsions when not pregnant (This is to rule out epilepsy)</p>
Obstructed labour	<p>Failure of the presenting part to descend in spite of uterine contractions, WITH secondary signs such as:</p> <ul style="list-style-type: none"> <li>• Severe moulding</li> <li>• Caput</li> <li>• Foetal heart rate <math>\leq 120</math> or <math>\geq 160</math> beats per minute</li> <li>• Stretched lower segment (Bandl's ring)</li> <li>• Bloody urine</li> </ul>	<p>Since it is difficult to tell exactly when a woman started true labour, I considered cases as having obstructed labour in any prolonged labour <math>&gt; 12</math> hours AND the baby was delivered by:</p> <ul style="list-style-type: none"> <li>• Caesarean section, or</li> <li>• Vacuum extraction</li> </ul>
Puerperal sepsis	<p>Foul smelling vaginal/ or abdominal wound discharge which may be accompanied by:</p> <ul style="list-style-type: none"> <li>• Fever <math>&gt;38^{\circ}\text{C}</math></li> <li>• Pelvic pain</li> <li>• Uterine tenderness</li> </ul>	<p>Foul smelling vaginal discharge which may be accompanied by fever OR</p> <p>Any caesarean wound discharge</p>



### 6.3.7 Construction of the interview questionnaire

While constructing the questionnaire, the principles of questionnaire design were followed to ensure that it was able to capture data accurately and in an unbiased way. The questions were made simple and were phrased in a lay out that could be easily understood by interviewers and interviewees [The questionnaire is presented in **Appendix IV (e)**].

The questionnaire was structured into separate sub topics such as a check list to ensure that a woman was eligible to be interviewed, socio-demographic information, antenatal care information and birth preparations (including emergency complications readiness plans), events around delivery and decisions regarding the place of delivery.

The focus of this questionnaire was on symptoms experienced by the women during pregnancy from 28<sup>th</sup> week to delivery and puerperium. The various symptoms of interest have to be reported in retrospect and subjectively, so the questionnaire was ordered so that a woman was first given the opportunity to describe, in response to a general enquiry, any symptoms which she experienced. This was then followed by a series of prompts (questions) addressing specific symptoms (conditions). The initial 'general enquiry' involved the woman being asked whether she had experienced any problem while 7 months pregnant and beyond. One of the following specific prompts (questions) that followed was, for example, a question about occurrence of fits. In this case, I had started with a question about fainting attacks since this was considered more familiar to the woman than fits. Once a woman answered about fainting attacks, she would be asked further about fits. In case she reports to have had a fit then more questions would be asked to see whether she really knew about the problem or someone else had informed her about the problem. She would even be asked if it was the first incident, if so, eclampsia would have been the likely diagnosis. A woman could have been a known epileptic and this would have been suspected if she reported to have had fits while not pregnant.

Some complications were easier to enquire about than others. In the case of prolonged labour the woman is unlikely to know the duration of true labour [whose active phase commence at 3 centimetres dilatation of the cervix (World Health Organization, 2007)]. Many women take their durations of labour from the time they first notice contractions, so this will tend to be an over-estimate of 'true labour' even more so if the woman has experienced the physiological Braxton Hicks contractions and taken them to be true labour. Therefore for this complication further

questions were asked to try to give a clue as to whether the situation was obstructed labour or not. Such questions included the duration of intense labour pains and the urge to bear down, assuming that intense pains are more likely to be ‘true’ labour pains, and the sensation to bear down indicates the expulsion stage of birth. A question was also asked whether someone tried to pull the baby out. Although there are recommendations against such practice, if such information is given then it would suggest that the labour was difficult, and hence very likely to be an obstructed labour.

In the process of constructing a questionnaire, I had extensively discussed with my supervisors and after constructing it, I pilot tested it in front of them to check on the feasibility and informativeness of questions. After constructing the questionnaire, once finalised, it was translated into ‘*Kiswahili*’ language.

### **6.3.8 Execution of interviewing**

#### **6.3.8.1 Supervision of interviewing**

Three field supervisors were selected to supervise the field work. The supervisors’ main roles included co-operation with the IC-DSS contact person in each village, and liaison with the village leaders regarding mobilization of women who were identified beforehand to be eligible for the study.

The supervisors also supervised all the interviewers during the interviewing stage to ensure good research practice and a smooth data collection process. They made sure that the ethical and consent procedures were followed and that all logistic issues ran smoothly. At the end of each day, each supervisor inspected questionnaires of three to four interviewers by going through each questionnaire to ensure that the questionnaires were filled properly. In case of incompleteness, the supervisor immediately contacted the interviewer so that she/ he re-visited the interviewee the next day for completion of the questionnaire.

The field supervisors were experienced in supervision since they had been working at the Ifakara IC- DSS as interview supervisors for a minimum of three years.

#### **6.3.8.2 Interviewers**

Ten interviewers received a two days training regarding field preparations, the objectives of the study and the interviewing process. The questionnaire was thoroughly discussed to ensure that all

the questions were well understood. In case of any difficulty or misunderstanding, I would make clarifications. As a preparation for the interviewing process, the interviewers were given an opportunity to 'role play' and rehearse. Likewise, I provided assistance and guidance whenever they faced any difficulty during the rehearsal.

The interviewers also pre tested with some equivalent women from a village not in the study sample. Fifty women were interviewed. The difficulties encountered during the interviews were discussed and a solution was agreed, that the order of some sections was altered to make the interview process easier.

### **6.3.8.3 Follow up of non response cases**

The protocol to be followed was that if a woman who was listed to be recruited could not be found at her house, then the interviewer would call twice more before that woman was declared a non response case. However, as has been mentioned earlier that the survey data collection took place during the rainy season which meant that some women would have moved to their family sites for cultivation. Therefore, if an interviewer was told by neighbours that a woman she was seeking had gone away for cultivation, then the interviewer would mark the woman as 'away farming' and make no further calls. However, in case a woman could not be found at her house due to other reasons then follow-up would persist as per protocol.

### **6.3.9 Ethics and confidentiality**

All the women approached for interview, were explained briefly about the objectives of the study and were asked for a written consent before the interview. They were assured about the confidentiality and that the information recorded would be analysed anonymously. The women, who consented, were then interviewed in a place where they thought was conducive for them and had privacy. For young girls who were below 18, who had given birth, a special assent form was prepared whereby their parents or guardians were also asked to sign as witnesses. In the case that such girls were married then, by the customs of Tanzania, they could sign the assent form without a witness. For all women who could neither read nor write, they were asked to apply a thumb print if they agreed to participate in the study (A copy of consent and assent forms are provided in **Appendix IV (a) & IV(c)** respectively).

The interviewers were well trained and experienced in interviewing women in the Kilombero IC-DSS area, so in case of an emotional situation, the interviewers would handle the situation by counselling the woman and not proceed with the interview unless the woman stated that she agreed to proceed with the interview.

Women who reported to have any medical complication during the interview would be directed to the health system within the study area.

### **6.3.10 Preparations for analysis**

#### **6.3.10.1 Data entry**

The information extracted from the Swahili version of the questionnaire was entered electronically into the computer by six experienced clerks using a Microsoft FoxPro software programme.

#### **6.3.10.2 Data cleaning**

Data was exported from Microsoft FoxPro software programme to SPSS software version 14. All the variables labels in the data set and responses of open ended questions were back translated into English language.

Data cleaning was then undertaken to maximise quality before analysis. All records were checked to ensure that they had a unique identification number and that there were no duplicates or blank records. There were neither duplicates nor blank records.

The frequency distributions were summarised for all categorical variables to visualize any obviously abnormal value. Using a syntax command, a list of records showing defects was produced. In this way, such a record could be cross-referenced to the questionnaire; hence any data entry error detected could be corrected in the dataset. Related variables were cross tabulated so as to identify any logical error. For instance a positive response to 'self reported bleeding' (general) should be followed by an indication of the 'the stage of pregnancy at which the bleeding occurred' (antenatal, labour, postpartum). If it is not then perhaps the original 'yes' is a data entry error. Where such an inconsistency in such information was found, then the respective questionnaire would be retrieved so that the data could be checked and any error that might be found dealt with. Cross tabulations would then be repeated to confirm correction.

### 6.3.10.3 Data coding and re coding

After thorough data cleaning, some variables were recorded to new (revised) variables such as 'age' to 'age group'. Furthermore, some string variables such as 'previous histories of fits' were automatically recoded to numeric variables. Some open ended variables such as 'reasons for the antenatal visits' were assigned indicative numeric codes.

New variables were created to indicate SMM conditions according to their stage of presentation. For instance severe intra partum bleeding was coded as 'yes' if the intra partum bleeding reported was accompanied by use of at least two fully soaked pieces of 'kanga' or blood transfusion services.

After coding for the various specific SMM conditions, broad categories of SMM conditions were created, defined by timing – antenatal (AN), intrapartum (IP) and postpartum (PP). For example, the category (any) IP SMM was coded 'yes' if any one or more of the set of IP SMM conditions was coded 'yes' (obstructed labour, severe intra partum bleeding and intra partum eclampsia). Similarly PP SMM indicates any of puerperal sepsis, postpartum haemorrhage and postpartum eclampsia SMM.

### 6.3.10.4 Statistical methods of analysis

Data analysis of the community survey findings included descriptive and inferential statistics as follows:

Descriptive statistics- was done using SPSS version 14 whereby categorical variables were tabulated to display frequencies and percentages. The variables included those under broad subgroups such as socio-demographic characteristics, self reported symptoms both volunteered and prompted, incidence of SMM with its subtypes, antenatal attendance, birth and emergency complication readiness plans. Graphs were used to show comparison of different variables between the community study and that of the hospital study described in **Chapter 5**.

Inferential statistics- The incidence of SMM with its subtypes were calculated as well as the confidence intervals. Where an association between two categorical variables was required, a Pearson's chi square test was used to test the association whereby a 'p value' of less than 5% was considered a statistically significant association.

## 6.4 Results

In the survey, 1331 women were identified to be eligible for interviewing. However, out of these women, only 690 (51.8%) could be interviewed. The other 641 could not be interviewed due to reasons such as women travelling to their remote family farm sites for cultivation (434), being out of the district (202), maternal deaths (4) and being mute (1). All the women approached had consented for interview. There were no outright refusals.

### 6.4.1 Demographic description of the study sample

The age of respondents of the community interview survey ranged from 16 to 47 years with a mean age of 28.03 years and standard deviation of 6.5 years. **Table 6-2** shows the age distribution among all the respondents. As can be seen, the majority, three quarters, were between 20 and 34 years while the remainder were adolescents or above 34 years of age.

**Table 6-2: Age distribution among the respondents**

Variables	No of cases N = 690	Percentage
Age		
<20	58	8.4
20-24	171	24.7
25-29	192	27.8
30-34	145	21.0
≥35	124	18.1

The parity distribution among respondents is shown in **Table 6-3** below. As can be seen, the women interviewed were predominantly of parity less than 5.

**Table 6-3: Parity distribution among respondents**

Variables	No of cases N = 690	Percentage
Parity	# 689	
1	105	15.2
2	142	20.6
3	137	19.9
4	122	17.7
5	71	10.3
6	43	6.2
7	33	4.8
8	21	3.0
9-11	15	2.2

# Number of interviews available for analysis is less than total 'N' due to missing values

**Table 6-4** shows the distribution of various socio-demographic characteristics for all the women interviewed. As can be seen, most of the women interviewed were married and had received at least primary school education. The activity mostly performed by the respondent was small scale farming 598 (87.6%) while a few had reported being employed 2 (0.3%) and doing petty business 26 (3.8%).

**Table 6-4: Socio-demographic factors among women interviewed**

Socio-demographic factors	No of cases N = 690	Percentage
<b>Marital status</b>		
<i>Married</i>	593	81.5
<i>Not married</i>	71	10.3
<i>Widow</i>	7	1.0
<i>Divorced</i>	16	2.3
<i>Others</i>	3	0.4
<b>Educational level attained</b>		
	# 689	
<i>None</i>	116	16.8
<i>Primary</i>	555	80.6
<i>Secondary</i>	18	2.6
<b>Occupation</b>		
	# 683	
<i>Housewife</i>	57	8.3
<i>Farmer</i>	598	87.6
<i>Small business</i>	26	3.8
<i>Employed</i>	2	0.3

# Number of cases is less than total 'N' due to missing values

#### 6.4.2 Symptoms of morbidity

The symptoms reported by respondents were of two types. The volunteered symptoms as defined earlier were symptoms reported after being asked a non specific question while prompted



symptoms were reported following an enquiry about a specific symptom. Furthermore the symptoms were categorized as clinically major meaning a symptom which is suggestive of a potentially life threatening condition commonly causing maternal mortality, while the clinically minor was considered of minimal clinical significance. In the survey, among all respondents, there were 42 (6.1%) who could not remember whether they had experienced any symptoms or not at any stage of pregnancy. Of the remainder 112 (16.2%) said they had had at least one symptom while 536 did not have any symptom (77.7%).

**Table 6-5** shows the volunteered symptoms reported by respondents that have been classified as 'clinically major'. Abnormal vaginal bleeding was the most commonly reported 'major' symptom, followed by swelling of legs and fever. In the table, there is a woman who had mentioned 'ruptured uterus' as a symptom she had experienced during childbirth.

**Table 6-5: Symptoms volunteered by respondents (no prompting) and categorized as 'clinically major'**

Type of major morbidity	Stage of pregnancy				Any stage N=648	%
	During pregnancy	During childbirth	During Postpartum	Unspecified		
Abnormal vaginal bleeding	10	35	22	3	71	11.0
Swelling of legs	8	1	1	1	11	1.7
Fever	8	0	1	0	9	1.4
High blood pressure	7	1	0	0	8	1.2
Headache	0	0	2	4	6	0.9
Fits	4	1	1	0	5	0.8
Abnormal vaginal discharge	3	0	0	1	4	0.6
Nasal bleeding	1	0	1	0	2	0.3
Ruptured uterus	0	1	0	0	1	0.2
Chest pain	1	0	0	0	1	0.2

\* Some row totals are less than the total of the frequencies across the three stages of pregnancy because one or more women reported that complication at more than one stage

**Table 6-6** shows the volunteered symptoms which were classified as 'clinically minor'. Abdominal pelvic discomfort was the dominant symptom presenting almost twice that of nausea and vomiting which was the second in the list.

**Table 6-6: Symptoms volunteered by respondents (no prompting) and categorized as 'clinically minor'**

Type of clinically minor morbidity	Stage of pregnancy				Unspecified	Any Stage N=648	%
	During pregnancy	During childbirth	During postpartum				
Abdominal pelvic discomfort	16	1	0	0	17	2.6	
Nausea/vomiting	7	0	0	2	9	1.4	
Backache	3	0	1	1	4	0.6	
Painful legs	2	0	1	0	3	0.5	
Overdue	1	0	0	0	1	0.2	
Boils	1	0	0	0	1	0.2	
Painful private parts	1	0	0	0	1	0.2	
Palpitation	1	0	0	0	1	0.2	
'Pregnancy not seen'	1	0	0	0	1	0.2	

\* Some row totals are less than the total of the frequencies across the three stages of pregnancy because one or more women reported that complication at more than one stage

**Table 6-7** shows the symptoms which were affirmed by women when prompted with specific questions, (i.e. prolonged labour, abnormal vaginal bleeding, abnormal discharge after delivery), and for abnormal discharge gives additional information obtained as to source (vaginal or wound), and whether accompanied by fever. Further additional data will be presented on the following pages for abnormal discharge, and for the other prompted conditions.

The overall rate of affirmed symptoms was 36.1%, with a substantial contribution of prolonged labour to be followed by symptoms of abnormal vaginal bleeding.

**Table 6-7: Symptoms affirmed by respondents after prompting**

Type of major morbidity	Stage of pregnancy				%
	During pregnancy	During childbirth	During postpartum	Any stage	
Prolonged labour (n=686)	~	178	~	178	25.9
Abnormal vaginal bleeding (n=686)	14	33	26	71	10.3
Abnormal discharge* (n=683)	~	~	47	47	6.2
Fits (n=684)	5	1	3	7	1.0
Total				249	36.1

\* includes vaginal and wound discharge where one woman did not specify the site of abnormal discharge

\*\* Some row totals are less than the total of the frequencies across the three stages of pregnancy because one or more women reported that complication at more than one stage

~ Not applicable

In the next tables (**Table 6-8 to 6-12**), I shall present more information regarding the prompted symptoms which have been shown in **Table 6-7**. The information was achieved following a series of questions regarding the major prompted symptoms.

With regard to abnormal vaginal bleeding, the number of fully soaked pieces of *kanga* was used to quantify the amount of blood loss. As previously mentioned in 6.3.5, use of at least two fully soaked pieces of *kanga* for protection was considered a blood loss of at least 500 mls by Prata and co authors (2005). **Table 6-8** gives information on the number of pieces of *kanga* used by women who had reported abnormal vaginal bleeding. Out of all the 71 women, about 65% had used at least 2 fully soaked pieces of *kanga*.

Furthermore, among all women with abnormal vaginal bleeding, 45 (64%) of them had sought health care treatment. **Table 6-9** shows the distribution of place of treatment which were accessed by women reporting abnormal vaginal bleeding. As can be seen, out of these 45 women, the majority 38 (84.5%) had gone to lower level health facilities and pharmacies.

**Table 6-8: Number of kanga used and women who received treatment among women with abnormal vaginal bleeding**

Variable	Frequency (out of n = 71)	Percentage
Number of fully soaked <i>Kanga</i>	# 69	
0	1	1.5
1	23	33.3
2	29	42.0
≥ 3	16	23.2
Women who received treatment		
Yes	45	64.3
No	25	35.7

# Number of cases is less than total 'n' due to missing values

**Table 6-9: Place of treatment accessed by women with abnormal vaginal bleeding**

Place of treatment accessed	Frequency (out of n = 45)	Percentage
Pharmacy	12	26.7
Dispensary	17	37.8
Health centre	9	20.0
Hospital	7	15.5

With regard to fits, other accompanied symptoms included headache and poor vision. **Table 6-10** presents information regarding the accompanied symptoms of fits, the person notifying a woman about her fits and prior history of fits. As can be seen, all women reporting of fits also reported to have had a headache, while 4 had poor vision. Five women recognised their episodes of fits while 4 women reported to have been told by a health provider and 3 by their relatives. Two women reported to have experienced fits during the other previous pregnancy, while one woman experienced fits while not pregnant.

**Table 6-10: Responses regarding further questions related to fits**

Question	Frequency (out of n = 6)
Accompanying symptoms	
<i>Headache</i>	6
<i>Poor vision</i>	4
Informant regarding woman's fits	
<i>Herself</i>	5
<i>Health staff</i>	4
<i>Relatives</i>	3
History of prior fits	
<i>In previous pregnancy</i>	2
<i>When not pregnant</i>	1

With regard to prolonged labour of more than 12 hours duration, **Table 6-11** presents more information which was enquired regarding the labour. As can be seen, there were 178 women who had reported a prolonged labour. However not all records indicated all the information regarding the labour. Therefore I shall present the percentages of responses out of the records which were available. The intensity of strong labour pains was enquired as this was considered an indicator for true labour. The sensation to bear down was also considered a sign of a woman approaching or being at the stage of expulsion of the baby (i.e. second stage of labour). In **Table 6-11**, the majority of women (85.2%) had intense labour pains lasting between 12 and 24 hours.

Only a few, about 15% had it lasting for more than a day. With regard to the sensation to bear down, the majority out of the 160 women had the sensation lasting between 12 and 24 hours while a few (1.9%) had it for more than a day. There were attempts made by either aunties, mothers in law or traditional birth attendants to pull the baby out during childbirth in 7.3% of women (data not shown). As can be seen in the same table, the majority had attended health facilities. The referral rate was 20.8% while the caesarean section was 16.9%.

**Table 6-11: Responses regarding further questions related to prolonged labour**

Question	Frequency (out of n = 178)	Percentage
Duration of intense labour pains in hours/ days	# 169	
12- <24 hours	144	85.2
≥ 1 day	25	14.8
Duration of sensation to bear down in hours/ days	# 160	
12- <24 hours	157	98.1
≥ 1 day	3	1.9
Use of health facility	# 170	
Yes	119	70.0
No	51	30.0
Cases referred to hospital	# 120	
Yes	25	20.8
No	95	79.2
Mode of delivery	# 177	
Vaginal	146	82.5
caesarean	30	16.9
Vacuum	1	0.6

# Number of responses is less than total 'n' due to missing values

**Table 6-12** shows information about abnormal vaginal discharge. As can be seen, slightly less than half of all the 43 women with vaginal discharge reported to have experienced a discharge which is copious in amount, while a third had sought treatment for the problem. In 30% of the cases, a treatment was given in injection form.

**Table 6-12: Responses regarding further questions concerning vaginal discharge**

Question	Frequency (out of n= 43)	Percentage
Amount		
<i>Minimal</i>	7	16.3
<i>Average</i>	15	34.9
<i>Much</i>	21	48.8
Smell		
<i>None</i>	15	34.9
<i>Minimal</i>	18	41.9
<i>Much</i>	10	23.3
Chills		
Yes	14	32.6
No	29	67.4
Seeking health care		
Yes	15	34.9
No	28	65.1
Place of treatment		
<i>Dispensary</i>	7	16.3
<i>Health centre</i>	6	14.0
<i>St Francis</i>	2	4.7
Type of treatment		
<i>Injection</i>	9	20.9
<i>Others</i>	34	79.1

### 6.4.3 From symptoms reported to classification of SMM

This section will describe the proportion of women developing SMM among those who had reported any of the clinically major symptoms. The symptoms which will be presented are abnormal vaginal bleeding, prolonged labour and abnormal vaginal discharge.

#### 6.4.3.1 SMM cases among those with abnormal vaginal bleeding

Table 6-13 presents the symptoms of abnormal bleeding. As can be seen, all the women who reported abnormal bleeding during ante partum period were categorized as SMM, while for the intra partum bleeding they were 71.4% and 84.6% for the postpartum bleeding.

Table 6-13: For women reporting of abnormal bleeding, number of cases classified as SMM, by timing of pregnancy

	Timing of abnormal vaginal bleeding					
	Ante partum		Intra partum		Postpartum	
	N = 15		N = 35		N = 26	
	n	%	n	%	n	%
Classified as SMM	15	100	25	71.4	22	84.6

#### 6.4.3.2 SMM cases among those with prolonged labour and abnormal discharge

Table 6-14 shows the proportion of women reporting prolonged labour and abnormal discharge who develop SMM in the form of obstructed labour and puerperal sepsis respectively. As can be seen in the table, 17.4% of women reporting prolonged labour were classified as having obstructed labour, while the majority (85.1%) of those reporting abnormal discharge had puerperal sepsis. The origin of the discharge was vaginal (43), abdominal wound (3) and unspecified (1).

Table 6-14: Clinically major symptoms (of prolonged labour and abnormal discharge) as reported by women on prompting by development of SMM

	Prolonged labour		Abnormal discharge	
	N=178		N=47	
	n	%	n	%
Classified as SMM*	31	17.4	40	85.1



### 6.4.3.3 Comparison of symptoms reported and SMM among women attending hospital for delivery and others

Women attending St Francis hospital for delivery were compared with others who delivered elsewhere regarding their reporting of symptoms (when prompted) and their classified SMM across all stages of pregnancy. **Table 6-15** shows that women who reported about symptoms on prompting were more likely to have attended to St Francis for delivery. The same table shows that women having any SMM and intra partum SMM were likely to have delivered at St Francis hospital. However, this was not the case for ante partum and postpartum SMM.

**Table 6-15: Comparison of symptoms and SMM development among women attending St Francis hospital for delivery and others who deliver elsewhere**

Variable	St Francis N=206		Elsewhere N=322		Pearson chi square test		
	n	%	n	%	chi test	df	P value
Prompted symptoms	# 199		# 307		15.7	1	<0.001
<i>Reported</i>	95	47.7	93	30.3			
Any interview based SMM	# 201		# 309		23.9	1	<0.001
<i>Present</i>	57	28.4	35	11.3			
AP interview based SMM*	# 22		# 14		0.2	1	0.629
<i>Present</i>	8	36.4	4	28.6			
IP interview based SMM	# 201		# 309		32.6	1	<0.001
<i>Present</i>	39	19.4	12	3.9			
PP interview based SMM	# 201		# 309		1.0	1	0.319
<i>Present</i>	20	10.0	23	7.4			

\* Number is remarkably less than 'N' (206) due to missing information for delivery at St Francis hospital

# Number of responses is less than total 'N' (206) and (322) due to missing values

#### 6.4.4 Incidence of SMM types

In the following two sections (i.e. 6.4.4 & 6.4.5); I shall present the annual incidence of SMM types which were obtained from the community interview survey. In this particular situation, I shall use a specific denominator which comprises of women who had delivered within the study year i.e. May 2008 to April 2009. As can be noted in the beginning of 6.4, that 690 women were interviewed. However, only 663 had delivered within the study period. **Table 6-16** therefore shows the incidence of SMM types among all women who were interviewed during the study period. As can be seen in the table, any SMM bleeding carried the highest incidence to be followed by puerperal sepsis.

**Table 6-16: The incidence of SMM types in the community interview based survey**

Type of SMM	Frequency (out of N = 663)	Percentage	95%CI
Any SMM bleeding	55	8.3	6.3-10.7
<i>Ante partum</i>	13	2.0	1.1-3.5
<i>Intra partum</i>	24	3.8	2.4-5.6
<i>Postpartum</i>	22	3.5	2.2-5.2
Puerperal sepsis	38	5.7	4.1-7.8
Obstructed labour	29	4.4	3.0-6.2
Eclampsia	6	0.9	0.3-2.0

#### 6.4.5 Overall incidence of SMM across all stages of pregnancy

A classification of SMM across all stages of pregnancy was derived from the major symptoms reported by the women during the survey together with other related features such as the type of treatment received, as shown in **Table 6-1**.

**Table 6-17** shows the incidence of (any) SMM by timing within pregnancy. [Note that some women were classified as SMM at more than one stage of pregnancy, so the overall SMM

frequency (111 ‘any SMM’) is not the total of the three pregnancy-staged SMM frequencies (17, 54 & 59). The incidence of any SMM (ante natal to postnatal) among the women interviewed was 16.7%. Antenatal SMM was about one third as common as intra partum and postpartum SMM, which had similar rates.

**Table 6-17: Classification of SMM among women interviewed**

Type of SMM	Frequency (out of N = 663)	Percentage	95%CI
Any SMM	111	16.7	14.0-9.8
Ante partum (AP) SMM	17	2.6	1.5-4.1
Intra partum (IP) SMM	54	8.1	6.2-10.5
Postpartum (PP) SMM	59	8.9	6.8-11.3
Any IP/ PP SMM	102	15.4	13.3-19.2

#### 6.4.6 Estimate of community incidence of SMM in one calendar year

With regards to the community incidence of SMM, this will be estimated using information obtained from the survey and the Ifakara Centre Demographic Surveillance System (IC-DSS) as far as the maternal deaths and all the number of women who were to be interviewed for the survey.

There were 4 maternal deaths in the community which were caused by SMM according to the verbal autopsy report. These women would have been eligible for interview if they did not die. There were also 1331 that were eligible to be interviewed for the survey. However, as described earlier that only 690 could be interviewed and of these 633 had childbirth within the study period. **Table 6-17** shows that among the 663 women interviewed during the study period, 111 had any SMM (16.7%). Therefore by estimation 1331 women, who were to be interviewed, would have given an estimate of 223 women with any SMM. On adding the 4 maternal deaths, a figure of 227 SMM cases was reached which is 17.1% of all the women eligible for interviewing in the community.

### 6.4.7 Antenatal clinic coverage and birth plans

Table 6-18 gives information related to antenatal care. As can be seen, the majority of the respondents had attended antenatal clinic and had lived within 2 hours distance to the clinic. Slightly more than half of the women attended at least 4 times. The majority had received health education and guidance regarding place of delivery.

Table 6-18: Antenatal clinic information among women interviewed

Antenatal clinic variables	n	Percentage
Attendance at antenatal clinic at least once	# 683	
Yes	667	97.7
No	16	2.3
Walking distance from home to nearest clinic (hours)	# 674	
<1	404	59.9
1-2	217	32.2
>2	53	7.9
Number of antenatal visits	# 674	
1-3	310	46.0
4	240	35.6
5-10	124	18.4
Antenatal education on pregnancy care	# 666	
Yes	556	80.5
No	110	15.9
Antenatal clinic guidance on place of delivery	# 669	
Yes	567	84.8
No	102	15.2
Complications detected at antenatal clinic	# 670	
Yes	73	10.9
No	597	89.1

# Number of responses is less than total N (690) due to missing values

### 6.4.7.1 Birth preparedness and emergency complication readiness plans

**Table 6-19** shows the birth and emergency complication readiness plans among women who were interviewed. The majority of respondents reported to have prepared themselves regarding birth and emergency complication.

**Table 6-20** shows the different types of items which the respondents had prepared towards birth. As can be seen, the majority had prepared for several items for delivery such as kanga, razor blade, and plastic basin. They also had set aside money to be used for delivery and other related expenses.

**Table 6-19: Birth preparedness measures and emergency complication readiness among respondents**

Responses regarding birth planning	N	Responding 'yes'	Percentage
Birth preparedness measures	679	663	97.6
Emergency complication readiness	681	555	81.5

**Table 6-20: Responses regarding preparations for birth**

Items prepared towards birth	Frequency (out of N=685 responding 'yes')	Percentage
Clothes/ kanga	619	90.4
Cotton wool	28	4.1
Gloves	65	9.5
Medicines	25	3.7
Money	267	39.0
Razor blade	537	78.4
Plastic mattress cover	176	25.7
Syringes	27	3.9
Surgical sutures	169	24.7
Plastic basin / bucket	466	68.0
Soap	30	4.4

**Table 6-21** shows the items prepared for emergency complication as well as if any other person was involved in the preparations. As can be seen in the table, the majority reported to have set aside money for emergency circumstances. About 13% had moved to stay with their relatives who were living near a health facility.

Other people were involved in the emergency preparations for the women while pregnant. These included mainly their husbands and mothers.

**Table 6-21: Responses regarding planning for an emergency complication**

Interview question	Frequency (out of N=685 responding 'yes')	Percentage
Items prepared in case of emergency complication		
<i>Transport</i>	78	11.4
<i>Moving near a health facility</i>	88	12.9
<i>Money</i>	536	78.2
<i>Arrangements for an escort</i>	4	0.6
Other people prepared in case of emergency complication		
<i>Husband/ partner</i>	418	61.0
<i>Mother</i>	103	15.0
<i>Mother in law</i>	31	4.5
<i>Sister in law</i>	15	2.2
<i>Brother in law</i>	8	1.2
<i>Father in law</i>	5	0.7
<i>Uncle/ aunt</i>	5	0.7
<i>Grandmother</i>	2	0.3
<i>Traditional birth attendant</i>	2	0.3
<i>Reverend</i>	1	0.2

**Table 6-22** shows an association of antenatal clinic attendance as well as the health education given at the clinic with the birth plans implemented by the women who were interviewed. As can be seen in the table, women who neither attended antenatal clinic nor had received health education during antenatal period were more likely not to have any plans prior to birth. The association was statistically significant (p value 0.002 and 0.031 respectively).

On the other hand with regard to emergency complication readiness plans, **Table 6-23** shows the there were more or less the same proportion of women having had emergency complication readiness plans among those who attended antenatal clinic and those who did not attend the clinic. Women receiving health education at the antenatal clinic were more likely to have had an emergency complication readiness plan (p value <0.001).

**Table 6-22: Association of having a birth plan with antenatal clinic attendance, and with health education provided at the antenatal clinic**

Variable	Birth Plans				Total	Pearson Chi square test		
	Yes		No			Chi sq	df	P value
	n	%	n	%				
Antenatal clinic attendance					# 676	9.594	1	0.002
Yes	649	98.0	12	85.7	661			
No	13	2.0	2	14.3	15			
Antenatal clinic education					# 660			
Yes	543	83.9	8	61.5	551	4.633	1	0.031
No	104	16.1	5	38.5	109			

# Number of responses is less than total N (690) due to missing values

**Table 6-23: Antenatal clinic attendance and education given in relation to emergency complication readiness plans among respondents**

Variable	Emergency complication readiness				Total	Pearson Chi square test		
	Yes		No			Chi sq	df	P value
	n	%	n	%				
Antenatal clinic attendance					# 678	0.025	1	0.875
Yes	541	97.8	122	97.6	663			
No	12	2.2	3	2.4	15			
Antenatal clinic education					# 661			
Yes	465	86.3	87	71.3	552	16.166	1	<0.001
No	74	13.7	35	28.7-	109			

# Number of responses is less than total N (690) due to missing values

### 6.4.8 Events around delivery

**Table 6-24** illustrates different issues around the decisions to be made regarding the place of delivery. It also illustrates the mode of delivery and the actual place of delivery. As it is shown, the majority of the women had already decided on the place of delivery while they were pregnant. When labour started, the proportion of women deciding on their own about the place of delivery was the highest compared to other decision makers such as husbands, mothers and mothers in law. There were a few who reported not to be having anyone deciding on their place of delivery. The majority of the women had a normal vaginal delivery and had attended health facilities. About a third of the women had delivered at home



**Table 6-24: Mode and place of delivery, and delivery decision-making**

Question	Frequency				
	Total	Yes		No	
	N=690	n	%	n	%
Made decision on place of delivery while pregnant	# 680	566	83.2	114	16.8
Person who decided on place of delivery once labour set in	# 669				
<i>Pregnant woman</i>		394	58.9	275	41.1
<i>Husband</i>		105	15.7	564	84.3
<i>Others</i>		59	8.8	610	91.2
<i>Mother</i>		58	8.7	611	91.3
<i>Mother in law</i>		49	7.3	620	92.7
<i>None</i>		3	0.4	666	99.6
<i>Traditional birth attendant</i>		1	0.1	668	99.9
Mode of delivery	# 683				
<i>Vaginal</i>		631	92.4	52	7.6
<i>Caesarean</i>		51	7.5	632	92.5
<i>first twin vaginal second twin by caesarean</i>		1	0.1	682	99.9
Place of delivery	# 681				
<i>Home</i>		222	32.6	459	67.4
<i>On the way to health facility</i>		13	1.9	668	98.1
<i>traditional birth attendant</i>		5	0.7	676	99.3
<i>Dispensary</i>		131	19.2	550	80.8
<i>health centres</i>		85	12.5	595	87.5
<i>Hospital</i>		225	33.0	456	67.0

### 6.4.8.1 Barriers in seeking, reaching and receiving health care services

Table 6-25 presents the barriers a woman faces at different levels when she wants to seek access and receive health care services during childbirth. As can be seen, about a tenth of women in the survey were faced with difficulties in seeking health care services during childbirth. The barriers included lack of transport, and lack of money.

Almost the same proportion had difficulties in reaching health facilities due the same problems of transport and money besides the long distance from their residences to the health facilities. There were very few who reported to have difficulties in receiving health care services upon arrival at a health facility.

**Table 6-25: Barriers and reasons for delay in seeking, reaching and receiving health care during among respondents**

Question	Total N	Responding 'yes'	
	responding	n	%
Barriers to seeking care?	682	69	10.1
Explanation for barriers to seeking care	685		
<i>lack of money</i>		23	3.4
<i>lack of transport</i>		42	6.1
<i>had to wait for husband</i>		25	3.6
<i>had to wait for mother</i>		6	0.9
<i>had to wait for mother in law</i>		3	0.4
Barriers to reaching health facility?	680	61	9.0
Explanation for barriers to reaching health care	685		
<i>Long distance</i>		39	5.7
<i>lack of money</i>		14	2.0
<i>lack of transport</i>		47	6.9
Barriers to receiving health care?	675	18	2.7
Explanation for barriers to receiving health care	685		
<i>congestion of patients</i>		2	0.3
<i>few staff</i>		6	0.9
<i>inadequate medicine</i>		3	0.4

### 6.4.9 Comparison of community and hospital study samples and findings

Comparison of community and hospital study samples was based on variables such as age, parity, and antenatal clinic attendance, outcome of baby at birth and the incidence of SMM with its subtypes.

#### 6.4.9.1 Age distribution

Figure 6-1 below shows a comparison of age distribution between the two studies. As can be seen, the community survey (IC-DSS) sample was predominantly between 20 and 29 years, with adolescents a small proportion (8%). On the other hand the hospital study sample had women who were predominantly of younger age, with 52% under 25 years. The proportion of adolescents in the hospital sample was almost three times that in the community survey, whereas the community survey had over 50% more women aged 30 or over.

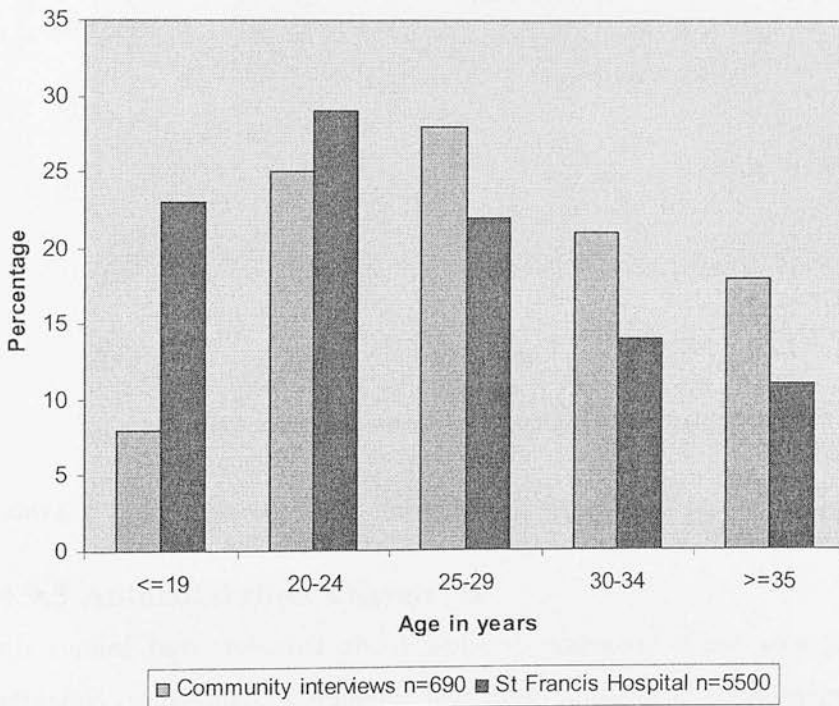


Figure 6-1: Comparison of age distribution in the community and hospital studies

### 6.4.9.2 Parity distribution

Figure 6-2 shows a comparison of parity across the two studies. Multiparous women were twice as common the community compared to the hospital study. In both studies, women with parity between 2 and 4 were predominant, but the proportion of women with parity one in the hospital study was almost thrice that of the community survey.

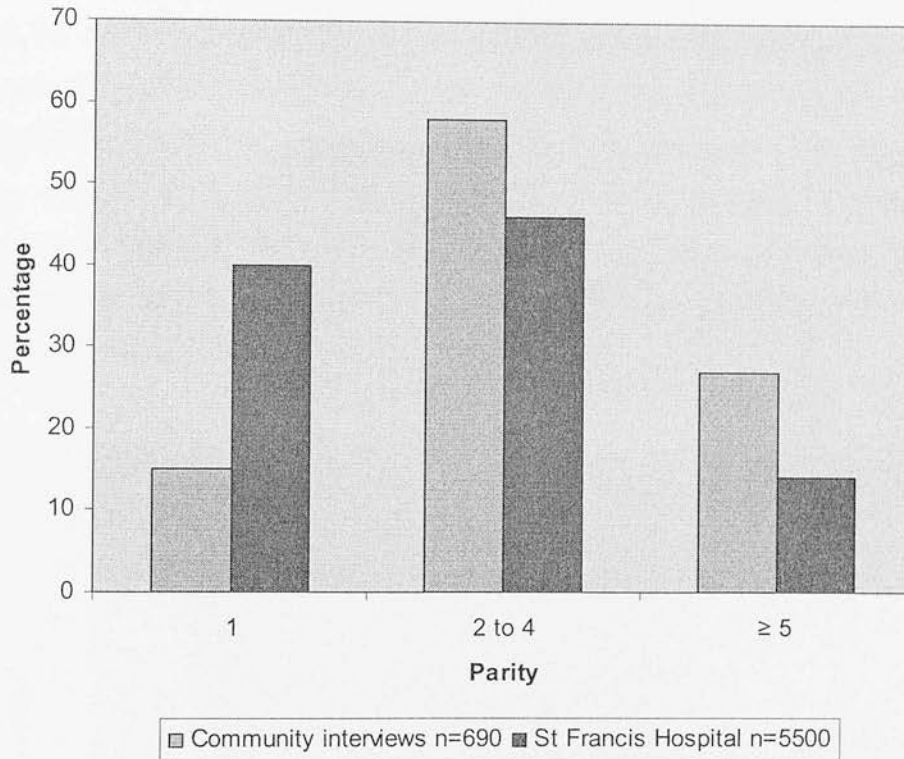


Figure 6-2: Comparison of parity distribution in the community and hospital studies

### 6.4.9.3 Antenatal clinic attendance

Both studies have reported about women's antenatal clinic attendance at least once. The community study had information regarding subsequent attendances. Therefore comparison between the two study samples could only be done for the single antenatal visit. In both studies, the majority (96%) had attended at least once at the clinic.

#### 6.4.9.4 Outcome for babies born

The outcome of babies was assessed in both studies at birth and the community survey enquired about the condition of the child at the time of interview. However, for the hospital study no further assessment was done on the condition of the baby. Comparison of the condition at birth for babies in both studies showed good outcome among the majority of babies. For the community study, 3.2% (21/658) of the babies born alive had died during infancy.

#### 6.4.9.5 Incidence of SMM by pregnancy stage and subtype

Figure 6-3 shows a comparison of the incidence of pregnancy stage of SMM occurrence between the two studies. The main difference between the studies was that in the hospital study intra partum SMM was nearly three times as common. The rate of intra partum only in the hospital was slightly more than double compared to that of the community survey. On the other hand the rate of postpartum SMM only was slightly lower for the hospital study compared to the community survey.

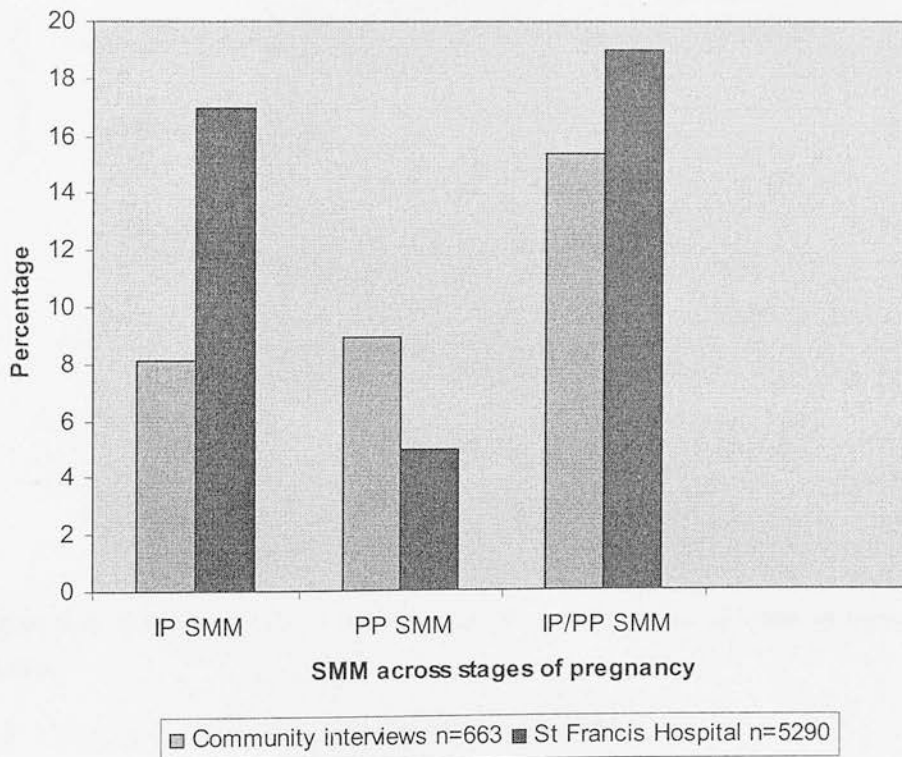


Figure 6-3: Comparison of incidence timing of SMM in community and hospital studies

Figure 6-4 shows a comparison of distribution of the intra partum and postpartum SMM types in the two studies. The top three conditions of SMM differed across the studies. In the community survey, the most predominant conditions were puerperal sepsis, obstructed labour and severe intra partum bleeding while in the hospital study the conditions included obstructed labour, intra partum and postpartum eclampsia. By far the biggest disparity was for obstructed labour, which the hospital incidence was almost two and a half times higher than the community survey. The rate of eclampsia in the hospital study (both intra partum and postpartum) was, respectively, double and treble the community figures. On the other hand, in the community survey, the rate of puerperal sepsis and intra partum haemorrhage were found to be higher than the hospital study (five-fold and four-fold, respectively).

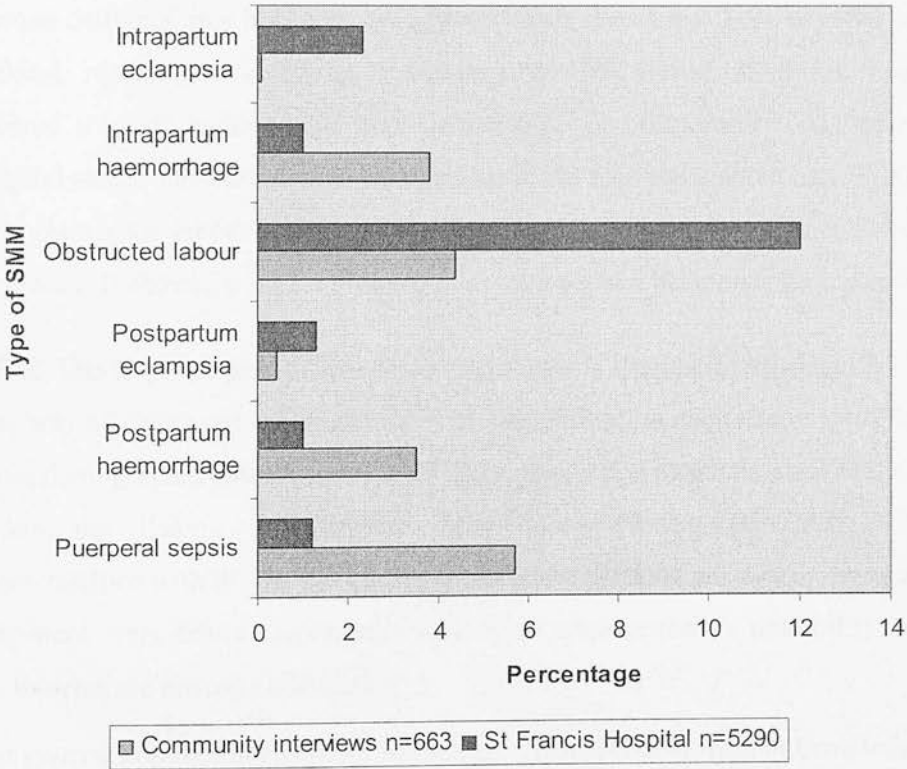


Figure 6-4: Comparison of distribution of IP and PP types of SMM in community and hospital studies

**6.5 Discussion specific to this chapter**

This section comprises of a discussion on the community interview survey findings. During the course of the discussion, I shall also quote some of the responses I obtained from in-depth

interviews of maternal health stakeholders which was briefly mentioned in 4.4 (iv) and had been conducted within the same study area.

### **6.5.1 Salient findings of the study**

The three commonest symptoms reported by women were prolonged labour, abnormal (copious) vaginal bleeding, and abnormal vaginal discharge. The incidence of SMM (any) among all interviewees was 16.7% while that of 'any intra partum and/or postpartum' SMM was 15.4%, ante partum only (2.6%), intra partum only (8.1%) and postpartum only (8.9%). About half of women attended antenatal clinic at least four times. The majority of women reported having had birth and emergency complication readiness plans before delivery. Slightly more than half of the women had made a decision on their own regarding the place of delivery. About two thirds of the women delivered in a health facility. Few women reported to have experienced barriers either in seeking, reaching or receiving health care services during childbirth. The community study showed a lower incidence of intra partum and/ or postpartum SMM when compared to the hospital study. The community intra partum SMM alone was about half of the hospital IP SMM, with obstructed labour and intra partum eclampsia being substantially lower than the hospital incidence. It showed a higher proportion of intra partum haemorrhage and puerperal sepsis.

### **6.5.2 Do the respondents truly represent their population?**

One way of ruling out selection bias is by comparing the respondents with the whole population using demographic data. **Appendix IV (g)** shows a few characteristics of the Kilombero women within the Ifakara Demographic Surveillance System (IC-DSS). Comparison of the characteristics with that of the women interviewed shows similarity in the age distribution except that there were fewer respondents who were adolescents. A possibility could be that fewer adolescents are having child birth.

The general population had more women having high parity, five of them being between 12<sup>th</sup> and 14<sup>th</sup> parity. With regard to the marital status, the majority in both groups were married although the proportion was higher among the women interviewed. More women in both groups had delivered their babies in health facilities; the proportion of home delivery being slightly higher in the general population.

Therefore having presented the similarities of some characteristics between the two groups, it is appreciated that the women interviewed reflect the women of child bearing age in the Kilombero IC-DSS.

### **6.5.3 Women's reporting of symptoms suggestive of maternal morbidity**

The symptoms reported by women were grouped as clinically major and minor. The major ones were considered of clinical importance since they were suggestive of conditions commonly causing maternal deaths. However, this does not imply that the minor were less important. They could as well lead to SMM but the possibility was minimal. The symptoms are presented as they were reported by women such as ruptured uterus, high blood pressure and 'pregnancy not seen' (Table 6-5 and 6-6). For such symptoms, a possibility could be that it was a direct translation of the conditions by the health providers. This is encouraging as it shows the commitment of the health providers in communicating health related matters to their clients. Under normal circumstances a hypertensive state is asymptomatic unless in severe form where it manifests as severe headache, blurred vision and ultimately convulsion.

### **6.5.4 Interview based SMM classification**

The use of a combination of symptoms and specific features such as type of treatment improves the possibility of a classified SMM. For instance, prolonged labour if delivered by caesarean section or vacuum gives an indication that such labour is likely to have had an element of obstruction. Regarding abnormal discharge, it was thought that any copious foul smelling discharge which may or may not be accompanied by fever could indicate puerperal sepsis. There were other measures which would give a clue pertaining to severity. For example use of an injection for treatment. This could be an antibiotic in injection form which is usually given in a serious infection unless it is just given for prophylaxis in case one anticipates an infection. On the other hand some measures could also indicate the mildness of the problem if the woman did not bother seeking health care and remained well or if she just received medication at the pharmacy. However this is not always the case since other factors could impede the woman to use health care facilities such as ignorance, cultural myths and lack of money.



### **6.5.5 Incidence of interview based SMM**

The incidence of any SMM (antenatal to postnatal, derived from self reported symptoms by interviewees) was 16.7%. The rate is close to that estimated by Midhet (2007) in rural Pakistan which was 20%. The two studies were both conducted in resource constrained countries, hence are likely to face multiple socio-demographic and health system related challenges which predispose to poor maternal outcome. The incidence of ante partum SMM and intra partum SMM were 2.6% and 8.1% respectively. These rates were each lower than the ones reported by Nilses et al (2002) in rural Zimbabwe. One of possible explanation for such a difference in the incidence is the difference in the classification of SMM between the two studies. Nilses et al (2002) had included all cases of prolonged labour irrespective of the mode of delivery whereby in our case I had labelled prolonged /obstructed labour as the ones who were delivered by caesarean or vacuum. In addition other non specific cases were also included in the morbidity classification whereas this study only included SMM classification which was derived from the symptoms reported by the women. Therefore it should be noted that there were some common conditions causing maternal mortality in Tanzania which could not be addressed in the specific questions during the interview, unless a woman mentioned them. For instance issues related to HIV/AIDS could not be discussed due to ethical issue, unless a woman mentioned the problem herself. In addition conditions such as severe anaemia in cardiac failure were not included in the specific questions as their symptoms might be related to other physiological or pathological conditions.

### **6.5.6 Birth and emergency complication readiness plans**

It is encouraging to find that most of the community survey respondents had received some form of education at the antenatal clinic regarding the dangers signs, birth plans, emergency preparations and delivery at a health facility. Similar findings were obtained by Mutiso and co authors (2008) who investigated on antenatal mothers receiving antenatal care in Kenya. In contrast, Pembe (2009) in Rufiji district in Tanzania, found that only about half of the women were able to cite at least one of the danger signs. However, Pembe's study questions used in his questionnaire were not similar to our study questions, hence a comparison has been made with caution. Sarker (2010), in the same district found a slightly higher percentage. A possibility for such a difference in the two districts within the same country could be lack of knowledge by the health providers regarding the importance of health education to women attending clinic. The

antenatal clinics could also lack health providers as well as community interventions programmes to disseminate such important messages. As described in **Chapter 2** that a woman knowing the early dangers signs and having birth and emergency complication readiness plans is likely to act promptly in case of an emergency situation or during labour (John Hopkins Program for International Education in Gynaecology and Obstetrics, 2004) In so doing the three types of delays which were also explained in **Chapter 2** are likely to be avoided thus saving women and newborns' lives.

As can be seen in **Table 6-19** that majority of the women interviewed in our community survey had had birth and emergency complication readiness plans when pregnant. Although none of the women mentioned arrangements for a blood donor or wanting their husbands to accompany them during labour, they mentioned their husbands being among other people who were prepared as well (**Table 6-21**). Our survey findings are better compared with that of Ilisayu and co authors (2010) in Northern Nigeria, who found that less than a third of the men made plans for their wives' health care, transport, delivery as well as baby and mother's clothes. This area in Nigeria is distinct in the sense that it has the worst maternal mortality ratio in the world (Adamu et al., 2003). In this area there is a high rate of women having unplanned pregnancies, a low rate of antenatal attendance and health facility use for delivery *ibid*. These factors could highly influence the low rate of birth plans, emergency complication readiness plans and men's involvement in ensuring safe childbirth for the wives.

Our community study also showed that women attending antenatal clinic were more likely to have birth plans as compared to the ones who did not attend the clinic (**Table 6-22**). This can be anticipated as it has been seen in the results whereby, those who attended antenatal clinic were counselled on several pregnancy matters such as identification of danger signs and plans regarding the place of delivery. On the other hand there was more or less equal number of women having emergency complication readiness plans among those who attended as well as those who did not attend clinic (**Table 6-23**). A possible explanation would be that the entire community is being sensitised the importance of preparations for emergency complication, hence even those who did not attend the clinic had prepared themselves. This is very likely since even among the maternal health stakeholders interviewed, the majority had mentioned about birth preparations and emergency complications readiness plans.

Mrs VM, an elderly woman mentioned about the preparations as follows:

*'Whenever my daughters became pregnant or my daughters in law, we would make sure that we prepare for necessary items such as a plastic basin, at least two pairs of kanga, razor blade and money. I am sorry if I have forgotten to mention other items, since it has been a while since my girls became pregnant.'*

A traditional birth attendant also emphasized the importance of a woman and her family to have established birth and complication readiness plans as follows:

*'There is a great need for these women to have an established birth plan. I, in collaboration with the village health workers would approach all pregnant women who live within our vicinity. Our role is to educate them on how to prepare themselves for delivery as well as other preparations in case of an emergency.'*

A 38 year old man described his strategy towards birth and emergency complication readiness plans, for his wife as follows:

*'Whenever my wife becomes pregnant, I would make sure that I have money, say 30,000 shillings (≅20 USD). This money will be kept aside for her delivery expenses and in case of an emergency complication. In order to get the money, I would sell some bananas (from my farm) to business men who come from Dar-es-salaam. In case the bananas are not yet ready to be sold, I would rent out a piece of land to some farmers who would pay me about 15,000 shillings (≅10 USD).'*

It is encouraging to see that husbands are very willing to assist their wives and are engaged in all the birth and emergency complication readiness plans. In Uganda, Kakaire and co authors (2011), found that among emergency obstetric referrals in rural Uganda, their counterparts were likely to be involved if they had attained at least secondary education [OR 3.8 95%CI (1.2-11.0)] and had a formal occupation [OR 1.6 95%CI (1.1-2.5)]. However the association could be confounded by other factors such as high wealth quintile enabling the husbands to implement the birth and emergency complication readiness plans.

The community survey findings show that women had to purchase some supplies such as gloves, plastic mattress cover and syringes. In Tanzania, maternal health services are supposed to be free of charge in all public health facilities while in some faith based hospitals, women are charged a small amount of service fee. However, in reality since these hospitals are usually overwhelmed with many patients, shortage of supplies is inevitable. Recently there has been a launch in Tanzania of a campaign to accelerate reduction of child and maternal mortality, whereby the president has announced that all pregnant women attending clinics countrywide will be provided with delivery kits (Mwachang'a, 2011). Such an initiative would be very helpful to these women

especially the ones in the rural areas who are faced with multiple challenges including financial constraints.

The other birth plan measure which was mentioned by a few women involved moving to a nearby health facility or to a relative who resided near a health facility. This would usually be a hospital whereby *comprehensive* Emergency Obstetric Care services (CEmOC) are provided. Such a measure is quite helpful for women who are staying in remote areas hence avoid unnecessary delays in case of emergency. In St Francis referral hospital, there is a maternity waiting ward whereby women living in remote areas could stay there before labour is established. One of the challenges faced by these women is that they need to have adequate money for their upkeep.

In our study, a few women mentioned having involved the traditional birth attendants in their birth plans. This is quite common in the rural areas. Traditional birth attendants used to conduct deliveries in Tanzania, however the national policy recommends that traditional birth attendants should remain as a link between the rural women and the health system, since evidence has now shown that they cannot provide adequate emergency obstetric care whenever an emergency complication arises. Therefore they are asked to escort these women to the health facilities and not conduct the deliveries. A 52 year old traditional birth attendant explained about their current status with regard to conducting deliveries as follows:

*'These days we do not conduct any deliveries here, instead we escort a labouring woman to the health facility. During that time, we would always check if a woman has carried all the required items such as gloves, a razor blade, pieces of kanga and some money.'*

### **6.5.7 Decisions on place for delivery**

The survey findings in **Table 6-24**, showed that the majority of the women had a mandate on deciding about the place of delivery for their pregnancies, and even when labour started, they are the ones who decided where to go. The husbands were also involved in the decision-making process. This is encouraging news, especially taking into consideration that it is happening in a rural setting where there are more socio-cultural gender factors favouring men. To some extent, it indicates that probably the community is informed about the importance of empowering women so that they are able to make informed choice about different reproductive health issues including childbirth issues. Such findings are contrary to many African societies where a woman does not have the power to decide on her own issues including health issues.

A study done by Danforth and co authors (2009) in Kasulu district, in north-western Tanzania, found that a woman was likely to go to a health facility for delivery if there was an agreement between her and her partner that delivery in a health facility was very important [OR 2.15 95%CI (1.32-3.52)].

### **6.5.8 Barriers to women's access to health care**

The survey shows that only a few women were faced with barriers in accessing health care services due to lack of transport and money (Table 6-25). Availability of transport is challenging to most of the people in remote areas in Kilombero district and any other rural areas of Tanzania. This is contributed by lack of communal transport. Therefore people have to hire transport which is usually very costly. In the district, there are ambulances but are very few to cater for the whole populations needs. Moreover, occasionally villagers are forced to contribute money for fuel which they may not have especially in emergency situation. This problem was also addressed by one of the district's council officials during the in-depth interviews as follows:

*'The District is having six ambulances which are stationed at St Francis referral hospital and the health centres. We are trying as much as possible to make sure that the ambulances operate for 24 hours. Unfortunately, there are times whereby we run short of fuel because of the minimal budget allocated for the district. In such a case, the relatives of the patients who need the facility are forced to contribute some money for fuel.'*

A 35 year old man was interviewed and complained of the challenges they face in reaching health facilities when their wives have an emergency complication. He said:

*'We do understand the importance of sending our wives to St Francis hospital in case of an emergency complication. However, the challenge which I and several other community members face is lack of enough money to pay for the fuel. The ambulance is available but the problem, we need to pay for the fuel which is about 80,000 shillings (≈60USD). The amount is too much for us.'*

Although, only a tenth of women in the survey reported to have been faced by barriers in either seeking, reaching or receiving health care, such challenges are predominant in many developing countries as has been illustrated in several studies (Magoma et al., 2010, Kawuwa et al., 2007).

## **6.6 Comparison of community and hospital study population**

### **6.6.1 Age and parity**

The community survey population were predominantly between 25 and 29 years with adolescents being the least. In contrast the hospital study population had predominantly a

younger population. Adolescents were almost a third of the hospital study (**Figure 6-1**). This could have been explained by the fact that young women are more likely to have obstetric complications necessitating them to be admitted in hospital as can be seen in findings of the hospital study (**Chapter 5**). The same group are likely to seek health care unlike the older ones. This has been found in the community study where there were a smaller proportion of adolescents who had delivered at home compared to the other age groups [20.7% v between 30% & 40% (data not shown in the table of results)]. Similar findings have been reported by the Tanzania Demographic and Health Survey (2005).

In both study populations, the number of women reduced in frequency from 30 years onwards. This corresponds generally to the population distribution of Kilombero district (Kilombero District Council, 2009). However, the hospital study had a smaller proportion of older women. As explained in **Chapter 5** that this group of women are expected to have fewer complications. The other reason could be that fewer women are having children at this age either due to the natural decline in fertility or use of permanent contraceptive methods. Generally having fewer adolescents giving birth indicates a good sign that adolescent pregnancies are few hence complications related to adolescent pregnancies are avoided as reported by (Kurth et al., 2010).

With regard to parity, the community study population included a larger proportion of multiparous women (44.2%) compared to the hospital study population (13.9%) [**Figure 6-2**]. A possible explanation could be that fewer multiparous women are attending the hospital because they feel that they are experienced with regard to birth related issues and that they also have a low risk towards complicated deliveries, hence can deliver at home. This has been seen in the community study where 40% of multiparous women had delivered at home as compared to primiparous (20%) and those with parity between 2 and 4 (31%) [Data is not shown in the table of results]. The same study showed a lowest proportion of women in the multiparous group who underwent caesarean section when compared to primiparous (22%) and those with parity between two and four (9%) [Data not shown in the table of results].

### **6.6.2 Use of antenatal clinic**

The antenatal attendance rate (of at least one visit), was high in both studies. The findings are similar to the Tanzania Demographic Health Survey (National Bureau of Statistics (NBS) [Tanzania] and ICF Macro, 2011) and slightly higher than the neighbouring countries (Kenya

National Bureau of Statistics (KNBS) and ICF Macro, 2010, Uganda Bureau of Statistics (UBOS) and Macro International Inc, 2007). It may reflect the continuous educational messages which are delivered in the community regarding the importance of attending antenatal clinic and other health related issues. Such community interventions have proved to give a positive impact regarding antenatal attendance and delivery by a skilled attendant as well as use of health facilities when an obstetric complication arises. The districts involved with the intervention programmes include Kwimba and Misungwi in northern Tanzania and Mtwara rural in the south-eastern part (Indu et al., 2010).

In the community survey, most of the clinics were within two hours distance from the women's residences. This could have influenced their attendance to the clinic as has been reported also by Matthews and Gubhaju (2004) in Nepal.

During in-depth interviewing, it was noted that about a third of the interviewees mentioned the importance of antenatal clinic attendance. For instance, Mrs YM, an elderly lady, who was both a mother and mother-in law, emphasized the following:

*'All pregnant women should attend antenatal clinic. That is where they receive health education on how to take care of their pregnancies and they also get their immunization. In fact there are a lot of important things happening at the clinic.'*

Both studies showed a high antenatal coverage of at least one visit. As described in **Chapter 5** that it was not possible to get accurate coverage for other subsequent visits due to poor documentation and absence of ante natal cards in some cases. Therefore further comparison could not be made with the community survey. Issues around the quality of antenatal care have already been discussed in **Chapter 2**.

### **6.6.3 Incidence of SMM with its subtypes**

The incidence of intra partum and or postpartum SMM types in the community interview study was lower than that reported in the hospital SMM incidence study. This could be influenced by several factors such as inability of the woman to correctly report a complication pointing towards an SMM. However when one visualises the specific SMM subtypes as reported in **Figure 6-6**, some of the interview based reported SMM, such as intra partum haemorrhage and puerperal sepsis were of higher incidence than the hospital study. This could be due to lack of use of prophylactic medications such as oxytocin and antibiotics for those not using health facilities.

However previous authors have documented overestimation of women's reporting of symptoms especially those who have used health facilities (Stewart and Festin, 1995). On the other hand the hospital based diagnosis could reflect a higher incidence since it includes even conditions which are asymptomatic such as some of the hypertensive conditions as mentioned above. The other difference could be on the classification since it may include other conditions which cannot be perceived by a woman. For instance in the hospital, a woman might be diagnosed as having impending uterine rupture and is grouped under the dystocia group or obstructed labour. In such a situation, it would be difficult for a woman to correctly report on the problem unless she had an obvious prolonged difficult labour or if she was told by a health care provider about her condition. This could have been an explanation of having almost a threefold increase of hospital based diagnosis of obstructed labour than the community survey (**Figure 6-6**).

#### **6.6.4 Outcome of SMM**

The majority of mothers in both studies had a good outcome in the sense that they were alive following the maternity period. This is usually the case in most circumstances. However, there were reported maternal deaths in both studies. In the hospital study the Maternal Mortality Ratio (MMR) during the study year was 335 per 100,000 live births (See **Table 5.8** for number of live births and **Table 5-28** for maternal deaths). The community study's MMR was 300 per 100,000 births (ie 4 maternal deaths per 1331 births). The number of live births could not be used as a denominator since it was not known for the non respondents.

In both studies, the majority (96%) of the babies were alive at birth. For the hospital study , the condition of the babies are not known after being discharged home since no follow up was made, however the community study inquired about the condition of the babies from birth up to the time of survey. About 3 % of the babies had died between the period of birth and survey (Data not shown).

### **6.7 Short summary of this chapter**

This chapter has described a community survey addressing the incidence of interview based SMM and women's health seeking behaviour. Issues of decision- making process on the place of delivery and the barriers the women face in accessing health care have also been discussed.



## **7 Towards validation of interview ascertainment of Severe Maternal Morbidity**

### **7.1 Introduction**

In the previous two chapters, the results for the two studies undertaken have been reported– the hospital based study addressing the annual incidence of intra partum and postpartum Severe Maternal Morbidity (SMM) at St Francis referral hospital, and the community survey within the hospital’s rural catchment area, to estimate community incidence of SMM. This chapter will describe analyses which were carried out to validate the interview based intra partum SMM classification.

### **7.2 Objectives**

The primary objective of the analyses in this chapter is to compare the community study SMM classifications with the hospital study classification, for those women in the interview study who also attended the hospital for delivery in the time period of the hospital study. This would give insight to the validity of using women’s reporting of symptoms to ascertain SMM.

### **7.3 Methods**

#### **7.3.1 Validation of interview based SMM classification**

Initially, I had intended to validate the interview based SMM classification for all women who had used any health facility for delivery, by review of their medical records for that delivery. However, failure to obtain research funding placed financial and time constraints, so I restricted myself to a preliminary validation for women who had attended at St Francis referral hospital during childbirth. This was possible for the community survey women who had delivered at St Francis hospital during the hospital SMM incidence study period described in **Chapter 5**. Therefore, validation of the interview-based SMM classification was undertaken for the subset of interviewees who had gone to St Francis referral hospital for delivery.

#### **7.3.2 Study design**

Paired design comparing each woman’s interview-based SMM classification against a ‘gold standard’, that is the hospital-based SMM classification for her delivery.

### 7.3.3 Data extraction for validation

Figure 7-1 below summarises the data extraction process towards validation of the interview based SMM classification. The field supervisors in the community interview survey provided me with a list of names of interviewees in the survey, who reported to have attended St Francis referral hospital for delivery. The list comprised of name of the interviewee, a study identification number, age, name of the village and date of admission at St Francis hospital (A copy of a blank list is provided at **Appendix V**).

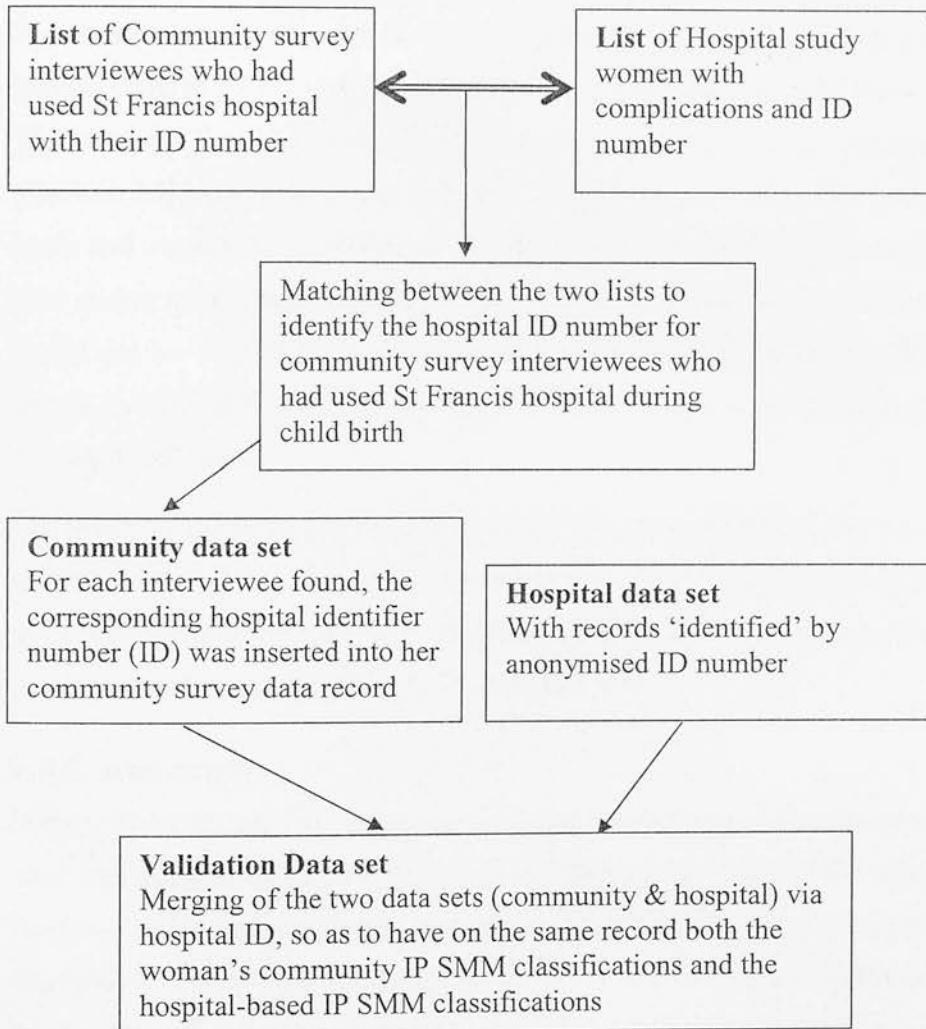


Figure 7-1: A diagram showing how information was obtained from hospital study data set for validation of community based intrapartum SMM

Clearly I did not wish to store the names of interviewees electronically, so I undertook matching of the names via paper lists of names as indicated in **Figure 7-1** and when a match was achieved, I would enter the (anonymised) hospital study identification number electronically into her community study record (which also had a unique community study ID number).

The community survey data set was then merged with the hospital SMM study data, extracting from the latter all data variables needed for the validation (i.e. the hospital SMM variables).

#### **7.3.4 Methodological drawbacks**

The validation process was faced with drawbacks since the community and hospital study periods differed [ie hospital (July 2008 to June 2009) vs community (May 2008 to April 2009)]. Therefore the lists of hospital study did not include names of community survey respondents who had delivered in May and June 2008. The problem could not be avoided since the hospital study had already been conducted before the community survey had commenced. And it was only during the preparations for the survey when we learnt from the IC-DSS coordinator, that it would not be feasible to interview women who had had childbirth within the hospital study period (ie July 2008 to June 2009) since some information had not been collected until the next routine ICDSS visits.

The nature of the recording of antenatal diagnosis in the hospital study was questionable as most of the records had been extracted from the antenatal cards only and not from the actual treatment given while in the antenatal ward. Therefore the interview based ante partum SMM lacked a gold standard hospital ante partum SMM to compare with.

#### **7.3.5 Assumption**

During the validation process, it was noted that the hospital study list had only names of women who had complications severe enough to necessitate hospital full admission either in the antenatal ward, postnatal ward or intensive care unit. Women having normal uncomplicated deliveries and who were discharged home within 6 to 24 hours of delivery were not included in the list. Therefore an assumption was made that whoever delivered normally and was not in the hospital study list had no intra partum SMM.

### **7.3.6 Statistical methods**

A description of the study sample for those who attended St Francis referral hospital for delivery was done in relation to others who went elsewhere. Inferential statistics using Pearson chi square test was used to determine if there was any association regarding demographic factors, reported prompted symptoms and the use of St Francis hospital.

The incidence of SMM according to stage of pregnancy was ascertained. Furthermore the measures of agreement between interview based and hospital based intra partum SMM classifications were calculated in the form of sensitivity and specificity with their respective confidence intervals. The term ‘sensitivity’ denotes the proportion of true positives which are correctly identified as positives while ‘specificity’ denotes the proportion of true negatives which are correctly identified as negatives (Kirkwood and Sterne, 2003). The results are displayed in 7.4.

### **7.3.7 Ethics and confidentiality**

Before women consented to participate in the interview study they were informed that for those who had their childbirth at St Francis referral hospital, some of their hospital records, solely those pertaining to the pregnancy that was the topic of the interview, would be retrieved, under strict confidentiality, for purpose of extracting diagnoses made at the time, for research. However, once the correct records were identified, all other subsequent analysis will be undertaken anonymously.

## **7.4 Results**

A total of 173 women out of 690 who were interviewed in the community based survey, reported to have been attended at St Francis referral hospital during childbirth. Since the intention was to give an estimate of one calendar year, the denominator used will be 663, as these were the women having childbirth within the study year. Therefore, the 173 women who had been to St Francis for delivery are the ones whose information will be validated using hospital study SMM classification as a gold standard. The validation process is described below.

### **7.4.1 Comparison of women delivering at St Francis hospital with others**

**Table 7-1** compares the demographic characteristics among women who had been to St Francis hospital for delivery and others who delivered elsewhere. As shown, there was a higher

proportion of: unmarried women, adolescents, and those being Para one in women who attended at St Francis hospital for delivery. The association was statistically significant (p value <0.05).

**Table 7-1: Comparison of age and parity among women attending to St Francis hospital for delivery with others who delivered elsewhere**

Variable		St Francis N=173		Elsewhere N=490		Pearson Chi square test		
		N	%	n	%	chi test	df	P value
Age	<20	22	12.7	34	6.9	8.7	4	0.068
	20-24	44	25.4	121	24.7			
	25-29	38	22.0	144	29.4			
	30-34	33	19.1	105	21.4			
	≥ 35	36	20.8	86	17.6			
Parity	1	47	27.2	54	11.0	25.8	2	<0.001
	2-4	87	50.3	297	60.6			
	≥ 5	39	22.5	139	28.4			

**Table 7-2** compares the socio-demographic characteristics among those who had been attended at St Francis for delivery with others who delivered elsewhere. As can be seen there were more single mothers among those who went to St Francis hospital, the association being statistically significant. (p=0.006)

**Table 7-2: Comparison of socio-demographic factors among women who attended to St Francis hospital with others**

Variable	St Francis N=173		Elsewhere N=490		Pearson chi square test		
	N	%	n	%	chi test	df	P value
Marital status							
<i>Married</i>	138	79.8	432	88.2	7.5	1	0.006
<i>Not married</i>	35	20.2	58	11.8			
Educational level attained			# 488		1.3	2	0.525
<i>None</i>	25	14.5	89	18.2			
<i>Primary</i>	143	82.7	386	79.1			
<i>secondary</i>	5	2.9	13	2.7			
Occupation	# 170		# 486		3.3	3	0.344
<i>Housewife</i>	18	10.6	37	7.6			
<i>Farmer</i>	143	84.1	430	88.5			
<i>Small business</i>	9	5.3	17	3.5			
<i>Employed</i>	0	-	2	0.4			

# Number of responses is less than total N due to missing values

#### 7.4.2 Incidence of interview based SMM among women who had used St Francis hospital

The incidence of SMM across all stages of pregnancy is shown in **Table 7-3**. As can be seen intra partum SMM was the dominant, while ante partum SMM carried the least incidence.

**Table 7-3: Incidence of interview based SMM across all stages of pregnancy for women who had used St Francis hospital for delivery**

Type of SMM	Frequency N= 173	Percentage	95% CI
Ante partum (AP) SMM	8	4.6	2.0-8.9
Intra partum (IP) SMM	37	21.4	15.5-28.3
Postpartum (PP) SMM	17	9.8	5.8-15.3
Any IP/ PP SMM	47	27.2	20.7-34.4
Any SMM (AP IP PP)	52	30.1	23.3-37.5

#### 7.4.3 Matching achieved between interview survey list and hospital study list

There were 173 records for the women who had been attended to St Francis for delivery, of which 48 names could be matched with names from the hospital study list. These women had had a '*full admission*' where they stayed in the maternity ward for more than 24 hours, hence were in the hospital study list of names. For the remaining 125, their names were not in the hospital study list since they had had a '*transient admission*' (ie normal uncomplicated delivery) and were discharged home within 6 to 24 hours of childbirth.

#### 7.4.4 Validation measures to assess the accuracy of interview based intra partum SMM.

**Table 7-4** presents summary statistics of the performance of the interview based ascertainment of intra partum SMM. The statistics which are used were 'sensitivity' which measures the proportion of actual positives which are correctly identified as positives and 'specificity' which measures the proportion of negatives which are correctly identified as negatives. As can be seen

from the table, the sensitivity for the interview based intra partum SMM was 59.3% while the specificity was 85.6%.

**Table 7-4: Sensitivity and specificity for the interview based SMM classification**

Interview based SMM	IP	Hospital based intra partum SMM classification		
		Yes	No	Total
Yes		16	21	37
No		11	125	136
Total		27	146	

Sensitivity (16/27)= 59.3% 95% CI (38.8-77.6)

Specificity (125/146)= 85.6% 95% CI (78.9-90.8)

#### 7.4.5 Discordance between interview and hospital based intra partum SMM classification

**Table 7-4** shows that, 21 cases had been classified as intra partum SMM by interview but were not having SMM by hospital classification. Further exploration was done to assess the discordance in order to avoid under or over reporting in the classification. This was achieved after checking specific obstetric conditions which were documented in the hospital data sets and which excluded these cases from being classified as an intra partum. Out of these cases, 14 had a normal uncomplicated childbirth while 3 had been diagnosed in the hospital as having foetal distress, one had oligohydramnios and another one had been diagnosed of having had a previous caesarean birth. There was one woman who was diagnosed of obstructed labour and another one as having a footling breech

However, **Table 7-4** also shows that 11 women were not classified as intra partum SMM by interviews, had hospital classification as intra partum SMM cases. Of the group, the reason they were classified as intra partum SMM in the hospital data were: 6 cases for hospital diagnosis of cephalopelvic disproportion (CPD), 1 had obstructed labour, 3 had placenta praevia and one case had uterine rupture.



## **7.5 Discussion specific to this chapter**

The sensitivity for the interview based SMM classification was 59.3% (95% CI 38.8-77.6) and specificity was 85.6% (95% CI 78.9-90.8).

Women's reporting on different morbid symptoms differed depending on the type of question. For instance more women reported on vaginal bleeding when they were prompted with specific question on bleeding. Their reporting could also be influenced by their perception on how severe the problem was. On the other hand, excessive vaginal bleeding during labour is subjective especially if a woman will be labouring with passage of amniotic fluid. A woman may also be in so strong labour pains that she cannot concentrate on the severity of bleeding unless she is informed by a health attendant or accompanying relative. Other factors may include whether or not she had experienced the same problem during previous pregnancies.

Some of the symptoms were subjective hence could indicate more than one condition. For instance fever could indicate malaria or sign of infection while abdominal discomfort could indicate pressure symptoms caused by the growing foetus or sign of urinary tract infection. The subjective nature was taken into consideration, thus incorporating common conditions which are linked when classifying the different interview based SMM as discussed below.

### **7.5.1 Recall bias**

As noted in **Chapter 3** that there has been a methodological concern regarding the validity and reliability of women's reporting of severe maternal morbid conditions. This has been due to inability of a woman to correctly recall what exactly had happened to her while she had the severe morbidity condition. Other authors considered that a woman would be able to recall a severe condition since she would have experienced such an adverse condition that she would not forget. Filippi and colleagues (2000) found that the validity of women's reporting was not affected for up to a period of four years since childbirth. This was supported earlier by Stewart and Festin (1995) who found similar results. In this validation study, the women had delivered within a period of one year. Therefore recall bias was not anticipated.

### **7.5.2 The approach for validation**

The current approach towards validating women's reporting of severe maternal morbidity has been identifying cases first at the health facilities then making a follow up to enquire about their symptoms later (Ronsmans and Filippi, 2004). In this way it is considered that the information is likely to be valid as it will be compared by that of health facility records which are usually the gold standard. This approach had been implemented by many authors (Stewart and Festin, 1995, Filippi et al., 2000, Coolman et al., 2010).

However, in our study we could not identify cases retrospectively in the hospital and then make a follow up at their residences since in Tanzania there are no established residential addresses due to poor infrastructure especially in rural areas. It was only recently where a project has been piloted in one region to introduce official physical addresses in terms of area postcode (Ubwani, 2010). Thus as described in **Chapter 4**, I opted to conduct the survey in the Ifakara Centre Demographic Surveillance System (IC-DSS) where all women who had undergone childbirth in a specified period are known and their residences could be located due to specific IC-DSS house numbers.

### **7.5.3 Validation of SMM classification and not symptoms reported**

Our approach of validating an interview based SMM classification has been different from other authors who validated specific symptoms reported by women against documented hospital records (Stewart et al., 1996, Bhatia and Cleland, 1995, Fortney et al., 1996, Ronsmans et al., 1997) or type of treatment given (Filippi et al., 2000). The reason for using the classification based approach was that I was not sure how sufficient the hospital records would be to document the specified symptoms as opposed to the working diagnosis.

### **7.5.4 Method of matching for validation**

The data used for validation comprised of about one third of all cases involved in the community survey. Fewer women were in the actual validation process since it was focussed only on intra partum events. Furthermore, the hospital based study period involved women who had delivered two months later than those involved in the interview survey. Therefore some of the records had to be excluded since they did not have corresponding information. In so doing the number of validation cases became even fewer. Therefore one may not be confident enough to infer about the population.

The validation data also had a larger proportion of women who had delivered normally hence their information was not available in the hospital study list which was used for matching. However, one may assume that the women who had normal deliveries were discharged home practically in good state otherwise they would have been included in the hospital list which showed all other women who remained in the maternity wards due to obstetric complications. A good number of them were women who had delivered by caesarean section.

There were cases that were labelled as having intra partum SMM such as abnormal bleeding but were discharged home immediately after normal delivery. In such a case, one would wonder whether the bleeding reported by the woman was physiologically abnormal since it is difficult to have accurate estimation during labour especially if the labour is accompanied by passage of amniotic fluid. The perception of SMM symptoms could be subjective when a woman is in strong labour pains as she is likely to exaggerate or under report an SMM event. Other authors have reported over estimation of symptoms such as vaginal bleeding in women who had been attended at health facilities (Stewart and Festin, 1995).

The study showed a low response rate of 52% due to many of the women having moved to their remote farms for cultivation. Although this problem was anticipated beforehand and that measures had been taken prior to survey by increasing the number of villages to attain the calculated sample size, one cannot ignore the high non response rate. The fact that majority of the non respondents had gone for farming, one would wonder whether the remaining women were not physically fit for farming, hence likely to cause a selection bias. However, majority (93.5%) of the interviewees had expressed themselves as being well and were performing their day to day activities (results not shown).

### **7.5.5 Sensitivity and specificity**

As reported in the **Table 7-4** the sensitivity of the interview based intrapartum SMM was 59.3% while the specificity was 85.6%. These according to Ronsmans (1997) show an acceptable sensitivity of at least 50% but a low specificity since it is less than 95%. It is difficult to make a comparison with other studies since they had calculated sensitivities and specificities for different sets of questions regarding several symptoms and not classification. Moreover they had used different definitions for the conditions. However one can assess the trend of the different conditions as far as the validity is concerned. Fillipi and co authors (2000) got disappointing

results of sensitivities and specificities of symptoms related to dystocia and puerperal infection as opposed to vaginal bleeding and eclampsia. The sensitivity in the validation study, although within the acceptable margin, is considered to be on the lower side. This could be due to relatively fewer women reporting on a symptom such as abnormal vaginal bleeding unless more probing questions were asked. The other explanation for a borderline sensitivity can be seen in **Table 7-4** whereby 11 women were classified as non intra partum SMM by interview classification but were labelled as intra partum SMM by hospital criteria. Conditions pointing towards hospital based classification were cephalo pelvic disproportion (CPD), obstructed labour and placenta praevia and ruptured uterus. All these conditions are difficult to be perceived by a woman using her own words since they are not symptom related, unless she is informed by the health staff. On the other hand some diagnosis may be particularly dependent on subjective physician factors. For instance in USA in the 1980s, there were six times more caesarean section for CPD than in Ireland among women with comparable risk status. The differences were believed to reflect cultural factors rather than real differences in the epidemiology of CPD (Sheehan, 1987). The hospital SMM incidence study described in chapter 5 showed a substantial contribution of obstructed labour among intra partum SMM cases. One may also wonder if all cases had truly reached a stage to be diagnosed as obstructed labour or were they misdiagnosed for cases such as cephalopelvic disproportion.

The specificity as has been pointed out earlier is low when compared to the recommended levels of at least 95% as reported by Ronsmans (1997). Other studies have found similar specificity in some conditions. However the lower specificity could be explained by overestimation of several symptoms pointing towards intra partum SMM. For instance a woman normally reports the symptoms according to her perception while the interview based intra partum SMM classification was formulated using the symptoms and some treatment modalities. An example is prolonged labour with caesarean section. This is classified as obstructed labour, hence an interview based intra partum SMM. On the other hand the same person might have developed another complication necessitating caesarean section such as foetal distress. Since the hospital intra partum SMM classification is based on diagnosis written by the attending doctor, if the indication for caesarean section is written as foetal distress, then this person will not be labelled as a hospital based intra partum SMM. This can be evidenced in **Table 7-4** whereby 21 cases

were being classified as intra partum SMM by interview based classification but were not labelled as intra partum SMM by hospital classification.

The confidence intervals for the sensitivity are wide as can be seen in **Table 7-4**. This could be due to a few cases.

## ***7.6 Short summary of this chapter***

This chapter has described a validation analysis of community interview based SMM. The classification was obtained from the findings of a community based interview survey described in **Chapter 6**. The validation was done to women who reported to have attended St Francis referral hospital. Therefore the corresponding hospital records were used as a gold standard.

Although the cases were too few to make any conclusive remarks, the findings have shed light on areas which need to be improved both in the interviewing process and record keeping at the health facility.

## 8 Overall discussion

This chapter presents the overall discussion regarding the hospital and community based studies which were described in **Chapters 5 and 6**, respectively. In addition, it also draws findings obtained from the validation of the interview based SMM classification in **Chapter 7**.

### *8.1 A merit of the research studies*

To my knowledge the research studies are the first to be conducted in Tanzania addressing the incidence of all intra partum and postpartum SMM. The hospital study, being conducted in a centre managing most of the complications in the district, has shed light on the clinical pattern of intra partum and postpartum SMM, which are the main conditions of maternal deaths in Tanzania and other developing countries (Mbaruku and Bergstrom, 1995, Urassa et al., 1997, Kazaura et al., 2006). Besides the incidence, other useful information includes the different related factors, some of which can be improved through appropriate preventive measures such as arrival of cases in critical condition. Furthermore the outcome of SMM across all stages of pregnancy is known as well as that of the baby. Such information is useful when one hospital is to evaluate on how best they provide emergency obstetric services. The process could be applied to other neighbouring health facilities so as to determine the performance of health facilities in an area.

The community interview survey has given an estimate of the incidence of SMM with its types. In addition to the estimates, the findings have provided us with substantial information on the health seeking behaviour for these rural women across all the stages of pregnancy. The women have given information on different measures taken for birth preparation as well as for an emergency complication. Other useful information has been the decisions around the place of delivery and the challenges faced when wanting to access health care services.

The hospital and the community interview survey complement each other since there have been some methodological challenges in both study designs as has been described in respective chapters. Both have unique characteristics as the hospital describes the sample of cases reaching the hospital while the community gives a true representation of the population. The validation component although has few records to make conclusive remarks, adds a value as it shows how

well a woman can report symptoms which may be potentially life threatening. On the other hand the validation analysis has shown areas of deficiencies in both classifications.

The involvement of villages belonging to the Ifakara Centre Demographic Surveillance System (IC-DSS) has supplemented information on the incidence of all SMM cases even the ones who did not use health facilities since the centre conducts verbal autopsies on maternal deaths.

## ***8.2 Is Kilombero District a true representation of Tanzanian population?***

The research studies have been conducted in the Kilombero District which mostly comprises of rural areas. The socio-demographic characteristics of women residing in the district resemble that of other rural district of Tanzania (National Bureau of Statistics [Tanzania], 2005). However some of characteristics of women in our research studies showed a better outcome when compared to the situation in other rural areas. For instance, the majority of women in the community incidence study reported to have decided on their own regarding the place of delivery. Additionally men were more involved in the birth and emergency complications readiness plans for the women. In the hospital study, some of the findings showed a relatively better outcome. For example, the foetal outcome among all types of maternity admissions. It could be that the study area, being a part of the Demographic Surveillance Site has been exposed to community intervention initiatives which in turn influence a better outcome of several reported issues. The people in the area could also be subjected to repeated interviews which may influence their responses to the community interview survey.

Regarding the hospital incidence study, a better foetal outcome of women admitted during the intra partum period could reflect a better intra partum care. However since no follow up was done on the babies after delivery, one could not rule out any morbidity which might have occurred during the neonatal period.

## ***8.3 The incidence and classification of SMM***

The incidence of intra partum and postpartum SMM in the hospital was higher than that of the community. Several factors could have contributed to a higher rate. Although the classifications between the hospital and community study were not similar, a possible explanation could be that women attending at the health facilities are likely to be having more obstetric complications.

This was seen in the community study where women attending to St Francis hospital for delivery were more likely to have reported a symptom (on prompting) as well as have any SMM or intra partum SMM (Table 6-15). On the other hand there could be under-reporting in some conditions as has been seen in the validation study where 11 cases of hospital based SMM could not be classified by the interviews (Table 7-4). Another possibility in this case is that some conditions may be asymptomatic hence can only be detected by the health professionals. There were 3 cases of placenta praevia who could not be classified using data collected during the interview. The condition may be detected without any symptoms.

The hospital SMM classification is close to that of Prual et al (2000) and Waterstone et al (2001), which both are based on specific conditions. However the difference lies on the inclusion criteria. In Waterstone, obstructed labour was not included as a case. This could be due to the fact that it is a rare condition in the study area.

The incidence rates were relatively high compared to studies done in the developed world (Brace et al., 2004, Waterstone et al., 2001) but were lower compared to those done in the developing countries by Nilses et al (2002). A review of multiple socio-economical and cultural factors has already been discussed in Chapter 2.

#### **8.4 The outcome of SMM**

There were few cases of maternal deaths in both hospital and community studies. In the hospital study, the majority of the maternal deaths had arrived at the hospital in critical condition. The case fatality rate was 1.7%, higher than the World Health Organization (2009) acceptable threshold. However, although it indicates poor quality of care, recommendations are that for interpretation, it should be calculated for all facilities in an area treating cases with obstetric complications.

In the hospital study, there were no intra partum deaths. This could indicate a better intra partum care among SMM cases, however, the duration of intra partum may be so short that a woman may die during the postpartum period while a complication had started during labour.

#### **8.5 Validation of interview based SMM classification**

This was an attempt to validate the interview based SMM classification. As have seen, there were challenges in almost every stage of the process. Since the numbers were few, one cannot



make any conclusive remarks. However, the discordance between the two classifications tells us more which could have been done. At hospital level, there is a need to have a consensus on the definition of SMM conditions so as to have uniformity. This would help when one is to monitor the outcome of a special condition. An example which featured clearly was obstructed labour. The incidence was substantially higher at the hospital and was diagnosed in cases who had not reported on prolonged labour during the interviews. On the other hand since the interviews focussed on four major prompted symptoms, it could easily miss any other condition related to obstructed labour. For instance in **Table 6-5**, it is shown that there was one woman who had reported to have had a ruptured uterus. This woman could not be detected by the questionnaire to have had an intra partum SMM since the symptoms were based on prompted ones.

## **8.6 Conclusions**

1. Intra partum and postpartum SMM contributes to the burden of SMM in the Kilombero district.
2. The maternal and foetal outcome among SMM cases has been good in most cases, however there are still cases of maternal and neonatal deaths especially in women who arrive in critical state at the hospital.
3. Obstructed labour contributes substantially to the intra partum SMM at St Francis referral hospital. However, the criteria for reaching the diagnosis in the hospital are diverse.
4. Women's attendance to antenatal clinic and use of health facilities during delivery and when complications arise is fairly good in Kilombero district. However the quality of health care services could not be assessed in the research studies.
5. Although, the sensitivity for ascertaining the interview based SMM classification is acceptable according to Ronsmans (1997), the results cannot be confidently inferred since the number of cases is minimal. A remarkable discrepancy between interview based SMM classification and that of the hospital indicates methodological problems on both sides.

## **8.7 Recommendations**

1. Efforts to ensure a timely use of emergency obstetric services when complications arise should focus on multiple levels of health care facilities as well as the community at large so that women are educated on the danger signs and the lower level facilities refer emergency obstetric services to the hospital in a timely manner.
2. There is a need to have a proper guideline on ways to diagnose SMM conditions such as obstructed labour so that there is uniformity in diagnosing the problem. In so doing, the precise incidence of obstructed labour will be known. There is also a need to improve medical record keeping so that adequate information is recorded regarding clinical signs, diagnosis and treatment provided.
3. There is a need to improve the tool used for enquiring about women's reporting of severe maternal morbidity so that other related conditions are not missed out. For example further questions could be asked in case a woman had undergone a caesarean section. In this way it would have been easier to detect any SMM related condition.

## **8.8 Way forward**

I intend to disseminate the research findings to different forums such as:

1. St Francis Referral Hospital Director. He will be able to share the information with the hospital staff. Issues such as improvement of medical records will be discussed and the importance of having guidelines in diagnosing and managing cases of obstructed labour.
2. Ifakara Demographic Surveillance System, through its annual newsletter, which is distributed to all the households. The recommendations made for both the community and lower health facility levels will be shared through the news letter.
3. Kilombero District Council. Recommendations will be made to improve community interventions programmes such that addressing transport services.
4. National, Regional and International scientific conferences.
5. Publications through National, Regional and International scientific journals such as Reproductive Health Matters , African Journal of Reproductive Health and East African Medical Journal.

### **8.9 Areas for possible future research**

The research studies have shown some avenues which needs to be explored and addressed, given the opportunity and availability of resources. Such areas include:

1. The feasibility of having a standard definition and identification of SMM cases in Tanzania context.
2. Conducting criterion-based clinical audit at health centres regarding use of partograph in labour and management of emergency cases before being referred to St Francis referral hospital.
3. Conducting criterion-based clinical audit at St Francis Referral Hospital regarding issues such as use of partograph in labour in detecting obstructed labour. Other useful topics are - indications for caesarean section and medical record keeping in several obstetric emergencies.
4. Conducting a larger study to assess the validity of women's reporting of obstetric complications using a questionnaire with detailed questions in case of a caesarean delivery.

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**Appendices I-VII**



## Appendix I (a): Definition of SMM conditions

Obstetric diagnosis	Criteria
Obstetric haemorrhage ( <i>which may be caused by various conditions such as abruptio placentae , placenta praevia and cervical tear</i> )	<p>Bleeding (from birth to 42 days postpartum)</p> <p>Vaginal birth <math>\geq</math> 500 mls</p> <p>Caesarean birth <math>\geq</math> 1000 mls</p> <p>Any bleeding :</p> <p>From 22<sup>nd</sup> week pregnancy to delivery of the baby</p> <ul style="list-style-type: none"> <li>Accompanied with signs of shock i.e pulse rate &gt; 100 beats per minute, Systolic blood pressure &lt; 90 mmHg</li> </ul>
Eclampsia	<p>History of Convulsions with</p> <p>Blood pressure <math>\geq</math> 140/90 mmHg</p> <p>Albuminuria <math>\geq</math> ++</p> <p>Other accompanying features:</p> <ul style="list-style-type: none"> <li>Severe headache, blurred vision and epigastric pain</li> </ul>
Severe Pre eclampsia	<p>Blood pressure <math>\geq</math> 160/110 mmHg</p> <p>Albuminuria <math>\geq</math> ++</p> <p>Other accompanying symptoms:</p> <ul style="list-style-type: none"> <li>Severe headache, blurred vision and epigastric pain</li> </ul>
Obstructed labour/ + chorioamnitis	<p>Failure of the presenting part to descend inspite of uterine contractions accompanied by secondary signs &amp; complications such as:</p> <p>Severe moulding</p> <p>Caput</p> <p>Fetal heart rate <math>\leq</math>120 or <math>\geq</math> 160 beats per minute</p> <p>Stretched lower segment( Bandl's ring)</p> <p>Bloody urine</p>
Uterine rupture	<p>Full thickness uterine tear -Diagnosis confirmed during laparotomy. or autopsy</p>
Puerperal sepsis	<p>Foul smelling vaginal/or abdominal wound discharge which may be accompanied by:</p> <p>Fever &gt;38<sup>0</sup>C</p> <p>Pelvic pain</p> <p>Uterine tenderness</p>

## Appendix I (a): Definition of SMM conditions

Severe anaemia	Haemoglobin less than 7 g/dl with accompanied symptoms such as <ul style="list-style-type: none"><li>• Very pale conjunctiva</li><li>• Shortness of breath</li><li>• Rapid pulse rate</li><li>• Fatigue</li><li>• Dizziness and drowsiness</li></ul>
Severe malaria	Heavy malaria parasitemia with complications such as convulsions, hypoglycaemia, pulmonary oedema and coma
AIDS	The most advanced stage of HIV infection whereby a person manifest with various opportunistic infections and or other chronic and malignant conditions. The blood levels of the CD4+ T- lymphocyte count is Less than 200/ $\mu$ L Less than 14% of total lymphocytes (Castro et al., 1993, CDC, 1993)



## **Appendix I (b): Millennium Development Goals (MDGs)**

1. To eradicate extreme poverty and hunger
2. To achieve universal primary education
3. To promote gender equality and empower women
4. To reduce child mortality
5. To improve maternal health
6. To combat HIV/AIDS, malaria, and other diseases
7. To ensure environmental sustainability
8. To develop a global partnership for development

Year	Population	Number of women	Number of women with obstetric complications
2005	1,000,000	500,000	100,000
2006	1,050,000	525,000	105,000
2007	1,100,000	550,000	110,000
2008	1,150,000	575,000	115,000
2009	1,200,000	600,000	120,000
2010	1,250,000	625,000	125,000
2011	1,300,000	650,000	130,000
2012	1,350,000	675,000	135,000
2013	1,400,000	700,000	140,000
2014	1,450,000	725,000	145,000
2015	1,500,000	750,000	150,000
2016	1,550,000	775,000	155,000
2017	1,600,000	800,000	160,000
2018	1,650,000	825,000	165,000
2019	1,700,000	850,000	170,000
2020	1,750,000	875,000	175,000

**Appendix II: Calculation for number of women with obstetric complications in Kilombero district**

**Appendix II: Calculations for number of women with obstetric complications in the district**

Information for the District's profile	<p><b>Crude birth rate (CBR) = 46 births per 1000 District's population (National Bureau of Statistics Tanzania 2005),</b></p> <p><b>Kilombero District population = 418,401 (Kilombero District Council, 2009)</b></p>
Information from WHO	<p><b>Number of pregnancies having a complication in a population = 15% of all pregnancies (World Health Organization, 2009b)</b></p>
Assumptions	<p>Number of pregnancies is close to number of births since data on number of pregnancies in the district is unknown</p>
Calculations	<p><b>Number of birth in a population = CBR * Total population in a district</b></p> <p><b>Therefore number of women having complication in the district = 15% * Number of births in a population</b></p> <p><b>= 0.15* (0.046* 418,401)</b></p> <p><b>= 2887</b></p>

Appendix III: Hospital Engineering Service Satisfaction Form

MC No: \_\_\_\_\_ Date: \_\_\_\_\_

Patient Information		MC - MR Number	
Name		MC	MR
Age			
Gender			
Room Number			
Ward			
Admission Date			
Specialist			
Service			
Location			
Referral			
Referral Date			
Referral Source			
Referral Type			
Referral Status			
Referral Date			
Referral Time			
Referral Place			

**Appendix III : Tools for Hospital SMM Incidence study**

### Appendix III: Hospital Incidence Study extraction form

IID number  Date of admission.....

**A. Personal information:**

ND = not documented

	ND	1	2	3	4
Age					
Gravidity					
Parity					
Number of living children					
Marital status		married	single	others	
Occupation		housewife	farmer	other, specify	
Highest educational level attained		none	primary	secondary	Post secondary

**B. Referral diagnosis**

None	APH	PPH	Obstructed labour	Eclampsia	Severe pre-eclampsia	Puerperal sepsis	Other Obstetric conditions	Other condition, specify

**C. Antenatal factors:**

	ND	1	2	3	4	5
Antenatal clinic attendance		yes	no			
Complication detected		yes	no			
Type of complication		APH	Eclampsia	Severe pre eclampsia	Other Obstetrics	
Treatment given		yes	no	If yes, specify		

### Appendix III: Hospital Incidence Study extraction form

#### Medical history:

	ND	1	2	3	4	5
History of medical disease		Yes	No			
Type of medical disease		Sickle cell disease	Heart disease	Anaemia	HIV/AIDS	Others Specify

#### D. General condition on admission

	ND	1	2	3
Clinical assessment by health provider		Well	Sick	Unconscious
Estimated gestational age in wks				
Patient's outcome	Yes	No, treated & discharged	No, died	

#### E. Intra partum information:

	ND	1	2	3	4	5	6
Use of partogram		Yes	No				
Intrapartum complication detected		Yes	No				
Doctor's diagnosis of complication		APH	Obstructed labour	Eclampsia	Severe Pre eclampsia	Other Obstetric specify	Others specify
Definitive treatment		Blood transfusion	Caesarean section	Hysterectomy	MgSO4	IV antibiotics	Others
Mode of delivery		Normal	Vacuum	Assisted breech delivery	Caesarean section	Others specify	
Delivery of placenta		Normal	Manual removal				

### Appendix III: Hospital Incidence Study extraction form

#### F. Condition of the baby 5 minutes after delivery:

	ND	1	2	3
APGAR score 5 minutes after delivery		Good $\geq 7$	Sick $<7$	Dead

#### G. Postpartum events:

	N D	1	2	3			
Condition of mother: $\leq 24$ hours after delivery		Good	Sick	Died			
Condition of mother: $>24$ hours after delivery		Well discharged home	Sick	Well but child sick	Died		
Postpartum complication		Yes	No				
Doctor's diagnosis of complication		PPH specify	Postpartum sepsis specify	Postpartum eclampsia	Others specify		
Treatment of complication		Blood transfusion	Uterine evacuation	Hysterectomy	MgSO4	IV antibiotics	Others specify

#### F. Patient's outcome

Patient's delivery status & outcome	Yes and discharged	Yes died but	No, treated & discharged	No, died

#### G: Length of hospital stay

Length of stay in days				

Appendix IV

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**Appendix IV: Tools for Community interview survey on SMM incidence**

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## Appendix IV (a):

Section) Community Health Sciences (Public Health Sciences  
SCHOOL of CLINICAL SCIENCES and COMMUNITY HEALTH

### CONSENT FORM FOR STUDY PARTICIPANTS OF COMMUNITY SEVERE MATERNAL MORBIDITY SURVEY

#### WHO ARE 18 YEARS AND ABOVE

I would like to invite you to participate in an interview concerning a study on maternal health problems. The **aim of the study** is to learn more about the events which occur in women during their pregnancy, childbirth and 42 days after. Questions concerning related issues will be asked to all women in this village whose pregnancies ended beyond 7 months between May 2008 and April 2009.

For those mothers who will report to have used a health facility for either delivery or treatment of a complication, their medical records will be traced back for more additional information.

**Confidentiality:** I would also like to reassure you that all answers which you provide us will be kept under strict confidentiality. Through out the study your answers will be referred using an identification number and not your name. The only time where your name shall be used will be during identification of the medical records if you report to have used a health facility during delivery or treatment. After the identification of the records, your name will be discarded immediately.

**Risks:** Your participation in this study does not involve any risk as you will just be answering questions. Should you feel uncomfortable with any question during the interview, please feel free to inform us.

**Benefits:** This study is among the few community studies on maternal health in Tanzania, so the information obtained is expected to be vital in helping us improve the health care in this community and other rural areas of Tanzania.

Lastly, I would like to inform you that your participation is voluntary. Please feel free and inform us if you are willing to participate for the interview and for us to access your hospital records if you had been to the facility.

Thank you for listening.

I agree to participate in the interview

I also agree that my hospital records to be reviewed by the  
Researchers of this study provided that my name does not appear in the  
Analysis and reports.

Signature of respondent OR	Thumb print of respondent ( <i>if not able to write</i> )
-------------------------------	---

Date of consenting .....

Name of Interviewer and signature.....

***For any queries and questions concerning the study please contact Dr Miriam Mgonja by phone number +255754262214 between July and December 2009***



## Appendix IV (b):

Community Health Sciences (Public Health Sciences Section)  
SCHOOL of CLINICAL SCIENCES and COMMUNITY HEALTH

**FOMU YA RIDHAA KWA AJILI YA KUSHIRIKI KATIKA MAHOJIANO YA UTAFITI WA AFYA YA  
AKINA MAMA KATIKA JAMII YA TANZANIA KWA AKINA MAMA WENYE UMRI WA MIAKA 18 NA**

**ZAIDI**

Ninapenda kukuaribisha ili ushiriki katika mahojiano kuhusu matatizo yanayowapata akina mama wajawazito.

**Lengo la utafiti** ni kutafiti kuhusu matatizo yanayowapata akina mama katika kipindi cha ujauzito hadi wakati wa kujifungua na ndani ya siku 42 baada ya kujifungua. Maswali mbalimbali ya utafiti huu, yataulizwa kwa akina mama waliojifungua kuanzia umri wa miezi saba wa mimba na kuendelea, kati ya Mei mwaka 2008 hadi Aprili 2009.

Kwa wale akina mama ambao walijifungulia sehemu yoyote inayotoa huduma za afya, au walipata matibabu sehemu hiyo, kumbukumbu za rekodi zao zitaangaliwa kwa ajili ya maelezo zaidi.

**Usiri:** Ninapenda kukuhakikishia kuwa majibu yako yote utakayojibu yatahifadhiwa katika usiri mkubwa. Kumbukumbu zako zote zitatambulika kwa kutumia namba ya siri na siyo jina lako. Jina lako litatumika tu wakati wa kutambua kumbukumbu zako ikiwa ulikwenda sehemu inayotoa huduma ya afya wakati wa kujifungua au kutibiwa. Baada ya kutambua kumbukumbu zako, jina lako litafutwa na tutaendelea kutumia namba ya siri.

**Athari:** Kushiriki kwako katika mahojiano haya, hakutasababisha madhara au athari zozote katika mwili wako. Endapo utajisikia hofu yoyote wakati wa mahojiano, tafadhali usisite kutujulisha.

**Faida:** Huu ni utafiti kati ya tafiti chache zilizofanyika katika jamii ya kitanzania kuhusiana na afya ya akina mama wakati wa uzazi. Ni mategemeo yetu kuwa, taarifa itakayopatikana kwenye mahojiano, itatusaidia sana katika kuboresha huduma za afya katika jamii hasa vijijini.

Mwisho napenda kusisitiza kuwa ushiriki wako katika mahojiano haya ni hiari yako. Tafadhali jisikie huru na tujulisha kama uko tayari kushiriki katika mahojiano haya na pia uko tayari, kumbukumbu zako zilizoko sehemu ya huduma ya afya zinukuliwe. Asante kwa kunisikiliza.

Nakubali kushiriki katika mahojiano

Nakubali kumbukumbu zangu zilizo katika sehemu inayotoa huduma ya afya zinukuliwe kwa ajili ya tafiti, ili mradi jina langu lisionyeshwe.

Sahihi ya mhojiwa  
AU

Alama ya dole gumba (*kama  
hawezi kusoma*)

Tarehe ya kutoa ridhaa .....Jina la mhojaji na sahihi.....

***kwa maswali yoyote kuhusu utafiti huu wasiliana tafadhani na Dr Miriam Mgonja kwa namba ya simu +255754262214 kati ya Julai na Desemba 2009***





Appendix IV(c):

Community Health Sciences (Public Health Sciences

Section)

SCHOOL of CLINICAL SCIENCES and COMMUNITY HEALTH

ASSENT FORM FOR STUDY PARTICIPANTS OF COMMUNITY SEVERE MATERNAL MORBIDITY SURVEY WHO ARE UNDER 18 YEARS

I would like to invite you to participate in an interview concerning a study on maternal health problems. The aim of the study is to learn more about the events which occur in women during their pregnancy, childbirth and 42 days after. Questions concerning related issues will be asked to all women in this village whose pregnancies ended beyond 7 months between May 2008 and April 2009.

For those mothers who will report to have used a health facility for either delivery or treatment of a complication, their medical records will be traced back for more additional information.

**Confidentiality:** I would also like to reassure you that all answers which you provide us will be kept under strict confidentiality. Through out the study your answers will be referred using an identification number and not your name. The only time where your name shall be used will be during identification of the medical records if you report to have used a health facility during delivery or treatment. After the identification of the records, your name will be discarded immediately.

**Risks:** Your participation in this study does not involve any risk as you will just be answering questions. Should you feel uncomfortable with any question during the interview, please feel free to inform us.

**Benefits:** This study is among the few community studies on maternal health in Tanzania, so the information obtained is expected to be vital in helping us improve the health care in this community and other rural areas of Tanzania.

Lastly, I would like to inform you that your participation is voluntary. Please feel free and inform us if you are willing to participate for the interview and for us to access your hospital records if you had been to the facility.

Thank you for listening.

- I agree to participate in the interview
- I agree that my hospital records to be reviewed

Signature / thumb print of respondent .....	Signature / thumb print of witness .....
--	---

Date of consenting .....Name of Interviewer and signature.....

*For any queries and questions concerning the study please contact Dr Miriam Mgonja by phone number +255754262214 between July and December 2009*

## Appendix IV (d):

Community Health Sciences (Public Health Sciences Section)  
SCHOOL of CLINICAL SCIENCES and COMMUNITY HEALTH

**FOMU YA RIDHAA KWA AJILI YA KUSHIRIKI KATIKA MAHOJIANO YA UTAFITI WA AFYA YA AKINA**

**MAMA KATIKA JAMII YA TANZANIA KWA AKINA MAMA WENYE UMRI CHINI YA MIAKA 18**



Ninapenda kukuaribisha ili ushiriki katika mahojiano kuhusu matatizo yanayowapata akina mama wajawazito.

**Lengo la utafiti** ni kutafiti kuhusu matatizo yanayowapata akina mama katika kipindi cha ujauzito hadi wakati wa kujifungua na ndani ya siku 42 baada ya kujifungua. Maswali mbalimbali ya utafiti huu, yataulizwa kwa akina mama waliojifungua kuanzia umri wa miezi saba wa mimba na kuendelea, kati ya Mei mwaka 2008 hadi Aprili 2009.

Kwa wale akina mama ambao walijifungulia sehemu yoyote inayotoa huduma za afya, au walipata matibabu sehemu hiyo, kumbukumbu za rekodi zao zitaangaliwa kwa ajili ya maelezo zaidi.

**Usiri:** Ninapenda kukuhakikishia kuwa majibu yako yote utakayojibu yatahifadhiwa katika usiri mkubwa. Kumbukumbu zako zote zitatambulika kwa kutumia namba ya siri na siyo jina lako. Jina lako litatumika tu wakati wa kutambua kumbukumbu zako ikiwa ulikwenda sehemu inayotoa huduma ya afya wakati wa kujifungua au kutibiwa. Baada ya kutambua kumbukumbu zako, jina lako litafutwa na tutaendelea kutumia namba ya siri.

**Athari:** Kushiriki kwako katika mahojiano haya, hakutasababisha madhara au athari zozote katika mwili wako. Endapo utajisikia hofu yoyote wakati wa mahojiano, tafadhali usisite kutujulisha.

**Faida:** Huu ni utafiti kati ya tafiti chache zilizofanyika katika jamii ya kitanzania kuhusiana na afya ya akina mama wakati wa uzazi. Ni mategemeo yetu kuwa, taarifa itakayopatikana kwenye mahojiano, itatusaidia sana katika kuboresha huduma za afya katika jamii hasa vijijini.

Mwisho napenda kusisitiza kuwa ushiriki wako katika mahojiano haya ni hiari yako. Tafadhali jisikie huru na tujulishe kama uko tayari kushiriki katika mahojiano haya na pia uko tayari, kumbukumbu zako zilizoko sehemu ya huduma ya afya zinukuliwe. Asante kwa kunisikiliza.

Nakubali kushiriki katika mahojiano

Nakubali kumbukumbu zangu zilizo katika sehemu inayotoa huduma ya afya zinukuliwe kwa ajili ya tafiti, ili mradi jina langu lisionyeshwe.

Sahihi / dole gumba ya mhojiwa .....	Sahihi / dole gumba ya shahidi .....
---	---

Tarehe ya kutoa ridhaa .....Jina la mhojaji na sahihi.....

***Kwa maswali yoyote kuhusu utafiti huu wasiliana tafadhani na Dr Miriam Mgonja kwa namba ya simur +255754262214 kati ya Julai na Desemba 2009***

Appendix IV (e):

Community interview survey Questionnaire

Village:  AMJT ID no

Date interview 

--	--	--

 Start time: 

	am/ pm	Circle
--	--------	--------

Initials of interviewer 

--

 End time: 

	am/ pm	Circle
--	--------	--------

H. INTERVIEWER'S CHECK LIST FOR ELIGIBLE WOMEN TO BE INTERVIEWED

	Yes	No	Unclear	Comment explaining 'Unclear'
	<b>1</b>	<b>2</b>	<b>3</b>	
Name, correct?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> ⇒	<input style="width: 100%; height: 20px;" type="text"/>
Ten cell leader, correct?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> ⇒	<input style="width: 100%; height: 20px;" type="text"/>
Did pregnancy end between May 08 and April 09?	<input type="radio"/>	<input type="radio"/> ↘	<input type="radio"/> ⇒	<input style="width: 100%; height: 40px;" type="text"/>
				<i>If not, Do not interview. Thank the woman</i>
Has the woman consented?	<input type="radio"/>	<input type="radio"/> ↘	Give reasons ⇒	<input style="width: 100%; height: 40px;" type="text"/>
				<i>If she has not consented , Do not interview Thank the woman.</i>

Appendix IV (e): Community interview survey Questionnaire

I. RESPONDENT'S DETAILS

Age at interview  Years  Number of living children

Date of birth (dd/mm/yy)

Number of deliveries a woman has had (i.e ending  $\geq$  7 months of pregnancy)

Number of abortions a woman has had (i.e ending  $<$  7 months of pregnancy)

Marital status Married  Single  Others  explain  $\Rightarrow$

*If married ask the next question , or else skip to Question on occupation*

Are you living with your partner? No  Yes  Others  explain  $\Rightarrow$

Occupation Housewife  Farmer  Others  explain  $\Rightarrow$

Educational level attained none  Primary school  Secondary school  College/ university

## Appendix IV (e): Community interview survey Questionnaire

### J. i. DETAILS OF WOMAN'S OUTCOME OF LAST PREGNANCY

Date of delivery (dd/mm/yy)			Gestational age at delivery (in months)	Number of live births	Number of still births	Are the babies alive?		
						1. Yes	2. No, one died	3. No
						If babies are not alive, give the age at which baby died		
						Days	Months	Year
<i>Baby 1</i>								
<i>Baby 2</i>								
<i>Baby 3</i>								
<p><b>If a baby has been lost, Express sympathy <i>and then ask</i></b></p> <p><i>'Do you feel alright to continue with the interview? The information would help us to understand the circumstances and challenges faced by pregnant women. Such information is vital in improving strategies to reduce maternal mortality as well as neonatal mortality'</i></p> <p><b>Are you OK to continue?</b> Yes <input type="radio"/> No <input type="radio"/> ⇒ Terminate interview with thanks</p>								

### C.ii

**Ask the following question only if the baby is alive otherwise Go to Question D**

Current age of baby  Year  Months

**Appendix IV (e):  
Community interview survey Questionnaire**

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**K. i. MODE AND PLACE OF DELIVERY**

What was the mode of delivery	Vaginal	Caesarean	Vacuum	Others <input type="radio"/>	
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<i>explain</i> ⇒	

Where did you deliver your baby?	Home <input type="radio"/>	Dispensary <input type="radio"/>	Health centre <input type="radio"/>	Hospital <input type="radio"/>	Others <input type="radio"/>
				<i>explain</i> ⇒	

Mention the name of the health facility

**D ii WOMAN'S SELF REPORTED SYMPTOMS DURING THE LAST PREGNANCY**

'Did you experience any problems when you were 7 months pregnant until the time of delivery and 42 days later?'

No                       Don't remember                       Yes

*If not, Go to Question D. iii, otherwise continue asking the Question Dii overleaf*



**Appendix IV (e):**

**Community interview survey Questionnaire**

D. ii continuing....

'Can you please tell me the problems which you experienced? Tell us why you became worried and if you received any treatment '

*INTERVIEWER, let the woman mention the problems (Do not prompt)*

*Put a tick in the corresponding answers in the table below.*

*In case the answers correspond to more than one response, put a tick in all of them.*

PROBLEM ✓ all mentioned	When in relation to delivery?		Describe symptoms & why 'worrying'	
	Before (months)	At Delivery	After delivery ngapi?	
Bleeding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Prolonged labour	<i>n.a.</i>	<input type="checkbox"/>	<i>n.a.</i>	
Others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Cannot recall	<input type="checkbox"/>			

**Appendix IV (e): Community interview survey Questionnaire**

**D. iii**

**WOMAN’S REPORTED SYMPTOMS OF LAST PREGNANCY, AFTER BEING PROMPTED BY INTERVIEWER**

‘I will now ask you about symptoms which you might have experienced when you were 7 months pregnant until the time of delivery and 42 days later’.

‘Did you ever experience fainting attacks?’ 1). Yes 2). No 3). Don’t remember

‘Did you experience fits?’ 1). Yes 2). No 3). Don’t remember. If **yes, when was that?** Please tick the answers below. If no fits **Go to Question D IV**

**FITS / CONVULSIONS**

At what stage of pregnancy did you experience fits? Pregnancy  Delivery  After delivery

Mention months			Mention days		
----------------	--	--	--------------	--	--

How did you know? I remember  Husband told me  Relatives  Health providers

Tell me if you had these symptoms? Headache  Poor vision

Did you experience fits before the last pregnancy? No  Yes

If yes, when was that? While pregnant  not  During the other pregnancy

## Appendix IV (e): Community interview survey Questionnaire

D. iv

WOMAN'S REPORTED SYMPTOMS OF LAST PREGNANCY, AFTER BEING PROMPTED BY INTERVIEWER

'I will continue asking you about symptoms which you might have experienced when you were 7 months pregnant until the time of delivery and 42 days later'.

'Did you ever experience copious vaginal bleeding?' 1). Yes 2). No 3). Don't remember

If yes, when was that? If not, go to **Question D iv (c)**

### a) SEVERE VAGINAL BLEEDING

At what stage of pregnancy did you experience bleeding?

Pregnancy  Delivery  After delivery

Mention months

Mention days

Did you use Kanga for protection?

Yes  No

If yes, mention .....

Total number used

Total number of fully soaked kanga

Did anybody witness?

Yes  No

If yes, mention the person

Husband

Health provider

Others  mention ⇒

**Appendix IV (e): Community interview survey Questionnaire**

D.iv. continues....

'Did you think of seeking health care due to the severe vaginal bleeding you experienced?' 1. Yes 2. No

If yes, when was that..? If not, go to **Question D v**

**b) SEEKING HELP FOR SEVERE VAGINAL BLEEDING**

Did you think of seeking help? Yes  No

At what stage of pregnancy? Pregnancy  Delivery  After delivery   
 Mention months | | Mention days | |

Did anybody else think of seeking help due to your bleeding? Yes  No

If yes, mention the person

Where did you seek help? Dispensary  Health centre  Hospital  Elsewhere  Did not seek care   
 Mention the place⇒

In case you sought help, what treatment did you get?

Did you receive blood transfusion? Yes  No

## Appendix IV (e) Community interview survey Questionnaire

D.iv. continues....

### c) HAEMATINICS (IRON SUPPLEMENTS)

Did you receive iron supplements? Yes  No

If yes, at what stage of pregnancy? Pregnancy  Delivery  After delivery

Mention months		Mention days	
----------------	--	--------------	--

Can you recall the type of iron supplements you were given? Yes  No

If yes, mention the type

Where were you given the iron supplements? Dispensary  Health centre  Hospital  Elsewhere   
*Mention the place ⇒*

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## Appendix IV (e) Community interview survey Questionnaire

### D.V. PROLONGED LABOUR

'I will continue asking you about symptoms which you might have experienced when you were 7 months pregnant until the time of delivery and 42 days later'.

'Did you experience labour which lasted **more than 12 hours..?**' 1. Yes 2. No 3. Don't know. If **not**, go to **Question D vi**

How long did you <b>experience labour pains?</b>	<input type="text"/>	Days	<input type="text"/>	Hours
How long did the <b>strong intense labour pains</b> last?	<input type="text"/>	Days	<input type="text"/>	Hours
How long did you experience <b>the urge to bear down?</b>	<input type="text"/>	Days	<input type="text"/>	Hours
Did anyone try to <b>pull the baby out</b> before you went to the health facility?	No <input type="radio"/>	Yes <input type="radio"/>	If <b>yes</b> , mention the person  ⇒	
Did you <b>go to a health facility</b> for help?	Yes <input type="radio"/> ⇒ If not, go to <b>Question D vi</b>			
If you went to a health facility, <b>mention the name</b>	<input type="text"/>			
What advice were you given at the health facility?	<input type="text"/>			
Were you referred elsewhere?	No <input type="radio"/>	Yes <input type="radio"/>	If <b>yes</b> , mention the place  ⇒	
Was vacuum used to get the baby out?	No <input type="radio"/>	Yes <input type="radio"/>	<input type="text"/>	
Did you get a caesarean?	No <input type="radio"/>	Yes <input type="radio"/>	<input type="text"/>	

**Appendix IV (e): Community interview survey Questionnaire**

**D.vi ABNORMAL DISCHARGE**

'Did you experience **abnormal vaginal or abdominal wound discharge** following childbirth?' 1. Yes 2. No 3. Don't remember. If not, go to **Question E**

How many days after childbirth did you experience the discharge?	<input type="text"/>	Days	
Where was the <b>discharge coming from</b> ?	Vagina <input type="radio"/>	Wound <input type="radio"/>	Other <input type="radio"/> <input type="text"/>
			Specify ⇒
How much was it?	Little <input type="radio"/>	Moderate <input type="radio"/>	Much <input type="radio"/>
Was it <b>smelly</b> ?	No <input type="radio"/>	A little <input type="radio"/>	Very much <input type="radio"/>
Was it accompanied by <b>fever</b> ?	No <input type="radio"/>	Yes <input type="radio"/>	
Was it accompanied by <b>chills</b> ?	No <input type="radio"/>	Yes <input type="radio"/>	
	1	2	3
Did you go to health facility for help?	Yes <input type="radio"/>	No <input type="radio"/>	
	⇒ <i>If not go to Question E</i>		
If, you went to a health facility <b>mention the place</b> ⇒	<input type="text"/>		
<b>What were you told</b> at the health facility regarding the discharge?	<input type="text"/>		
Were you given <b>an injection</b> for the discharge?	No <input type="radio"/>	Yes <input type="radio"/>	

**Appendix IV (e) Community interview survey Questionnaire**

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**L. ANTENATAL CLINIC INFORMATION**

How long in terms of hours, does it take you to walk from your home to the antenatal clinic? Less than 1 hour  1-2 hours  More than 2 hours  Don't know

Did you attend antenatal clinic in your last pregnancy? Yes  No  *If not, go to Question F*

How many times did you attend the clinic?

Do you have any reasons for such an attendance? Yes  No  Don't know  If yes, mention the reasons

Were there any problems detected at the clinic regarding your pregnancy? No  Don't remember  Yes  If yes, mention the problems

Were you given health education regarding your pregnancy and any possible danger signs? No  Don't remember  Yes

Were you ever advised on the place of delivery? No  Don't remember  Yes



**Appendix IV (e) Community interview survey Questionnaire**

**M. DECISIONS REGARDING THE PLACE OF DELIVERY & BIRTH PLANS**

- Did you decide beforehand on the place of delivery? No  Don't remember  Yes
- When labour started, who made a decision regarding the place of delivery? Myself  Husband  Mother in law  TBA  Others   
Mention .....
- If you intended to go to a health facility, were you aware of things you needed to prepare for childbirth? Yes  No  Don't know

If the things are known, please mention the things *Interviewer, please tick against the item which will be mentioned by the respondent.*  
**(DO NOT PROMPT)**

Items prepared for delivery	
Razor blade	<input type="radio"/>
Clothes / Kanga	<input type="radio"/>
Money	<input type="radio"/>
Cotton wool	<input type="radio"/>
Medicine	<input type="radio"/>
Gloves	<input type="radio"/>
Others	<input type="radio"/>
Mention =>	

## Appendix IV (e): Community interview survey Questionnaire

### EMERGENCY COMPLICATION READINESS

Did you prepare your self in case a complication arose during pregnancy, childbirth and 42 days later?

No

Don't know  Yes

*Interviewer, please tick against the item which will be mentioned by the respondent.*

*(DO NOT PROMPT)*

Items prepared in case of emergency	
Money	<input type="radio"/>
Transport	<input type="radio"/>
Moving near health facility	<input type="radio"/>
Others	<input type="radio"/> <i>Mention =&gt;</i>

Did any other person prepare himself in case you developed a complication during pregnancy, childbirth and 42 days later?

No

Yes

*If yes, put a tick in the next two questions regarding the person and respective items otherwise, go to Question G*

Mention the person who prepared items in case of emergency

Husband

Mother in law

Mother

Others

*Mention =>*

Husband

Money

Transport

Blood donor

Others

*mention =>*

Mother in law

Money

Transport

Blood donor

Others

*mention =>*

Mother

Money

Transport

Blood donor

Others

*mention =>*

Others

Money

Transport

Blood donor

Others

## Appendix IV (e): Community interview survey Questionnaire

### Appendix IV (e): Community interview survey Questionnaire

#### N. BARRIERS IN SEEKING, ACCESSING AND RECEIVING HEALTH CARE DURING DELIVERY

Were there any  
barriers in seeking  
health care when  
labour started? No

Don't  
remember

Yes

*Interviewer, please  
tick against the  
barriers which will  
be mentioned by the  
respondent.*

*(DO NOT PROMPT)*

Barriers in seeking health care during labour	
Had to wait for husband to come home	<input type="radio"/>
Had to wait for mother in law	<input type="radio"/>
Had to wait for mother	<input type="radio"/>
Lack of transport	<input type="radio"/>
Lack of money	<input type="radio"/>
Others, mention	<input type="radio"/>

Were there any  
barriers in reaching  
health facility when  
labour started? No

Don't  
remember

Yes

*Interviewer, please  
tick against the  
barriers which will  
be mentioned by the  
respondent.*

*(DO NOT PROMPT)*

Barriers in reaching health facility during labour	
Long distance	<input type="radio"/>
Lack of transport	<input type="radio"/>
Lack of money	<input type="radio"/>
Others, mention	<input type="radio"/>

## Appendix IV (e): Community interview survey Questionnaire

G. continues.....

### BARRIERS IN RECEIVING CARE AT THE HEALTH FACILITY DURING DELIVERY

Were there any barriers in receiving health care at the health facility when labour started? No  Don't remember  Yes  *Interviewer, please tick against the barriers which will be mentioned by the respondent.*

*(DO NOT PROMPT)*

Barriers in receiving health care at the health facility during labour	
Shortage of staff	<input type="radio"/>
Lack of medicine	<input type="radio"/>
Patients congestion	<input type="radio"/>
Others, mention	<input type="radio"/>

### O. CURRENT HEALTH STATUS

How do you perceive your health now when compared to the time you had your last pregnancy? Well  Better, though still weak  Weak  Others   
Specify  
⇒

*Thank you!*

**Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii**

Kijiji:  AMJT ID no

Tarehe	<input type="text"/>	Muda kuanza:	<input type="text"/>	Asubuhi/mchana	Zungshia
Herufi za kwanza	<input type="text"/>	Muda kumaliza:	<input type="text"/>	Asubuhi/mchana	Zungushia
Jina la Mhojaji	<input type="text"/>				

**A. MHOJAJI HAKIKI TAARIFA ZA MAMA NA KUJUA KAMA AMETOA IDHINI YA KUHOJIWA**

	Ndiyo	Sivyo	Utata	Elezea utata uliopo
	1	2	3	
Jina , ni sawa?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> ⇒	<input type="text"/>
Balozi wa nyumba, ni sawa?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> ⇒	<input type="text"/>
Mimba iliishia kati ya May 08 na Aprili 09?	<input type="radio"/>	<input type="radio"/> ↘	<input type="radio"/> ⇒	<input type="text"/>
Mama ametoa idhini ya kuhojiwa?	<input type="radio"/>	<input type="radio"/> ↘	Andika sababu ⇒	<input type="text"/>
			<i>Kama sijavyo usiendelee na mahojiano, Mshukuru</i>	
			<i>Kama hajatoa idhini, usiendelee na mahojiano , mshukuru.</i>	

Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

B. TAARIFA YA MHOJIWA

Umri wa mama leo  Miaka  Idadi ya watoto hai

Tarehe ya Kuzaliwa

(siku/mwezi/mwaka)

Umezaa mara  Mimba

ngapi? ngapi zimeharibika chini ya miezi 7?

(miezi 7 kuendelea)

Ndoa Nimeolewa  Sijaolewa  Mengineyo

elezea ⇒

*Kama ameolewa uliza swali linalofuata, vinginevyo uliza swali linalohusu kazi*

Je, unaishi Hapana  Ndiyo  Mengineyo

na mwenzi wako? elezea ⇒

Kazi Mama nyumbani  wa Mkulima  Mengineyo

elezea ⇒

Elimu Sijasoma  Msingi  Sekondari  Chuo

**Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii**

**C. i. TAARIFA ZIFUATAZO ZINAHUSU MATOKEO YA MIMBA ILIYOPITA**

Tarehe uliyojifungua (siku/mwezi/mwaka)	Umri wa mimba wakati unajifungua (miezi)	Idadi ya mtoto/watoto waliozaliwa	Idadi ya mtoto/watoto waliozaliwa wafu	Je mtoto/ watoto waliozaliwa hai ni wazima hadi leo?		
				1. Ndiyo	2. Hapana, mmoja mzima	3. Hapana

**Ikiwa wamefariki, taja umri waliokufa**

	siku	miezi	Mwaka
Mtoto 1			
Mtoto 2			
Mtoto 3			

**Ikiwa mtoto / watoto wamefariki, onyesha simanzi kisha uliza**

*Je unafikiri utaweza kuendelea na mahojiano? Mahojiano haya yatatusaidia kuelewa matatizo yanayowapata akina mama wajawazito. Taarifa zitasaidia kupunguza idadi ya vifo vya wakina mama wajawazito na watoto wachanga*

**Je unajisikia vizuri kuendelea? Ndiyo  Hapana  ⇒ Sitisha mahojiano, mshukuru**

**C.ii**

**Uliza maswali kama tu mtoto/ watoto wako hai kuhusiana na mimba iliyopita vinginevyo nenda swali namba D**

Umri wa mtoto/watoto sasa  Miaka  Miezi

**Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii**

**D. i. MAELEZO YA MIMBA ILIYOPITA**

Ulijifungua  
kwa njia  
gani

Kawaida

Operesheni

Kuvutwa  
kwa  
mashine

Mengineyo  
elezea ⇒

Ulijifungulia  
wapi

Nyumbani

Zahanati

Kituo  
cha  
afya

Hospitali

Mahali  
pengine   
*Taja jina*

Taja jina la  
sehemu ya  
huduma ya  
afya

--

**D ii DALILI ZITAKAZOTAJWA NA MAMA MWENYEWWE KATIKA MIMBA ILIYOPITA**

'Je, uliwahi kujisikia mwenyewe kuwa unapata matatizo yoyote ya kiafya katika mimba yako ya mwisho? Yaani dalili zilizokuogopesha afya yako kipindi cha ujauzito, kujifungua na ndani ya siku 42 baada ya kujifungua?'

Hapana

Sikumbuki

Ndiyo

*Kama hapana  
nenda swali D. iii*

*Kama ndiyo  
endelea kujibu  
swali ukurasa  
unaofuata*



**Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii**

D. ii inaendelea....

‘Tafadhali taja hayo matatizo ..., tueze kwa nini ulikuwa na hofu, na pia kama ulipata matibabu’

**MHOJAJI**, muache mama ataje matatizo mwenyewe. (Usimtajie)

Weka alama ya vema katika **majibu yanayoshabihiana na majibu yaliyotolewa**.

Kama dalili ni zaidi ya moja, tafadhali rekodi dalili zote.

Kipindi gani katika mimba?				
TATIZO	Ujauzito (miezi)	Kujifungua.	Baada ya kujifungua siku ngapi?	Elezea dalili na kwa nini ulihofu
✓ weka vema				
Kutoka damu	<input type="text"/>	<input type="radio"/>	<input type="text"/>	<input type="text"/>
Degedege/ kifafa	<input type="text"/>	<input type="radio"/>	<input type="text"/>	<input type="text"/>
Uchungu wa muda mrefu	<i>n.a.</i>	<input type="radio"/>	<i>n.a.</i>	
Mengineyo	<input type="text"/>	<input type="radio"/>	<input type="text"/>	<input type="text"/>
1	<input type="text"/>	<input type="radio"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="radio"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="radio"/>	<input type="text"/>	<input type="text"/>
Sikumbuki		<input type="radio"/>		

## Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

### D. iii DALILI ZITAKAZOULIZWA NA MHOJAJI

'Sasa nitakuuliza kuhusu dalili ambazo zinaweza kuwa zilikutokea wakati wa mimba yako baada ya miezi 7, wakati wa kujifungua na siku 42 baadaye.'

'Je, uliwahi kupata tatizo la kupoteza fahamu katika mimba yako?' 1). Ndiyo 2). Hapana 3). Sikumbuki

'Je uliwahi kupata **Kifafa** katika kipindi chochote cha mimba yako? 1). Ndiyo 2). Hapana 3). Sikumbuki. Kama ndivyo, ni lini? nenda D.iii Kama sivyo, nenda **D iv**

### D.iii Inaendelea Dalili zitakozoulizwa na mhojaji...

#### KIFAFA CHA MIMBA

Kipindi gani cha ujauzito?	Ujauzito <input type="radio"/>	Kujifungua <input type="radio"/>	Baada ya kujifungua <input type="radio"/>
	Taja miezi		Taja siku
Ulijuaje kuwa ulipata kifafa?	Nakumbuka <input type="radio"/>	Mume aliniambia <input type="radio"/>	Ndugu <input type="radio"/> Wataalam wa afya <input type="radio"/>
Je, ulipatwa na dalili hizi?	Kichwa kuuma <input type="radio"/>	Kutokuona vizuri <input type="radio"/>	<b>Weka vema jibu</b>
Uliwahi kupata kifafa kabla ya mimba hii?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	
	Kama ndiyo, kipindi gani?	Wakati ujauzito <input type="radio"/>	sina Wakati wa ujauzito mwingine <input type="radio"/>

## Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

### D. iv Inaendelea Dalili zitakozoulizwa na mhojaji

'Nitaendelea kukuuliza dalili zifuatazo kama zilikutokea katika mimba yako ya mwisho baada ya miezi 7, wakati wa kujifungua, na pia siku 42 baadaye...'

'Je katika kipindi hicho uliwahi kutokwa na **damu nyingi** sehemu ya ukeni? Ikiwa ni hivyo, lini? 'Kama sivyo, nenda D iv (c) chini

#### a) KUTOKWA DAMU NYINGI

Kipindi gani cha ujauzito?	Ujauzito <input type="radio"/>	Kujifungua <input type="radio"/>	Baada ya kujifungua <input type="radio"/>
	Taja miezi		Taja siku
Ulitumia kanga kujisitiri?	Ndiyo <input type="radio"/>	Hapana <input type="radio"/>	
	Kama ndiyo Taja...	ni Idadi jumla ya kanga	Idadi jumla ya kanga zilizolowana kabisa
Je kuna mtu mwingine aliyeshuhudia tatizo lako?	Ndiyo <input type="radio"/>	Hapana <input type="radio"/>	
	Kama ndiyo mtaje.	ni Mume <input type="radio"/>	Mtaalam wa Mwingine <input type="radio"/> afya <input type="radio"/> mtaje ⇒

## Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

D.iv. inaendelea....

### b) KUTAFUTA MSAADA KWA AJILI YA KUTOKWA NA DAMU

'Katika kipindi hicho cha ujauzito, kujifungua na ndani ya siku 42 baada ya kujifungua, Je, wewe au mtu mwingine mliwahi kufikiria kutafuta msaada kwa ajili ya hilo tatizo la kutokwa damu nyingi? 1. Ndiyo  
2. Hapana

Ikiwa ni kweli, Je, ni kipindi gani? Ikiwa *sivyo*, nenda D v

(Zingatia majibu yatokane na swali lililopita)

Je, ulifikiria kutafuta msaada? Ndiyo  Hapana

Kipindi gani cha ujauzito? Ujauzito  Kujifungua  Baada ya kujifungua   
Taja miezi | | Taja siku | |

Je, kuna mtu mwingine aliyefikiria kutafuta msaada? Ndiyo  Hapana

Kama ndiyo, mtaje

Je ulienda wapi kutafuta msaada? Zahanati  Kituo cha afya  Hospitali  Kwingine  Sikwenda

taja ⇒

Kama ulienda, Uliielezwa nini kuhusu tatizo lako?

Uliongezewa damu? Ndiyo  Hapana

**Appendix IV (f) :Hojaji ya tafiti ya akina mama katika jamii**

D.iv. inaendelea....

**c) DAWA ZA KUONGEZA DAMU**

Uliwahi kupewa dawa za kuongeza damu? Ndiyo  Hapana

Ikiwa ni ndiyo, Je ni kipindi gani cha ujauzito? Ujauzito  Kujifungua  Baada ya kujifungua

Taja miezi | | Taja siku | |

Je,unaweza kuitaja aina ya dawa uliyopewa? Ndiyo  Hapana

Kama ndiyo, itaje

Je ulipewa wapi dawa hizo? Zahanati  Kituo cha afya  Hospitali  Kwingine   
*taja =>*

---

## Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

### D.V. UCHUNGU WA MUDA MREFU

Nitaendelea kukujulisha dalili ambazo zinaweza kuwa zilikutokea kipindi cha mimba iliyopita na wakati wa kujifungua..'

'Je, uchungu wako ulikuwa ni wa muda mrefu zaidi ya **masaa 12...**? 1. Ndiyo 2. Hapana 3. Sijui. Kama ni kweli naomba nikuulize maswali zaidi. Kama si kweli **nenda Swali D vi**

Uchungu kwa ujumla ulichukua muda gani?	<input type="text"/>	Siku	<input type="text"/>	Masaa
Maumivu makali yalichukuwa muda gani?	<input type="text"/>	Siku	<input type="text"/>	Masaa
Kitendo cha kujisikia kusukuma mtoto kama wakati wa kupata haja kubwa kilichukuwa muda gani?	<input type="text"/>	Siku	<input type="text"/>	Masaa
Je kuna mtu aliyejaribu kukuzalisha kwa kumvuta mtoto kabla hujaenda sehemu ya huduma ya afya?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	Kama ndiyo mtaje	<input type="text"/>
			⇒	
Je ulianda sehemu ya huduma ya afya ili kupata msaada?	Ndiyo <input type="radio"/>	⇒	Kama hapana nenda swali <b>D</b>	<input type="text"/>
			<b>vi</b>	
Kama ulianda sehemu ya huduma ya afya au sehemu nyingine taja jina la sehemu ⇒	<input type="text"/>			
Ulipewa ushauri gani kuhusu uchungu?	<input type="text"/>			
Je, walikupa rufaa ya kwenda hospitali?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	Kama ndiyo mtaje	<input type="text"/>
			⇒	
Je mtoto alivutwa kwa mashine?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	<input type="text"/>	<input type="text"/>
Ulipasuliwa?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	<input type="text"/>	<input type="text"/>

## Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

### D.vi UCHAFU MWINGI USIO WA KAWAIDA

'Baada ya kujifungua, uliwahi kutokwa na **uchafu mwingi** katika sehemu za ukeni au kidonda cha operesheni?' 1. Ndiyo 2. Hapana 3. Sikumbuki

Ikiwa ni ndiyo, ulizia taarifa zaidi, ikiwa sivyo nenda swali **Swali E**

Ulianza kutoka siku ya ngapi baada ya kujifungua?	<input type="text"/>	<i>Siku</i>	<input type="text"/>
<b>Uchafu ulitokea wapi?</b>	Ukeni <input type="radio"/>	Kidonda tumboni <input type="radio"/>	Kwingine <input type="radio"/>
			<i>Taja ⇒</i>
<b>Ulitoka kiasi gani?</b>	Kidogo <input type="radio"/>	Kiasi <input type="radio"/>	Mwingi <input type="radio"/>
Ulitoa harufu?	Hapana <input type="radio"/>	Kidogo <input type="radio"/>	Sana <input type="radio"/>
Ulipata homa ?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	
Je, mwili ulitetemeka ?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	
	1	2	3
Ulikwenda sehemu ya huduma ya afya kuomba msaada?	Ndiyo <input type="radio"/>	Hapana <input type="radio"/>	
	<i>⇒ Kama hapana nenda Swali E</i>		
Kama ulienda sehemuya huduma ya afya taja jina ⇒	<input type="text"/>		
Ulipewa maelezo gani kuhusu kutokwa na uchafu?	<input type="text"/>		
Ulipata tiba ya sindano.?	Hapana <input type="radio"/>	Ndiyo <input type="radio"/>	

## Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

### E. HUDUMA YA KILINIKI

Ikiwa utatembea kwa miguu, itachukuwa muda gani toka nyumbani kwako hadi kiliniki ?	Chini ya saa 1 <input type="radio"/>	Kati ya saa 1 & 2 <input type="radio"/>	Zaidi ya saa 2 <input type="radio"/>	Sijui <input type="radio"/>
Uliwahi kuhudhuria kiliniki katika mimba iliyopita?	Ndiyo <input type="radio"/>	Hapana <input type="radio"/>	<i>Ikiwa hapana nenda swali F</i>	
Kama ulihudhuria , taja mara ngapi				
Kuna sababu zozote zilizokufanya uhudhurie idadi uliyotaja hapo juu?	Ndiyo <input type="radio"/>	Hapana <input type="radio"/>	Sijui <input type="radio"/>	Taja sababu kama ndiyo
Uliwahi kupata matatizo ya kiafya wakati unahudhuria kiliniki?	Hapana <input type="radio"/>	Sikumbuki <input type="radio"/>	Ndiyo <input type="radio"/>	Kama ndivyo, Taja matatizo
Ulipewa elimu ya afya kuhusu matunzo ya mimba yako na dalili zinazoashiria hatari?	Hapana <input type="radio"/>	Sikumbuki <input type="radio"/>	Ndiyo <input type="radio"/>	
Uliwahi kupewa mwongozo kuhusu mahali pa kujifungulia mtoto wako?	Hapana <input type="radio"/>	Sikumbuki <input type="radio"/>	Ndiyo <input type="radio"/>	



## Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii

### F. UAMUZI WA SEHEMU YA KUJIFUNGULIA MTOTO

Ulipokuwa mja mzito, uliwahi kuamua sehemu ambayo ungependa kujifungulia ?

Hapana  Sikumbuki  Ndiyo

Uchungu ulipokuanza, ni nani aliyetoa uamuzi wa sehemu ya kujifungulia mtoto wako?

Mwenyewe  Mume  Mama mkwe  Mkunga wa jadi  Wengine  Taja.....

Unafahamu ni vitu gani ambavyo ungepaswa kujiandaa kuwa navyo kabla ya kijifungua?

Ndiyo  Hapana  Sijui

Ikiwa unavifahamu vitaje vitu hivyo

***Mhojaji weka alama ya vema kwenye jedwali jibu litakalotajwa na mhojiwa***

***(USIMTAJIE)***

Vifaa vya kujifungulia	
Nyembe	<input type="radio"/>
Nguo / Kanga	<input type="radio"/>
Hela	<input type="radio"/>
Pamba	<input type="radio"/>
Dawa	<input type="radio"/>
Mipira ya mikono	<input type="radio"/>
Mengineyo	<input type="radio"/>
<i>Taja =&gt;</i>	

**Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii.**

**UAMUZI WA SEHEMU YA KUJIFUNGULIA MTOTO**

Je. Katika mimba Hapana  Sijui  Ndiyo  *Mhojaji weka alama ya vema kwenye jedwali jibu litakalotajwa na mhojiwa (USIMTAJIE)*

iliyopita, ulijiandaa endapo dharura ya kiafya ingeweza kutokea wakati wowote?

Vifaa vya dharura	
Hela	<input type="radio"/>
Usafiri	<input type="radio"/>
Kuhamia karibu na huduma ya afya	<input type="radio"/>
Mengineyo	<input type="radio"/> Taja ⇒

Kuna mtu mwingine ambaye alijiandaa endapo dharura inayodhuru afya yako ingetokea ? Hapana  Ndiyo  *Ikiwa sivyo, uliza swali G*

Mtaje aliyekiandaa kwa dharura kisha taja alivyojiandaa hapo chini Mume  Mama mkwe  Mama  Wengine  Taja ⇒

Mume Hela  Usafiri  Mtoa damu  Mengineyo  Taja ⇒

Mama mkwe Hela  Usafiri  Mtoa damu  Mengineyo  Taja ⇒

Mama mzazi Hela  Usafiri  Mtoa damu  Mengineyo  Taja ⇒

Wengine Hela  Usafiri  Mtoa damu  Mengineyo  Taja ⇒

**Appendix IV (f) :Hojaji ya tafiti ya akina mama katika jamii.**

**G. VIKWAZO KATIKA KUPATA HUDUMA YA AFYA WAKATI WA KUJIFUNGUA**

Je, kulikuwa na vikwazo vyoyote ulipotaka kupata huduma ya afya ulipoanza uchungu? Hapana  Sikumbuki  Ndiyo  *Ikiwa ndivyo, tafadhali taja vikwazo hivyo. Mhojaji weka alama ya vema kwenye jedwali ( USIMTAJIE)*

Vikwazo vilivyomkwamisha mama kwenda kupata huduma ya afya	
Ilibidi kumsubiri mume arudi nyumbani	<input type="radio"/>
Ilibidi kumsubiri mume mkwe aje	<input type="radio"/>
Ilibidi kumsubiri mama aje	<input type="radio"/>
Kukosekana usafiri	<input type="radio"/>
Kukosa hela	<input type="radio"/>
Mengineyo, Taja	<input type="radio"/>

Je, kulikuwa na vikwazo vyoyote katika kuifikia huduma ya afya ulipoanza uchungu? Hapana  Sikumbuki  Ndiyo  *Ikiwa ndivyo, tafadhali taja vikwazo hivyo. Mhojaji weka alama ya vema kwenye jedwali ( USIMTAJIE)*

Vikwazo vilivyomkwamisha mama kuifikia huduma ya afya	
Umbali mrefu	<input type="radio"/>
Kukosekana usafiri	<input type="radio"/>
Kukosekana kwa fedha	<input type="radio"/>
Mengineyo , Taja	<input type="radio"/>

**Appendix IV (f): Hojaji ya tafiti ya akina mama katika jamii.**

G inaelelea.....

**VIKWAZO KATIKA KUPATA HUDUMA YA AFYA WAKATI WA KUJIFUNGUA**

Je, kulikuwa na vikwazo vyoyote vya wewe kupata huduma ulipofika sehemu ya huduma ya afya?  Hapana  Sikumbuki  Ndiyo

*Ikiwa ndivyo, tafadhali taja vikwazo hivyo. Mhojaji weka alama ya vema kwenye jedwali ( USIMTAJIE)*

Vikwazo vilivyomzuia mama kupata huduma alipofika sehemu ya huduma ya afya	
Wahudumu wachache	<input type="radio"/>
Dawa hakuna	<input type="radio"/>
Wagonjwa wengi	<input type="radio"/>
Mengineyo, Taja	<input type="radio"/>

**H. AFYA YA MAMA WAKATI WA MAHOJIANO**

Je, leo unajisikiaje hali ya afya yako ukilinganisha na wakati ulipojifungua?  Nzuri  Nafuu japo bado dhaifu  Dhaifu  Mengineyo

Elezea ⇒

**Asante sana!**

Appendix IV (g): Table showing age and parity of the women of IC-DSS in Kilombero district

Variables	No of cases N = 3265	Percentage
Age	# 2590	
<20	302	11.6
20-24	670	25.9
25-29	664	25.6
30-34	486	18.8
≥ 35	468	18.1
Parity		
1	646	19.8
2	647	19.8
3	588	18.0
4	496	15.2
5	341	10.4
6	212	6.5
7	153	4.7
8	96	2.9
9-11	80	2.4
12-14	5	0.1
Marital status		
Married	2400	73.5
Not married	865	26.5
Place of delivery		
Health facility	1932	59.2
Home	1237	37.9
Other place	96	2.9

Appendix V

Method of community interview based SMM classification for the study area in 2016. The study area is located in the district of ...

No.	Name	Age	Sex	Education	Occupation	Religion	Marital Status
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
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42							
43							
44							
45							
46							
47							
48							
49							
50							

**Appendix V: Tools for validation of Community interview based SMM classification**

No.	Name	Age	Sex	Education	Occupation	Religion	Marital Status
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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41							
42							
43							
44							
45							
46							
47							
48							
49							
50							



## Appendix VI

### Appendix VI

#### Appendix VI

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## Appendix VI: Tools used for maternal health stakeholders in-depth interviews

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**Appendix VI (a):**

Community Health Sciences (Public Health

Sciences Section)

SCHOOL of CLINICAL SCIENCES and COMMUNITY HEALTH

**CONSENT FORM FOR STUDY PARTICIPANTS OF THE MATERNAL HEALTH STAKEHOLDERS' IN-**

**DEPTH INTERVIEW STUDY**

I would like to invite you to participate in an in-depth interview which will involve a range of maternal health stakeholders in this district.

The **aim of the study** is to explore about your knowledge and views on different maternal health issues with a special emphasis on severe maternal morbidity. During the interview, I shall be writing down some notes while at the same time use an audio tape recorder to record the conversation. The recorder will assist me to obtain all that will be discussed in case I forget some important points.

**Confidentiality:** I would also like to reassure you that all the information which you will provide me will be kept under strict confidentiality, using a unique identification number and not your name.

**Risks:** Your participation in this study does not involve any risk as you will just be express your views on maternal health issues. Should you feel uncomfortable with any question during the interview, please feel free to inform me.

**Benefits:** This study is among the few community studies on maternal health in Tanzania involving maternal health stakeholders who have a greater role in ensuring safe delivery for Tanzanian women.

Lastly, I would like to inform you that your participation is voluntary. Please feel free and inform me if you are willing to participate for the interview.

Thank you for listening.

I agree to participate in the interview

I also agree for the conversation to be recorded by an audio tape recorder.

Signature of respondent OR	Thumb print of respondent ( <i>if not able to write</i> )
-------------------------------	---

Date of consenting .....

Name of Interviewer and signature.....

***For any queries and questions concerning the study please contact Dr Miriam Mgonja by phone number +255754262214 between July and December 2009***

## Appendix VI (b):

Community Health Sciences (Public Health Sciences Section)  
SCHOOL of CLINICAL SCIENCES and COMMUNITY HEALTH

**FOMU YA RIDHAA KWA AJILI YA KUSHIRIKI KATIKA MAHOJIANO YA KINA YATAKAOWASHIRIKISHA**

**WADAU WA AFYA YA AKINA MAMA WAJA WAZITO**



Ninapenda kukuaribisha ili ushiriki katika mahojiano ya kina yatakaowashirikisha wadau mbalimbali wa afya ya akina mama wajawazito katika wilaya hii.

**Lengo la utafiti** ni kudodosa uelewa na fikra zako kuhusu mambo mbali mbali yanayohusu afya ya akina mama wajawazito tukizingatia zaidi matatizo ya afya wanayopata akina mama hawa. Wakati wa mahojiano hayo nitakuwa nikinukuu mahojiano hayo katika daftari. Pia nitatumia chombo cha kitaalam kurekodi mahojiano yetu ili kutunza kumbukumbu.

**Usiri:** Ninapenda kukuhakikishia kuwa taarifa zozote utakazonieleza zitahifadhiwa katika usiri mkubwa. Kumbukumbu zako zote zitatambulika kwa kutumia namba ya siri na siyo jina lako.

**Athari:** Kushiriki kwako katika mahojiano haya, hakutasababisha madhara au athari zozote kwani utakuwa unajieleza tu na kutupa maoni yako. Endapo utajisikia hofu yoyote wakati wa mahojiano, tafadhali usisite kutujulisha.

**Faida:** Huu ni utafiti kati ya tafiti chache zilizofanyika katika jamii ya kitanzania zilizohusisha wadau mbalimbali wa afya ya mama wajawazito. Wadau hawa wana nafasi kubwa katika kuboresha afya ya akina mama hawa wa kitanzania.

Mwisho napenda kusesitiza kuwa ushiriki wako katika mahojiano haya ni hiari yako. Tafadhali jisikie huru na nijulishe kama utaweza kushiriki katika mahojiano haya na pia kama uko tayari kumbukumbu zako zilizoko sehemu ya huduma ya afya zinukuliwe. Asante kwa kunisikiliza.

Nakubali kushiriki katika mahojiano

Nakubali kumbukumbu zangu zilizo katika sehemu inayotoa huduma ya afya zinukuliwe kwa ajili ya tafiti, ili mradi jina langu lisionyeshwe.

Sahihi ya mhojiwa

AU

Alama ya dole gumba (*kama hawezi kusoma*)

Tarehe ya kutoa ridhaa .....

Jina la mhojaji na sahihi.....

***Kwa maswali yoyote kuhusu utafiti huu wasiliana tafadhali na Dr Miriam Mgonja kwa namba ya simur +255754262214 kati ya Julai na Desemba 2009***

## Appendix VI (c):

### TOPIC GUIDE FOR QUALITATIVE INTERVIEWS OF MATERNAL HEALTH STAKEHOLDERS:

#### *For stakeholders who have no medical background*

1. Self introduction
2. Informed consent
3. Objectives of the interviews/ study
4. Knowledge/ awareness of SMM burden and specific conditions at the district
5. Is SMM so much of a problem? If so, why?
6. Relationship of SMM with maternal mortality
7. Role of respondent in combating SMM
8. Challenges in combating SMM
9. How can we ensure safe delivery for the women in the district?
10. Possible solutions for the challenges at the district's level
11. Is there a need for birth and complication readiness plans for the pregnant women?
12. If so can you mention the birth and complication readiness plans?
13. For husbands, how exactly do you do prepare yourself when your wife becomes pregnant Do you face any challenges in implementing the preparations? What are the challenges? And how best can you address them?
14. Is antenatal clinic important? If so, can you elaborate?

#### *For stakeholders who have medical background*

1. Self introduction
2. Informed consent
3. Objectives of the interviews/ study
4. Knowledge/ awareness of SMM burden and specific conditions at the health facility
5. Is SMM so much of a problem? If so, why?
6. Relationship of SMM with maternal mortality
7. Role of respondent in combating SMM
8. Challenges in combating SMM
9. Possible solutions for the challenges in combating SMM

## Appendix VI (d):

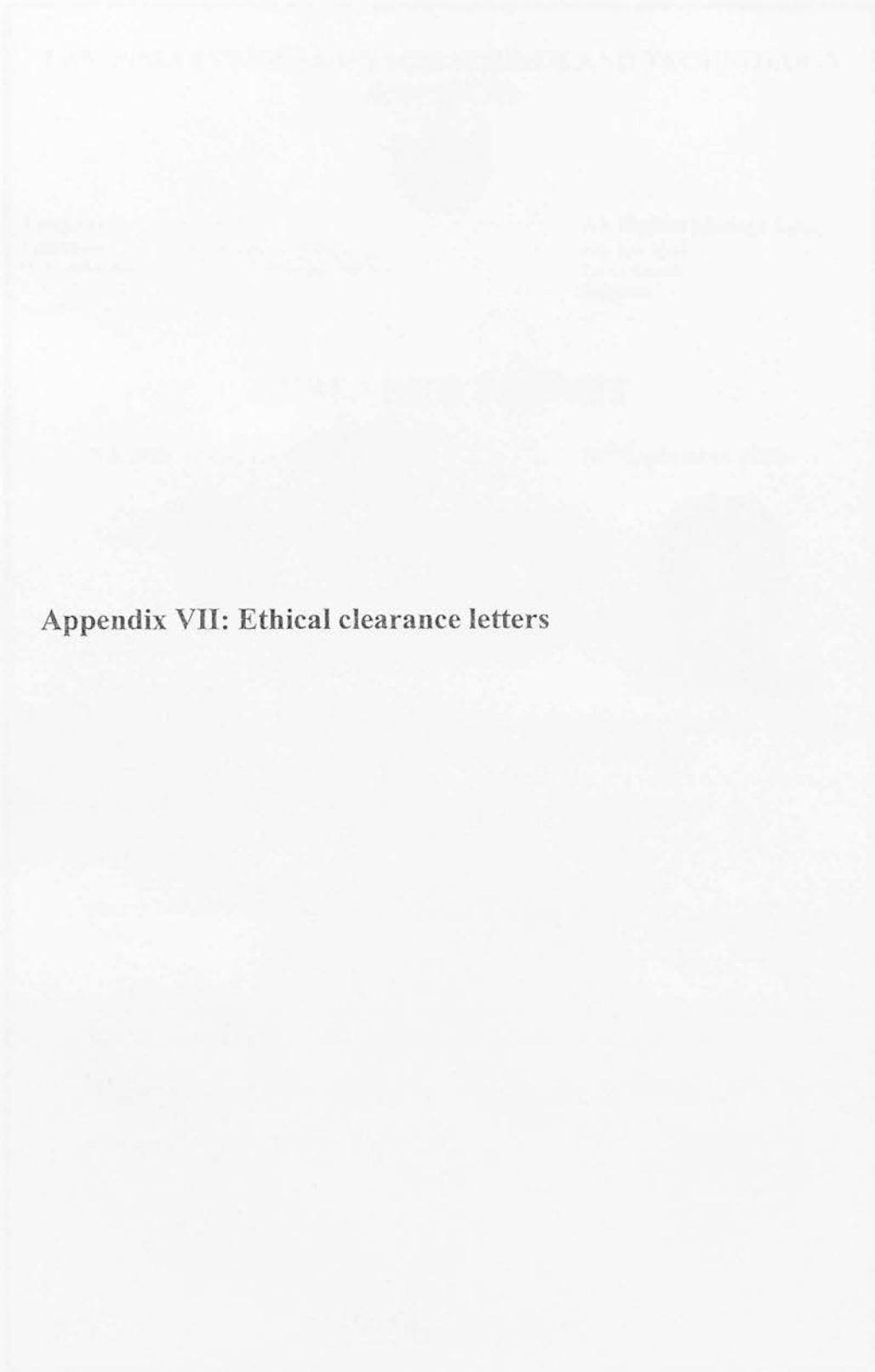
### KIELELEZO CHA MAHOJIANO KWA WADAU WA AFYA YA AKINA MAMA WAJAWAZITO

*Mahojiano kwa wadau wasio na utaalumu wa afya*

1. Utambulisho
2. Ridhaa ya kushiriki katika mahojiano
3. Madhumuni ya mahojiano/ utafiti.
4. Ujuzi na uelewa kuhusu matatizo ya kiafya ya akina mama katika wilaya wanayoyapata wakati wa ujauzito, kujifungua na kabla ya arobaini.
5. Je matatizo haya ya akina mama ni tatizo makubwa? kama ndivyo, nini kinachosababisha ukubwa wa matatizo hayo?
6. Uhusiano wa matatizo hayo na vifo vya akina mama .
7. Nafasi na mchango wako katika kutatua matatizo hayo
8. Changamoto zinazomkabili mdau katika kupambana na matatizo hayo
9. Tutahakikishaje akina mama wanajifungua salama katika wilaya?
10. Mapendekezo ya suluhisho kwa changamoto zinazomkabili mdau katika kupambana na matatizo haya
11. Je, kuna haja ya maandalizi kwa ajili ya uzazi na endapo dharura itatokea kwa akina mama wajawazito?
12. Ikiwa kuna umuhimu, Taja maandalizi hayo
13. Kwa akina baba, unajiandaaje kumsaidia mkeo katika maandalizi haya? Kuna changamoto zozote? Zitaje. Je, ni njia gani bora ambayo unaweza kuitumia kutatua changamoto hizo?
14. Je, kuna umuhimu wa kiliniki ya ujauzito? Ikiwa ndiyo, elezea

*Mahojiano kwa wadau wasio na utaalumu wa afya (anza na swali 1-3 hapo juu)*

1. Ujuzi na uelewa kuhusu matatizo ya kiafya ya akina mama
2. Je matatizo haya ni makubwa? kama ndivyo, nini kinachosababisha?
3. Uhusiano wa matatizo hayo na vifo vya akina mama
4. Nafasi na mchango wako katika kutatua matatizo hayo
5. Changamoto zinazomkabili mdau katika kupambana na matatizo hayo
6. Mapendekezo ya suluhisho kwa changamoto zinazomkabili mdau katika kupambana na matatizo haya



**Appendix VII: Ethical clearance letters**

**TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY  
(COSTECH)**



**Telegrams:** COSTECH

**Telephones:** (255 - 022) 2775155 - 6, 2700745/6

**Director General:** (255 - 022) 2700750&2775315

**Fax:** (255 - 022) 2775313

**Email:** telecance@costech.or.tz

Ali Hassan Mwinyi Road

P.O. Box 4302

Dar es Salaam

Tanzania

## RESEARCH PERMIT

No. 2009 -138- NA-2009-78

15<sup>th</sup> September 2009

1. Name : Miriam Lucy Mgonja

2. Nationality : Tanzanian



3. Title : "Integrated Studies Addressing the Burden of Severe Maternal Morbidity in Rural Tanzania"

4. Research shall be confined to the following region(s): Morogoro

5. Permit validity 15<sup>th</sup> September 2009 to 14<sup>th</sup> September 2010

6. Local Contact/collaborator: Prof. Sirel Massawe, Muhimbili University of Health and Allied Sciences, P.O. Box 65001, Dar es Salaam

7. Researcher is required to submit progress report on quarterly basis and submit all Publications made after research.

M. Mushi

for: DIRECTOR GENERAL

THE UNITED REPUBLIC OF  
TANZANIA



National Institute for Medical Research  
P.O. Box 9653  
Dar es Salaam  
Tel: 255 22 2121400/390  
Fax: 255 22 2121380/2121360  
E-mail: [headquarters@nimr.or.tz](mailto:headquarters@nimr.or.tz)  
NIMR/HQ/R.8a/Vol. IX/853

Ministry of Health and Social Welfare  
P.O. Box 9083  
Dar es Salaam  
Tel: 255 22 2120262-7  
Fax: 255 22 2110986

22<sup>nd</sup> July 2009

Dr Miriam Mgonja  
Department of Obstetrics and Gynaecology  
Muhimbili National Hospital  
P O Box 65117, Dar es Salaam

**CLEARANCE CERTIFICATE FOR CONDUCTING  
MEDICAL RESEARCH IN TANZANIA**

This is to certify that the research entitled: Integrated studies addressing the burden of severe maternal morbidity in rural Tanzania, (Mgonja *et al*), has been granted ethics clearance to be conducted in Tanzania.

The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is made available to the Ministry of Health and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine.
5. Approval is for one year: 22<sup>nd</sup> July 2009 to 21<sup>st</sup> July 2010.

Name: Dr Mwelecele N Malecela

Signature

ACTING CHAIRPERSON  
MEDICAL RESEARCH  
COORDINATING COMMITTEE

Name: Dr Deo M Mtasiwa

Signature

CHIEF MEDICAL OFFICER  
MINISTRY OF HEALTH, SOCIAL  
WELFARE

CC: RMO  
DMO

**INSTITUTIONAL REVIEW BOARD**

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National Institute of Medical Research  
P. O. Box 9653  
Dar es Salaam  
Email: [headquarters@nimr.or.tz](mailto:headquarters@nimr.or.tz)

15<sup>th</sup> July 2009

Dr. Miriam Mgonja  
University of Edinburgh  
Medical School  
Teviot Place  
Edinburgh

IHI/IRB/No. A 72-2009

**INSTITUTIONAL CLEARANCE CERTIFICATE FOR CONDUCTING  
HEALTH RESEARCH**

On 15<sup>th</sup> July 2009, the Ifakara Health Institute Institutional Review Board (IHI IRB) reviewed the study entitled:  
“**Integrated Studies Addressing the Burden of Severe Maternal Morbidity in Rural Tanzania**”.  
Submitted by the Principal Investigator Dr. Miriam Mgonja.

The following documents were reviewed:

1. Protocol
2. Informed Consents
3. Questionnaires
4. CVs

The study has been approved for implementation after IRB consensus.

This certificate thus indicates that; the above-mentioned study has been granted an Institutional ethics clearance to conduct the above named study in St. Francis Ifakara Hospital - Tanzania.

The Principal Investigator of the study must ensure that, the following conditions are fulfilled during or after the implementation of the study:

1. PI should submit a six month progress report and the final report at the end of the project
2. **Any amendment**, which will be done after the approval of the protocol, must be communicated as soon as possible to the IRB for another approval.
3. All research must stop after the project expiration date, unless there is prior information and justification to the IRB.
4. There should be plans to give feedback to the community on the findings
5. Any publication needs to pass through the IRB.

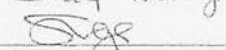
*The IRB reserves the right to undertake field inspections to check on the protocol compliance*

JOYCE K. IKINGIRA



Signature  
Chairperson

Sally Anteyo



Signature  
Administrator