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Maternal Death Surveillance and Response in Tanzania

Challenges to successful implementation

ALI SAID



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Abstract

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Tanzania has one of the highest maternal mortality ratios (MMR) in the world. Tanzania introduced the Maternal Death Surveillance and Response (MDSR) system to facilitate deaths notification and learning from death reviews in order to prevent future deaths. The aim was to describe the strengths, challenges and impact of implementing the MDSR system in Tanzania. A mixed methods study was conducted in the Lindi and Mtwara regions in Southern Tanzania. The system's adequacy was assessed in terms of notification of deaths, categorization of causes of deaths and identification of three delays. The notification of deaths in the MDSR system was compared to other standard estimates. The causes of deaths and delays identified by the MDSR system were compared to an expert panel's review using Cohen's K statistic. Community members' perceptions and experiences of events leading to death were explored. The availability and documentation of narrative summaries used in death review meetings and action plans created by the MDSR committees were also assessed. A checklist was used to assess the summaries while the SMART criterion was used for assessing the action plans. Health providers and managers were interviewed through focus group discussions and key informant interviews on their perceptions and experiences in implementing the MDSR system.

The MDSR system performed well in categorizing the causes of maternal deaths (K statistic 0.76). Notification of deaths in the MDSR system was incomplete (MMR 137/100,000 live births) and there was inadequate identification of all three delays (K statistics < 0.2). Caregivers failed to account for pregnancy complications during birth preparations. They also described challenges in interactions with health providers in health facilities and were excluded from the care of the deceased woman. Families suffered social, psychological and economic consequences from maternal deaths. Most narrative summaries used in death review meetings were not comprehensively written. Less than half of action plans met the SMART criteria. Health providers and managers expressed high ambitions in implementing the system with notable policy, attitude and quality of care changes. They further described many organizational, contextual and individual challenges facing the system.

Addressing the above challenges will enable the MDSR system to effectively improve quality of care and reduce maternal deaths.

Keywords: Maternal death, Maternal death surveillance and response, maternal mortality, MDSR, maternal death review, MDR, quality improvements

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To my children Nadia and Adnan
To the newborns who lost their
mothers to maternal deaths

List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

- I Said A, Målqvist M, Pembe AB, Massawe S, and Hanson C. (2020) Causes of maternal deaths and delays in care: comparison between routine maternal death surveillance and response system and an obstetrician expert panel in Tanzania. *BMC Health Serv Res* **20**, 614 <https://doi.org/10.1186/s12913-020-05460-7>
- II Said A, Målqvist M, Massawe S, Hanson C, and Pembe AB. Community perceptions and experiences on the events leading to facility maternal deaths; a verbal autopsy qualitative study. (*Submitted*)
- III Said A, Pembe AB, Massawe S, Hanson C, and Målqvist t M. (2021). Maternal death surveillance and response in Tanzania: comprehensiveness of narrative summaries and action points from maternal deaths reviews. *BMC Health Serv Res* **21**, 52. <https://doi.org/10.1186/s12913-020-06036-1>
- IV Said A, Sirili N, Pembe AB, Massawe S, Hanson C, and Målqvist M. Mismatched ambition, execution and outcomes: Health providers and managers` experiences on implementing maternal death surveillance and response system in Tanzania; A qualitative study. (*Submitted*)

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Abbreviations

DED	District Executive Director
DMO	District Medical Officer
FGDs	Focus Group Discussions
HMT	Health Management Team
ICD MM	International Classification of Diseases Maternal Mortality
ICD 10	International Classification of Diseases 10 th Version
KII	Key Informants Interview
LMICs	Low- and Middle-Income Countries
MDC	Masasi District Council
MDSR	Maternal Death Surveillance and Response
MMC	Mtwara Municipal Council
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MMR	Maternal Mortality Ratio
MUHAS	Muhimbili University of Health and Allied Sciences
NDC	Nanyamba District Council
PPH	Postpartum Hemorrhage
RCHCo	Reproductive and Child Health Coordinator
RMO	Regional Medical Officer
SA	Social Autopsy
SDGs	Sustainable Development Goals
SMART	Specific, Measurable, Attainable, Relevant, Time-bound
TDC	Tandahimba District Council
VA	Verbal Autopsy
WHO	World Health Organization

Introduction

Maternal Mortality Ratio

Globally, the maternal mortality ratio (MMR) has declined but the level is still unacceptably high with 295,000 maternal deaths reported in 2017. Most of these deaths (94%) occur in low-and middle-income countries (LMICs) in South East Asia and Sub-Saharan Africa [1-3]. In the past decade, South East Asia has achieved larger reduction in the MMR than Sub-Saharan Africa (60% vs. 40%). Existence of high MMR signifies inadequate efforts to address their causes at community and health facilities. The lifetime risk of a woman dying from maternal death is many times higher for adolescents and those living in LMICs than those in higher income countries [3-5]. Maternal deaths have consequences for the society and often indicate a failure within the health system to help a woman go through pregnancy safely. Families and communities in general suffer a wide range of social, psychological and economic consequences from maternal deaths [6, 7]. This calls for global efforts to strategize effective methods to improve quality of care and reduce maternal deaths.

Maternal death and its causes

Each pregnancy journey is different but women anticipate a positive pregnancy experience and the safe birth of a healthy newborn [8]. Depending on their risks and quality of care provided oftentimes women experience complications during pregnancy, delivery or afterwards resulting in prolonged morbidity or death [9-11]. According to the international classification of diseases version 10 (ICD 10) “the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes” is termed as maternal death [12]. Causes of maternal death are classified as direct or indirect depending on their circumstances of occurrence. The direct causes of death are those that result from obstetric complications such as postpartum hemorrhage (PPH), puerperal sepsis and septic abortions [13]. The indirect causes are those resulting from preexisting disease conditions or those that

develop during pregnancy (not direct deaths) that are exacerbated by the pregnancy state, such as anemia and heart diseases [13]. This recommended classification provides consistent data and helps in strategizing targeted interventions to prevent maternal deaths [14, 15]. The ICD Maternal Mortality (ICD MM) also classifies the causes of death into nine groups which are mutually exclusive and totally inclusive. These are; 1) Pregnancy with abortive outcome 2) Hypertensive disorders in pregnancy childbirth and the puerperium 3) Obstetric hemorrhage 4) Pregnancy related infections 5) Other obstetric complications 6) Unanticipated complications of management 7) Non obstetric complications 8) Unknown /undetermined 9) Coincidental causes. Groups one to six are direct causes, group seven includes indirect causes and group nine is not classified as maternal death but as pregnancy related death [13].

Underlying reasons for maternal deaths signify breakdown in quality of care and are conceptualized by the three delays model; delay in decision making to seek care (delay one), delay in getting to a health facility (delay two) and delay in receiving care once the woman reaches the health facility (delay three) [16]. The delays model provides health system researchers and health providers a detailed assessment of reasons for occurrence of maternal deaths. Recommendations for improvement of quality of care in health systems often address one or all the three delays. In some settings the first and second delay are increasingly addressed [17, 18] while in others they are still the largest contributor of maternal deaths [19]. In most LMICs, health systems are still struggling to provide quality and timely health care (the third delay) to pregnant women [20-22].

In recent years, the international community has set a goal to reduce the global MMR to 70 per 100,000 live births by the year 2030, a specific target found under Sustainable Development Goal 3 (SDG3) [1, 23]. This will require countries to work at least three times as much as they worked for Millennium Development Goal 5, with targets to address the reasons for the high number of maternal deaths [24]. Tanzania has seen progress in maternal health care in recent years but still has one of the highest MMR in the world, at 524 per 100,000 live births, which is more than half of what it was in the 1990s [3]. To address the high maternal mortality ratio, different strategies such as maternal death surveillance and response have been recommended.

Maternal Death Surveillance and Response (MDSR)

The Maternal Death Surveillance and Response (MDSR) system aims to identify and review maternal deaths to understand the magnitude of the problem and learn lessons to improving quality of care. Death reviews for learning and prevention purposes have been in practice for a long time; for example, in the United States, different systems have been in place since the

20th century [25]. In the UK, the system has been running for longer than in any other country and has evolved over the years into the Maternal Newborn and Infant Clinical Outcome Review Program (MNI-CORP) [26]. Confidential enquiries into maternal deaths in the UK, Netherlands and South Africa are used for identification, reporting and analysis of maternal deaths, and to provide recommendations for quality improvement [26-28]. In LMICs maternal death reviews have been in practice since the 1990s and have described causes of maternal deaths as relating to, gaps in provision of quality of care, data management issues, as well as first, second and third delays [29-32]. However, maternal death reviews have been met with problems such as lack of response to the recommendations, poor structure, fear of blame, lack of skills, missing data, lack of support and hence, inability to reduce maternal mortality [30, 33, 34]. To reinvigorate and improve the reviews, the World Health Organization (WHO) introduced the MDSR system [35] which emphasized addressing the challenges facing the previous systems. The MDSR system entails ‘a continuous maternal deaths audit that provides valuable information about the causes and avoidable factors to maternal deaths, the lessons learnt are used to prevent future similar deaths’. There is more emphasis on continuous surveillance (at community and facility levels), to timely notify deaths and respond through actions from analysis of data [35, 36]. Typically a team of health professionals review the circumstances of deaths, as well as the underlying causes and contributing factors such as delays in care seeking and provision [16, 35, 37, 38]. Evidence has shown that recommendations from MDSR can be used to improve quality of care in health systems by implementing them into the action plans [13, 39, 40]. Maternal death surveillance and response is implemented through a number of steps (Figure 1).

Identification and notification

The first step is identification and notification. All maternal deaths that occur in health facilities should be notified within 24 hours and those from the communities (outside health facilities) within 48 hours. Timely notification ensures appropriate response by the system using correct and consistent data. Studies in MDSR implementing countries have reported inadequate notification of maternal deaths. For example, less than half of the facilities in Ethiopia notified deaths on time, while in Zimbabwe lack of knowledge among health providers, absence of notification forms and unknown notification pathways hindered the process [41-43]. In Rwanda, the identification of deaths in health facilities was not inclusive, indicating possibility of missing data in the system [44]. The situation is worse for deaths occurring in communities and so involving the community in deaths notification will improve their identification and notification [45, 46].

Inadequate notification may be one reason for failure of the system to prevent maternal deaths.

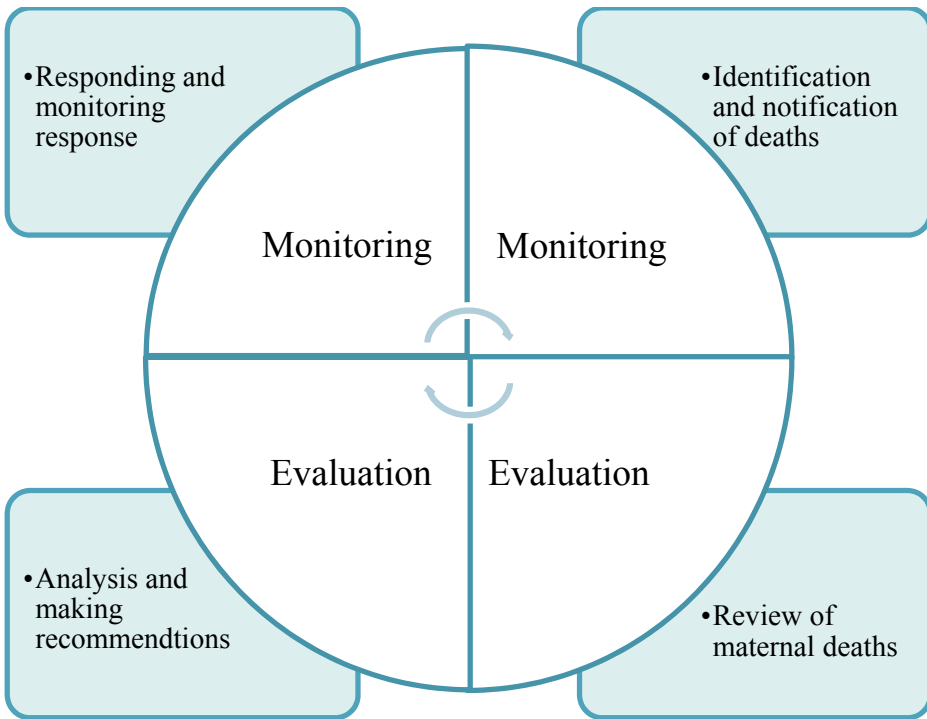


Figure 1: MDSR cycle adapted from the WHO MDSR cycle

Death review

Notification is usually followed by a facility and/or community-based maternal death review, held by designated MDSR committees. A facility-based review is meant to explore events preceding the death in the health care system. It usually reveals the gaps in quality of care in terms of time, equipment, expertise, supplies, communication, human resource and governance [47-49]. The information from facility reviews are complemented by community based reviews which seek to identify the personal, family or community factors that may have contributed to deaths in women who died outside of medical facilities [50]. The use of Verbal Autopsy (VA) and or Social Autopsy (SA) to understand events that led to deaths in the community or in weak vital registration systems is recommended [51, 52]. This involvement of the community in MDSR is desired to enhance the learning process. Both reviews reveal the causes of maternal deaths and avoidable factors from the community and health facilities [53]. For this reason, it is important for the MDSR committees to correctly and consistently categorize

causes of maternal deaths according to ICD-MM [54, 55]. This categorization provides data consistency and increased specificity of action plans for the causes of deaths [56]. It also reduces possibility of underestimation or overestimation of maternal deaths data. Challenges are reported when health providers categorize causes of death in many settings. In Malawi, there was poor agreement (K statistic 0.2) on the categorization of medical causes of maternal deaths between health care providers and researchers. Health care providers failed to assign an underlying cause of death in a third of all deaths and indicated immediate causes (a condition leading directly to death) such as hypovolemic shock as the underlying cause instead [57]. Complications of management or abortion complications were misclassified in a study carried out in five Sub-Saharan African countries [58]. Mgawadere et al in Malawi reported significant differences in categorization of causes of deaths between a researcher panel and health providers. The panel of experts categorization led to 18.6% lower proportion of indirect maternal deaths and also re-categorized all contributing factors [59]. In Suriname, there was high agreement in categorizing abortion complications and obstetric hemorrhage but less agreement for other causes between physicians, national and international MDSR committees [60]. In these settings, it is clear that health care providers face challenges in deciding the medical causes of deaths. This could be due to lack of knowledge or misinterpretation of the definition of cause of death. In the UK, applying ICD-MM to maternal deaths had little impact on the categorization of cause of death or estimating the rate of maternal mortality [61]. In Sri Lanka, it was suggested that using ICD-MM classifications may increase the estimation of maternal deaths [62]. The difference can be postulated to be due to long time experience in reviewing maternal deaths in the UK system compared to in LMICs.

In view of the importance of having the correct information on cause of deaths, as well as contributing factors to inform strategies, we planned to 1) estimate the completeness of reporting of facility maternal deaths and 2) assess the categorization of causes of deaths and three phases of delays by comparing the MDSR system to an expert panel of independent obstetricians. Gaps identified will help put forward recommendations to improve the MDSR system.

The Narrative summary

During review meetings, the MDSR committees are recommended to utilize a specially prepared narrative summary of events that preceded the deaths [35, 63]. The information in the summaries depends largely on documentation of medical files and interviews of health providers and family members. The narrative summary is used for discussions during MDSR meetings at health facilities, districts and sometimes at regional levels of the health system. In the Tanzanian MDSR system the summary is kept as a confidential document

as a hard and/or electronic copy, with or without the medical file. In some cases, it is the only document of the deceased woman that can be found in health facilities. Record keeping in medical files in health facilities is weak and faces challenges as health care providers fail to follow recommendations during gathering and storing of information [64-66]. Abstraction of information from such medical records can lead to inadequately written summaries. Since the MDSR system recommends utilizing summaries prepared from multiple sources, they are generally expected to have comprehensive information about the death to help the committees reach correct conclusions.

Action plans

During facility and community reviews, analysis and interpretation of the data provides basis for recommending action plans. The action for response should be immediate and/ or long-term plans, evidence based and specific for the health facility and community and involve all stakeholders [67]. The action plans are tailored to address the specific underlying causes of death and any contributing factors. The action plans from maternal death reviews are recommended to be clearly defined, with specific timelines and a responsible person to facilitate tracking and measuring of implementation. They are recommended to be *Specific, Measurable, Attainable, and Realistic with specific allocated Time* (SMART). In Nigeria, use of a scorecard to track MDSR activities pointed out facilities that had recommended actions without clearly defined activities [68]. Recommended action plans may be difficult to implement and/or follow up if they are not SMART.

Response

Response is an important component of the system, which entails among other things implementation of review meetings recommended actions plans at all levels of the health system [35]. The implementation of action plans addresses issues that contributed to maternal deaths. These can be health care seeking obstacles at family and community levels, problems in health facilities such as the availability of staff, and equipment. Further contributors are decision making by providers, accountability, facility infrastructure and staff knowledge and skills. Studies in many LMICs have shown implementation of recommendations from maternal death reviews as a catalyst in the efforts to improve quality of care and reduce maternal deaths. One example is the quality of care, risk management and technology in obstetrics (QUARITE) trial in Senegal and Mali. This intervention included maternal death reviews and resulted in reduction of maternal deaths in intervention areas [69]. In Nigeria, states that were performing MDSR had 67% of recommended actions implemented during a three months period [68]. Even though not all actions

were implemented, it had measurable impact within the concerned states such as setting up of blood donation centers and clubs. In Rwanda, recommendations from death reviews targeted different aspects of care such as availability of medicines, quality improvements, referral systems, governance and human resources. These were aimed at all levels of the health care system from the community, health facility and higher levels [70]. Implementation of recommendations from the National Maternal Mortality Survey in Egypt improved utilization of antenatal care, improved health facilities, increased skilled birth attendance, improved education for women and contraception use [40]. The ultimate impact of these interventions was reduction of maternal deaths by 52% over eight years. Studies on maternal death reviews including causes and contributing factors have been documented in Tanzania, but there is little documentation on the implementation of recommendations from the reviews and its impact on level of maternal deaths [29, 30, 71-73].

Furthermore, MDSR systems in LMICs have been reported to face other challenges that need to be addressed to make it more efficient. These include poor integration and separation from the health information system, missing links between the review information and response, lack of knowledge, legal framework, governance, accountability, resources, low community involvement and lack of follow up on recommendations [58, 68, 74].

Maternal Death Surveillance and Response also involves monitoring and evaluation. It entails follow up of the implementation of each component of the system, from identification to response at all levels. It also includes gathering and disseminating information from the lower levels to higher levels of the health system with provision of feedbacks.

The MDSR system in Tanzania

Efforts to reduce deaths through reviews/audits have been in practice in Tanzania since 1984 through the 1990s [75-77]. In 2015, the reviews were improved by introduction of the MDSR system, with dissemination of a new guideline that was adapted from WHO as well as other similar guidelines. The guideline specifies the need for a multidisciplinary MDSR committee for any facilities that provide delivery services [63]. This committee is to be composed of clinical and non-clinical staff such as obstetricians, medical doctors, clinical officers, nurses and midwives, facility management personnel, laboratory personnel and ambulance drivers. The recommended teams are found in zonal, regional and district hospitals where maternal deaths commonly occur.

In these health facilities, the MDSR review meetings are organized and completed within seven days of occurrence of a maternal death. The meeting uses a narrative summary of the events preceding the death which is prepared by a designated person using information from medical files and interviews

of health care providers and relatives who cared for the patient. There is no clear guide for the interviews of relatives and VA is not routinely performed. The narrative summary is prepared following a specific checklist and examples stipulated in the guideline. Medical files or health providers who cared for the woman can be referred to when more information is needed. At the end of the meeting a specific maternal deaths reporting form is filled and is sent to higher levels within the health system [63]. The form contains information on demographic characteristics, events leading up to the death, management given, complications which occurred, medical causes of death and contributing factors along the three delays model. The underlying medical causes of deaths are recommended to be categorized following ICD 10 rules but there is no formal training on this. The recommended action plans put forward during the meeting address the identified three delays in care and are SMART. Community based reviews have no clear guide but there are recommendations to notify on community maternal deaths.

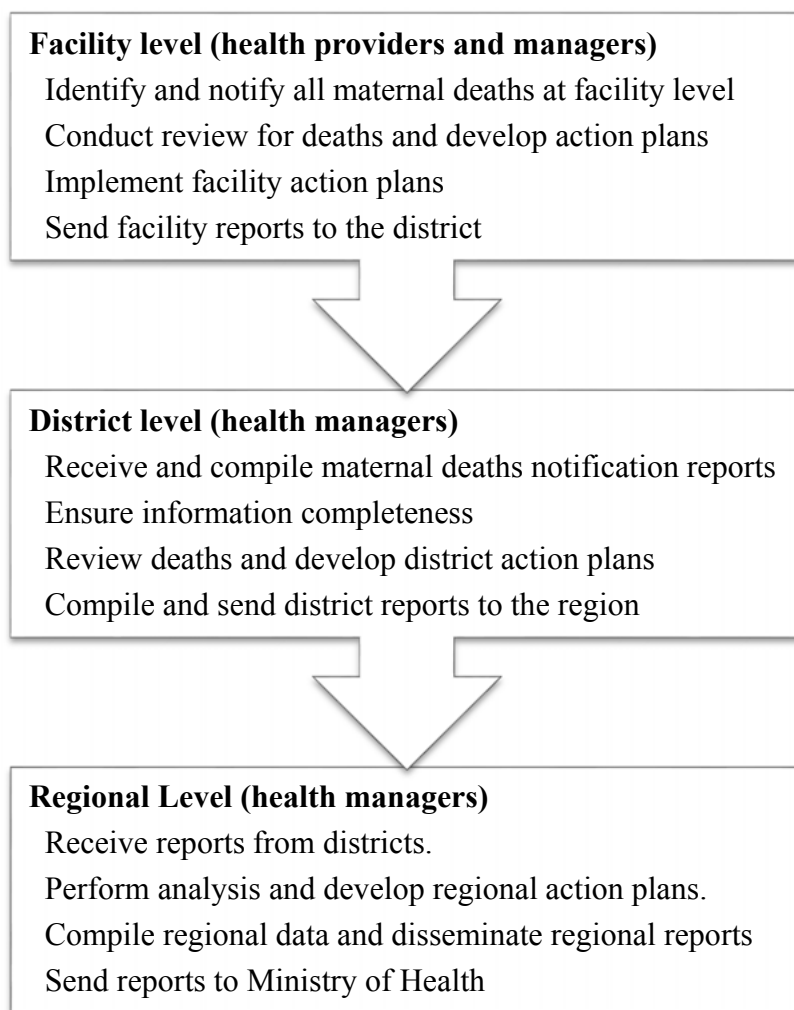


Figure 2: Health providers and managers responsibilities in MDSR in Tanzania

Health providers' and managers perceptions and experiences with MDSR

The MDSR system in Tanzania also involves interactions of health providers and managers at different levels of the health system (Figure 2). These interactions involve reporting different information about deaths, sending and receiving feedback and supervision from higher levels. The reports from death reviews at health facilities and sometimes communities are sent to higher levels of the health system (district or regional). The district/region is responsible for compiling the reports, providing feedback to the facilities/communities and sending aggregated information to the national

level, the Ministry of Health Community Development Gender Elderly and Children (MoHCDGEC). The ministry compiles national reports, disseminates the reports and uses the information to provide guidelines and strategies to avoid deaths recurring in the same pattern. This implies that MDSR involves the whole health system from the community to national level. This flow of information and feedback is important in strengthening the health system by addressing deficiencies that can lead to maternal mortality and morbidity

Understanding health providers' and managers' experiences in implementing the system can identify strengths and gaps in implementation and track the impact of the system from implementers' perspectives. Problems facing health providers and managers in maternal death reviews are lack of response, accountability and lack of supportive supervision which stopped some providers from staying involved in the system [71]. This resulted to poor implementation of the review process and hence a low impact on quality improvement and reducing maternal deaths. Health providers also have expressed that being shouted at, blaming, focusing on mistakes only and pointing out who made the mistakes during the reviews are the main demotivating factors that occur in this process [78]. On the other hand, health providers believed MDSR has contributed to their professional development through on job learning of the gaps identified in review meetings [78]. Providers' positive experience with MDSR can act as motivating factor for them to take part in system activities.

Community perceptions and experiences on maternal deaths

The Tanzanian MDSR guideline of 2015 does not have recommendations for community based reviews or use of VA. Verbal autopsy uses a standardized questionnaire to interview relatives or caregivers and sometimes neighbors to investigate the circumstances (medical causes and contributing factors) of the death that occurred in the community, facility or both [35, 53, 79, 80]. Information from the community can augment and increase understanding of maternal deaths occurring in facilities [35, 81, 82]. Community discussions about deaths has been shown to increase community awareness and understanding, commitment and health care seeking behavior [83]. In Bangladesh, Indonesia and Nigeria community-based reviews using VA and SA described causes and contributing factors to death, community perceptions of causes and community sensitization in activities to reduce maternal deaths [84-89]. Community inclusion in MDSR activities needs better understanding of community perceptions on the causes of death.

General community members' perceptions on causes of death have been studied but there is a lack of information on caregivers' perceptions and experiences with the chain of events leading up to maternal deaths occurring in facilities. Descriptions of community/caregivers contact with health care

providers will recommend strategies for improvement. Therefore, we aimed to explore how caregivers perceive and experience events that preceded a maternal death, from the home to the health facility through modified VA interviews. Understanding these experiences will provide information for action in community-based reviews and help shape provider-family interactions in the process of caring for pregnant women

Rationale

Tanzania's maternal mortality ratio is still one of the highest in the world [1, 3, 90]. In view of the large increase of facility deliveries it can be assumed that the majority of mothers who die today had contact with the health care system and died in health facilities. Tanzania introduced MDSR in line with WHO recommendations to strengthen and re-vitalize the death review system, which was introduced in 1984. The efficiency of the system depends on complete identification of all maternal deaths (from communities and facilities), review of all deaths, correct categorization of causes of deaths and identification of all delays and clearly defined action plans. To accomplish its objectives, the system also depends on implementers' training, complete documentation of events leading to deaths, the right attitudes of implementers and community members' involvement. Furthermore, accurate understanding of the context in which maternal deaths occurs requires a wider examination of circumstances surrounding them. Women who die in health facilities and their caregivers face numerous challenges in the family and community that can contribute to untimely reception of care in health facilities. To understand the social, cultural, behavioral and health system factors that contribute to maternal deaths, interviews with family members is recommended [80, 91, 92]. This can be done for facility and community maternal deaths.

The MDSR committees in health facilities can make incorrect categorization of causes of maternal deaths (no adherence to ICD 10) and contributing factors [57, 59, 93]. There is little evidence on the adherence to ICD-MM during categorization of the causes and the extent to which the three delays are identified in the Tanzanian MDSR system. The system categorizes causes of maternal deaths using death summaries during the review meetings. It is not known if the narrative summaries have sufficient information to adequately assess events leading to deaths. Previous literature suggests implementers' experiences have not been well described [94]. Since the introduction of the MDSR system in Tanzania, the perceptions and experiences of health providers and managers on how the process has been implemented have not been described. We sought to; 1) examine the completeness of death notifications, accuracy of categorization of causes of death, 2) identification of three delays and 3) comprehensiveness of summaries used in reviews and action plans in the MDSR system, 4) describe providers and managers experiences with different aspects of the MDSR system.

Verbal autopsy provides information for the clinical diagnosis of maternal deaths that occurred in the community with or without contact to a health facility [35, 54, 95-98]. The Tanzanian MDSR system does not include community based MDSR and VA is rarely performed since little evidence exists on how to do this. Understanding community perceptions of events leading to maternal deaths will assist in strategizing ways to include communities within the MDSR system.

The findings from this thesis will help policy makers and other stakeholders to design intervention programs to make the MDSR in Tanzania an efficient tool for health system strengthening. It will also help the community to be aware and participate in activities for the prevention of maternal deaths through advocacy and accountability.

Aims and Objectives

Overall aim

The overall aim of this thesis was to assess the strengths, challenges and impact of the implementation of the MDSR system in Tanzania.

Specific objectives

Paper I

To compare causes and care delays of maternal deaths categorized through the MDSR process to those from a panel of independent experts.

Paper II

To explore the perceptions and experiences of community members on the events leading up to a facility maternal deaths

Paper III

To assess the comprehensiveness of narrative summaries and recommended action plans from the MDSR system and their implementation.

Paper IV

To explore perceptions and experiences of health providers and managers on the implementation of the MDSR system

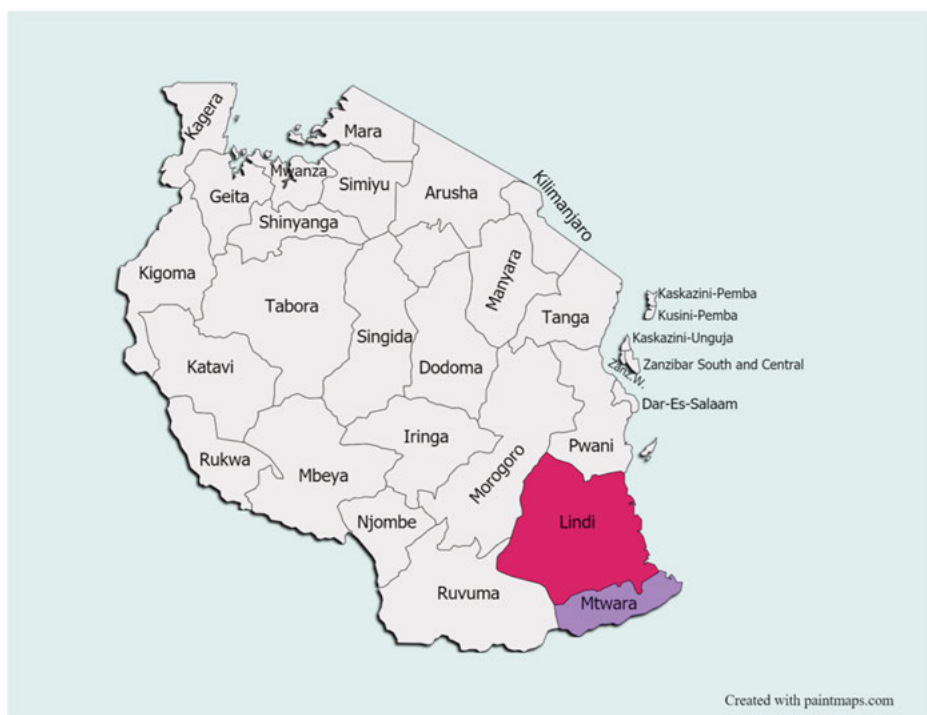
Methods

Study design

This was a descriptive study using both qualitative and quantitative components of data collection. The first and third papers were cross-sectional descriptive studies. The second and fourth papers were qualitative studies. Methods of each paper are summarized in Table 1.

Study setting

Tanzania is a country located in the East Coast of Africa, with a population of almost 60 million people according to the World Bank, which is approximately 15 million more than a 2012 census estimation [99, 100]. The country is administratively divided into 31 regions and 169 districts. The districts are comprised of rural districts (district councils) and urban districts (town councils, municipal councils and city councils). The health system follows a pyramidal shape, which is a decentralized district health system. Financing of the health system through the districts takes into consideration population size, population below the poverty line, under-five mortality, disease burden and distance covered by medical transportation means [101, 102]. The health care structure includes national hospitals, zonal hospitals and regional referral hospitals (all under MoHCDGEC) as well as district hospitals, district designated hospitals, health centers and dispensaries (under Presidents Office Regional Administration and Local Government ministry – PO RALG). This devolution and division has implications in resource allocation, staff management and policy implementation. The MDSR system is under the MoHCDGEC and all maternal deaths are notified there. The studies in this thesis were conducted in two regions, Lindi and Mtwara, from Southern Tanzania (Map 1), with a population of 2 million.



Map 1: Administrative map of Tanzania

The health system in the two regions is comprised of two regional referral hospitals, eight district hospitals, four faith based hospitals, 40 health centers and 399 dispensaries. The MMR in Lindi and Mtwara was 456 and 579 per 100,000 live births respectively according to the 2012 census [103]. The fertility rate is one of the lowest (3.8) in Tanzania with most women (80%) delivering in health facilities in both regions. The caesarean section rate is 6.0% in Lindi and 10.3% in Mtwara [90].

The two regions were selected because they have high facility deliveries and it is assumed that a large proportion of maternal deaths then occur in health facilities. Another reason is that the MDSR system in these regions has received good support from a development partner and it was possible to obtain the most data on maternal deaths including medical files.

In 2018, the two regions reported a total of 132 maternal deaths, of which 122 were facility and 10 were community deaths. From the regional data, out of 122 facility maternal deaths, 23 occurred in the two regional hospitals, 54 in the eight district hospitals, 31 in the three faith-based hospitals, 12 deaths in nine health centers and two deaths in two of the dispensaries.

Study population

We included maternal deaths that were notified within the MDSR system from January 1st to December 31st 2018 in the two regions, caregivers of women who died and health providers and managers of health facilities where deaths occurred. (Table 1)

Table 1: Overview of methods and populations used in the thesis

Paper	Study design	Data collection	Study population	Analysis
I	Descriptive cross-sectional	Causes and delays from the MDSR system & from Independent expert panel review	Reported facility maternal deaths from January 1 st to December 31 st 2018	Comparison by Cohen's K statistic
II	Qualitative	Indepth interviews	Caregivers (family members who cared for deceased women)	Narrative thematic analysis
III	Descriptive cross-sectional	Checklist for assessing the comprehensiveness of narrative summaries and action plans	Reported facility maternal deaths from January 1 st to December 31 st 2018	Descriptive statistics
IV	Qualitative	Focus group discussions and Key informant interviews	Health providers and managers	Thematic analysis

Paper I and II

Sampling procedure

All facility maternal deaths that were reported in the MDSR system and their caregivers (family member that was there during pregnancy, illness and death at health facility) in the two regions were included. Out of 122 facility maternal deaths that were planned for inclusion, seven were excluded since they were reviewed in the pilot study and one death had no information for tracing. We set out to trace 114 families of deceased women for VA interviews with their caregivers and completed 106/114 (93%). Others were not traced for VA due to different reasons such as lack of or incorrect information, bad roads and weather. All 106 deaths were included in paper I. Out of these we purposively selected 20 interviews of caregivers for the analysis in paper II.

These were selected on the basis of having rich information (15 minutes or more of interview time). We also made sure to select different caregivers such as husbands, mothers, grandmothers, aunts and others. Saturation of data during analysis was noticed at 16 interviews, but we continued sampling and analysing until we reached 20 interviews.

Data collection

Data collection for paper I was accomplished in three steps: 1) Abstracting and collecting information from MDSR documents, 2) Performing VA, (Included data for paper II) and 3) Independent obstetricians' panel review.

We worked closely with the regional Reproductive and Child Health Coordinators (RCHCo) to collect information from regional, district and facility monthly death report summaries and the ministry of health maternal death report forms using a pre-defined checklist. We also made phone calls to respective districts and health facilities to enquire about any missing information. For each death we collected demographic information such as name of the deceased woman, age, date of death, place of death (region, district and facility), referral facility, antenatal care facility, home address (ward, village/street), name of village/street leader and name of husband/partner. We also wrote down the recorded cause of death and the three delays identified by facility MDSR committees. We then requested and photocopied with permission all medical files of the deceased women that were available in the health facilities.

Verbal autopsy

The field team consisted of the first author (AS) and two trained VA interviewers. We traced families of the deceased women in their places of residence for VA interviews with caregivers. This was accomplished with the help of demographic information, health care providers and local government leaders. In each district, we first visited the office of the District Executive Director (DED) and then we visited the district medical officer (DMO) who directed us to the district RCHCo, who was the MDSR focal person. We then went to the facility where the death occurred and we were directed to the village of the deceased. At the family home the purpose of our visit was explained and we requested the family to identify the person (s) who was present during the deceased woman's illness from home to death at health facility (caregiver). One of our two VA interviewers then identified a quiet place with audio secrecy and conducted the interview.

The interviews were conducted using the translated standard questionnaire provided by WHO [104]. The questionnaire was piloted and the translation were reviewed and corrected accordingly. In addition to the standard inquiries, open ended questions relating to their perceptions and experiences regarding

events that occurred before the death were added for paper II. At the commencing of the interview, the participants were asked to narrate the sequence of events from home during pregnancy, labor, delivery and ultimately death in the facility. This included all issues that occurred during decision making, care seeking, referrals and events in the facility. There were also questions and probes on the three delays of care. The information collected from these interviews was used for paper II. Then the interviewer proceeded to ask the closed ended questions included in the VA questionnaire

Review by expert panel

Using the information obtained from VA as well as copies of available medical files a group of three experts, consisting of two experienced obstetricians in MDSR from Muhimbili University of Health and Allied Sciences (MUHAS) and one from the Mtwara regional hospital reviewed all maternal deaths. Based on these two sources, the expert panel determined; i) the underlying cause of death including the ICD-MM coding, ii) categorized cause of death according to the nine groups in ICD-MM and iii) three phases of delays by consensus [13]. For each death, the expert panel first went through the VA information and decided the cause from there. Then they went through the available medical files and together with information from the VA they determined the above variables by consensus.

Paper III

Data collection

Narrative summaries were also requested when the field team visited the health facilities in which deaths had occurred. This included a narrative summary of events preceding the death and action plans recommended by the MDSR committee meeting. Then the main author (AS) did a desk review of the narrative summaries using a checklist that was made from recommendations in the 2015 Tanzania MDSR guideline using an excel sheet [63].

The information in the guide was divided into four domains each with several attributes (Table 2). The domains were 1) Demographic characteristics and Antenatal care information (12 attributes), 2) Delivery/abortion information for those who delivered/aborted before admission (six attributes) 3) Referring information (four attributes) 4) Information of events after admission (20 attributes). Presence or absence of information/attributes in each domain were scored and coded as present (1), not present (2) or not applicable (3) depending on the case. The researcher read each summary

repeatedly to make sure all information was available or not, even if it was not explicitly mentioned.

Table 2: Domain and attributes assessed in the summaries

<u>Domain 1.</u> Demographic characteristics and Antenatal care information	<u>Domain 2.</u> Delivery/abortion information for those who delivered/aborted before admission	<u>Domain 3.</u> Referral information	<u>Domain 4.</u> Information of events after admission
Date of review, Maternal death review number, Patient code, Age, Marital status, Gravidity, Parity, Live children, Mode of delivery of previous pregnancy, Date of last caesarean section, Number of antenatal care visits during this pregnancy, Risk factors detected during this pregnancy	Date of delivery/abortion, Duration of amenorrhea, Status of baby at delivery (dead/alive/abortion), Place of birth/abortion (home/facility), Assisted by whom, Information on complications that occurred after delivery	Type of referring facility, Reason for referral, History of the case, How does a woman's position in the community affect her referral	Date of admission, Main reason for admission, Summary of history, physical examination and investigations, Initial diagnosis at admission, Summary of case evolution, Sequence of events of abortion/delivery, Indication of surgery, Diagnosis made at complications, How does a woman's position in the community affect the process after admission, Treatments given, Time between diagnosis of complication and treatment, Complementary Investigation results present, Summary of case evolution (monitoring vital signs, input out-put, bleeding), Date of Death, Time between complications and death, cause of death, Pregnancy outcome, Other information (from community or other centres)

Then action plans were read through and the researcher indicated the target of each as community, facility or higher level. The action plan was further analyzed to identify specific issues it addressed in the community or facility. For community action plans, the researcher indicated whether the action was for decision making at the family level, recognition of danger signs, health seeking behavior or traditional practices. Action plans in the health facility were assessed to determine whether they addressed service delivery, human

resources, equipment and supplies, the referral system, accountability or facility infrastructure. The action plans were then assessed for appropriateness, by checking whether they were *Specific, Measurable, Attainable, Relevant and Time-bound* (SMART). An action point was considered *Specific* if it clearly mentioned activities to be implemented, the method of implementations, a responsible person and the expected outcomes. An action point was considered *Measurable* if it could be evaluated against standards. *Attainability* meant that the action could be implemented considering the resources and available skills. A *Relevant* action was considered as an action that was needed considering the case and the dysfunction identified. An action was considered *Time-bound* when it had a specific time for starting or ending or both.

Paper IV

Study setting

Four districts within the Mtwara region were selected based on the number of maternal deaths that occurred in 2018. Two districts with the highest number of maternal deaths (Mtwara municipal council (MMC), and Masasi district council (MDC) and two with the lowest number (Nanyamba district council (NDC) and Tandahimba district council (TDC) were selected. The MMC has a regional hospital, MDC has a faith-based hospital, TDC has a district hospital and NDC has a health centre as its main facility.

Study participants

Key informants were purposively selected for interviews on the basis of their position within the health system and involvement in MDSR activities. These were government officials from the DED's office, health managers from regional and district health management teams (HMTs), and selected health managers from one regional hospital, one district hospital, one faith-based hospital and one health centre.

Participants of the focus group discussions were recruited from facility MDSR committees of the four selected councils. These included clinicians, nurses, midwives, laboratory staff, pharmacy staff and other members. Health managers in the MDSR committees were excluded from the FGDs.

Data collection

Questions for both KIIs and FGDs focused on the MDSR system from initiation to implementation. The questions were inspired by a study from Uganda, the Tanzanian MDSR guideline of 2015 and the WHO MDSR

guideline [35, 63, 105]. The participants were asked their experiences and perceptions on the initiation of the MDSR system in their work places and its institutionalization. There were questions on their roles in the system, on death identification, notification and reviews. They were also asked more details on the review process, formulation of action plans and their implementation. Further details on challenges encountered in all of these processes were asked. Lastly, participants were asked to provide their perceptions on the impact of the MDSR system on themselves, their facilities and maternal care in general. All interviews were audio tape recorded and participants' demographic characteristics were collected. Three interviewers collected the data and field notes were taken. Daily field meetings were held between interviewers to discuss the direction of the data and themes emerging from the data.

Data analysis

Quantitative data

Quantitative data collected for paper I and III was entered and cleaned in IBM SPSS Statistics for Windows version 25 (IBM corp., Armonk, N.Y., USA) for analysis. In paper I, we used Cohen's K statistic to determine the level of agreement in categorizing the underlying causes and the three delays of care between the MDSR system and the expert panel. We defined K of <0 as no agreement, 0-0.2 as slight agreement, 0.21-0.4 as fair, 0.41-0.6 as moderate, 0.61-0.8 as substantial and 0.81-1 as an almost perfect agreement [106].

In paper III, comprehensiveness of each narrative summary was determined by calculating the individual proportion of information depending on each case. For each summary, the total amount of present information was calculated. Then the proportion of present information was calculated from the expected total amount of information for each case. Lastly the proportional score of each summary was categorized as *poor*, *average*, or *good/comprehensive* if it had 0-74%, 75-94% or 95% and above of the required information respectively. Four items were too ambiguous to understand, and therefore they were removed from the final analysis. The cut off points were based on those used in a study by Mohseni et al in Iran [64] and were used for analysis and description purposes and are not recommended standard cut off levels. Action points were considered to be SMART if all the criteria were met. Descriptive statistics were used for the final analysis.

Qualitative data

We performed verbatim transcription of the audio recordings before analysis of paper II and IV. The selected interviews in paper II were analyzed by thematic narrative analysis inspired by Butima [107]. The following steps

were followed during analysis; 1) first we did verbatim transcription and organized the data with some editing, 2) we read through the data to understand the data, 3) we did manual coding, 4) we made categories from the codes, 5) we re-organized the categories into subthemes and themes and 6) then we interpreted the data. The results were shared with other authors and their opinions shaped the last categories, subthemes and themes. The VA interviewers looked at the final results and thought they summarized the data well

The Braun and Clarke method of thematic analysis was used for paper IV [108]. The first author (AS) went through the written transcripts a few times to get a general overview of the data. We then reviewed the themes and subthemes identified from the field notes. Manual open coding was followed by formulation of categories. The categories were then reviewed and abstracted to subthemes and themes.

Ethical consideration and Clearance

All data collected in this project were confidential and were only used for study purposes. No names of deceased women, their caregivers, health care providers or health managers' or government officials' titles were used during the review or report writing. All deceased women, their caregivers and health care providers and managers were assigned a code for identification during the review of documents and analysis. Caregivers, health providers and managers who took part in the VA, KII and FGDs received detailed explanations on the purpose of the interview and confidentiality was ensured. After participants received information about the purpose of the study, they were asked to sign a consent form for the interviews and audio recordings. Participants were allowed to drop from the interview at any time if they chose to do so. The VA interviewer conducted the interview alone and no other person was allowed to hear the conversation. A few caregivers had emotional responses during the interviews, often crying when talking about the death of the woman. During these instances, the interview was immediately halted and the caregiver was allowed to finish the emotional response. They were then asked to continue and allowed to stop if they wished to stop. At the end of the interview, they were advised to see a psychologist or care provider at the nearest facility.

Ethical approval to conduct the study was requested and granted by the MUHAS Senate Research and Publication Committee, reference number 2017-23-07/AEC/Vol.XII/343 and later renewed as number P.MUHAS-REC-06-2020-291. Permission to access the confidential documents and conduct the studies was granted by the MoHCDGEC, PO RALG, DEDs' offices, Regional Medical Officers', DMOs' and local village authorities.

Results

Completeness of data, accuracy of categorizing causes of deaths and identification of three delays (Paper I)

A total of 132 maternal deaths were reported in the two study regions in 2018 and 96,265 children were reported to receive the Bacillus Calmette Guerin (BCG) vaccine according to the District Health Information System. We used this as a proxy for live-births in the two regions and calculated the MMR as 137 per 100,000 live births (95% Confidence Interval of 115-163). We analyzed 109/114 (96%) maternal deaths; out of these, VA was completed for 106/114 (93%) and medical files were available for 91/114 (80%) deaths.

About 60% of deceased women were 30 years and above, 70% were married/living with a partner, 59% had primary education, and 63% were small scale farmers. About half of the deceased women (48% and 51%) died within a day of being sick and within 24 hours of delivery respectively. More than 75% died in the postpartum period, 71% had a live birth and 60% were delivered by caesarean section before death.

The expert panel and the MDSR committees categorized the same causes of deaths in 65% of maternal deaths (K statistic was 0.60, moderate agreement). The agreement increased to 81% of deaths when the causes were categorized according to ICD-MM groups (K statistic 0.76, substantial agreement) (Table 3).

Table 3: Level of agreement of the ICD-MM groups between expert panel and MDSR system (N=99)

ICD-MM GROUPs FROM EXPERT PANEL	ICD-MM GROUPs FROM MDSR SYSTEM								
	1.Pregnancy with abortive outcome	2.Hypertensive disorders in pregnancy	3.Obstetric Hemorrhage	4.Pregnancy related infection	5.Other Obstetric complications	6.Unanticipated Complications of Management	7.Non obstetric complications	8.Unknown/undetermined	9.Coincidental causes
1.Pregnancy with abortive outcome	6	0	1	0	0	0	0	0	0
2.Hypertensive disorders in pregnancy	0	15	2	2	1	0	1	0	0
3.Obstetric Hemorrhage	1	1	35	0	2	0	0	0	0
4.Pregnancy related infection	0	0	0	5	1	0	0	0	0
5.Other Obstetric complications	0	0	0	1	6	0	1	0	0
6.Unanticipated Complications of Management	0	0	0	0	0	5	1	1	0
7.Non obstetric complications	0	0	0	0	0	0	7	0	0
8.Unknown/undetermined	0	0	0	0	1	1	1	0	0
9.Coincidental causes	0	0	0	0	0	0	0	0	1

In identifying the three delays of care, the expert panel identified more in all categories than the MDSR committees with low agreement (K statistic 0.2). The expert panel found phase three delays in 100% of deaths compared to the MDSR committees' 93%.

For phase-one delays the expert panel found 77% of deaths had "Delays in decision-making" compared to the MDSR committees' 55%. Generally, agreement in identifying specific delays in all phases was low (K statistic less than 0.5) between the expert panel and the MDSR committees (Table 4).

Table 4: Comparison of identified delays to maternal deaths between the expert panel and MDSR system

	Expert panel	MDSR system	
	Frequency (%) N=74	Frequency (%) N=42	K statistic
Phase one delays			
Delay in decision making	57(77.0)	23(54.8)	0.04
Delayed referral from home	40(54.1)	17(30.5)	0.30
Failure to recognize problem	25(33.8)	16(38.1)	0.24
Unwillingness to seek care	15(20.3)	6(14.3)	0.30
Traditional practices	4(5.4)	4(9.5)	0.05
Poverty	2(2.7)	1(2.4)	0.00
Delay in starting antenatal care	17(23.0)	10(23.8)	0.23
Phase two delays	N=24	N=10	
Delayed arrival to health facility	10(41.7)	6(60.0)	-0.5
Lack of money for transport	10(41.7)	2(20.0)	0.00
Lack of transport from home	10(41.7)	1(10.0)	-0.33
No facility within reasonable distance	4(16.7)	1(10.0)	0.00
Bad roads	2(8.3)	0(0.0)	0.00
Phase three delays	N=101	N=78	
Human errors or mismanagement	94(93.1)	53(67.9)	0.16
Delayed management after admission	77(76.2)	30(38.5)	0.22
Inadequate skills of the provider	64(63.4)	44(56.4)	0.16
Delayed arrival from referring facility	44(43.6)	21(26.9)	0.41
Suboptimal antenatal care	37(36.6)	26(33.3)	0.05
Lack of supplies and equipment	10(9.9)	34(43.6)	0.13

Caregivers' perceptions and experiences of events leading to maternal deaths (Paper II)

Family members who cared for deceased women from pregnancy, delivery and death expressed their perspectives and experiences on the events of deaths from the home to the health facility. Caregivers reported to understand the concept of birth preparedness and made efforts to accomplish it. The male partners were the main providers of resources for birth preparedness and health care seeking. Even though this was the case, decision to seek care once labor or complications started at home was made by joint discussions between the male partners and other members of the family, especially elderly women (mother, grandmother, aunt or neighbor) and sometimes elderly men.

Birth preparedness was made in the background of beliefs or experiences of uneventful pregnancies and deliveries. This meant that simple birth preparations (money, transport, and an escorter) by the family/caregivers were inadequate to account for any complications. Family members found themselves in short supply of resources when complications requiring referral or prolonged hospital stay occurred.

Once the woman was admitted to the hospital for delivery or management of complications, caregivers felt physically and emotionally separated from her. Caregivers had little access to the woman and had to struggle to get information about the patient. The lack of information was compounded by the fact that caregivers also had to attend to other family issues such as work and children at home.

Caregivers also thought providers did little to address their desire for information. They felt that providers were neglecting and ignoring them despite their efforts to communicate. Providers were also perceived to be harsh, have too much power and making efforts to hide their inadequacies. Some caregivers lost hope with the health system and made plans to seek care in other facilities or with traditional healers.

The death of the pregnant woman, whether the delivery happened or not, caused psychological suffering for the caregivers and families. Caregivers went through different stages of grief such as denial, anger accompanied with blame, bargaining, depression and acceptance. Some caregivers had experienced maternal deaths before and acknowledged that the magnitude of the problem is big, but not known. The death of the mother also affected the newborn that was alive as well as other children at home. Caregivers and families made efforts to provide for the newborn. Elderly women in the village found themselves carrying the burden of caring for the newborns. Their lack of resources meant that basic needs such as milk, clothes and health care were hard to come by.

How comprehensive are narrative summaries and action plans from maternal death reviews? (Paper III)

The health facilities were able to provide 76/122 (62%) narrative summaries of the maternal deaths that occurred in 2018. Recommended action plans were missing in two of the narrative summaries. Missing summaries were due to poor record keeping, movement of documents to meetings outside facilities and data keepers reshuffling their offices. Ten summaries (13%) had names of the deceased, which is contrary to the recommendation of “No name, No blame, No shame”.

The commonly present demographic characteristics (Table 2 in methods) were age and gravidity (91%), and the least (9%) was the maternal death review number. The mode of delivery for the last pregnancy was written in 12% of summaries and almost all summaries of women who previously delivered by caesarean had not indicated the date of previous caesarean section.

The majority (95%) of summaries of the deceased women who delivered before admission had information on date and place of delivery and the duration of amenorrhea was indicated in 42% of them. The referring facility was written in 88% of the narrative summaries.

In table 5, more than 94% of the summaries had reason and date for admission written, summary of case evolution, sequence of delivery/abortion events, and indication for surgery and date of death. Overall, 49% of the summaries scored poor, 50% average and only 1% were comprehensive.

Table 5: Assessment of presence of information on the events after admission in the health facility (N=76)

Variable in the summary	Frequency	Percent
Date of admission	73	96.1
Main reason for admission	75	98.7
Summary of history, physical examination and investigations	70	92.1
Initial diagnosis at admission	67	88.2
Summary of case evolution	72	94.7
Sequence of events of abortion/delivery occurred*	62	95.4
Indication of surgery written	44	95.7
Is there diagnosis made at complications	61	80.3
Treatments given	66	86.8
Time between diagnosis of complication and treatment	49	64.5
Complementary Investigation results present	36	47.4
Summary of case evolution (monitoring vital signs, input output, bleeding)	39	51.3
Date of death	73	96.1
Time between complications and death	62	81.6
Cause of death	67	88.2

Pregnancy outcome	67	84.2
Other information (from community or other centers)	12	15.8
How does woman position in community affects process after admission	0	0.0

We analyzed 285 action plans, 85% were for facility, 14% were for community and about 1% for higher levels of the health system. Forty two percent of facility action plans indicated the need to improve service delivery by increasing knowledge and skills of health care providers. Few (46%) action plans were specific, while only 42% were deemed SMART.

Mismatched ambition, execution and outcomes (Paper IV)

Interviews with health care providers in health facilities (MDSR committee members) and managers at the regional, district and facility levels revealed their desire and ambition to make sure the system is implemented as intended. This was expressed by health providers and managers who thought their leaders worked hard to implement different aspects of the system across all levels. Timely notification and review were emphasized and implementers tried to perform these according to the guideline. They collaborated with other facilities during the review process, and used multiple sources of information with emphasis on a non-threatening atmosphere.

These efforts resulted in good outcomes for the quality of care and behavior of health providers and managers. Implementation of the review process and follow up of deaths helped providers and managers realize the impact of maternal deaths on live newborn babies. The occurrence of maternal deaths made health providers feel guilty and responsible. Some expressed a lack of desire to work or the need to be transferred to other wards. This was the reason for a behavioral change campaign among providers and stakeholders to save mother's lives to help the babies. Providers and stakeholders contributed money, milk cans and other items to the babies of deceased mothers.

Implementation of MDSR compelled health providers to realize that their actions, even outside the maternity wards such as in the theatre, pharmacy, laboratory or health managers' office can have bad consequences for mothers. Changes in practice occurred on issues concerning the maternity ward and implementation of these recommendations improved the quality of care in health facilities, districts and regions in general. The changes included innovative solutions targeting lack of resources and late notification, policy changes, changes on the management of certain conditions and solutions to improve data quality.

Even though the system was implemented at all levels and there were tangible outcomes, it was implemented through a flawed process. The challenges spanned from organizational issues to person based factors.

Factors adversely affecting the MDSR system were:

- Substandard implementation due to incomplete cascading of training, poor dissemination and utilization of the guideline.
- The review process relied on incomplete information and in some places focused a lot on routines and formalities such as filling in the reporting form.
- The organization and management of the system was also flawed due to inappropriate selection of providers for training, relying on only a few people for decision making, the separation from other notification and quality improvement teams and too much dependence on a developmental partner.
- Breach of confidentiality and the culture of assigning blame from health managers affected all aspects of the system, such as notification and death reviews.
- Lack of incentives for participating in MDSR activities, especially review meetings, was a de-motivating factor for health providers.
- The need for continuous supervision from health managers due to the poor attitude of some providers.
- Implementers were discouraged by repeated mistakes and the lack of implementation of action plans.

Discussion

Main findings

This thesis reports that the implementation of the MDSR system in Tanzania has both successes and challenges. Health providers expressed their willingness and effort to notify death on time. The notification process was however hindered by a lack of commitment and fear of blame. The maternal deaths notified through the system were below the expected number of deaths. The review process is regularly performed in health facilities. During the review process, the system performed relatively better in categorizing the causes of maternal death but faced challenges in identifying the delays in care, especially the third delay. The information used during the review process (narrative summaries) is inadequately prepared and stored. There is also lack of training, limited use of the guideline and a fear of blame during the review meetings. The action plans written by MDSR committees address mostly the third delay but are not specific. Their implementation has had some positive changes in providers' attitudes, professional conduct and health system changes. The response step is affected by a lack of implementation of action plans, unmotivated providers and lack of follow up.

The facility-based reviews failed to include community aspects and in turn did not address community problems. On the road to maternal deaths, caregivers made inadequate efforts to prepare for birth and did not account for complications. In health facilities, caregivers and health providers had poor communication dynamics. Caregivers and families experienced psychological trauma due to maternal deaths. Newborns of deceased mothers faced many uncertainties and became the burden of elderly women in the villages.

The MDSR in a complex health system

The health system is a complex structure consisting of different subsystems, which work together to accomplish the overall goal of improving the health of people. Each subsystem is also comprised of individual models, whose changes may affect the system's overall performance. The MDSR is such a subsystem, which aims to improve the quality of care by learning from previous events. System theorists argue that the strength of any system

depends on the overall property of the system and less on individual components or subsystems [109]. This may be true in some systems, but other theorists hypothesize that there is a direct relation between the overall quality of a system and functions of the subsystems and individual components [110]. Both of these can explain the relationship of MDSR as a subsystem within the health system. The health system's effectiveness may depend on how each of its subsystems, such as facilities, staff, management, audits etc. are organized and linked to each other, rather than the quality of each subsystem. Yet, it is also true that the health system can be highly affected by how the subsystems are implemented and managed.

An integrated systems approach is emphasized by Chuang and Inder [111]. In this model, they considered the relationship between hierarchy, control and communication in a health system. The quality of a subsystem in the hierarchy such as MDSR can affect the overall effectiveness of the health system. This is well emphasized by the proponents of a systems thinking approach [112, 113]. Brett Anderson urged that 'embracing systems theory in health care can reduce adverse events and improve patient care without ignoring individual accountability' [114]. These concepts underpin the importance of connecting separate models in the system and understanding their dynamics in isolation as well as in connection to each other. The lack of systems thinking is due to managers' inability to accept complexity due to the fear of losing control of events. Most of the previous studies on MDSR systems did not apply a systems thinking framework [94].

We propose that the lack of systems thinking by MDSR implementers brought about most of the challenges described in this thesis. Health providers and managers failed to recognize that the substandard implementation of some steps might have wide spread negative feedback for the whole system. We discuss how lack of community involvement, substandard initiation, assigning blame and lack of recognition affected the identification, notification, and review processes of deaths, as well as providers understanding of community grievances. We also discuss good outcomes from the implementation of the system and how this provided continued motivation for the implementers.

Inadequate deaths notification

Maternal deaths identification and notification is an important first step in the MDSR system that ensures the timely follow up of deaths and accuracy of data. An efficient notification system ensures that maternal deaths are notified from both health facilities and communities. Our findings reveal that deaths notified through the MDSR system are fewer than the expected number from both national and international reports [3, 90]. This inadequate identification and notification of deaths in the MDSR system could be due to missed deaths from the community, as only ten deaths were reported from the community in

both regions. The MDSR system was also reported by health providers and managers to be separate from other notification systems leading to data discrepancies.

Health providers explained that they tried to notify deaths on time by using innovative means such as mobile phone communication (WhatsApp groups and SMS). However, some deaths were notified late or never notified and others were incorrectly notified as maternal deaths. This was due to lack of commitment by some providers and the fear of blame from health managers. Health managers were perceived to be harsh and they believed in being strict when following up on deaths. Underreporting of maternal deaths for various reasons has been reported in high- (Netherlands, Taiwan, France), middle- and low-income countries (Morocco and Zimbabwe) [115-119]. Even though the reasons for under-reporting are different depending on the context, it points to weaknesses in reporting systems overall. To improve identification and notification of deaths, MDSR systems ought to be integrated with other reporting systems and should emphasize a non-threatening atmosphere for providers to notify on time. Another way to strengthen the system is to use local government leaders and community health workers to increase community involvement in notification of deaths [120-122]. Further studies on notification processes are proposed in order to improve death identification and data accuracy [94].

A flawed death review process

In Tanzania, all health facilities that provide delivery services have MDSR committees which review all maternal deaths. The review is a key process to identify the underlying medical causes of deaths and the contributing delays. Quality improvement recommendations depend largely on correct and reflective review processes. In contrast to many other studies, the MDSR committees in Tanzania for the most part categorize the causes of deaths correctly during the reviews [57, 59, 93, 123]. We postulated that this is due to the utilization of MDSR reporting forms which include the ICD 10 derived short list of common causes. This helped providers identify the likely underlying causes of deaths. However, some deaths still had the wrong categorization of the underlying cause, similarly reported in other studies highlighted above.

Comparatively, there were more challenges in identifying the three delays of care. The MDSR committees failed to identify shortcomings in care that may have contributed to the deaths' occurrence. The third delay was not well analyzed and the MDSR committees fell short in most of them. Studies have shown that in this era of high facility deliveries the third delay is becoming increasingly important [32, 124]. Failure to identify the third delay means that action plans put forward were inadequate in addressing the true causes of

deaths. Poor categorization of correct causes of deaths and delays in care in the Tanzanian MDSR system were due to lack of training for health providers and focusing on routines such as form filling instead of critical reflection during review meetings. Other reasons for poor reviews were due to the incomplete dissemination and utilization of the guideline and using incomprehensive narrative summaries during reviews. Preparation of narrative summaries was explained to be affected by missing information in medical files, failure to follow the guideline and unfriendly and ambiguous guide. In the US and UK, medical records were described to be inadequately documented and sometimes inaccessible [66, 125-127]. Summaries abstracted from such records are bound to be incomprehensive and are not recommended for assessing quality of care [128]. Providers also explained that the culture of assigning blame, fear of repercussions and lack of incentives negatively affected the review meetings. The issue of fear of blame has also been narrated in other studies in low and middle income countries [124, 129]. Training health providers, addressing fear of blame by ensuring meeting confidentiality and including an obstetrician in all review meetings will improve identification of all delays of care.

Impact of implementing unspecific action plans

Implementing recommended action plans is an important aspect of the MDSR system that will bring about change and improve the quality of care. Systematic documentation of action plans and their implementation is part of this process. Documentation of action plans in the MDSR system failed, to a large extent, to follow the SMART criteria. There was also a lack of systematic documentation on the implementation of each of the action plans. There is inadequate literature on the comprehensive documentation of action plans following SMART criteria in MDSR systems. The few reported studies in Nigeria and northern Tanzania reported inadequacies in documenting action plans [68, 130]. Even though the MDSR guideline provides instructions for writing action plans, it lacks clarity on how to document its implementation [63].

Health providers and managers described both success and challenges in implementing the action plans. Action plans were not implemented due to lack of funds and poor commitment from some health providers and managers. These problems have been echoed in previous studies on maternal deaths reviews in Tanzania and other LMICs [71, 94]. The challenges facing documentation and implementation of action plans did not completely prevent MDSR from bringing about change. Implementation of action plans from MDSR systems in Ethiopia and Nigeria have had an impact on quality improvements issues such as knowledge and skills of health providers, equipment and facility infrastructure [68, 131]. In our study, health providers

and managers reported changes from the implementation of MDSR. These were the behavioral changes of providers, concerns for the newborn, recommendations on management of certain conditions, policy changes, staff training and supervision and equipment procurement. In other settings, implementation of recommendations from maternal deaths reviews has been documented to improve quality of care and reduce the MMR [40, 69]. Efforts to address challenges facing MDSR will lead to even more changes to improve the quality of care.

Neglected community perspectives

Community involvement in MDSR is essential in order to understand the full picture or context of these deaths. This increases community awareness and involvement in efforts to reduce maternal deaths [85, 132]. Health providers and facility managers admitted to having little or no inclusion of community members in MDSR activities. Community follow up of maternal deaths was limited to mostly district health managers without facility involvement. This means the MDSR system lacks a community perspective and has a limited understanding of events leading to death. In our study, caregivers described their perceptions on the events from pregnancy to deaths in health facilities. Birth preparation (funds, transport, place for delivery and escorting person) was practiced but families that experienced maternal deaths failed to account for the occurrence of pregnancy complications in their preparations. Different settings have differing levels of understanding, birth preparation practices, and complication readiness [133-136]. Failure to consider potential complications meant that families could not afford prolonged hospital stays or referrals due to obstetric complications. Failure to comprehend the risks associated with pregnancy is one reason for poor birth preparations [137].

The male partner as the main resource provider for preparedness was not the sole decision maker on matters of when and where to seek care. This was also reported in rural areas of the Rukwa region in Western Tanzania [138]. Other members of the family especially elderly women played a prominent role in decision making regarding health care seeking. Understanding the family dynamics in decision making is another step in providing targeted interventions at the community level.

Caregivers acknowledged that their interactions with the health system while taking care of their sick pregnant mother in health facilities was anything but perfect. There was a lack and breakdown of communication between providers and caregivers. Caregivers felt they were always in the dark about complications happening to their loved one. Providers were perceived as harsh and seemed to avoid discussions with the caregivers. Providers should understand that caregivers have valuable information that can help during the management of the pregnant woman [139]. Reasons for this breakdown of

communication between caregivers and providers are privacy issues, lack of respect, language barriers and the low social status of the patient [140, 141]. The MDSR system in Tanzania should bring to light this communication breakdown in order to create action plans to address them. The only way to understand this is to include the community in maternal deaths discussions. Literature in LMICs shows that maternal deaths have major social, psychological, health and economic repercussions for both the family and society [6, 7]. These can affect the newborns, children, male partners, other relatives and communities surrounding the women. The challenges facing families as a result of maternal deaths were emotional journeys in grieving, changes in family dynamics and plan to care for the live newborn and other children. The survival of these newborns is severely compromised compared those whose mother survived their pregnancy [142].

The study describes the missed information when the community is not involved in MDSR activities. Prevention of maternal deaths should start in the family where issues of recognition of danger signs, decision making, birth preparation and complication readiness and challenges on the road to health facilities can be identified and addressed. The community also has valuable information to improve the quality of care in health facilities. Interactions of caregivers with providers can reveal short comings in health facilities such as lack of equipment and supplies, health provider negligence and poor infrastructure.

Methodological considerations, strengths and limitations

Mixed methods

We used both quantitative and qualitative methods in assessing different aspects of the system. Wisdom and Crisswell suggest that the use of mixed methods provides better and synergistic analysis and utilization of data [143]. They further emphasize that mixed methods can be used in planning, collecting and analyzing data, using same or different samples and exploring the same phenomenon or system from multiple angles. Mixed methods are also used in evaluating complex interventions such as the MDSR system. In this thesis, the quantitative studies looked more closely on the data and documents from the MDSR system. The results from the quantitative studies also informed on issues to be explored in the qualitative studies. Findings from the qualitative studies were compared and used to explain the quantitative studies results from providers' and managers' perspectives. In explaining their perceptions and experiences, they also explained the findings from the quantitative studies. The qualitative data provided reasons for inadequate notification, strength and shortcomings of the review process. Even though

the third study was unable to describe implementation of each action plan, the subsequent qualitative interviews with health providers and managers provided a glimpse into this matter. The participants were further able to explain the impact of implementing the action plans from the reviews.

The main limitation of this design was found in paper I and II. These two studies were conducted concurrently so there was little room for them to inform each other during the data collection. However, these two studies had different aims and so different types of data were collected.

Quantitative studies

The first and third papers were quantitative studies that were cross-sectional and descriptive due to the aims of the studies. The main strength of paper I was the utilization of an expert panel that included experienced obstetricians in both clinical management and MDSR. This ensured the causes and delays identified were close to the real situation. They also had complementary information from VA making the study unique. Other such studies did not have a panel that utilized the combination of information from medical files and VA. This can also be the reason for the expert panel's identification of more delays than MDSR committees in paper I. Despite this, it not easy to understand how much information the committees used, since they also had first-hand information from health providers who managed the patients. The main limitation of this paper is the fact that there was more than one MDSR committee. Comparing data by using Cohen's K statistic could have limitations in this situation. The authors concluded that since each death was reviewed by one MDSR committee and one expert panel, the K statistic still could be used.

Paper III is also one of only a few studies, if any, that looked at the narrative summaries used in MDSR systems. Its main strength is the fact that the summaries were assessed using a checklist derived from the MDSR guideline. The assumption was that the MDSR implementers used the guide during summary preparation. This assumption was later explained in the qualitative study showing that summary writers had little access and utilization of the MDSR guideline. The assessment of the summaries and action plans was performed by one person (AS). The assessor used a checklist to avoid his biases and was pragmatic in the assessment process. The assessor read each summary several times to make sure the information in the checklist was present even if it was not explicitly mentioned.

Qualitative studies

We utilized both KIIs and FGDs in the qualitative studies. The KIIs were mainly used for health managers and government officials since they had different roles in the system and gathering them in a focus group would have

been difficult. This also made logistics easier since the researchers were able to trace a manager who was not available at a later date. The face-to-face interviews of key informants also provided their perceptions, practice and experiences without fear of breaching confidentiality. The FGDs included MDSR committee members who were health care providers but *not managers* in their work places. This ensured that participants discussed the implementation of MDSR openly without the fear of any repercussions from their managers at work. The participants were able to explain the real situation on the implementation of MDSR in their facilities. The main limitation of the study was the inclusion of providers and managers at facility, district and regional levels. We missed the perspectives of implementers at higher levels both zonal and national that could have impact on policy changes.

Interviews of caregivers in paper II provided a better understanding of perceptions from the community on events leading up to maternal deaths. This could be strength and a limitation as the caregivers might be biased in blaming health providers for the deaths.

Our qualitative studies trustworthiness was inspired by Lincoln and Guba in design, data collection and analysis [144]. Participants in the qualitative studies were selected based on their knowledge and experience with the subject matter. The MDSR committee members and specific health managers were in unique positions to understand the daily implementation of the system. Furthermore, caregivers were selected because they were present during the pregnancy and illness. Credibility was ensured through daily meetings and a pre-data collection orientation to the tool. This meant that all interviewers were on the same page. We also triangulated data collection methods such as KIIs and FGDs and we included more than one data collector for both studies. Two interviewers took part in paper II and three in paper IV. All interviewers were experienced as they had taken part in other studies. Data saturation was also the basis for the final number of participants. We included several more interviews to make sure saturation was achieved and that there was no more new information.

Ethical dilemma

This study involved the review of sensitive confidential documents, interviews of caregivers at home, health providers and managers. Most documents used had names of the deceased women, their partners and sometimes other relatives. Each death also had multiple documents that needed to be matched. Coding and matching the documents and data proved to be challenging and the author had to go back to names several times to make sure the correct documents were matched. Only the first author had the ability to decipher the codes. During expert panel reviews, the documents had names of the deceased visible but the panel was asked to maintain confidentiality. Interviews of caregivers during VA faced dilemmas since they were held in

their homes making it difficult to conceal the identity of the participant from other family members. This is an inherent ethical dilemma of community-based death reviews. Furthermore, interviews of caregivers were in a few instances associated with emotional responses by the interviewee. These episodes also proved difficult for the interviewers who discussed their experiences during daily field meeting. The VA interviewers could do little to help the caregivers and had to advise them to see a counselor at their local health facility. Interviews of health managers and government officials challenged the researchers in concealing their identity. Readers of this thesis might have liked to know which health managers and officials were interviewed but to maintain confidentiality their managerial positions in the health system and government were concealed.

Conclusions

The MDSR system in Tanzania is implemented at different levels, with successes in categorizing causes of deaths and making and implementing recommendations. The system has had an impact on improving certain aspects of quality of care such as personal behavior, knowledge and skills of providers, policy changes and infrastructure improvements.

The system faces challenges in death notifications, reviews and lack of training, breach of confidentiality and blame, implementation of action plans, lack of integration with other systems and lack of incentives for implementers. The system also lacked information from and involvement with community members. Tanzania's MDSR system has to be improved in order to achieve the targets within SDG3.

Recommendations

National level

- The MoHCDGEC should improve the planning and implementation of training of providers in health facilities on MDSR.
- The guideline should be improved to include a more user-friendly guide on how to prepare narrative summaries, recommendations on how to perform community reviews and how to document the implementation of action plans (use of scorecards).
- Dissemination of the guideline needs to reach implementers in health facilities.
- Integration of the MDSR committee with other death notification and quality improvement systems is paramount.
- The issue of blame should be addressed by putting in legal protection mechanisms for health providers.

Regional level

- Regional health leadership should closely supervise the implementation of regional action plans.
- The needs of the facility, district or region should dictate the selection of health providers for training.
- The regional health leadership ought to facilitate the inclusion of a few obstetricians available in the regional facility MDSR meetings in hospitals and other facilities to improve the review process and enhance learning.
- The issue of blame needs to be honestly addressed to enable health managers to follow up on deaths without use of threats.

District level

- District health management teams should take part in facility review meetings to supervise the process and provide expert assistance.
- District health managers do not need to be harsh in following up on deaths and personal attribution to death.
- Health managers must make sure all facility and district recommendations are implemented.
- Live newborns that are left by their deceased mothers ought to be put in district plans to address their needs.
- Psychological support for families affected by maternal deaths is paramount in helping caregivers and should be included in community reviews.

Facility level

- Health facilities need to emphasize the importance of timely notification of deaths.
- Mechanisms to identify maternal deaths in other non-maternity wards in the hospitals are required.
- There is a need for better record keeping of documents for all facility maternal deaths including medical files, narrative summaries and reporting forms.
- Facility review meetings and narrative summary writing must follow the guideline and not focus on routines.
- Facility managers must respect meeting confidentiality to avoid a cycle of blame and avoidance.
- Narrative summary writers need a supportive environment to write in, without fear of blame.
- Facility review meetings will benefit from the inclusion of an obstetrician to facilitate identification of third delays.
- Health care providers should communicate better with caregivers regarding the progress of the patient
- Caregivers need better access to their patient once admitted to the ward.
- Antenatal clinics ought to emphasize complication readiness when providing health education to pregnant women.

Community level

- Community involvement in MDSR review meetings will foster better community understanding and facility quality improvement efforts.
- Communities should be educated to take active part in the identification and notification of community maternal deaths.
- There is a need to use community health workers and local government leaders to facilitate the identification and notification of community maternal deaths.

Further studies

This thesis discusses the successes and challenges of implementing the MDSR system from community, facility and regional levels in Tanzania. It has explored different aspects of the system from data accuracy, availability and comprehensiveness of documents, notification, reviews and action plans. We have also explored the caregivers' experiences

There is a scarcity of literature on the implementation of MDSR at higher levels of the health system such as zonal, national hospitals and the central government. We need to study the movement of death data from lower levels to its utilization to effect policy change. We have discussed discrepancies in estimating MMR between MDSR and other national estimates. This ought to be explored to make sure all maternal deaths are counted and the true magnitude is reported. We also need evidence on how to involve communities in maternal death reviews without causing distress to families and while ensuring confidentiality. Further follow up on the lives of newborns left by deceased mothers is needed in order to strategize interventions.

Summary in English

In Tanzania, the maternal mortality ratio is still high at 524 per 100,000 live births. To reduce this burden the World Health Organization (WHO) recommended the implementation of the Maternal Death Surveillance and Response (MDSR) system. Tanzania introduced the MDSR system in 2015 with more emphasis on facility-based reviews and little community involvement. The system is implemented in all regions in Tanzania and facilities are required to have MDSR committees to review all maternal deaths. We aimed to determine the strengths, challenges and impact of implementing the MDSR system in Tanzania.

The study was conducted in the Lindi and Mtwara regions in Southern Tanzania, employing both quantitative (two papers) and qualitative methods (two papers). In the first paper, we compared causes of deaths and delays in care recorded in the MDSR system to the assessment of an independent expert panel of obstetricians. We found that the MDSR committees performed well in categorizing causes of deaths but had challenges in identifying delays in care. Paper II, described community perceptions and experiences on events leading to maternal deaths in health facilities. Caregivers performed inadequate birth preparations that did not account for complications; faced challenges in communicating with providers regarding their admitted patient and suffered social, psychological and economic consequences from maternal deaths.

The third paper was a desk review of narrative summaries to explore comprehensiveness using a checklist from the guideline and action plans using *Specific, Measurable, Attainable, Relevant, Time-bound* (SMART) criteria. The narrative summaries used in the MDSR system were not comprehensively written due to missing information and the action plans were not specific on the issues that needed to be addressed. Paper IV, collected qualitative data from health providers' and managers' experiences in implementing MDSR through focus group discussions and key informant interviews. Implementers had high ambitions to implement the system with notable policy, attitude and quality of care changes. The system implementation also faces many organizational, contextual and individual challenges.

In general, this thesis provides a glimpse into the implementation of MDSR in Tanzania. Recommendations from this thesis will improve the system and efforts to reduce maternal deaths. The thesis can also be generalized in other contexts, especially in LMICs where MDSR is implemented.

Summary in Kiswahili

Vifo vya akina mama vinavyotokana na matatizo ya uzazi bado vinatokea kwa wingi ndani ya Tanzania. Katika jitihada za kupunguza tatizo hili, shirika la afya duniani lilipendekeza utekelezaji wa mfumo wa ‘Ufuatiliaji na Uhakiki wa Vifo vya Akina Mama vinavyotokana na Matatizo ya Uzazi’ (MDSR). Tanzania ilianza utekelezaji huo mwaka 2015 kukiwa na msisisitizo wa uhakiki wa vifo vinavyotokea kwenye vituo vya kutolea huduma za afya (hospitali, vituo vya afya na zahanati) bila kuhusisha jamii. Mfumo huu unatekelezwa katika mikoa yote ya Tanzania na vituo vya kutolea huduma za afya vinahitajika kuwa na kamati ya kuhakiki vifo hivyo. Lengo la tasnifu hii lilikuwa kuweka bayana uwezo, changamoto na matokeo ya utekelezaji wa mfumo huu ndani ya Tanzania.

Tafiti zilifanyika katika mikoa ya Lindi na Mtwara iliyopo kusini mwa Tanzania kwa kutumia njia za utafiti wa upimaji (tafiti mbili) na utafiti wa ubora (tafiti mbili). Katika utafiti wa kwanza, tulilinganisha visababishi vya vifo na ucheleweshaji wa huduma uliorekodiwa kwenye mfumo wa MDSR na tathmini iliyofanywa na jopo la wataalamu. Tuligundua kwamba kamati za MDSR zilifanya vizuri katika kutathmini visababishi vya vifo lakini zilikuwa na changamoto kubwa katika kutambua ucheleweshaji wa huduma uliyotokea. Utafiti wa pili ulielezea maoni na uzoefu wa wanajamii kwenye matukio yaliyopelekea vifo vya akina mama vya uzazi katika vituo vya kutolea huduma za afya. Wanajamii walielezea kufanya maandalizi ya kujifungua lakini hawakuzingatia matatizo yanayoweza kutokea wakati wa ujauzito na kujifungua; walikutana na changamoto katika mawasiliano na watoa huduma za afya kuhusu mgonjwa wao aliyelazwa na pia walipata matatizo ya kijamii, kisaikolojia na kiuchumi kutokana na vifo vya akina mama vya uzazi. Utafiti

wa tatu ulitathmini muhtasari wa matukio vya kifo ili kujua ukamilifu wake. Tulumia orodha ya ukaguzi iliyowekwa kwenye muongozo wa MDSR. Mipango kazi ilitathminiwa pia kwa kutumia vigezo vya *Maalumu (Specific)*, *Inayopimika (Measurable)*, *Inayopatikana (Attainable)*, *Inayohusika (Relevant)* na *Muda (Time)* (SMART). Muhtasari inayotumika kwenye mfumo wa MDSR haikuandikwa kwa ukamilifu kwa sababu ya ukosefu wa habari nyingi na mipango kazi haipo *Maalumu* kwa mambo yaliyohitaji kushughulikiwa. Utafiti wa nne ulikuwa utafiti wa ubora ulioelekezwa kwa watoa huduma na viongozi wao ili kufahamu maoni na uzoefu wao katika kutekeleza mfumo wa MDSR. Tulumia njia za majadiliano kwenye kundi na mahojiano ya watoa habari muhimu. Watekelezaji hawa wa MDSR walielezea shauku kubwa ya kutekeleza mfumo huu na waliona matokeo yake katika mabadiliko ya sera, mtazamo wa watoa huduma na ubora wa huduma. Lakini walikutana na changamoto nyingi za kimumo, mazingira na za kibinafsi katika kutekeleza mfumo.

Kwa ujumla tasnifu hii inatoa mwanga wa hali ya utekelezaji wa mfumo wa MDSR ndani ya Tanzania. Mapendekezo ya tasnifu hii yataboresha mfumo huu na jitihada za kupunguza vifo vya akina mama vinavyotokana na matatizo uzazi. Tasnifu hii pia inaweza kutumika katika mazingira mengine katika nchi za kipato cha chini na cha kati zinazotekeleza mfumo wa MDSR.

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