

Leading change in the maternal health care system in Tanzania:
Application of operations research

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Leading change in the maternal health care system in Tanzania:
Application of operations research

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List of Abbreviations

AMDD	Avert Maternal Deaths and Disabilities
AMO	Assistant Medical Officers
ANC	Antenatal care
CO	Clinical Officers
CSR	Caesarean section rate
DHS	National Demographic and Health Surveys
EmOC	Emergency obstetric care
HISM	Health Management Information System
MCHA	Maternal and child health aide
MDG	Millennium Development Goals
MMR	maternal mortality ratio
NM	Nurse-midwives
NPC	Non-Physician Clinician
OR	Odds Ratio
PHNB	Public health nurse grade B
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
WHO	World Health Organization
WISN	Workload Indicators for Staffing Need

Chapter 1

GENERAL INTRODUCTION

Magnitude of the Problem

Globally about 358,000 women die annually due to complications of pregnancy and childbirth. Almost all (99%) occur in resource limited countries, and Tanzania is one of eleven countries contributing two thirds (65%) of the global burden of maternal mortality [1]. Although some reports indicate that maternal mortality ratio (MMR) in Tanzania is 449/ 100,000 live births [2], others have reported figures as high as 790/ 100,000 live births [1]. Other indicators show that only 47% of all pregnant women in Tanzania deliver in health facilities and only 46% are assisted by skilled personnel [3, 4]. The met need for emergency obstetric care, at 15-30%, and the caesarean section rate (CSR) of 3% are critically below ideal levels and constitute the lowest rates in the world [3, 5]. Such low process indicators for emergency obstetric care (EmOC) are worrisome and suggest that a significant number of mothers is not receiving essential services which are quite often life-saving. Considering that these figures comprise those from urban areas where services are more accessible, it can be comprehended that the situation is even worse in rural areas, where majority of people in Tanzania live and most of the work for this thesis was based.

Although maternal mortality ratios in sub-Saharan countries are still strikingly very high, and the EmOC process indicators poor, the good news is that 74-98% of these deaths can be averted [6-8]. Based on this understanding, reducing maternal mortality ratio by 75% between 1990 and 2015 was enlisted in the UN Millennium Development Goals (MDG) adopted at the 2000 Millennium Summit of which the government of Tanzania is a signatory. Recent reports on the progress reached in reducing maternal mortality indicated huge disparities among countries and regions in the world, even among those with similar economic power. For instance, between 1990 and 2008 countries in Latin America and the Caribbean, and Northern Africa remarkably reduced maternal mortality ratios (MMR) by 41% and 59% respectively

while countries in sub-Saharan Africa only reduced it by 26%. The annual decrease of maternal mortality in sub-Saharan Africa was 1.7% which is far below the 5.5% annual decline rate, which is necessary to achieve the fifth Millennium Development Goal [9]. These reports indicate that while other regions are performing quite well sub-Saharan Africa looks to be already off-track of achieving the MDG set for maternal survival. Achieving this goal is one of the greatest challenges in sub-Saharan Africa including Tanzania. The existing disparities of maternal mortality ratio and low EmOC process indicators in resource limited countries raise questions about the factors for change and which interventions should be considered to avert the situation in sub-Saharan Africa and Tanzania in particular.

Factors for Change

In-depth reviews indicate that maternal health care in resource limited countries is affected by a wide range of interlinked factors. It is generally agreed that not getting adequate and appropriate care in time is the overriding reason why women die in resource limited countries [10-13]. This argument suggests that severe adverse outcomes of pregnancy and childbirth are mostly linked to substandard care. Substandard care could be related to the patient: where a woman or her relatives caused delay that contributed to severe adverse pregnancy outcome; or health care provider by delaying or mismanaging the case; or administration related: where something that is the responsibility of the health authority was not available [13-15].

Factors related to patients have been linked to culture, social structure, economic status and nutrition [10, 11, 16]. Quite often poverty, illiteracy, negative beliefs and lack of autonomy in the decision-making process have been reported to contribute to poor health seeking behavior, delay to make a decision and reach a health facility in case of obstetric emergency [17]. On the other hand, early marriages and childbearing, high parity and malnutrition during pregnancy have been reported to predispose women to ill-health and complications during pregnancy and childbirth [10, 11].

Health care provider-related factors could either be delaying appropriate care or mismanagement of patients. These are commonly attributed to inadequate knowledge and skills in obstetric care, negative attitude towards patients, lack of accountability, inadequate commitments and high workload pressure [13, 18].

Health system administration related failures have been identified as a major contributing factor to substandard care for maternal health and associated adverse outcome [12, 14, 18, 19]. These factors include shortage of qualified human resources, inefficient referral systems, inadequate essential equipment, supplies and drugs for EmOC, insufficient supervision, lack of hallmarks of leadership and management of available resources for maternal care [12, 13, 18]. For instance, reports indicate that currently the health system in Tanzania operates with 32% of the required skilled workforce and doctor population ratio is as low as 1:25,000 [20-22]. The situation is worse in rural areas where the majority of available skilled staff do not like to go and hence worsening the problem of maternal health care in these areas.

Problem-Solving Approach

In order to develop a set of sound and scientifically derived solutions for maternal health care in Tanzania particularly in rural areas the concept and key principles of operations research were considered. The World Health Organization (WHO) defines operations research on reproductive health as the research aimed to provide evidence-based scientific data and appropriate technologies to solve problems, improve service delivery and utilization, and recommend relevant policies [23]. In principle, operations research involves application of scientific methods, techniques and tools to problems involving the operations of a system so as to provide those in control of the system with optimum solutions to problems. It is considered to be a systematic and analytical approach to decision-making and problem-solving. Sequentially, its key steps include (1) Problem Orientation, (2) Problem Definition, (3) Model Formulation, (4) Model Solution (5) Model Validation and Output Analysis, and (6) Implementation of the Solutions and Monitoring. These steps are widely followed when solving problems in various sectors including health [24-26].

Problem Orientation: The primary objective of this step is for the research team to get a clear picture of the problem. It involves review of literature relevant to the problem in order to determine if others have encountered the same (or similar) problem in the past, and if so, to determine and evaluate what was done to address the problem. This step involves data collection with the objective of translating the problem into a model that can then be tested and objectively analyzed. This is usually done by observing the system in operation.

Problem Definition: The objective here is to further refine the deliberations from the orientation phase to the point where there is a clear definition of the problem in terms of its dimensions, scope and the results desired. While a complete system level solution is always desirable, this may often be unrealistic when the system is very large or complex and in many cases one must then focus on a portion of the system that can be effectively isolated and analyzed. Other components of problem definition include specification of factors that will affect the objective and the constraints on the courses of action.

Model Formulation: is a defining characteristic of the operations research project and testing the model.

Model Solution: In this step the solution of the problem is obtained with the help of model. It is all about identifying and selecting solutions for the problem.

Validation and Analysis: Once a solution has been obtained two things need to be done before one even considers developing a final policy or course of action for implementation. This phase is meant to verify that the solution itself makes sense and to establish how robust the solution is.

Implementation of the Solutions and Monitoring: this last step involves the implementation authority to implement recommendations obtained for the model, followed by monitoring of the system.

These key principles of operations research are almost similar to the key components of the clinical audit cycle which include identification of the clinical problem, collection of information, analysis of results, development of action plan, implementation of action plan and repeating

the cycle. The studies presented in this thesis were designed to apply the principles of operations research to test the feasibility and effectiveness of introducing obstetric audit in rural district hospitals and scaling up CEmOC services in health centres located in hard to reach areas in rural Tanzania with a view of improving quality of care, accessibility and utilization of maternal health services. The first part of this operations research comprises of pre-test studies and is entitled as "Gap Analysis" which comprised of *Problem Orientation and Problem Definition* in the areas of maternal health care in Tanzania. This part comprises baseline data on maternal health in rural and urban Tanzania which were carried out using cross-sectional studies. This part also provides a comprehensive description of evidence-based solutions for Maternal Health in resource limited settings. It synthesizes applications of evidence based-interventions for maternal health care published within the last 30 years. To justify selection and prioritization of interventions it was considered important to learn the lessons and experiences from other resource limited countries. In order to achieve this, a systematic review of interventions for maternal health was carried out. This approach was considered to be more objective and superior to the opinions of "experts," which are commonly subjective. It was believed that this approach would lead to better and more consistent decisions. The second part involves "Formulation of Models", Model Solutions, Validation and Analysis. This part provides two models of maternal health care interventions in rural Tanzania. The first model involves introduction of audit system for maternal health care in a rural district hospital, Saint Francis Designated District Hospital (SFDDH). The second model is that of three health centres located in hard to reach areas in 2 rural districts in Morogoro region (Kilombero and Ulanga) in Tanzania [Figure 1]. This model describes how comprehensive EmOC services at health centre level were introduced and monitored. The principal results from these two models are presented in this thesis.



Figure 1. Map of Tanzania indicating study areas: Dar es Salaam (1), Kilombero (2) and Ulanga (3) districts

GAP ANALYSIS: ORIENTATION AND DEFINITION OF THE PROBLEM OF MATERNAL HEALTH CARE IN TANZANIA

Chapter 2

Dar es Salaam Perinatal Care Study: Needs Assessment for Quality of Care

This chapter presents a list of factors underlying the present poor maternal outcome resulting from a cross sectional study conducted in 9 health facilities in Dar es Salaam, Tanzania. It applies the concept of quality assurance in a health system to describe the determinants of maternal health at the health care level classified into structural, systemic and process factors.

Chapter 3

Staffing needs for quality of perinatal care in Tanzania

This chapter highlights the link between maternal adverse outcomes and the shortage of skilled staff. It employs the WHO safe motherhood needs assessment instruments to assess the availability of human resources for health and uses the WHO designed Workload Indicators for Staffing Need (WISN) and Tanzanian standard activities and components of the workload for labour ward nursing to calculate nurse staffing requirements and WISN ratios, in Dar es Salaam hospitals in Tanzania.

Chapter 4

Partogram use in the Dar es Salaam perinatal care study

This chapter describes the quality of partograms used to monitor labour in Dar es Salaam hospitals, Tanzania. It links the findings and quality of management of labour and poses the urgency for in-service training to address the importance of documentation and regular partogram audit in order to reduce maternal and perinatal deaths.

Chapter 5

Bridging the gaps in the Health Management Information System in the context of a changing health sector.

This chapter describes the importance of Health Management Information System (HMIS) for evidence-based policy-making, informed decision-making during planning, implementation and evaluation of health programs; and for appropriate use of resources at all levels of the health system. The chapter uses HMIS data for maternal and child health resulting from the Kilombero district study to describe the gaps and factors influencing HMIS in Tanzania and outlines the proposed solutions to address the problems.

Chapter 6

Factors for change in maternal and perinatal audit systems in Dar es Salaam hospitals, Tanzania

This chapter describes clinical audits in maternal and perinatal areas following 25 years of formal introduction in Tanzania. The chapter presents a detailed account on the existence, performance and practical barriers to the implementation of maternal and perinatal mortality audits in Dar es Salaam, Tanzania. The chapter concludes by proposing how the audit could be improved.

Chapter 7

Maternal health interventions in resource limited countries: a systematic review of packages, impacts and factors for change

This chapter presents a list of evidence-based interventions from resource limited countries in the past 30 years. It applies the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to systematically review articles reporting the implementation of interventions, their impacts and underlying factors for maternal health in these countries. It concludes by proposing scaling up the lessons learnt.

FORMULATION OF MODELS, MODEL SOLUTIONS, AND VALIDATION AND ANALYSIS

Chapter 8

Using audit to enhance quality of maternity care in resource limited countries: lessons learnt from rural Tanzania

This chapter presents the experiences of introduction of audits for maternal mortality and severe maternal morbidity (4M study) at Saint Francis Designated District Hospital, in Kilombero, Tanzania. The findings resulting from introduction audit in this hospital include the magnitude of the problem of maternal mortality and severe morbidity, avoidability (areas of substandard care), implementation of audit recommendations and factors for change in audit in this hospital. This chapter describes the potentials of obstetric audit for quality care improvement and suggests that it can be implemented even in resource limited rural areas.

Chapter 9

The quality of antenatal care in rural Tanzania: what is behind the numbers of visits?

This chapter presents alarming gaps in antenatal care (ANC) services delivery identified after introduction of audit for maternal mortality and severe maternal morbidity (4M study) and a cross-sectional study carried out in Kilombero district hospital in Tanzania. This chapter describes the association between poor antenatal care and severe adverse pregnancy outcome. It ends by recommending to those in control of the health system to intensify efforts and invest more in ANC in order to improve the quality of maternal health care in rural Tanzania.

Chapter 10

Barriers to conducting effective obstetric audit in Ifakara: a qualitative assessment in an under-resourced setting in Tanzania

This chapter explores the barriers encountered when introducing maternal mortality and severe morbidity audit at Saint Francis Designated District Hospital, in Kilombero, Tanzania. In addition, it explores how these barriers decreased the impact of audit on quality improvement of obstetric care in this hospital. This chapter concludes by proposing solutions for effective implementation of obstetric audits.

Chapter 11

Tanzanian lessons in using non-physician clinicians to scale up comprehensive emergency obstetric care in remote and rural areas

This chapter employs the concept of “task shifting” to address the acute shortage of skilled workforce for maternal health in Tanzania with a view of scaling up comprehensive emergency obstetric care services (CEmOC) in hard to reach rural areas. The chapter presents results of introduction of CEmOC services in remote health centres in Tanzania following training of Non-Physician Clinicians in CEmOC and anaesthesia. The chapter concludes by calling upon the global community to scale up the innovation in an attempt to improve the quality of maternal health care in resource limited settings.

Chapter 12

GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

**GAP ANALYSIS: ORIENTATION
AND DEFINITION OF THE PROBLEM
OF MATERNAL HEALTH CARE IN
TANZANIA**

CHAPTER 2

Dar es Salaam perinatal care study:
needs assessment for quality of care

(East Afr J Public Health 2008; 5: 17.21)

DAR ES SALAAM PERINATAL CARE STUDY: NEEDS ASSESSMENT FOR QUALITY OF CARE

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Abstract

Objective: Poor obstetric care in low income countries has been attributed to a wide range of factors. We conducted a perinatal care needs assessment in Dar es Salaam health institutions to assess the factors underlying the present poor perinatal outcome.

Methods: A cross sectional study was conducted in 2005 in all four public hospitals and all five public health centres purposively selected, and in six dispensaries selected using simple random sampling method. WHO Safe Motherhood needs assessment instruments were used to assess structural, systemic and process needs for quality perinatal care. Health care providers, administrators and clients were interviewed about perinatal care services in their respective health institutions.

Results: The majority (72%) of all deliveries in Dar es Salaam took place in the four available public hospitals. The potential coverage of comprehensive and basic emergency obstetric care (EmOC) services were 360% and 350% of the United Nations minimum recommended health institution categories per 500,000 population respectively. The coverage for health centres and dispensaries based on Tanzanian standards were 20% and 24% respectively. Two of the hospitals did not provide theatre and blood transfusion services for 24 hours per day. Two public health centres did not provide delivery services at all and 83% of the dispensaries had poorly established obstetric services. There was only one public neonatal unit that served as a referral institution for all sick newborns delivered in public health institutions in the region.

Conclusion: This paper reveals the state of inadequate infrastructure, equipments and supplies for perinatal care in Dar es Salaam public health institutions. A major investment is needed to establish new public infrastructure for maternal and neonatal care, upgrade and optimize use of the existing ones, and improve supply of essential material resources in order to achieve the Millennium Development Goals set for maternal and child survivals by 2015.

Key words: Perinatal care, quality of care, needs assessment, Dar es Salaam, emergency obstetric care

Background

In Tanzania, like in many other low income countries, maternal and perinatal mortality and morbidity are problems of public health importance. While the delivery rate in health institutions in Dar es Salaam has increased from 85% in 1991-92 to 90% in 2004 (1,2) the majority of births take place in the few available government-owned institutions with very high patients load at the expense of suboptimal care and poor outcome. In the year 2001, for example, in Temeke, the only municipality that had over 90% of health institutions reporting to the municipal Health Information Management System (HIMS) coordinator, only 1% of all deliveries (285 out of 27,504) took place in the non-government owned health institutions (3). The maternal mortality ratio (572/100,000 live births) in Dar es Salaam (4) together with a hospital-based perinatal mortality rate of 123/1000 births in 2003 at Muhimbili National Hospital (5) illustrate the existing poor quality of perinatal care in this area.

The determinants of maternal and perinatal deaths at the health care level are many and varied: structural, process and systemic. When applying the concept of quality assurance in a health system, the term “structure” has been used to mean the conditions under which care is provided e.g. premises, equipment, staff etc, while “process” means the activities that constitute the patient-provider interaction including diagnosis, treatment and prevention activities.

“Systemic” has been used to mean interactions of different items and activities which bring about certain results. For instance, referrals between health institutions – which can be hindered by bad roads, lack of transport or unaffordable transport, and inadequate procedures – may affect the state of patient’s illness and survival. It has been estimated that 88-98% of maternal deaths can be avoided in the circumstances of most low income countries (6). At Muhimbili National Hospital (MNH), the referral teaching hospital in Dar es Salaam region, persistently high maternal and perinatal mortality rates have been attributed to poor quality of care within the hospital as well as the surrounding hospitals that refer women to this institution (5). According to WHO recommendations a set of activities has been identified as essential for maternal and infant survival; the associated structural, systemic and process prerequisites have been listed, and are studied here.

In order to design an intervention plan that is grounded in existing gaps and root causes, a perinatal care needs assessment study was conducted in 16 health institutions in Dar es Salaam, from February to April 2005.

Methods

Study setting

The study was conducted in Dar es Salaam, the largest business city in Tanzania. The city is located along the coast of the Indian Ocean, in the east of the country. Though not recognized politically as the capital, the headquarters of the majority of the ministries, many other governmental and nongovernmental organizations as well as foreign embassies are located here. In 2002, the city had a population of 2,497,940 people with an annual growth rate of 4.3% (7).

In Dar es Salaam, there are a total of 18 hospitals, 10

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health centres and 60 dispensaries (owned by the government and non-government agencies) that provide maternity services. The government health institutions in the region include Muhimbili National Hospital which is a university teaching hospital, three municipal hospitals and five health centres. There are fourteen hospitals and five health centres that are non-government owned, providing reproductive and child health (RCH) services. As in many other countries, health centres and dispensaries in Tanzania are expected to provide basic emergency obstetric care (EmOC) while hospitals should provide comprehensive EmOC services on a 24 hour basis (8). The later provides caesarean section and blood transfusion services in addition to the basic EmOC services.

Sampling and size of studied institutions

For overall data, a list of public health institutions that provide perinatal care services was made according to the level of care (9). For in-depth study, a purposive sampling method was employed to select all four public hospitals (Muhimbili National Hospital and the three municipal hospitals) and all five public health centres (although two health centres did not provide delivery services). Simple random sampling was used to select six dispensaries from a list of all public dispensaries that provided perinatal care services. The focus on government health institutions was justified, firstly because they serve the majority of the population (since maternity service is provided free of charge in Tanzania) and, secondly the problems in the most funded institutions by the government were likely to occur throughout the system. A total of 13 (21%) health institutions were involved in the full analysis, just short of the recommended 25% of the health institutions when assessing quality of care for a specific area (10-11).

Data collection

We obtained the total number of health institutions with reproductive and child health services and number of deliveries in the region from the Dar es Salaam city medical office of health and then determined the coverage of the services. The WHO Safe Motherhood needs assessment tool with its checklist was used to assess the availability of basic equipment, human resources, drugs and supplies, total number of births, caesarean sections, maternal and perinatal deaths in 2004 (12). We also used a structured questionnaire with closed- and open-ended questions from the same tool to interview 53 service providers and 16 administrators of the perinatal care units or institutions. A separate in-depth interview with the heads of institutions or maternity units was used to explore the systemic issues related to care and outcome. Exit interviews with closed- and open-ended questions were also conducted with 397 mothers attending postnatal clinics who had previously attended antenatal clinic during their last pregnancy and/or had delivered in the same institution to gather their experiences and perception with the care they had received. All data were then entered and analyzed using Epi-Info 6 software program.

Ethical clearance was obtained from Muhimbili University of Health and Allied Sciences and permission to conduct the assessment was obtained from the respective authority of the institutions. Informed consent was also obtained from all interviewees in each health institutions and all the contacted interviewees agreed to participate.

Results are presented in absolute numbers and proportions. We did not conduct inferential statistical tests due to the reliance on inclusive data for some results and on a purposive (non-random) sample for others.

Results

The total number of deliveries in Dar es Salaam region in 2004 was 71,907 of which 14,845, 25,314 and 31,748 were from Ilala, Temeke and Kinondoni municipality respectively (13). Approximately 83% (59,816/71,907) of all deliveries in Dar es Salaam region took place in the 16 examined institutions and 72% of these deliveries (51,787/71,907) took place in the four government hospitals. In the 16 studied institutions only 13% of all deliveries (8,029/59,816) took place in the dispensaries, health centres and Hindu Mandal private hospital combined. The delivery bed capacity, performance and outcome statistics in the Dar es Salaam government facilities are presented in Table 1.

Structural needs

There are 18 hospitals and 70 basic health institutions (health centres and dispensaries) in Dar es Salaam providing potential coverage of 360% comprehensive EmOC services and 350% of basic EmOC respectively based on the United Nations (UN) minimum recommended health institution categories per 500,000 population. As noted below, this potential was not well realized in practice. The coverage of hospitals, health centres and dispensaries based on standards of the Ministry of Health of Tanzania were 138%, 20% and 24% respectively (Table 2).

Among the studied institutions, two municipal hospitals did not provide theatre and blood transfusion services for 24 hours per day. Theatre services were irregularly provided at Mwananyamala hospital and were provided for only 12 hours a day at Amana hospital. Two out of five public health centres did not provide delivery services at all and the majority (83%) of the dispensaries had poorly established delivery services reporting delivery rates as low as two deliveries for a period of six months prior to the study. Even the health centres and dispensaries that offered delivery services did not perform all six functions required for a basic emergency obstetric health institution. The least performed functions included assisted vaginal delivery. Vacuum extractors were found in only two health centres and in none of the dispensaries. Forceps delivery was never performed at all. The average distance from dispensaries to the first referral institution was 21 km, taking an average of 40 minutes. Only one (7%) out of 15 public health institutions had a neonatal care unit. Women were discharged on the same day of delivery, unless they

had a problem that necessitated transfer to Muhimbili National Hospital. Basic equipment and other items required for maternal and perinatal care were available in all hospitals. On the contrary, two (40%) health centres lacked either infant weighing scales, speculums, clothes/towels to dry a baby, blankets to wrap a baby, masks, ambu bags and/or resuscitation tables.

Most of the essential drugs and consumable supplies were available in all institutions. The few supplies that were lacking in some included cord ties (found only in 50%), and intravenous kits, blank partograms and syphilis test kits that were found in 81-94% of the institutions. While antibiotics like ampicillin, benzathine benzyl penicillin or procaine benzyl penicillin and ceftriaxone, and sulfamethoxazole + trimethoprim were available in the majority (69- 88%) of the institutions, gentamycin injections were only found in 44% of them. The findings related to human resources have been reported elsewhere (14).

Process needs

Maternal and perinatal mortality audits existed only at the national hospital and both were established less than one year before the study. The other health institutions discussed maternal and perinatal care outcome variably, during routine daily or weekly clinical meetings and/or monthly health management team meetings together with other issues. The quality of the partograms used to monitor labour in this region was suboptimal and has also been reported in detail elsewhere (15).

Systemic needs

While each municipal hospital had one functioning ambulance, this was only true for one health centre. All respondent administrators argued that one ambulance at the municipal hospital cannot satisfy the referral service needs for the dispensaries and health centres that refer patients to these hospitals. Most dispensaries and health centres reported that; "even if we call for an ambulance

from the referral health institution, commonly the ambulance does not come or would be brought very late". The reasons offered included lack of fuel or the ambulance not being available or used for other purposes. Among the dispensaries, two had neither a functioning radio call nor a telephone.

There was no functioning formal networking relationship between the major stakeholders of perinatal care in the region i.e. the national hospital and municipal health institutions. The guidelines for antenatal care were found in 5 (31%) health institutions while those for intrapartum, postnatal and neonatal care were each found in one (6%) institution. Educational materials showing warning signs for the complications of pregnancy, and those for postpartum care, newborn care, breast feeding and maternal nutrition were available in less than half of the institutions. Only educational materials for family planning and sexually transmitted diseases including HIV/AIDS existed in over half of the institutions.

Patient interviews

Of all 397 interviewed women, 73% reported that they had discussed the place of birth with a health worker, 54% had discussed the benefit of birth in the health institution and what to do when there was an emergency pregnancy complication, and 49% had been advised on how to take care for the newborn. More than one third (37%) had discussed how to reach the health institution in case of emergency. Among the groups of danger signs suggested in the WHO needs assessment instruments only two (a group of hypertension/headache/swelling/fits, and that for haemorrhage/heavy bleeding) were mentioned by at least a quarter of the respondents. Although more than 94% of the women were satisfied with maternal and perinatal care, almost half of them (51% - 57%) reported that their blood pressure, abdomen and their babies were not assessed after delivery, and that they were neither taught how to care for the baby nor counselled about family planning.

Table 1: Maternity and labour ward bed capacity, performance and outcome statistics in Dar es Salaam government facilities in the year 2004.

	Health Institutions						
	DISP (n= 6)	HC* (n= 3)	AMN	MNY	TMK	MNH	Total
Bed capacity and performance							
Total maternity admissions	0	0	14,845	13,196	18,729	24,793	71,563
Number of births	413	7349	12,432	12,465	15,347	11,543	51,787
Delivery rate (per day)	1	20	34	34	42	32	142
Total maternity beds	0	45	76	36	47	246	405
Total delivery beds	6	7	4	4	3	12	47
Caesarean section rate (%)	0	0	3	3	4	32	10
Perinatal outcome							
Maternal mortality ratio	0	0	166	115	220	646 [‡]	477 [‡]
Perinatal mortality rate	9	16	29	27	25	94	41

DISP = dispensaries, HC = health centres, AMN = Amana, MNY = Mwananyamala, TMK = Temeke, MNH = Muhimbili National Hospital

*Two health centres did not provide delivery services and a private hospital were excluded from this analysis, [‡] Only nurses working in the labour ward were included, [‡] When including the 102 women who died at MNH having delivered elsewhere MMR was 1602/100,000 live births and the overall MMR was 852/100,000 live births[‡].

Table 2. The coverage of health institutions potential for EmOC services in Dar es Salaam region (with a total population of 2,497,940 people).

Types of health institution/ standards	Set standards (health institution category per specified population)	Minimum Expected number	Actual number	Coverage (%)
<i>UN standards</i>				
Comprehensive EmOC	1/500,000	5	18*	360†
Basic EmOC	4/500,000	20	70*	350†
<i>Tanzanian standards</i>				
Hospitals	1/200,000	13	18	138
Health centres	1/50,000	50	10	20
Dispensaries	1/10,000	249	60	24

* Government and non-government owned health institutions potential for EmOC services.

† Coverage of health institutions potential for provision of EmOC services

Discussion

The United Nations process indicator for availability of EmOC services requires a minimum of one comprehensive and four basic EmOC facilities for every 500,000 population. Assuming that all 18 hospitals (public and private) in Dar es Salaam could provide comprehensive EmOC services, the coverage would be 3.6 times higher than the UN minimum recommended per 500,000 population and for basic EmOC service the coverage would be 350%. Despite such a high potential coverage for EmOC services the majority (72%) of all deliveries in Dar es Salaam took place in the four public hospitals i.e. Muhimbili National Hospital and the three municipal hospitals.

Such a skewed utilisation of maternal care casts serious doubts on the quality of care provided in these health institutions. These four public institutions were severely congested with perinatal patients that largely exceeded available infrastructure and material resources. The infrastructures for obstetric care, particularly the labour rooms, antenatal and postnatal wards at the municipal hospitals were grossly inadequate such that they could not cope with the number of admissions and deliveries. The high congestion of perinatal patients in the public health institutions despite the presence of many non-government health institutions could be explained partly by the national policy of providing delivery services free of charge. It could also be due to existing poverty among the people such that they cannot afford the costs for delivery services in the non-government owned health institutions. Such congestion of perinatal patients in the public hospitals could also be contributed by under-utilization of the available public dispensaries and two health centres that did not provide delivery services at all.

The huge differences between health service coverage using the UN versus Tanzanian set standards could be explained by the fact that the Tanzanian standard was meant for rural populations and uses both health institution per specific population and specified geographical accessibility whereas the international standard uses institutions per population without specifying geographical accessibility. In a city like Dar es Salaam within a radius of

10 kilometers the population is far more than 10,000 and 50,000 that dispensary and health centre institution are required to handle respectively, hence explaining the findings of more hospitals. On the other hand, the UN standard which is based on a regional population of at least 500,000 population can be easily achieved given the number of health institutions, the geographical accessibility can be undermined since all the institutions could be skewed towards the urban and leave the rural area unattended.

The presence of only one neonatal unit that served all public health institutions raised questions about how well this unit could provide care for all newborns in need of special care who have been delivered in Dar es Salaam. Based on the understanding that about 10-15% of newborn infants develop problems requiring special care (16), it can be estimated that more than 6000 newborns born annually in Dar es Salaam public health institutions need special care at this neonatal unit. This figure is too huge to be handled by one unit and the findings reflect the existing limitations in management of the newborns in Dar es Salaam health institutions.

Failure to provide theatre services for 24 hours in two municipal hospitals which are first-referral institutions enhances delay to institute treatment of obstetric emergencies. A delay to treat life-threatening obstetric emergencies is known to be associated with increased maternal and foetal mortalities and morbidities. Similar findings were also reported in a survey done in the same health institutions in 2003 indicating that there have been no improvements ever since (3). Lack of 24 hour perinatal services at the district hospitals is an endemic problem in low income countries (17). Lack of comprehensive services in Dar es Salaam municipal hospitals could have contributed to the high maternal and foetal morbidity and mortality at Muhimbili National Hospital, the tertiary referral institution. In keeping with the Ministry of Health of Tanzania recommendations, obstetric services in the first referral hospital must be available regularly and at all times and conveniently to the members of the community (18).

Although all health institutions had almost all basic equipment needed for perinatal care, it was noted that

some of these were not adequate. With the use of the WHO designed perinatal care needs assessment tool it was not possible to determine the adequacy of the available equipment. This finding indicates the existing limitations of the tool that must be addressed in order to optimize its use. In an earlier study in the same area also reported shortage of equipment for emergency obstetric care as one of the major factors that impeded provision of obstetric services in these institutions (3). Shortage of simple essential supplies like cord ties in 50% of the health institutions indicated the existing huge limitations to safe clean delivery. Lack of guidelines for antenatal, intrapartum, postnatal and neonatal care in most institutions (69 – 94%) was a critical observation that could have been associated with suboptimal care. Guidelines for clinical management are crucial in order to provide evidence based management and optimal care. Lack of reliable means of transport at the dispensaries and in most health centres made the link with first referral hospitals very unpredictable and unreliable, and contributed to delay in transporting emergencies. Ready availability of transport to link all levels of maternity care especially in emergencies is one of the fundamental characteristics of a well-organized system of formal maternity care (19). The problems of maintenance and lack of fuel for the ambulances at the first referral hospitals, as excuses for their unreliability, need special attention. With increasing awareness of the benefits of hospital delivery, the absence of reliable transport for referral cases could have contributed to the severe under-utilization of delivery services in these dispensaries. Telephone or radio communication to the referral centres are important items even in the presence of an ambulance and need to be in place in all the institutions in the referral chain.

Failure of the majority of the interviewed women to immediately recall most of the danger signs of complications of pregnancy indicated the low coverage of health information delivery and the gaps of knowledge. Such poor performances of the health system could be explained by shortage of staff and educational materials. In the domain of perinatal care, communication strategy is a crucial element in a national plan, as is its successful implementation by countries (20). The gaps of knowledge found in this study call for review of the reproductive health education provision from the antenatal to the postnatal period. This is important because knowledge helps to make the right decisions whenever health problems arise. There is a need to have a checklist to remind health workers when they give messages to clients during this period of time.

Conclusion:

This paper reveals the state of inadequate infrastructure, equipments and supplies for perinatal care in Dar es Salaam public health institutions. A major investment is needed to establish new public infrastructure for maternal and neonatal care, upgrade and optimize use

of the existing ones, and improve supply of essential material resources in the Dar es Salaam regional health delivery system in order to achieve the global Millennium Development Goals set for maternal and child survivals by 2015.

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CHAPTER 3

Staffing needs for quality of perinatal care in Tanzania

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ORIGINAL RESEARCH ARTICLE

Staffing Needs for Quality Perinatal Care in Tanzania

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ABSTRACT

In Tanzania maternal and perinatal mortalities and morbidities are problems of public health importance, and have been linked to the shortage of skilled staff. We quantified the available workforce and the required nursing staff for perinatal care in 16 health institutions in Dar es Salaam. WHO safe motherhood needs assessment instruments were used to assess the availability of human resources, WHO designed Workload Indicators for Staffing Need (WISN) and Tanzanian standard activities and components of the workload for labour ward nursing were used to calculate nurse staffing requirements and WISN ratios. There was a severe shortage of essential categories of health staff for perinatal care in all institutions. The ranges of WISN ratios for nursing staff working in the municipal hospitals' labour wards were; nurse officers 0.5 – 1, trained nurses/midwives 0.2 - 0.4 and nurse assistants 0.1. These findings reflect extremely huge perinatal care workload pressure and suggest the urgent need for more staff in order to achieve the global millennium development goals set for maternal and infant survival (*Afr J Reprod Health 2008; 12[3]:113-124*).

RÉSUMÉ

L'importance des dotations en personnel de soin périnatal en Tanzanie En Tanzanie, les mortalités maternelles et périnatales et les morbidités sont des problèmes de santé publique importants qui sont liées au manque de personnel qualifié. Nous avons quantifié la main d'œuvre disponible et les infirmiers requis pour les soins périnatals dans 16 établissements sanitaires à Dar es Salam. Les instruments de d'évaluation de la maternité sans danger de l'OMS ont été utilisés pour évaluer la disponibilité des ressources humaines. Les indicateurs de la répartition du travail pour la dotation en personnel (IRDP) conçus par l'OMS et les activités standards tanzaniennes et des composants de la répartition des infirmiers des salles d'accouchement ont été utilisés pour calculer les besoins d'infirmiers requis et la proportion de l'IRDP. Il y avait un manque sévère des catégories du personnel sanitaire pour des soins périnatals dans tous les établissements. Les gammes des proportions de l'IRDP pour des personnels infirmiers travaillant dans les salles d'accouchement des hôpitaux municipaux étaient : des officiers infirmiers 0,5 – 1, infirmiers/sages femmes qualifiées 0,2 – 0,4 et les aides - infirmiers 0,1. Ces résultats reflètent extrêmement la pression énorme de la répartition du travail et suggèrent le besoin urgent de la dotation en personnel afin de réaliser le but du développement mondial millénial mis pour la survivance maternelle et infantile (*Afr J Reprod Health 2008; 12[3]:113-124*).

KEY WORDS: Perinatal care, Standard workload, Activity standard, WISN ratio

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Introduction

The tragedies of maternal and perinatal mortalities and morbidities in Tanzania are problems of public health importance. Statistics show that in Tanzania maternal mortality ratio is 578/100,000 live births and perinatal mortality rate ranges “between” 42 - 125/1000 births¹⁻². Although the magnitude of maternal morbidity in Tanzania is not well known, the presence of such high mortality predicts high incidences of maternal and perinatal morbidity in the country. The health workforce is one of the key determinants of the efficiency and effectiveness in the delivery of perinatal care and its outcome. Attendance at delivery by skilled personnel equipped with appropriate supplies and equipments has been found to be strongly associated with reduction of maternal mortality than many other interventions, hence a priority strategy³. The association between shortage of trained attendants during childbirth and obstetric outcome has been clearly established in countries with varied economic resources⁴⁻⁶. Countries in Africa, Asia and Latin America where less than 50% of births are attended by skilled staff have high maternal and perinatal mortality figures⁷.

In Tanzania, like many other low income countries, the shortage of skilled staff for perinatal care has been associated with limited national budgets for training adequate number of personnel. Deaths of personnel due to diseases like HIV, migration from rural areas to cities and to high-income countries (brain drain) have contributed

also to the shortage. Health workers' attitudes, lack of morale, absenteeism, and passivity in attending life-threatening obstetric emergencies have also been associated with poor obstetric care and outcome⁸. Based on the recognition of the role of skilled staff for quality perinatal care, some experts have doubted the achievement of Millennium Development Goals set for maternal and child health by 2015, if purposive investments are not made to the recruitment and retention of health professionals⁹.

In order to achieve the main objective of reducing newborn and maternal mortality, one of the fundamental strategies of the National Health Policy of Tanzania is to ensure that a sufficient number of adequately trained personnel are available, motivated and productive. In the past four decades the government of Tanzania has been training various sub-cadres of health professionals including assistant medical officers (AMOs), clinical officers (COs), maternal and child health aide (MCHA) and Public Health Nurse grade B (PHNB). These cadres are employed in the regional and district hospitals, health centers and dispensaries. AMOs are holders of an advanced diploma in clinical medicine and are expected to provide the general care up to the level of regional hospital. The MCHA and PHNB are regarded as enrolled nurses because they have less training than the nurse midwives. The national regulations allow enrolled nurse to assist deliveries under supervision. Since the establishment of training courses for these cadres, they

have been quite instrumental in the Tanzanian health care delivery system such that they occupy the large proportions of care providers from the district hospital way down to the dispensaries levels.

This article presents results of the Dar es Salaam perinatal care study which was conducted in 2004 to assess the structural, process and systemic needs in the domain of perinatal care. The article also attempts to quantify the available workforce in providing perinatal care and the required nursing staff in the municipal hospitals using the “*Workload Indicators of Staffing Need (WISN)*” developed for the World Health Organization. This manual outlines the activity standards, standard workload and components of the workload for different categories of health care providers at different levels of health care in some countries in Africa, Asia and Europe. The manual also provides a formula used to determine the required staffing based on these standards¹⁰.

Methods

Study Area: The study was performed in Dar es Salaam, one of the densely populated regions in Tanzania. In 2002, the region had a population of 2,497,940 people with an annual growth rate of 4.3%¹¹. The majority of women in this region receive reproductive and child health services from public health institutions¹².

Sampling Design and Size: A list of public health institutions that provide perinatal care services with their levels of

care was obtained from the Dar es Salaam city medical officer. A purposive sampling method was employed to select all four public hospitals (Muhimbili National Hospital and all three municipal hospitals), one private hospital, and all five public health centres available in the region. A simple random sampling technique was used to select six dispensaries from a list of all public dispensaries that provided perinatal care services. The focus on public health institutions was justified because problems in the most reputable institutions were likely to occur throughout the system. A total of 16 health facilities were involved in the analysis, fulfilling WHO recommendation to cover at least 25-30% of the health facilities in the area when assessing quality of care¹³⁻¹⁴. A simple random sampling technique was also employed to select five midwives working in the labour wards/maternity units for interview from each health institution. Where the available number was less than five, all midwives working in the maternity units were recruited for interview to make a total of 48 from all health institutions.

Data Collection: Data collection was done by the local authors with assistance from four trained field assistants. Ethical clearance was obtained from Muhimbili University College of Health Sciences as part of a bigger study on perinatal care needs assessment. Permission to conduct the assessment was obtained from the respective authorities of the institutions. WHO safe motherhood needs assessment

instruments¹⁵ were utilised to assess the availability of human resources, to interview the in charge of the surveyed institutions to explore the existing strategies for staff motivation. The midwives working in the perinatal care units were interviewed about their previous midwifery training and the level of immediate recall of the symptoms and dangers signs of pregnancy which would prompt them to refer the patient to the hospital. Quantitative data was entered and analysed using Epi-Info 6.

Definitions, Standards and WISN Method

We assessed the available workforce in all health institutions, by type of institution and type of provider. Secondly, we assessed the institutional staff motivation strategies and training of the health providers. We determined the required nurse staffing and WISN ratio in the municipal hospitals using the WISN method¹⁰.

Registered nurses were those who according to the National Board of Nurses of Tanzania are recognized as nursing officers or nurse midwives, while enrolled nurses

were those who had less training than nurse midwives (e.g. MCHA, and PHNB). Standard workload was defined as the amount of work which could be done by a health care provider in a year during the time available for work after due adjustment. Activity standard was defined as the average unit time required by each staff category for a specific activity while allowance factor referred to the set unit time that the staff would spend doing other related official activities like documentation, report writing, etc within the same shift. Staff requirement was defined as the number of staff required in the facility in order to meet the workload according to the professional standards which have been set. WISN ratio was calculated as the ratio of the available number of staff to the required in the health facility. A ratio less than one indicates the work pressure is high and hence urgent need of action to adjust the staffing levels.

In Tanzanian public service the statutory working week is 5 days and the number of working hours per day is 8. The staff requirement in the studied hospitals was calculated based on the national statutory standards and standard workload. The standard activities and components of the workload for the nursing categories working in the labour

Table 1: Components of workload and standard activities for the nurses in the labour wards at the district and regional hospitals in Tanzania

Staff category	Components of the workload	Standard activities
1 Nursing officer	Supervision, assessment of labour, assist delivery, documentation	One nurse in charge plus one more for every 10 deliveries/day
2 Nurse midwives/ trained nurses	Assessment of labour, assist delivery, documentation	4 hours per delivery plus 2 hours per shift
3 Nurse assistant	Assessment of labour, assist delivery under supervision	3 hours per each delivery

wards at the district and regional hospitals in Tanzania are as shown in Table 1¹⁰.

In our study the scope of the calculation for staff requirement was confined to the nursing staff working in the labour wards. This is because only the nursing staff had consistently data available for components of the workload performed in the previous year, necessary for determination of staff requirement. It was not possible to collect all data for all components of the workload performed by other categories of staff in the previous year.

The available working time per year (in days) was calculated using the following method¹⁰;

Annual leave (4 weeks x 5 days/week)	= 20
Public holidays per year	= 17
Off-the-job (sickness and all other absences) days per year	= 21
Total unavailable days per year	= 58
Unavailable weeks per year (58 ÷ 5)	= 11.6
Available weeks per year (52 – 11.6)	= 40.4
Available days per year (40.4 x 5)	= 202
Available hours per year (202 x 8)	= 1616
Allowance factors (2 ÷ 8)	= 25%

The following formula was used to calculate the staffing requirement[10];

Total staff requirement = Allowance multiplier x (volume of activity in a year/standard workload for the activity)

Where:

Standard workload = Available time in the year/ activity standard

Allowance multiplier = 1 / (1 - total allowance factor).

It should be noted that individual allowance factor for nursing staffing is not indicated. Supervision and administrative activities are parts of the nursing officer's responsibilities.

Limitations of WISN method:

1. The accuracy of the method depends on the accuracy of the record keeping at the health institutions. As for this study, the chances of errors were minimized by ensuring that the number of deliveries collected from the health institutions was collected as accurately as possible by trained midwives directly from delivery registries and not from the compiled maternity reports.
2. The method utilizes statistics from the past year and gives the estimates of what the staffing levels should have been.

Results

The Workforce and Workload Indicators: The distribution of health providers in all health institutions is presented in Table 2. More than three quarters (81%) of the 27 obstetricians were allocated to the national hospital.

There were 28 anaesthetists of which only four were allocated in the three municipal hospitals, and only two neonatologists. One of the neonatologists spent most of his working time doing administrative work at Muhimbili University College of Health Sciences. The total number of nursing officers working at the labour wards in the municipal hospitals ranged from 2 -5, trained nurses/midwives ranged from 9 to 14 and nurse assistants from 2 - 3. The institutional nurse staffing requirements and WISN ratios for nursing officers in these hospitals are presented in Table 3. The WISN ratios for trained

nurses/midwives working in the labour wards in Dar es Salaam municipal hospitals ranged from 0.2 to 0.4 and that for nurse assistants was 0.1.

Previous Training and Level of Recall for Danger Signs: The majority of the interviewed midwives (87%) from all the health institutions reported that they had previously received practical training in midwifery (Table 4). Half of the midwives (50%) had had their last midwifery training more than 5 years before the study. More than three quarters (77%) reported that they had special training on the use of the

Table 2: Number of health care providers in 16 health institutions in Dar es Salaam during the study period 2005

Personnel	MNH [†]	MH n = 3	H M	HC n = 5	Disp n = 6	Total n = 16
Specialists (obstetricians)	22	4	1	0	0	27
General practitioners	17	8	1	2	0	28
Anaesthetists/anaesthetic nurse/assistants	24 [§]	4	1	0	0	28
Pharmacists/assistants	3	6	5	4	0	18
Neonatologists	2	0	0	0	0	2
Assistant medical officers	0	63	0	8	0	71
Clinical officers/assistants	0	65	0	33	21	119

Key: MNH = Muhimbili National Hospital, MN = Municipal hospitals, HM = Hindu Mandal hospital, HC = health centres, Disp = dispensaries,

† As opposed to other institutions where the numbers represent institutional figures, at MNH only those who were allocated to the maternity wards (antenatal, labour and postnatal wards) were included except for anaesthetists

§ MNH had 24 anaesthetists of different kinds and included; 5 anaesthetists, 6 Assistant medical officer anaesthetists, 11 anaesthetic nurses, and 2 resident anaesthetists. They work on a rotational basis and at any time one of them is allocated to obstetric theatre according to their duty roster.

Table 3: The workload indicators for nurses working in the labour wards in Dar es Salaam municipal hospitals based to the 2004 delivery statistics

Deliveries/Staff category	Amana	Mwananyamala	Temeke
<i>Total annual deliveries</i>	12,432	12,465	15,347
<i>Delivery rate (per day)</i>	34	34	42
<i>Nursing officers</i>			
Requirement	4.4	4.4	5.2
In position	4	2	5
WISN ratio	0.91	0.45	0.96
<i>Nurse midwives(trained)</i>			
Requirement	40	40.1	49.4
In position	8	14	9
WISN ratio	0.20	0.35	0.2
<i>Nurse assistants</i>			
Requirement	23.1	23.1	28.5
In position	2	2	3
WISN ratio	0.09	0.09	0.1

partogram to monitor progress of labour; however the percentage was lowest (37%) among nurses from dispensaries. Although most health workers (81%) indicated to have been trained on how to take care of neonates and premature babies during their pre-service training, most of them (87%) had never seen neonatal care guidelines.

The level of recall of 48 midwives was assessed for danger signs of the complications of pregnancy. Of all the groups only danger signs directed to the group of eclampsia were spontaneously recalled by over half (72%) of the interviewed midwives (Table 5). The groups of danger signs that were least recalled were those directed to sepsis

(6%), intrauterine fetal death (10%) and obstructed / prolonged labour 27%.

Workforce Motivation Strategies: There was a diversity of motivation strategies in place reported in health institutions. The most reported incentives included paying overtime and timely promotion in 69% and 56% of the institutions respectively. Other strategies reported by less than 50% of the institutions included plans to increase the salaries, in-service training, seminars and workshop, and provision of mid morning tea for staff. Hindu Mandal hospital, the only private hospital in the survey, was the only health institution that had no established strategies for staff motivation.

Table 4 Proportions of midwives who had attended training in midwifery, neonatal care and use of partogram in Dar es Salaam health institutions

Training category	Dispensaries n (no. of midwives) =16	Health centers n = 12	Hindu Mandal n = 5	Municipal hospitals n = 15	Muhimbili National Hospital n = 5	Total n = 48 n %
Midwifery						
< 5 years	6	6	0	8	4	24 (45)
≥5 years	10	6	5	7	1	29 (55)
Practical midwifery training	13	11	5	13	4	46 (87)
Neonatal care						
Never	5	0	1	1	0	7 (13)
< 5 years	4	10	2	11	5	32 (60)
≥5 years	7	2	2	2	0	13 (25)
Partogram	6	11	4	15	5	41 (77)
Neonatal care practicals	11	12	5	13	3	44 (83)
Care for premature baby	11	9	5	14	4	43 (81)
Guideline for neonatal care	1	0	4	2	3	10 (19)

Discussion

Our findings indicated severe shortage of health care providers in almost all health institutions in Dar es Salaam region. The workload pressure at the municipal hospitals, which function as first referral facilities in the region, was very huge and exceeded the available human resources. The findings of low WISN ratios for trained nurses and nurse assistants as low as 0.2 and 0.09 respectively indicate

severe shortage of these staff in these hospitals. These findings suggest that the staff are under an extremely huge work pressure and reflect what extent the desired professional standards can be met by the available staff. During the period of study there were only four assistant anaesthetists in all three municipal hospitals, two neonatologists in all facilities and no nurse specialized in neonatal care.

Table 5 Number and proportions of midwives from Dar es Salaam health institutions who could spontaneously mention at least one the symptoms/signs of a group of danger signs for pregnancy complication

Group of danger signs	Dispensaries (midwives) N = 16	Health centers n = 12	Municipal hospitals n = 15	Muhimbili National Hospital n = 5	Total N = 48 N	%
Previous bad obstetric history / abdominal scar/ previous still birth	7	7	4	2	20	42
Hypertension / headache / swelling / fits	10	7	12	5	34	71
Anaemia / pallor/ fatigue/ breathlessness	7	3	8	2	20	42
Cessation of fetal movement / baby does not move	3	0	2	0	5	10
Abnormal lie/ position of fetus	5	4	2	0	11	23
Sepsis / foul smelling discharge / postpartum abdominal pain	1	0	2	0	3	6
Light bleeding / spotting	3	1	4	1	9	19
Haemorrhage / heavy bleeding	8	4	9	4	25	52
Multiple pregnancy / large abdomen	6	5	4	1	16	33
Obstructed / prolonged labour	5	4	1	3	13	27
Other specify	8	6	6	1	21	44

Shortage of staff for perinatal care has been reported in Tanzania and many other countries including high income ones¹⁶⁻¹⁸. The impact of low coverage of skilled staff on women and fetuses in the context of perinatal care is critical and includes the high rates of failure to rescue from complications of pregnancy leading to maternal and perinatal morbidity and mortality^{5,6,19,20}. The shortage of staff leads to high workload pressure which in turn leads to staff spending much less time on each activity than is set by the activity standards in the

country. This indicates that the quality of service being delivered is even below the locally accepted standards¹⁰.

Such low coverage of essential staff for perinatal care in Dar es Salaam public health institutions can partly explain poor quality of perinatal care and outcome. With only four assistant anaesthetists among the three Municipal hospitals, it was impossible to provide anaesthesiology services for 24 hours per day, a requirement for first referral hospitals.

A problem of lack of 24 hour availability of key staff has been reported

to be endemic in low income countries [21]. Quite often district hospitals and health centres function for only a fraction of the day (often morning) and are virtually inactive the rest of the day and all the night as were found in this study²¹. However, this may be true even when there is an adequate number of health personnel. Based on the concept of brain drain of staff from rural to urban areas we can conclude that the picture of low coverage of skilled health providers seen in Dar es Salaam region likely reflects an even more serious shortage of the health providers all over the country. While this study has revealed a severe shortage of workforce, it has been also reported that the current trend of staff productivity in the country is too slow to meet the increasing staffing requirements²². These findings suggest that the Millennium Development Goals set for maternal and newborn survival are unlikely to be achieved in Tanzania unless focused strategic interventions for human resource are implemented.

The levels of recall for danger signs of the complications of pregnancy among the midwives were critically low. The fact that recall is the lowest level in the hierarchy of cognitive domain such a poor recall of the danger signs of complications of pregnancy suggests that these health care providers also lacked the higher levels of the domain. The higher levels of cognitive domain are of great value in management of diseases and include: comprehension defined as the ability to interpret, translate and make use of an idea; extrapolation, defined as predicting effects and consequences;

application, defined as the ability to utilise knowledge and apply facts; synthesis defined as the ability to bring together separate components of knowledge to form a complete thing; and evaluation that refers to the ability to make judgments based on knowledge²³. Poor knowledge of the health workers in the context of complications of pregnancy has also been reported in other parts of this country⁸. Such poor knowledge could be a reflection of the existing gaps in the teaching and learning processes in the training institutions as well as lack of regular on-the job training in the domain of perinatal care. The gaps of knowledge could have contributed to poor perinatal care and outcomes in this region. These findings suggest the need of on the job competency-based training in order to improve the levels of knowledge and skills. As it has been learned in other intervention programs such training should also be complemented by innovative incentives, management protocols and employment of adequate numbers of health providers in order to improve the quality of care and have sustainable provision of essential obstetric care services in health institutions²⁴.

Conclusion and Recommendation

The shortage of human resource in the domain of perinatal care is great and is associated with poor performance and outcomes in Dar es Salaam health institutions. We recommend for more staff, innovative incentives to motivate and retain trained staff, on the job competency-based training and

introduction of management protocols to standardize practice in order to achieve the global millennium development goals set for maternal and newborn survival.

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CHAPTER 4

Partogram use in the Dar es
Salaam perinatal care study

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CLINICAL ARTICLE

Partogram use in the Dar es Salaam perinatal care study

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Progress of labor
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Abstract

Objective: To assess the quality of partograms used to monitor labor in Dar es Salaam hospitals, Tanzania. **Methods:** The study team reviewed the records of the parameters of labor, and maternal and fetal conditions in 367 partograms, and interviewed 20 midwives. **Results:** All midwives interviewed had been previously trained to use the partogram. Of all partograms reviewed, 50% had no records of duration of labor. Although cervical dilation and fetal heart rates were recorded in 97% and 94% of the partograms respectively, 63% and 91% of these were judged to be substandard. Substandard monitoring of fetal heart rates was strongly associated with poor fetal outcome ($P < 0.001$). Blood pressure, temperature, and pulse rates were not recorded in 47%–76% of partograms. **Conclusion:** These findings reflect poor management of labor and indicate urgent in-service training to address the importance of documentation and regular partogram audit in order to reduce maternal and perinatal deaths.

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1. Introduction

Ever since the first graphic assessment of progress of labor was designed by Friedman [1] and further improved by

Philpott and Castle [2] nearly four decades ago, much work has been done to improve it and adopt its use globally. Responding to the recommendations of the Safe Motherhood Conference held in Nairobi in 1987, the World Health Organization (WHO) produced a partogram and tested its practical value to reduce maternal and perinatal morbidity and mortality [3]. Based on the findings of this study, WHO recommended its widespread use for all women during

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labor [3]. Similarly, several other studies support that proper use of the partogram is associated with improved quality of care and pregnancy outcome [4,5]. The Ministry of Health of Tanzania has adopted WHO's old partogram prototype, and its use in labor is obligatory at all levels of obstetric care.

Guidelines for use of the partogram require that its parameters should be regularly assessed and plotted in order to achieve optimal monitoring and pregnancy outcomes. Proper use of the partogram allows midwives to display the details of labor in a pictorial manner and compare them with the ideal profile against time, in order to enable easy identification of abnormal labor patterns, early intervention, and prevention of obstetric complications [6].

Many studies have reported the practical value of using the partogram, but few have audited its quality in low income countries. Such a study in Benin showed that appropriate use of the partogram was poor [7]. Although midwives recognize that the partogram has practical benefits, some perceive it to be associated with restrictions in their clinical practice, reduced autonomy, and limited flexibility to treat each woman as an individual [8]. Such perceptions could be associated with inadequate documentation of the required parameters in the partogram. This study was conducted in 2004 to investigate use of the partogram in public hospitals in Dar es Salaam, Tanzania.

2. Materials and methods

The study was carried out in 4 public hospitals in Dar es Salaam, Tanzania: Muhimbili National Hospital (the tertiary referral hospital), Amana, Mwananyamala, and Temeke municipal hospitals. These health facilities serve over 2.5 million people in Dar es Salaam with an annual growth rate of 4.3%, as recorded in the 2002 national census [9]. Statistics have shown that, over recent years, the majority (as high as 72%) of the registered births in this city are conducted in these facilities [10].

The design of the study was to review and record details of the partograms used to monitor progress of labor, and maternal and fetal condition.

The study team aimed to review 100 partograms from each of the 4 public hospitals in Dar es Salaam in 2004. The team managed to collect only 77 partograms from Amana because for the majority of mothers in labor in this hospital the partogram was written on the back of their antenatal cards, and the women were later discharged with their cards. Simple random sampling was used to obtain the partograms from the other hospitals. A

total of 367 partograms was collected and this was considered an adequate number to ascertain whether the guidelines for its use were being followed appropriately.

The research team systematically reviewed all partograms and documented the required information using a WHO Safe Motherhood questionnaire developed for assessment of partogram use [11]. There were no patients' records, except for a few at Muhimbili and thus these were not reviewed. The team also interviewed the midwives working in the maternity units/labor wards about their previous formal training on how to use a partogram. Five midwives working in the labor wards were randomly selected for interview from each hospital to make a total of 20.

The main outcome measures included number of hours from the time of admission until time of delivery, cervical dilation over time, uterine contractions, fetal heart rate, maternal blood pressure, temperature, pulse rate, and crossing of the action line. The parameters were assessed to determine whether they had been monitored according to standard protocol. Standard protocols were defined based on time intervals as follows [11]: (1) cervical dilation monitored at least once every 4 h; (2) fetal heart rate, blood pressure, and maternal temperature monitored at least hourly; (3) condition of baby after birth should always be recorded on the card.

Records not meeting the protocol standards were judged as substandard, or not recorded if no information had been documented. The Fisher's exact test was used to assess association between the quality of records of different partogram parameters and fetal outcomes.

Ethical clearance for the study was obtained from Muhimbili University College of Health Sciences, and permission to conduct the study was obtained from the respective authority of the institutions.

3. Results

The number of deliveries in 2004 ranged from 11,543 at Muhimbili hospital to 15,347 at Temeke hospital. The delivery rates ranged from 32 to 42 per day at Muhimbili and Temeke hospitals, respectively. The birth/nurse ratios per year ranged from 550 to 1395 at Muhimbili and Temeke hospitals, respectively (Table 1).

There were no written guidelines on how to use the partogram for recording and management of labor in any of the labor wards. The number of hours from admission to delivery could not be calculated in half of the records because either the admission or delivery time, or both, were not recorded. Measurement of cervical dilation was recorded

Table 1 Labor ward performance statistics in Dar es Salaam public hospitals in 2004

Performance statistics	Hospital				
	Amana	Mwananyamala	Temeke	Muhimbili	Total
Number of births	12,432	12,465	15,347	11,543	51,787
Number of cesarean deliveries	376	383	578	3640	4977
Cesarean delivery rate (%)	3	3	4	32	10
Delivery rate (per day)	34	34	42	32	142
On call nurse/birth ratio per year ^a	690	623	1395	550	740

^a Only nurses working in the labor ward/room were included.

Table 2 Proportions of partograms with records of parameters of labor, maternal and fetal conditions in Dar es Salaam public hospitals^a

Parameters of labor	Amana (n=77)	Mwananyamala (n=98)	Temeke (n=99)	Muhimbili (n=93)	Total (n=367)
Cervical dilation					
Not recorded	4	3	4	1	3
Substandard	34	85	83	36	61
Monitored to standards	62	12	13	63	36
Action line crossed	20	0	1	9	7
Uterine contractions					
Not recorded	95	57	82	13	61
Substandard	4	41	18	30	24
Recorded to standards	1	2	0	57	15
Blood pressure					
Not recorded	75	43	71	2	47
Substandard	18	55	28	11	29
Monitored to standards	6	2	1	87	24
Fetal heart rates					
Not recorded	3	15	5	0	6
Substandard	94	80	95	74	86
Monitored to standards	3	5	0	26	8
Condition of the baby after birth					
Not recorded	3	89	91	1	49
Recorded					
Not good (Apgar 1–6)	8	0	0	10	6
Good (Apgar 7–10)	85	11	9	84	43
Still birth	4	0	0	5	2

^a Values given as percentages.

in 97% of the partograms, but almost two thirds (62%) of these were judged to be substandard. Gloves were available in all hospitals but the adequacy of the supplies was not investigated. Uterine contractions were not recorded in 61% of the partograms. Of those that were recorded, 61% were judged to be substandard. The action line of the cervical graph was crossed in 7% of the recorded partograms. Maternal blood pressure, temperature, and pulse rate were not recorded in 47%, 70%, and 76% respectively (Table 2). While over 87% of the partograms recorded at the municipal hospitals had no records of maternal temperature and pulse rate, at the national hospital these parameters were lacking for 14% and 19% of records, respectively.

Fetal heart rate was not recorded in 6% of the partograms reviewed and was judged to be substandard in 86%. Condition of the baby after birth was assessed using only the Apgar score system as there were no facilities for cord blood sampling in the hospitals; Apgar score was not recorded in almost half (49%) of the studied partograms. The highest omission (91%) was found in the partograms collected from Temeke hospital. In 84% of the partograms where the condition of the newborn had been recorded, live babies were born in good condition (Apgar score 7–10). In Muhimbili and Amana hospitals, where at least 89% of the partograms had records of live fetuses on admission and the conditions of the babies were recorded after birth, a statistically significant difference was found for fetal outcome between substandard versus standard monitoring of fetal heart rate ($P<0.001$; Table 3). Although there was no statistically significant difference for fetal outcome

between those who had crossed versus those who had not crossed the action line, there was a trend towards a poorer outcome among those who had crossed the action line ($P=0.06$). All 20 midwives interviewed from the 4 public hospitals reported that they had previously received training on use of the partogram.

Table 3 Association between the quality of monitoring the parameters of labor and fetal outcome at Amana and Muhimbili hospitals

Parameter	Fetal outcome		P value
	Apgar score <7, including stillbirth (n=25)	Apgar score 7–10 (n=162)	
Fetal heart rates			
Not recorded	1	6	
Substandard	10	16	
Standard	14	140	$P<0.001$
Cervical dilation			
Not recorded	1	4	
Substandard	13	59	
Standard	11	99	$P=0.09$
Action line			
Not crossed	19	145	
Crossed	6	17	$P=0.06$

4. Discussion

This study revealed high proportions of unrecorded parameters on labor ward partograms in public hospitals in Dar es Salaam, coupled with substandard monitoring of progress of labor that may have played a major role in the maternal and fetal health outcomes. Lack of records for the condition of babies after birth in almost half (49%) and suboptimal monitoring of fetal heart rate in 86% of the studied partograms indicate seriously poor documentation, monitoring, and supervision of labor. Our findings from Amana and Muhimbili hospitals showed that substandard intrapartum fetal monitoring was strongly associated with poor fetal outcome ($P < 0.001$). In order to achieve good fetal outcome it is extremely important to monitor fetal condition during labor [12].

Cervical dilation was the most frequently recorded parameter of the progress of labor (up to 97%), while uterine contractions were not recorded in almost two thirds (61%) of the partograms reviewed. Such a wide variation in the records suggests that midwives prioritized cervical dilation over the other parameters. In light of the recent report on improved user-friendliness and labor outcomes with use of the simplified WHO partogram (which has omitted the latent phase, fetal head descent and moulding [13]), it is possible that not all parameters in the old partogram are necessary to ensure optimal outcome of labor. However, the study team believes that fetal head descent is also important when it comes to decision-making as are the other parameters such as strength and frequency of uterine contractions, which were poorly monitored in the present study.

Suboptimal documentation of some parameters of the progress of labor could hinder early detection of complications. Early detection and timely intervention of obstetric complications are the most important activities to prevent perinatal mortality and morbidity [14] and this underlines the core purpose of using the partogram. The finding of poor documentation of parameters of progress of labor in these health institutions indicates a serious problem. The fact that there were no records of duration of labor in 93% and 90% of the partograms at Temeke and Mwananyamala hospitals respectively, shows the urgent need for improvement in this area. Poor documentation of the parameters found in this study reflects poor intrapartum care and partly explains the existing high maternal and perinatal mortality in this region [15,16].

Although all midwives interviewed in this study had formal training on how to use the partogram, the tools were poorly utilized. The impact of such training was not reflected in their performance. Inadequate intrapartum monitoring of labor has also been reported to exist in other low income countries [17]. Suboptimal use of the partogram is a longstanding problem in Dar es Salaam hospitals; the same problem was reported in 2002 and midwives attributed it to shortage of staff and high patient workload that gave little time for the charting activity [18]. Regardless of the reasons, optimal monitoring of labor using the partogram remains crucial for good pregnancy outcomes [3]. In areas with high workload pressure [15,16,18,19], these findings support the introduction of the simplified partogram to reinforce its optimal use in order to reduce undesirable pregnancy outcomes.

Poor use of partogram records found in the present study were a reflection of poor monitoring, management, and

supervision of labor in Dar es Salaam public hospitals. In order to remedy the situation, pre-service and on-the-job training in use of the partogram, supervisory mechanisms, use of a simplified WHO partogram prototype, and regular partogram audits must be implemented.

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CHAPTER 5

Bridging the gaps in the Health
Management Information System in the
context of a changing health sector

(BMC Med Inform Decis Mak 2010; 10: 36)

RESEARCH ARTICLE

Open Access

Bridging the gaps in the Health Management Information System in the context of a changing health sector

Angelo S Nyamtema

Abstract

Background: The Health Management Information System (HMIS) is crucial for evidence-based policy-making, informed decision-making during planning, implementation and evaluation of health programs; and for appropriate use of resources at all levels of the health system. This study explored the gaps and factors influencing HMIS in the context of a changing health sector in Tanzania.

Methods: A cross sectional descriptive study was conducted in 11 health facilities in Kilombero district between January and February 2008. A semi-structured questionnaire was used to interview 43 health workers on their knowledge, attitude, practice and factors for change on HMIS and HMIS booklets from these facilities were reviewed for completeness.

Results: Of all respondents, 81% had never been trained on HMIS, 65% did not properly define this system, 54% didn't know who is supposed to use the information collected and 42% did not use the collected data for planning, budgeting and evaluation of services provision. Although the attitude towards the system was positive among 91%, the reviewed HMIS booklets were never completed in 25% - 55% of the facilities. There were no significant differences in knowledge, attitude and practice on HMIS between clinicians and nurses. The most common type of HMIS booklets which were never filled were those for deliveries (55%). The gaps in the current HMIS were linked to lack of training, inactive supervision, staff workload pressure and the lengthy and laborious nature of the system.

Conclusions: This research has revealed a state of poor health data collection, lack of informed decision-making at the facility level and the factors for change in the country's HMIS. It suggests need for new innovations including incorporation of HMIS in the ongoing reviews of the curricula for all cadres of health care providers, development of more user-friendly system and use of evidence-based John Kotter's eight-step process for implementing successful changes in this system.

Background

A health management information system (HMIS) is a process whereby health data are recorded, stored and processed for policy-making, planning, implementation and evaluation of health programs. The system is crucial for evidence-based policy and informed decision-making at all levels from national down to the institutional levels. Evidence-based decision making is critically important for the appropriate use of scarce resources particularly in resource limited countries like Tanzania.

The HMIS in most developing countries are inefficient and are greatly affected by unreliability of data resulting from underreporting [1]. Reports from sub Saharan Africa indicate that vital health decisions, in this context, are made based on crude estimates of disease and treatment burdens [2,3]. Findings from this region indicate that the problem of under reporting is huge and is linked to lack of knowledge and practice among the health workers characterized by insufficient analysis skills, training and lack of initiative for using information [4-6].

In Tanzania the first version of the health management information system was launched in 1993 and the

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second in 1998 [7]. The first version was entirely in English and it was soon realized upon testing that the users had limited commands in this language and was therefore technically changed to Kiswahili, the national language. Thus, the Health Management Information System is called in Kiswahili as *Mfumo wa Taarifa za Huduma za Afya (MTUHA)*. The latest version involves manual data entry into 12 HMIS booklets. The system covers all health programs and health care services, and requires all health facilities, regardless of ownership, to use this system and report to the district health authority on quarterly basis. The overall goal of this system is to optimize the performance of health services at all levels of administration through the timely provision of necessary and sufficient information needed by the health managers to monitor, evaluate and plan their activities [7,8]. Its success requires a system that is integrated, decentralized, functional and reliable [9].

The conception of this study was based on the concerns about the poor quality data and inadequate integration of the HMIS despite a number of changes it has undergone since inception and the need to bridge the gaps in the on-going changes in health sector. In an attempt to strengthen the health services to meet national and international commitments, the government of Tanzania has developed the Primary Health Service Development Program (PHSDP) whose main goal is to accelerate provision of quality primary health care services to all by 2017. This program is implemented by increasing intakes of trainees for health care, reviewing and standardizing curricula for all medical and paramedical cadres to competence-based [10]. The review of the curricula is spearheaded by the National Council for Technical Education (NACTE) an organ which was empowered by the government through the Act No. 9 of 1997 to coordinate technical education and set qualification standards for the awards. This article explores the gaps and factors for change in HMIS in Tanzania and presents a detailed account on how they could be best bridged in the ongoing changes in country's health sector. It attempts to link the required changes in the HMIS and the evidence-based John Kotter's eight-step process for implementing successful changes in any organizations [11].

Methods

Study area and design

Tanzania is divided into 25 administrative regions that are subdivided into 113 districts that are further subdivided into divisions, wards and villages. Administratively, the ministry of health is the main coordinating body for health information in the country, the regional level is responsible for coordinating activities in the districts and the districts are responsible for coordinating

services delivery activities at the health facility levels. The 12 HMIS booklets in Tanzania include the guidelines, summary (from the other books), village profile, inventory (ledger for equipment, drugs and supplies), outpatient services, antenatal services, postnatal services, family planning services, communicable diseases, HMIS report book, dental services and delivery services. These booklets consist of forms and registers, where the registers are pre-set frameworks for data processing.

In an attempt to map the gaps and factors for change in the country's HMIS a cross-sectional descriptive study was conducted between January and February 2008 in Kilombero, one of the most rural districts in Tanzania. Kilombero district is in the southeastern part of the country about 230 km from Morogoro, the headquarters of the region and 420 km from Dar es Salaam, the largest business city in the Tanzania. The district has a total area of 14,018 km², a population of 321,611 people [12] and 44 health facilities. Among these health facilities are 2 hospitals both owned by non-governmental institutions, 4 health centres (all owned by the government) and 38 dispensaries of which only 15 are owned by the government. The health facilities were as far as 180 km from the district headquarters and are expected to provide all primary health care services, refer complicated cases and complete the relevant booklets.

Sampling and size

A stratified random sampling technique was used to obtain one hospital, one health centre and 9 dispensaries. Of these facilities, 5 were governmental and 6 non-governmental. A total of 11 health facilities were involved in the analysis, fulfilling WHO recommendation to cover at least 25-30% of the health facilities in the area when assessing quality of care [13,14]. The study team aimed to interview at least 5 health care providers including those in-charge of the health facility available on the day of study visit. However, the team managed to interview 43 care providers because many of the facilities had less than five health care providers. At the hospital a list of care providers was obtained from the administration and the following departments were included: outpatient, reproductive and child health (RCH) clinic and labour ward where at least 2 health workers were interviewed from each department.

Data collection, processing and analysis

Data collection was carried out by the author and 4 research assistants. A semi-structured questionnaire was used to interview health care providers and facility administrators to assess their level of knowledge, attitudes and practices concerning HMIS and factors for change (Additional file 1). After the interview the

research team requested to see the 2007 HMIS booklets (number 6, 7 & 12) in order to review the completeness of records. The parameters recorded in booklet 6 (antenatal services register) included: 1) booking visit: date, registration number, name, age, gravidity, gestation age, height, danger signs; 2) re-attendance visits: presence of anaemia, oedema, proteinuria, lie of the foetus, vaginal bleeding, syphilis test, date of TT vaccine for the index pregnancy, last childbirth (year, live or died) and referral information. The parameters for book 7 (under-five services register) were: date, registration number, date of birth, weight, date for BCG, DPT, polio, measles vaccinations and vitamin A, mother's information (name and TT vaccination status); and those for book 12 (delivery services register) were: date, registration number, name of the mother, age, gravidity, parity, date of admission, date of delivery, mode of delivery, birth before arrival (BBA), complication of labour, status at birth (live birth or stillbirth), condition of the mother at discharge and name of the health provider. The parameters which were mostly not recorded were documented. In the cases of frequent incomplete records, the research team inquired about reasons for the incompleteness. The research team also interviewed the district HMIS coordinator for the factors that affected health information system. The data were entered in the Statistical Package for Social Science (SPSS) version 10 and analyzed by generating frequencies. Exact binomial confidence intervals at 95% were used to compare the proportions of clinicians and nurses with regards to the training, knowledge, attitude and utilization of HMIS data in their health facilities. The permission to carry out this study was obtained from district medical authority and verbal consent was obtained from the interviewees.

Results

Characteristics of respondents

A total of 43 health care providers from 11 health facilities were interviewed. Among these 23 (53%) were clinicians and 20 (47%) nurses. While the clinicians included 20 (47%) clinical officers and medical officers 3 (7%),

the nurses included 8 (19%) nurse officers, 11 (26%) enrolled nurses and 1 (2%) medical attendant.

Training and knowledge on HMIS

More than three quarters (81%) of respondents had never been trained on HMIS (Table 1). There was no statistically significant difference in proportions of health workers trained for HMIS between the clinicians 17% (95% CI: 2% - 32%) and nurses 20% (95% CI: 2% - 38%). Almost two thirds (65%) failed to define properly what HMIS is. Of the respondents, only 7% recalled 7-9 booklets, 18% recalled 5-6 booklets, 42% mentioned 1-5 booklets and more than one third (33%) failed to recall even one out of twelve HMIS booklets. While 54% did know who are supposed to use the information collected at the health facility, 40% didn't know the importance of HMIS. There was no significant difference in knowledge about the importance of HMIS between clinicians 61% (95% CI: 41% - 81%) and nurses 60% (95% CI: 41% - 81%). On the other hand, more than one third (37%) of all respondents did not know the HMIS information flow pattern.

Attitude towards HMIS

Generally almost all respondents (91%) had positive attitude towards HMIS. There was no significant difference in attitudes of health workers towards HMIS between clinicians 87% (95% CI: 74% - 99%) and nurses 95% (95% CI: 93% - 98%). Thirty nine respondents (91%) agreed that the system (HMIS) was worthy for the time and other resources spent filling and processing data, and that it was important to continue with the system. However, 42% of the respondents pointed out that the current HMIS was difficult, complicated and that it needed to be simplified. Although they were generally positive they needed a better system.

Practice on HMIS

Of the respondents 42% had never used the HMIS data collected at the health facility level for planning, budgeting and evaluation of services provision. This was attributed by almost three quarters (70%) to poor knowledge

Table 1 Proportions of health workers with training, knowledge, positive attitude and utilized HMIS data in Kilombero district

	Clinicians n = 23		Nurses n = 20		Total n = 43	P value
	%	95% CI	%	95% CI	%	
Trained on HMIS	17%	2% - 32%	20%	2% - 38%	19%	0.826
Defined properly HMIS	17%	2% - 32%	55%	33% - 77%	35%	0.010
Knew the importance of HMIS	61%	41% - 81%	60%	41% - 81%	60%	0.954
Positive attitude towards HMIS	87%	74% - 99%	95%	93% - 98%	91%	0.365
Utilized HMIS data for decision making	52%	32% - 72%	65%	44% - 86%	58%	0.395

Note: CI = Confidence interval

on data analysis. The other major reasons for failure to utilize the local data were poor quality of data and poor managerial skills reported by 16% and 7% of the respondents respectively.

Completeness of HMIS booklets

Of all reviewed HMIS booklets only a single delivery register from only one health facility was judged to be 100% complete. These booklets, however, were not filled in as many as 55% of the health facilities (Table 2). The types of information that was found not recorded in the booklets for postnatal services (child vaccination/weight) were measles vaccine, DPT 3, polio vaccine and Vitamin A. These services were not recorded in these booklets despite the fact that it was assumed that these important health interventions had been given to the clients.

The type of information which was mostly not filled in the delivery booklets was the condition of the mother at discharge. The parameters which were commonly missing in the antenatal services' booklets were pregnant mothers' risk factors, VDRL test, TT vaccination and height. Reasons for such incompleteness found were lack of VDRL reagent, workload pressure, forgetfulness and poor knowledge on data recording.

Recommendations for HMIS improvement

Almost all respondents (95%) recommended training of health care providers in order to improve HMIS. Almost a quarter (23%) of respondents recommended for improved supervision and increased staffing levels at the facility level. Only 19% recommended for revision and simplification of the HMIS to be more user-friendly. The respondent from the district authority reported that the process of health data in the current HMIS was long and difficult, with many booklets and forms with some repeating information. Poor knowledge on HMIS among health workers was linked to lack of training on the system and workload pressure. In view of these gaps the system was recommended for revision.

Discussion

Our findings revealed a wide range of interlinked factors responsible for the inefficiency and ineffectiveness of the HMIS in Tanzania. The lack of clear understanding of the purpose, users and flow pattern of health data

collection was linked to poor quality of data collection and suggests that decision-making in the country health system may be less than adequately informed. This study has revealed higher proportion (65%) of care providers who failed to define properly what HMIS is than that (47%) reported in previous studies [6]. These findings suggest a declining knowledge on this important system. On the contrary, despite such low knowledge on HMIS, the majority of the care providers (91%) had positive attitude towards the system, indicating substantial acceptability, a positive potential factor for improvement. The existing huge gap of knowledge on such an important system can be linked to lack of training which was as high as 81% of care providers. On the other hand the findings suggest lack of emphasis on HMIS in the pre-service curricula and hence a lack of evidence-based training in medical and paramedical training institutions in the country. Considering the ongoing process to develop and introduce competence-based educational curricula for all medical and paramedical training programs in the country and the government 10 year program to expand training of care providers, incorporation of HMIS in the new curricula is greatly suggested. The government of Tanzania through its 10 year PHSDP (2008 - 2017), intends to train 460,000 health care providers by the year 2017 and improve the provision of health services to the level of every village and ward [10,15]. The author believes that incorporation of HMIS in the new curricula will improve not only knowledge, skills, culture and efficiency of HMIS but will also cut-down the investment required for on-the-job training for health care providers.

The failure to collect health data as seen in 55% of the health facilities for HMIS delivery booklets, indicates the high degree of poor documentation, underreporting and data inaccuracy from the district up to the national level. The HMIS guidelines require health care providers to complete relevant booklets immediately after provision of health care services before the patients or clients leave the facility. The impact of such poor compliance with this system is worrisome and suggests that vital public health decisions are made based on crude district and national estimates of burden of the problems. The failure to use health data collected at the health facility level as reported by 63% of care providers indicates that

Table 2 Level of completeness of HMIS booklets from Kilombero district health facilities, 2007

Types of HMIS booklets	Proportions of health facilities, n = 11			
	Level of completeness of HMIS booklets			
	100%	75% - 99%	50% - 74%	Never filled the booklets
Postnatal services booklets	0%	73%	0%	27%
Delivery booklets	9%	36%	0%	55%
Antenatal services' booklets	0%	36%	36%	27%

the primary purpose of data collection is to report to higher levels suggesting a high prevalence of the “*mailbox syndrome*”. The “*mailbox syndrome*” is a phenomenon whereby a crucial information generated at the health facility level is mailed rather than used locally for quality care improvement [16]. This syndrome is contrary to the concept of decentralization which is currently implemented in the country. These findings suggest also that the existing HMIS has not been institutionalized in the sense of being integrated into the everyday activities, an important factor for its sustainability and reliability.

Like many other reports the incompleteness and poor use of health data collected at a health facility, found in this study, can be attributed to poor knowledge on HMIS; inadequate financial, human and technological resource capacity; lack of user-friendly systems; lack of coordination and evaluation, as well as inadequate policies to manage the sustainability of the system [17,18]. Considering the lengthy and laborious HMIS procedural requirements for completion of the booklets and the context of acute shortage of care providers, revision for a more user-friendly system is highly recommended.

The fact that these factors have been documented and remained unattended in Tanzania over many years, indicates a high degree of irresponsiveness and unaccountability in the country health system [19,20]. These findings suggest in part poor leadership performance. Carrying out “*business as usual*”, a static mindset among the key actors and poor supervision of health systems are progress blocking agents which have been reported as the leading factors for poor performance of health sectors in sub-Saharan Africa [21]. These findings call for more commitment, dedication and accountability within an HMIS organization [22]. Considering these factors and the fact that Tanzania is already off-track in HMIS, evidence-based John Kotter’s eight-step process for implementing successful changes is indicated for effective system in this country. These steps are: to create a sense of urgency for change, create powerful group guiding the change, develop and communicate the change vision and strategy, empower others to act, produce short-term wins, press harder and faster after the first successes and create a new culture for sustainability [11].

Conclusions

This article has revealed a state of poor health data collection, lack of data-based decision-making at all levels and the factors for change in the country’s HMIS. It calls for new innovations including incorporation of HMIS in the ongoing reviews of the educational curricula for all cadres of health care providers, development of more user-friendly system and use of evidence-based

John Kotter’s eight-step process for implementing successful changes in this system.

Additional material

Additional file 1: Knowledge, attitude and practice on health management information system in Kilombero district, Tanzania.

A semi-structured questionnaire used to assess training, knowledge, attitude and practice on health management information system among health workers in Kilombero district. The tool also explores the gaps and factors for change in the existing health management information system.

Abbreviations

BCG: Bacille Calmette-Guérin (Tuberculosis) Vaccine; DPT: Diphtheria, Pertussis and Tetanus toxoids; HMIS: Health Management Information System; NACTE: National Council for Technical Education; PHSDP: Primary Health Service Development Program; RCH: Reproductive and child health; VDRL: Venereal Disease Research Laboratory (test for syphilis); TT: Tetanus Toxoid.

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Authors’ contributions

ASN designed the study, was involved in data collection and analyzed the data and wrote the manuscript.

Competing interests

The author declares that they have no competing interests.

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CHAPTER 6

Factors for change in maternal and
perinatal audit systems in Dar es
Salaam hospitals, Tanzania

(BMC Pregnancy Childbirth 2010; 10: 29)

RESEARCH ARTICLE

Open Access

Factors for change in maternal and perinatal audit systems in Dar es Salaam hospitals, Tanzania

Angelo S Nyamtema*¹, David P Urassa², Andrea B Pembe³, Felix Kisanga² and Jos van Roosmalen^{4,5}

Abstract

Background: Effective maternal and perinatal audits are associated with improved quality of care and reduction of severe adverse outcome. Although audits at the level of care were formally introduced in Tanzania around 25 years ago, little information is available about their existence, performance, and practical barriers to their implementation. This study assessed the structure, process and impacts of maternal and perinatal death audit systems in clinical practice and presents a detailed account on how they could be improved.

Methods: A cross sectional descriptive study was conducted in eight major hospitals in Dar es Salaam in January 2009. An in-depth interview guide was used for 29 health managers and members of the audit committees to investigate the existence, structure, process and outcome of such audits in clinical practice. A semi-structured questionnaire was used to interview 30 health care providers in the maternity wards to assess their awareness, attitude and practice towards audit systems. The 2007 institutional pregnancy outcome records were reviewed.

Results: Overall hospital based maternal mortality ratio was 218/100,000 live births (range: 0 - 385) and perinatal mortality rate was 44/1000 births (range: 17 - 147). Maternal and perinatal audit systems existed only in 4 and 3 hospitals respectively, and key decision makers did not take part in audit committees. Sixty percent of care providers were not aware of even a single action which had ever been implemented in their hospitals because of audit recommendations. There were neither records of the key decision points, action plan, nor regular analysis of the audit reports in any of the facilities where such audit systems existed.

Conclusions: Maternal and perinatal audit systems in these institutions are poorly established in structure and process; and are less effective to improve the quality of care. Fundamental changes are urgently needed for successful audit systems in these institutions.

Background

The persistently high maternal mortality ratio (MMR) of 572/100,000 live births in Dar es Salaam [1] together with a hospital based MMR of 1602/100,000 live births in 2004 and a perinatal mortality rate (PNMR) of 123/1000 births from 1999 to 2003 at Muhimbili National Hospital have been noted with great concern [2,3]. From the Safe Motherhood Initiative perspectives, one of the simplest and cost effective strategic interventions to reduce maternal and perinatal deaths is to improve the quality of care in the existing health institutions [4]. This has been achieved through establishment of effective maternal and perinatal audit systems [5,6].

An effective audit system is a cycle that consists of identifying cases, collecting information, analyzing the results, formulating recommendations, implementing change and re-evaluating practice, and this cycle must be repeated regularly [7-9]. An audit panel looks into factors in the structure, process and outcome before giving its opinions. Structure is defined as the resources available for care, including the staff, equipment and facilities, and their organization. Process is the utilization of these resources in the provision of health care, and outcome refers to the result of the health care provision process [10]. In such reviews the audit panel determines the causes of death, areas of substandard care and any other preventable factors and recommends how to improve future management.

Spontaneous adoption of simple health practices is often very slow and the integration can take up to centu-

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ries after their effects are known if an internal change agent is not created [11,12]. Although maternal and perinatal audits at the level of care were formally introduced in Tanzania around 25 years ago [13], little is known about their existence, performance, and practical barriers to their implementation in Dar es Salaam. This study assessed the structure, process and impacts of these audit systems and how they could be improved in Dar es Salaam and Tanzania in general.

Methods

Study setting

The study was conducted in Dar es Salaam, a city with more than 2.5 million people, 19 hospitals, 10 health centers and 60 dispensaries (government and non-government owned) that provided maternity services [3]. The study included the four main public hospitals namely Muhimbili National Hospital, Amana, Mwananyamala and Temeke municipal hospitals, and four major private hospitals namely Aga Khan, Hindu Mandal, Mikocheni and Massana. The sample of the hospitals exceeded 30% of the health facilities recommended by WHO/UNICEF to represent a certain geographical area when assessing obstetric care services [14]. In Tanzania, the national guideline for composition of maternal mortality audit committee at the hospital level requires involvement of medical officer in-charge of the facility, head of the department of obstetrics and gynaecology, matron, obstetricians, nurse in-charge of the labour ward, pharmacist, head of the laboratory, district medical officer, district nurse officer, district reproductive and child health coordinator and all doctors present on the day of audit. In addition to this list paediatricians and nurse in-charge of neonatal unit are recommended for the perinatal mortality audit committee.

Data collection

The study used both qualitative and quantitative methods. The qualitative component involved in-depth interviews of 29 respondents with a range of 1 - 5 purposely selected from each hospital. These were either members of maternal and perinatal audit committees or only administrators (heads of the department of obstetrics and gynaecology or in-charge of maternity wards) in places where such committees did not exist. The interviews investigated the existence, structure (composition), process and outcome of such audits in clinical practice and how they could be improved in their hospitals. The interview guide (Additional file 1) used the components of an ideal model audit to assess composition, timing and frequency of audit meetings, selection of cases, feedback provision, dissemination of recommendations, record keeping, analysis of results and use of audit recommendations for institutional planning and budgeting. The inter-

views were tape recorded on interviewee's consent. Immediately after the interview, the interviewees listened to the tape to clarify certain issues and confirmed that all the main points were included in the notes.

The quantitative component used a semi-structured questionnaire (Additional file 1) to interview 30 health care providers in the maternity wards, available on the day of study, to assess their awareness, attitude and practice towards maternal and perinatal death audits. In both interview categories (qualitative and quantitative) the study explored the level of implementation of audit recommendations and interviewees' suggestions for improvement of the audit systems in their respective facilities. The research team also reviewed records of the institutional deliveries, maternal and perinatal deaths, their causes as well as audited cases for 2007. The choice for 2007 records was based on the assumption that the data for 2008 had not been compiled in some of the facilities at the time of the study which started in January 2009.

The avoidable factors for audited cases were categorized according to the "3 Delays Model", defined as; phase 1: delay in decision to seek care, phase 2: delay in reaching care, and phase 3: delay in receiving care or substandard care [15]. The audit committees determined the phase of delay by establishing the time spent at home before a decision was made to seek health care after onset of complication, time spent after having made this decision to reaching care, time interval between admission and administration of treatment. This time was then compared with 1) the estimated time interval from onset of complication to death for various obstetric complications and 2) the requirements for birth preparedness and complication readiness. It is estimated that, if untreated, maternal death occurs on average in 2 hours from postpartum haemorrhage, 12 hours from antepartum haemorrhage, 2 days from obstructed labour and 6 days from infection [16]. The concept of birth preparedness and complication readiness, a strategy to promote planning for normal birth and timely use of skilled maternal and neonatal care in case of an emergency, requires a woman to seek care immediately after onset of danger signs of complications, improved accessibility of health care and prompt provision of appropriate care upon admission [17].

The audit committees reviewed the management offered to the deceased mother and determined the quality of care by comparing it with that recommended in the national management guidelines for obstetric emergencies, considered as standard care in the country. '*Substandard care*' was defined as any care considered being below acceptable standards [18]. The death was only attributed to substandard care if the management given was judged by the audit team to have contributed signifi-

cantly to the death of the mother and that the standard treatment may have altered the outcome.

Data analysis

The audio-taped interviews were transcribed and then translated from Swahili to English. A qualitative content analysis method as described by Graneheim and Lundman [19] was used to analyse the data. Analysis included thorough reading of the transcribed text to identify meaning units i.e. statements that were related to the topic of analysis. The meaning units were condensed, abstracted, coded and then categorized according to similarities and differences in content. The quantitative data from health care providers' interviews and review of institutional records were entered into the EPInfo6 program. Data was summarized by frequency tables.

Ethical Considerations

Ethical clearance was obtained from Muhimbili University of Health and Allied Sciences, Senate Research and Publication Committee. Permission to conduct the study was obtained from the respective municipal and hospital authorities. Anonymity and confidentiality were discussed and informed verbal consent was obtained from each respondent. The tape records and written information were kept confidential and restricted to the research team only.

Results

Institutional Pregnancy Outcome in 2007

Of all deliveries (70,661) in these institutions 97% took place in the four government owned hospitals with the highest rate at Amana (24,862). The combined hospital-based MMR was 218/100,000 live births ranging from zero at Hindu Mandal to as high as 385/100,000 live births at Muhimbili. Of all maternal deaths which occurred in these institutions 78% were attributed to eclampsia, obstetric haemorrhage, severe anaemia, sepsis and ruptured uterus. There were 3,134 perinatal deaths, of these 57% were stillbirths and 40% were attributed to birth asphyxia, prematurity and neonatal sepsis. The causes of stillbirths were not established. The average hospital based PNMRR was 44 deaths per 1000 births and ranged from 17 at Amana to as high as 147 deaths per 1000 births at the Muhimbili, the only public hospital in Dar es Salaam which had a neonatal intensive care unit during the study period (Table 1).

Existence of maternal and perinatal death audits

Maternal death audit committees existed only in 50% (4) of the studied hospitals (i.e. Temeke, Mwananyamala, Amana and Aga Khan). At Muhimbili maternal and perinatal audit committees were established around 2002 and lasted for about 2 years. During the study period, selected maternal deaths were discussed weekly at departmental

level mainly by the doctors, medical students and a few midwives. The discussion lacked documentation and disseminations of key decision points. Three respondents attributed the death of previous audit committees to the failure of the hospital administration to implement audit recommendations. This led to demoralization when the audit team repeatedly noted the same avoidable factors being associated with consecutive deaths despite strategic interventions having been recommended. In addition, one of the key respondents reported that *"there is also a serious decline of accountability and commitment among the staff, and this can be tracked from the hospital top-most administrators down to the care providers"*.

Perinatal audit committees only existed at Aga Khan, Amana and Hindu Mandal hospitals. However, the committees met occasionally on a monthly basis at Amana and two times a year at Hindu Mandal. When asked why there was no any audit committee at Mikocheni hospital, one respondent said, *"it is because most deaths had clearly known causes, for instance, intrauterine fetal deaths, fetal distress and so on"*. None of the key respondents linked the absence of such audit committees to the lack of resources like finance, supplies or human in any of the studied institutions.

Structure of the audit committees

Municipal health managers were only involved in these committees at Temeke and Amana hospitals. However, none of the municipal medical officers, representatives from theatre or pharmacy was involved in any of the hospital audit committees. Laboratory representatives were only involved at Aga Khan hospital.

Auditing process

Audit meetings were conducted within the first 24 hours after occurrence of death only at Aga Khan hospital. There were neither records of the key decision points nor action plan in any of the facilities where such audit systems existed to help members of the committee to track the implementation of recommendations given in the previous meetings. The audit reports were never analyzed later in any of these hospitals. All facilities with audit systems gave feedback to the responsible care providers. Audit reports in private hospitals were never disseminated anywhere beyond their hospitals. It was reported that audit recommendations were used for hospital planning and budgeting for maternal care improvement in all facilities where the system existed.

Audit results

Of the audited maternal deaths in 2007 at Amana, Mwananyamala, Temeke and Aga Khan hospitals 69% (43) were associated with substandard care at the facility (Table 2). Almost one third (28%) of all perinatal deaths which occurred at Aga Khan hospital were audited. Of

Table 1: Causes of maternal and perinatal deaths in Dar es Salaam hospitals in 2007

Parameters	MNH	Amana	M/mala	Temeke	Aga Khan	Miko-cheni	Hindu Mandal	Massana	Total
<i>Causes of Maternal Deaths</i>									
Eclampsia	12	0	3	26	1	0	0	1	43
Obstetric haemorrhage	7	5	6	11	1	0	0	0	30
Ruptured uterus	4	2	2	4	0	0	0	1	13
Severe anaemia	5	0	7	9	0	0	0	0	21
Puerperal sepsis	1	2	5	2	0	0	0	0	10
Others	7 ^s	3	6	16	0	0	0	0	33
Total deaths	36	12	29	68	2	1	0	2	150
<i>Causes of Perinatal Deaths</i>									
Stillbirths	397	399	436	482	26	5	7	33	1,785
Birth asphyxia	581	5	43	46	0	1	0	0	676
Prematurity	339	6	41	9	1	0	0	0	396
Sepsis	70	5	76	14	1	0	0	0	166
Congenital malformations	1	0	2	0	4	0	0	0	7
Others	41	7	32	9	7	1	0	7	104
Total deaths	1,429	422	630	560	39	7	7	40	3,134
Total deliveries	9,743	24,862	15,464	18,490	1,094	288	316	404	70,661
MMR	385	49	193	378	187	353	0	269	218
PNMR	147	17	41	30	36	24	22	99	44

NOTE:

§ = of these 3 were due to ruptured ectopic pregnancy; MMR = maternal mortality ratio (deaths per 100,000 live births); PNMR = perinatal mortality rate (deaths per 1000 births); MNH = Muhimbili National Hospital; M/mala = Mwananyamala.

these 55% (6) were judged to be associated with phase three delay, 18% (2) phase two delay and 27% (3) phase one delay.

Awareness, knowledge, attitude and practice towards maternal and perinatal death audits

The level of awareness of maternal and perinatal death audit committees was as high as 87% (26) among the

interviewed health care providers. On the contrary, half of the respondents from Amana hospital were not aware of the existence of such committees in their institution. Of the respondents from the five facilities with maternal and/or perinatal death audit systems more than one third (35%) reported that the objectives of such audits had not been communicated to all care providers in the depart-

Table 2: Phases of delay for mothers died in Dar es Salaam hospitals in 2007

Phase of delay for audited maternal deaths	Aga Khan n = 2	Amana n = 12	M/mala n = 29	Temeke n = 68	Total n = 111
Phase 1	0	0	4	11	15
Phase 2	0	3	1	0	4
Phase 3	2	6	13	22	43
Total audited deaths (%)	2 (100%)	9 (75%)	18 (62%)	33 (49%)	62 (56%)

Note:

n = total number of maternal deaths which occurred in the specified health facility. Phase 1: delay in decision to seek care, phase 2: delay in reaching care and phase 3: delays in receiving care or substandard care

ment, and the figure was as high as 50% at Amana, Mwananyamala and Temeke hospitals.

Only 60% (12) of all respondents from the institutions where maternal and/or perinatal death audits existed, were aware of at least one recommendation which had been provided by either maternal or perinatal death audit committee in their hospitals. Similarly, only 40% (8) of the respondents in these facilities remembered and mentioned at least one action that was implemented in the hospital because of maternal or perinatal audit committee recommendations. The few mentioned actions taken as a result of the audit recommendations at Temeke and Amana included writing of statements, internal transfer and removal from supervisory roles of the staff that were held responsible for the deaths. All 30 (100%) respondents, including those from places where maternal and perinatal death audits did not exist, believed that audits can affect how people conduct maternal and newborn care anywhere including their hospitals (Additional file 2).

Discussion

Factors for absence of audit committees

Maternal and perinatal audit systems have emerged as a fundamental principle in the context of obstetric care in the world over the recent years. Clinical audit systems improve patient care and service delivery, enlighten care providers on their strengths and weaknesses, improve knowledge and behaviour change in their patient care and enhance cost-effective use of resources [9,20,21]. The absence of maternal and perinatal audits in 50% and 63% of the hospitals respectively could be mainly linked to the lack of commitment, dedication and accountability of key staff and leadership. The reasons given in some facilities for the absence of such an important tool indicate that the philosophy for this tool has not been well conceptualized. The absence of such audit systems in the teaching hospitals like Muhimbili, Mikocheni and Massana, suggests lack of emphasis on clinical audits in their curricula, lack of evidence-based training and that their graduates are less likely to take lead for the same at their future working places. On the contrary reports from other African countries show that such audits are largely found in larger hospitals and academic institutions [22].

Such unacceptably slow pace of replicating proven best practices in this region is worrisome and suggests poor leadership performance. Leadership is about change, and is all about getting things done [23]. Carrying out "*business as usual*", lack of proactivity and a static mindset among the key actors and poor supervision of health systems are progress blocking agents which have been reported as the leading factors for poor performance of health sectors in sub-Saharan Africa [24]. These findings

call for a more proactive and dedicated leadership at national and institutional levels.

A need for effective audit systems in Dar es Salaam institutions

The fact that 69% of maternal and 55% of perinatal deaths were related to substandard care at the facility level indicates a high degree of poor obstetric care and a need for effective audit systems. Similar findings have been reported from within health institutions in other low income countries indicating that 50% - 77% of all perinatal deaths are avoidable through treatment of common conditions, closer monitoring and skillful management of labour [25-27]. The findings that the leading causes of maternal death were eclampsia, haemorrhage and severe anaemia indicate conditions that can be prevented by improving the quality of care through early detection of danger signs and prompt treatment.

Audit committees' structural factors

Failure to take part of the key decision makers like the municipal and hospital medical officer in charge and other administrators in some of the municipal hospitals' audit committees (as recommended by the Ministry of Health of Tanzania) raised questions about how well the decisions made during deaths' review meetings were adopted into municipal and hospital plans. Although this category of audit members may not be technical during audit discussions, they have been reported to have a big role to play when it comes to implementation of the key points made for change. Lack of key hospital decision makers in the audit committees at Muhimbili which were established in the early 2000 s was linked to poor implementation of audit recommendations, disappointment and ultimately death of the committees. Quite often the same administration-related factors were linked to maternal deaths and various recommendations had been discussed over and over yet without implementation. In places where establishment of maternal and perinatal audits have led to improved quality of obstetric care, the success has been particularly attributed to the process of accountability of both health providers and key decision makers [9,28]. Clinical audit must be well structured, conducted according to acceptable principles and there must be commitment to the process from a care provider through the health managers and policy makers, otherwise it is unlikely to bring change [8,20,29].

Change factors in the audit process

The absence of records of the key decision points, recommendations and action plans, as well as lack of regular analysis of the audit reports in any of the facilities where audits were reported to exist, indicates poor documentation and poor information management systems. Commonly, action plans help members of the committee to

track the implementation of recommendations given in the previous meetings. Usually, quarterly to six-monthly analysis of audit systems is recommended for evaluation of recurrence of substandard care factors and the success of implementation of the recommendations [30]. The lack of documentation at maternal death discussions at the national hospital and failure of the private hospitals to disseminate their audit reports to the city and national authorities indicate lack of links with the overall policy making authorities. This denies these organs from important information to base their decisions and policy making upon.

Potential factors for efficient audit systems

The high level of awareness, knowledge and positive attitudes (83 - 100%) towards maternal and perinatal audit committees among the care providers including those from places where such committees did not exist, indicate substantial acceptability, readiness and willingness for change in service provision in these institutions. Failure of care providers (40 - 60%) to mention at least one recommendation or any action which had ever been taken following audit suggests either lack of recommendations formulation during audit or poor implementation. The fact that up to 82% of the recommendations made during audits in other African countries are implemented [31] indicates a need to improve efficiency of the existing audit systems in Dar es Salaam hospitals. The reported punishment of staff held responsible for the deaths following audit may lead to incorrect information in future incidences and create conflict among staff and should be strongly discouraged [9].

Considering these factors and the fact that Tanzania is already off-track for the maternal mortality-related Millennium Development Goal with MMR of 529/100,000 live births in 1995 and 578/100,000 live births in 2005 [32] evidence-based John Kotter's eight-step process for implementing successful changes in any organization is indicated for effective audit systems in this region. These steps are: to create a sense of urgency for change, create powerful group guiding the change, develop and communicate the change vision and strategy, empower others to act, produce short-term wins, press harder and faster after the first successes and create a new culture for sustainability [33].

Conclusions

Clinical audits are greatly rewarding for patients and health providers. These are within reach in low income countries like Tanzania, but they are just not being done or conducted ineffectively in most institutions. The existing maternal and perinatal audit systems in Dar es Salaam health institutions are still poorly established in structure and process; and are less effective to improve the quality

of care. Fundamental changes are urgently needed for successful audit systems in these institutions.

Additional material

Additional file 1 Instruments I and II for data collection. Instrument I: Topic guide for the in-depth interview of the members of the maternal and perinatal death audit committees. Instrument II: a questionnaire for interview of health workers working in maternity wards on maternal and perinatal audit systems

Additional file 2 Table 3: Awareness of, knowledge, attitude and practice towards maternal and perinatal death audits among the health care providers in maternity wards. Awareness of, knowledge, attitude and practice towards maternal and perinatal death audits among the health care providers in the maternity wards at Muhimbili National Hospital, Amana, Hindu Mandal, Mwananyamala, Mikocheni, Temeke, Massana and Aga Khan hospitals.

Abbreviations

H/Mandal: Hindu Mandal hospital; M/mala: Mwananyamala hospital; MMR: Maternal mortality ratio; MNH: Muhimbili National Hospital; PNMR: Perinatal mortality rate; UNICEF: The United Nations Children's Fund; WHO: World Health Organization.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

ASN participated in design of the study, data collection, analysis and drafted the manuscript. DPU participated in design of the study, data collection and the analyses and reviewed the manuscript. ABP participated in design of the study and reviewed the manuscript. FK participated in data collection and reviewed the manuscript. JVR participated in design of the study and reviewed the manuscript. All authors read and approved the final manuscript.

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CHAPTER 7

Maternal health interventions in resource limited countries: a systematic review of packages, impacts and factors for change

(BMC Pregnancy Childbirth 2011; 11: 30)

RESEARCH ARTICLE

Open Access

Maternal health interventions in resource limited countries: a systematic review of packages, impacts and factors for change

Angelo S Nyamtema^{1*}, David P Urassa² and Jos van Roosmalen^{3,4}

Abstract

Background: The burden of maternal mortality in resource limited countries is still huge despite being at the top of the global public health agenda for over the last 20 years. We systematically reviewed the impacts of interventions on maternal health and factors for change in these countries.

Methods: A systematic review was carried out using the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Articles published in the English language reporting on implementation of interventions, their impacts and underlying factors for maternal health in resource limited countries in the past 23 years were searched from PubMed, Popline, African Index Medicus, internet sources including reproductive health gateway and Google, hand-searching, reference lists and grey literature.

Results: Out of a total of 5084 articles resulting from the search only 58 qualified for systematic review. Programs integrating multiple interventions were more likely to have significant positive impacts on maternal outcomes. Training in emergency obstetric care (EmOC), placement of care providers, refurbishment of existing health facility infrastructure and improved supply of drugs, consumables and equipment for obstetric care were the most frequent interventions integrated in 52% - 65% of all 54 reviewed programs. Statistically significant reduction of maternal mortality ratio and case fatality rate were reported in 55% and 40% of the programs respectively. Births in EmOC facilities and caesarean section rates increased significantly in 71% - 75% of programs using these indicators. Insufficient implementation of evidence-based interventions in resources limited countries was closely linked to a lack of national resources, leadership skills and end-users factors.

Conclusions: This article presents a list of evidenced-based packages of interventions for maternal health, their impacts and factors for change in resource limited countries. It indicates that no single magic bullet intervention exists for reduction of maternal mortality and that all interventional programs should be integrated in order to bring significant changes. State leaders and key actors in the health sectors in these countries and the international community are proposed to translate the lessons learnt into actions and intensify efforts in order to achieve the goals set for maternal health.

Background

Reducing maternal mortality has been at the top of the global health agenda for over the last 20 years and we know that 74-98% of maternal deaths can be averted even in the circumstances of most low income countries [1,2]. The burden, however, is still huge and every year 0.36 million maternal deaths [3], 4 million stillbirths and

3 million early neonatal deaths are related to complications of pregnancy and childbirth globally. This figure is by far higher than the total of 5 million estimated deaths due to HIV/AIDS, tuberculosis and malaria combined [4]. The vast majority (99%) of estimated global maternal mortality occurs in resource limited settings, Sub Saharan Africa accounting for more than half [3,5]. While other regions like Latin America and the Caribbean, and Northern Africa had remarkably reduced maternal mortality ratio (MMR) by 41% and 59% respectively between 1990 and 2008, Sub Saharan Africa had only reduced it

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by 26%. The annual decrease of maternal mortality in Sub Saharan Africa was 1.7% which is far below the 5.5% annual decline rate, which is necessary to achieve the fifth Millennium Development Goal concerning maternal mortality reduction with three quarters [3]. The existing disparities of the trends in reducing maternal mortality in resource limited countries raise questions about the existing factors for change for replication of evidence-based interventions.

Maternal mortality is a complex problem requiring complex interventions. This article attempts to explore the available evidences, integration of maternal health interventions and the factors influencing implementation in resource limited countries. It challenges the key actors in resource limited countries to acknowledge the problem and scale up the means and advocated measures to address this scandal.

Methods

Search strategy description

This review used the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [6]. A comprehensive literature search for relevant articles was carried out from PubMed, Popline, African Index Medicus, general internet sources including reproductive health gateway and Google, hand-searching, reference lists and the grey literature. The following free terms were used for electronic searching: "maternal", "mortality", "interventions", "randomized controlled trials" and "emergency obstetric care indicators". With the help of information resource specialist the search details were designed according to specifications of each database (Additional file 1). The last search was carried out on June 30th 2010.

Inclusion criteria

We included randomized controlled trials (RCTs) and quasi-experimental designs with and those without control groups undertaken in resource limited countries that reported in English language the implementation of interventions, their impacts for maternal health within the past 23 years (i.e. from 1987 after launching the global Safe Motherhood Initiative in Nairobi, Kenya). The decision to start from 1987 was arbitrary and based on the need of reviewing recent data. Although the best and most objective way would have been to assess the impacts of these interventions by using RCTs, the investigators wanted also to review the evidences from quasi-experimental studies. By resource limited countries we meant low income (gross national income [GNI] per capita of \$975 or less) and lower middle income countries (GNI \$976 - \$3,855) as classified in 2008 by The World Bank [7]. We included in the analysis only articles that clearly specified types of interventions, duration

of implementation and used either MMR or at least one of the emergency obstetric care (EmOC) services indicators as outcome measures. We also extracted the underlying factors for maternal health interventions from the reviewed articles. These included factors which affected the implementation of interventions and all underlying reasons for insufficient implementation of maternal health interventions in these countries. Insufficient implementation was defined as poor coverage in terms of degree of integration of interventions and area as well as the efficiency of implementation. The investigators were interested in these factors because they could have affected the impacts of the interventions in these countries.

Exclusion criteria

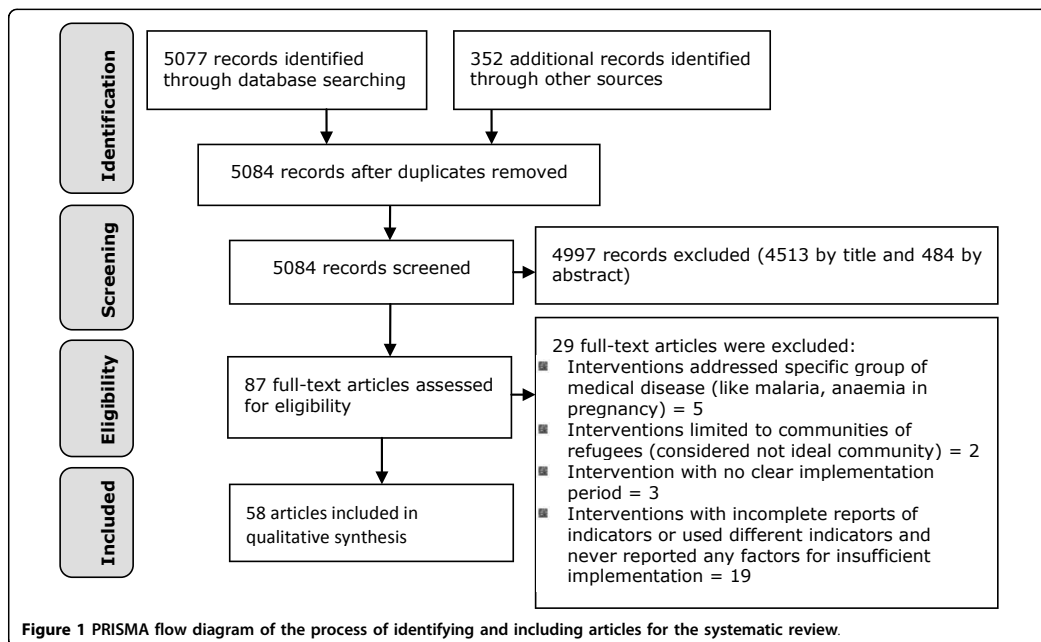
We excluded articles reporting drug and procedural interventions addressing unique communities (like refugees) and individual medical conditions during pregnancy like malaria, anaemia and pre-eclampsia. Articles whose lists of interventions or implementation period were not clear, success reports over 23 years ago and those from countries other than low income and lower middle income were also excluded.

Quality and risk of bias assessment

The first author identified the articles, imported them into the EndNote X reference management software, removed the duplicates, examined the titles, then abstracts and retrieved the full text of relevant abstracts for further assessment (Figure 1). The first two authors independently assessed full-texts for inclusion in the review and completed the data extraction form for those that were eligible for inclusion. Uncertainties were resolved through discussions. Internal validation and generalizability of the included articles were carried out using a devised quality assessment tool (Additional file 2). The possibility of publication bias of RCTs and quasi-experimental designs with control groups was assessed using a funnel plot.

Data collection and analysis

A designed eligibility form was used to document all full-text articles assessed for eligibility, the judgment reached whether a study was eligible and reasons in case of exclusion. A data extraction form was used to collect all necessary information from eligible articles. This form had six sections designed to collect information on (i) general information of the articles: name of reviewer, title, authors, year of publication, type of study (ii) general characteristics of the project: country involved, setting (whether rural, urban or both), sources of funds (whether local, external or both), total period of implementation, (iii) implemented interventions, (iv) outcome



measures: results of interventions (v) underlying factors for implementation and (vi) quality and risk of bias. Indicators for outcome measures were changes in MMR and EmOC services indicators (also known as UN emergency obstetric care process indicators) i.e. case fatality rate (CFR), proportion of births in EmOC facilities, the met needs for EmOC and the caesarean section rate (CSR) before and after implementation of the intervention. Although the overtime changes of MMR may be confounded by a wide range of factors, it is generally acceptable as key health indicator used to evaluate the impacts of interventions for maternal care [8,9]. These indicators were preferred for this review because they are globally recommended for assessment, monitoring and evaluation of availability, utilization and quality of EmOC services [10]. All these items were entered initially into Excel software and then transferred to the Stata software for analysis. Supplementary information with a summary of characteristics of all studies included in this systematic review is available in the journal's website appendix (Additional file 3).

Principal summary measures

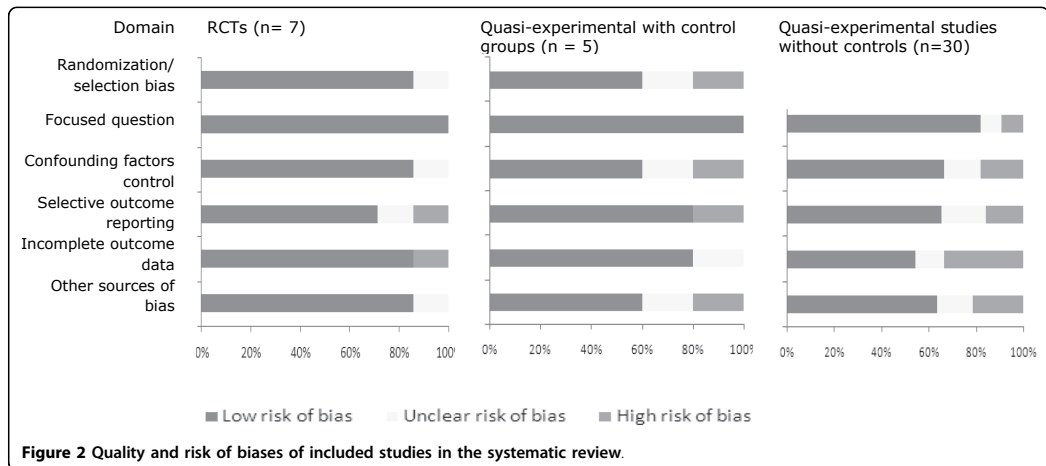
The raw data were extracted from these articles followed by computation of the odds ratio and 95% confidence intervals for all indicators used in these studies. Meta-analysis was not carried out because of wide

variations of packages, time intervals and indicators used for outcome measures of interventions.

Results

Out of a total of 5084 articles published in English language resulting from the search, 87 full-text articles were assessed for eligibility. Of these only 58 qualified for systematic review and included 46 articles reporting maternal health interventional outcomes measured using MMR and/or EmOC services indicators. Of these 4 pairs of articles reported about the same programs and were thus merged to get a total of 42 interventional programs. Other articles included in this review were 12 interventional programs which used outcome measures other than MMR and EmOC services indicators but reported underlying factors for implementation in resource limited settings. The rest were excluded from the review with reasons (Figure 1).

The quality of RCTs and quasi-experimental designs with control groups were satisfactory as most of the information was from studies with low risk of bias (Figure 2). Expectedly there were more unclear and high risks of biases among the quasi-experimental designs without control groups than the former studies. Although the review team did not access the protocols for these studies (accessed only one [11]), no single study completed the set of EmOC services indicators and there was huge variability



of the indicators across the studies suggesting the possibility of selective outcome reporting. The funnel plot for RCTs and quasi-experimental designs with control groups was asymmetrical suggesting increased possibility of high risk of publication bias especially for the small studies (Figure 3). However, this asymmetrical view could have been caused by other factors, such as differences in study qualities and heterogeneity. In view of this, the review team proceeded with further analysis although this selectivity posed a threat to the validity of the effects of the interventions.

Implementation of the interventions

Of all 42 interventional programs only 7 (17%) were randomized controlled trials, 5 (12%) quasi-experimental designs with control groups and the rest were quasi-experimental designs without control groups. From these interventional programs a list of interventions for maternal health was established (Table 1). The implementation processes of maternal health interventions followed almost the same simple logical framework with minimal variations (Figure 4). Mostly, the interventions were developed following descriptive retrospective reviews or needs assessments in the respective project areas which were conducted to identify the magnitude of the problem, the causes and underlying factors for the high ratios of maternal deaths. These pre-interventional studies were carried out in order to develop and implement more focused interventions. These activities were then followed by setting priorities, setting order of implementation of the interventions followed by monitoring and evaluation.

Despite the diversity of country contexts and the multifaceted nature of maternal health and its determinants,

the interventions overlapped considerably with each other across the programs. Attempts were made to classify the interventions according to level of prevention: interventions targeted at preventing pregnancy (primary), preventing obstetric complications (secondary) and preventing death once obstetric complications had occurred (tertiary prevention).

Training in comprehensive EmOC, placement and motivation of care providers, refurbishing existing health facility infrastructure and improving supply of essential drugs, consumables and equipment for obstetric care were the most frequent interventions integrated in 52% - 65% of the programs. Community-based information, education and communication (IEC) were involved in 37% (20) of the programs. The IEC addressed the danger signs of pregnancy complications, birth preparedness and complication readiness in an attempt to shorten delays through better awareness and promoting health facility deliveries.

The success of these programs was attributed to increased health facility deliveries, knowing when to reach out for assistance, and increased awareness and knowledge of the danger signs of pregnancy complications. Interventions which focused on linking traditional birth attendants (TBAs) with the health care system were implemented in various countries including Gambia, Honduras and some provinces in China. The training focused on creating TBAs' awareness of the importance and practice of clean delivery and early referral to the formal health care system with essential obstetric services to avoid delays in case of complications. Training of TBAs in countries where the community commonly utilized their services had strong impacts on maternal health outcomes only when it was

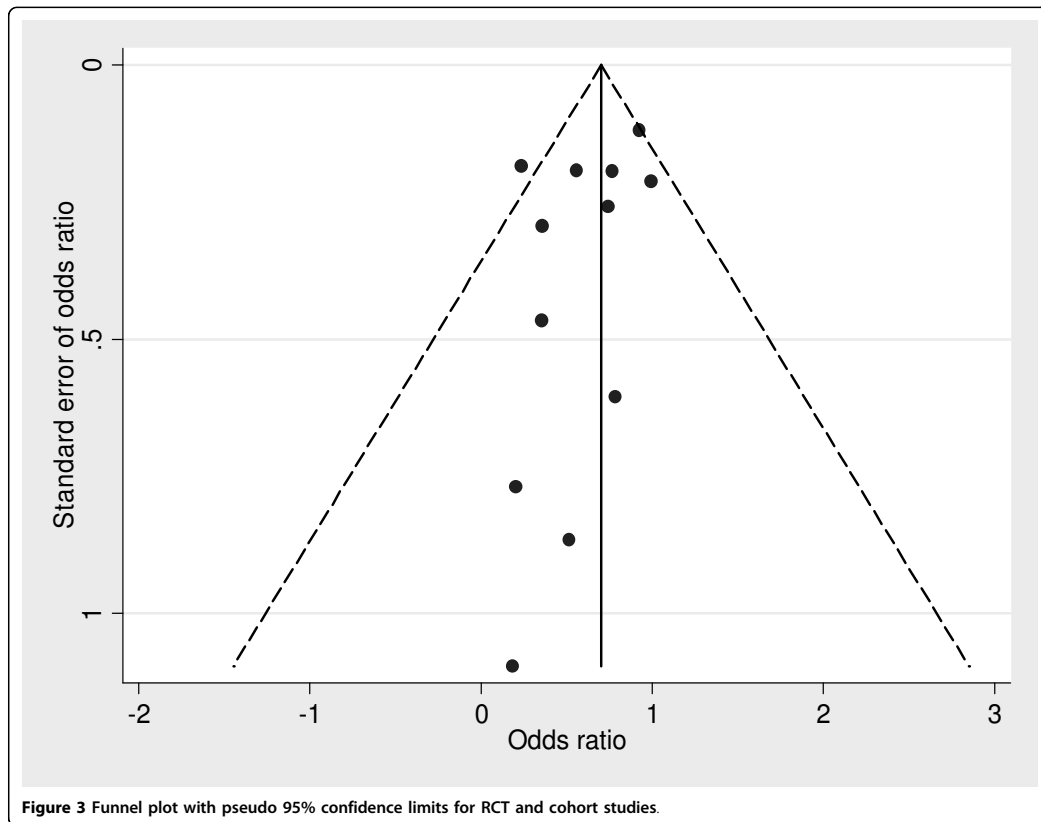


Figure 3 Funnel plot with pseudo 95% confidence limits for RCT and cohort studies.

supported by functioning referral systems and good working relationships with the formal health care systems.

All 22 interventional programs for maternal health from Sub Saharan Africa were small scale mainly confined to a hospital (district or state) and/or small surrounding communities. Countrywide reduction of MMR was reported in China, Bangladesh, Nepal, Honduras and Bolivia. In these countries the efforts targeted specific geographic areas with high ratios of maternal mortality with special attention to the most remote rural areas. The interventions included development of health facility accountability like health facility performance based funding (in some Chinese provinces), development of financing systems like community based funds and removing financial barriers to maternal health care services like the establishment of Maternal and Child National Insurance (Bolivia, China and Nepal). These policies were reported to increase women's access to skilled attendance.

Impacts of the interventions

A wide range of indicators were used to assess the impacts of these maternal health care interventions. Depending on the type of intervention the most frequently used outcome (impact) indicators were MMR (67%) and EmOC services indicators (52%). Other indicators (not included in the analysis) were mean time from onset of complications/or admission to treatment, number of referred patients, utilization of obstetric and blood services, community awareness and knowledge on obstetric care. Of all RCTs only a study from Pakistan used at least one EmOC services indicator in addition to MMR. While only 2 (29%) RCTs reported statistically significant maternal mortality reduction, significant reduction was found in as high as 60% (3) of quasi-experimental designs with control groups (Table 2).

Maternal mortality ratio was remarkably reduced by as high as 80% from 933 to 186/100,000 live births (OR = 0.20, 95% CI = 0.09 - 0.44) for only 6 years using exclusively locally available resources as reported from one of

Table 1 Category, frequency and level of prevention of the interventions for maternal health extracted from the included programs

SN	Category of interventions	Level of prevention	Frequency/percentage n = 54
Community based interventions			
1.	Community based Information, Education and Communication: Focus: <i>awareness of danger signs of pregnancy complications and birth preparedness and importance of health facility delivery services</i>	2,3	20 (37%)
2.	Establishing community based funds for obstetric complications [loans and/or transport programs]:	2	10 (19%)
3.	Training and/or linking traditional birth attendants to the health system: Focus: <i>Clean delivery and shorten delays for complications of pregnancy and childbirth.</i>	2,3	15 (28%)
4.	Supplementing vitamin A or β carotene during pregnancy: To prevent infectious maternal morbidity and mortality	2	2 (4%)
Health facility based interventions			
5.	Establishing/refurbishing blood banks and blood policies	3	11 (20%)
6.	Training on CEmOC, placement and motivation of care providers	3	35 (65%)
7.	Refurbishing/upgrading existing health facility infrastructure and equipment for obstetric care	3	28 (52%)
8.	Improving supply of drugs, consumables and equipment for obstetric care	3	30 (56%)
9.	Strengthening referral system and transport of patients	2,3	25 (46%)
10.	Construction of new health facilities for CEmOC services	2	2 (4%)
11.	Enabling policies and political commitment: Focus: <i>To increase health facility utilization and accessibility of essential obstetric care services</i>	1,2,3	10 (19%)
12.	Establishment of revolving funds at the EmOC health facility	3	4 (7%)
13.	Establishing family planning services	1	3 (6%)
14.	Establishing maternity waiting homes	2	1 (2%)
15.	Establishing mobile maternal health services, outreach and/or supportive supervision programs	2	7 (13%)
16.	Improving and/or promoting antenatal care	2,3	6 (11%)

*Level 1: primary prevention (preventing pregnancy); 2: secondary prevention (preventing obstetric complications); 3: tertiary prevention (preventing death once obstetric complications have occurred).

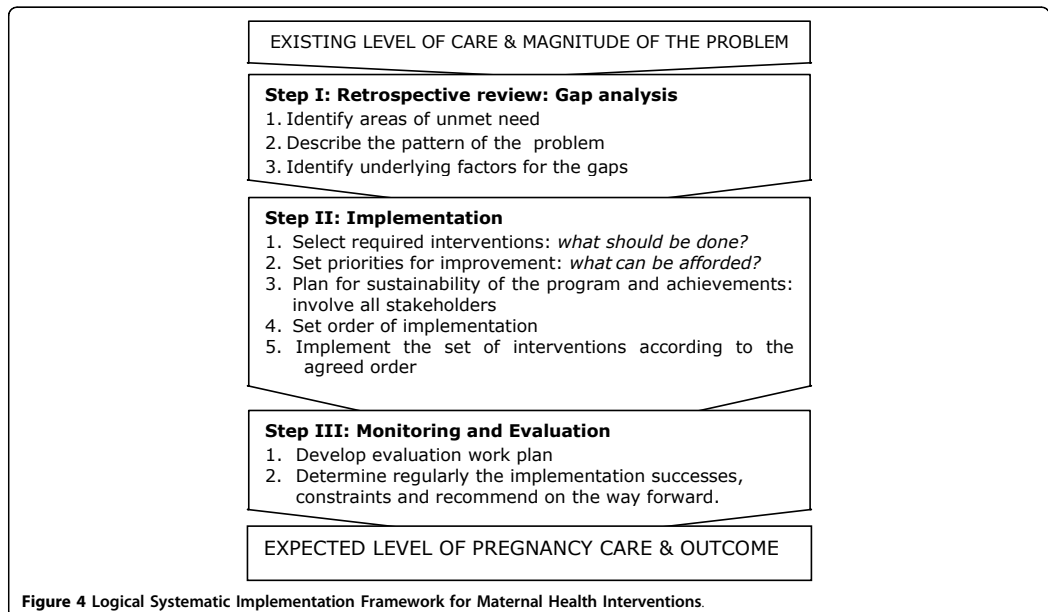


Figure 4 Logical Systematic Implementation Framework for Maternal Health Interventions.

Table 2 The packages of interventions and their impacts for maternal health in resource limited countries

Country	Integrated interventions (from table 1)*	Time Interval (years)	Maternal deaths/live births		Odds ratio (95% CI)
			Intervention	Control	
Randomized controlled trials					
Zimbabwe [26]	16	2	6/9,394	5/6,138	0.78 (0.24 - 2.57)
Zimbabwe [27]	16	3	2/6,483	4/6,696	0.52 (0.09 - 2.82)
Pakistan [28]	3,15	2	27/10,093	34/9,432	0.74 (0.45 - 1.23)
India [29]	1	3	49/9,388	60/8,819	0.77 (0.52 - 1.12)
Nepal [30]	4	3.5	59/14,948	51/7,241	0.56 (0.37 - 0.84)
Nepal [31]	1	3	2/2,899	11/3,226	0.20 (0.04 - 0.91)
Ghana [11]	4	29 × 10 ³ §	138/39,601	148/39,234	0.92 (0.73 - 1.17)
Quasi-experimental designs with control groups					
Angola [32]	3,6	4	55/18,755	66/5,363	0.24 (0.16 - 0.34)
Gambia [33]	3, 6,9,15,16	3	1/769	5/714	0.43 (0.02 - 1.55)
Bangladesh [34]	3,6-9,15,16	3	6/4,424	20/5,206	0.35 (0.66 - 0.89)
Bangladesh [¶] [35]	1, 3,6-9,13,16	4	41/10,890	50/13,169	0.99 (0.66 - 1.50)
Gambia [36]	3,8,9	7	11/405 to 13/1,236	4/267 to 7/727	0.36 (0.20 - 0.64)
Quasi-experimental designs without control groups			After intervention	Before intervention	
Egypt [1,37]	1,6-9,11	7	585/696,428	772/443,678	0.48 (0.43 - 0.54)
Senegal [38]	5-8,15	3	27/6,622	50/6,017	0.49 (0.30 - 0.80)
Pakistan [39,40]	3,9,11,13,15,16	5	34/52,982	48/55,454	0.74 (0.48 - 1.15)
Tanzania [41]	5,6,7,8	5	8/4,296	28/3,000	0.20 (0.09 - 0.44)
Peru [42]	1,6,7,9,15	4	2/3,119	9/3,002	0.21 (0.05 - 0.99)
Nigeria [43]	5,6,7,8	6	7/1,208	47/2,999	0.37 (0.17 - 0.81)
Nigeria [44,45]	1,2,6,7,8	6	7/815	44/861	0.16 (0.07 - 0.36)
Nigeria [46,47]	2,5-8,12	5	0/130	1/139	0.53 (0.02 - 16.02)
Bangladesh [48]†	1,3, 9,13,16	13	86/46,320	299/10 ⁵	0.62
Cameroon [49]†	6,9	10	60/10 ⁵	260/10 ⁵	0.23
China [1]†	1,3,5-9,11	16	61/10 ⁵	100/10 ⁵	0.61
China [50]†	1,3,6,9,11	3	114/10 ⁵	456/10 ⁵	0.25
Honduras [51]†	1,3,6-9,14	7	108/10 ⁵	182/10 ⁵	0.59
Bolivia [1,52]†	7-9,11	11	230/10 ⁵ †	390/10 ⁵	0.59
India [53]†	6-11	14	90/10 ⁵	380/10 ⁵	0.24
Nepal [54]†	1,2,5-8,11	10	281/10 ⁵	539/10 ⁵	0.52

Note: *The numbers given to the interventions correspond to those given in table 1; § Follow up years (the interventions were started in 2000 - 2008 but at different times across the clusters); ¶ Interventions were implemented at various intervals and we analyzed results from the last 4 years when a complete package was implemented. † Odds ratio was calculated from MMR before and after intervention due to incomplete raw data in the review articles.

the regional hospitals in Tanzania (Table 3). Similarly, only 40% (6) of programs which used CFR to assess impact of their interventions reported statistically significant reduction. The four most successful interventional programs reduced CFR by over three quarters (i.e. 77% - 100%). The met need for EmOC was used as an outcome measure indicator in only 10 reports and the mean increase was as high as 149% (ranging from 24% to 444%) after a mean period of 5 years. Even the nine interventional programs which lacked community-based packages reported increased institutional deliveries by an average of 74% after a mean period of 6 years of

health facility quality care improvement and development of enabling policies.

Factors for change

The problem of insufficient implementation of maternal health interventions was generally attributed to three main interlinking factors i.e. leadership and management, resources and end-user related factors. The leadership and management related factors included insufficient commitment of politicians and other key actors which led to insufficient funding of health systems, under utilization of available resources, lack of

Table 3 Impacts of interventions for maternal health in quasi-experimental studies without control groups in resource limited countries

Country	Interventions (from table 1)*	Time Interval (years)	Odds ratio and 95% CI of EmOC services indicators		
			Births in EmOC facility	CFR	CSR
Tanzania [55]	5-8	4	3.00 (1.46 - 6.18)	0.66 (0.11 - 4.04)	1.51 (0.15 - 15.46)
Ethiopia [55]	6,7,8	4	1.26 (0.15 - 10.23)	0.47 (0.16 - 1.44)	1.64 (1.50 - 1.80)
Bangladesh [56]	1,6-8,11	6	2.36 (2.33 - 2.39)	0.04 (0.03 - 0.05)	2.00 (0.37 - 10.97)
Mali [57]	2,6,8,9	3	2.78 (2.70 - 2.86)	0.48 (0.32 - 0.73)	1.09 (0.94 - 1.25)
Peru [42]	1,6,7,9,15	4	0.96 (0.91 - 1.02)	0.06 (0.00 - 34.26)	2.53 (1.93 - 3.33)
Rwanda [58]	6,7,8	4	0.94 (0.88 - 0.99)	0.56 (0.26 - 1.20)	1.59 (1.41 - 1.60)
Mozambique [59]	6,7,8,9	4	3.91 (3.80 - 4.02)	0.54 (0.35 - 0.84)	-
Tanzania [60]	1	2	41 (10 - 171)	-	-
India [53]	6-11	15	4.13 (1.99 - 8.55)	-	-
Nepal [54]	1,2,5-8,11	10	2.52 (1.04 - 6.11)	-	-
Vietnam [61]††	6-9,15	4	3.11 (2.53 - 3.82) 1.2 (0.99 - 1.46)	-	38 (2 - 636) 1.43 (1.02 - 1.99)
Pakistan [62]	3, 6,16	2.5	2.04 (1.83 - 2.28)	-	1.44 (1.09 - 1.91)
Mozambique [63]‡	7,8,9,10	3	8.61 (8.04 - 9.23)	-	2.69 (2.54 - 2.85)
Senegal [38]	5-8,15	3	-	0.42 (0.09 - 1.84)	2.75 (0.27 - 27.72)
Tanzania [41]	5,6,7,8	5	-	0.32 (0.21 - 0.48)	3.83 (1.63 - 8.99)
Nigeria [43]	5,6,7,8	6	-	0.72 (0.31 - 1.66)	1.12 (1.07 - 1.17)
S Leone [64]	1,6-8,12	6	-	0.11 (0.03 - 0.36)	1.68 (1.50 - 1.87)
Nigeria [65]	2,6,7,8	4	-	0.89 (0.31 - 2.61)	17 (1 - 300)
Nigeria [44,45]	1,2,6,7,8	6	-	0.17 (0.07 - 0.39)	-
S Leone [66,67]	1,2,5,6,9	3	-	0.43 (0.08 - 2.21)	-
Nigeria [46,47]	2,5-8,12	5	-	0.17 (0.01 - 4.74)	-

Note: *The numbers given to the interventions correspond to those given in table 1; CSR = caesarean section rate; CFR = case fatality rate; † Only one part of the report is included here as the program had other sites and the data were not combined. †† Had two interventional areas: a) Hai Lang district hospital and b) Hoang Hoa district hospital.

enabling policies for maternal health care, poor management, misplacement of priorities and lack of credibility, loyalty to the assignments, innovativeness and leadership skills. Other leadership and management related factors were social and political instabilities as reported in Angola and Sierra Leone. On the contrary, remarkable successes in reducing maternal mortality in China, Egypt, Honduras, Bangladesh and Bolivia (reported above) were attributed to strong political commitment, good leadership in reproductive health and presence of enabling policies.

Eleven articles linked insufficient implementation of maternal health interventions to lack of resources. These included limited national budgets for health care versus high costs required to scale up maternal health interventions. Under-funding of health systems resulted into lack of essential drugs, supplies and equipment, insufficient health facilities and qualified human resources as well as inefficient referral systems. The review indicated that more than three quarters (80%) of all included interventional programs were supported by the international donor community.

Four articles cited a pattern of end-user factors which were by large linked to cultural, low social and economic status and nutrition. Illiteracy and cultural factors like lack of autonomy in the decision-making process, early marriages and dietary practices during pregnancy affected nutrition, access to health services and community participation in implementation of maternal health interventions. In places where enabling policies did not exist as reported in Nigeria and Sierra Leone, poverty affected utilization of obstetric care services.

Discussion

This study has revealed a heterogeneous picture for the nature, extent of integration of interventions and results. Generally, RCTs revealed insignificant impact of the interventions for maternal health. This could be explained partly by the fact that almost all (86%) RCTs studied the impact of single interventions and were implemented for shorter periods as opposed to quasi-experimental programs which integrated multiple interventions and for longer periods. These findings suggest that no single magic bullet intervention exists for

reduction of maternal mortality and that all interventional programs should be integrated in nature in order to bring significant changes [12].

On the other hand, results from quasi-experimental studies constituted the body of evidence of the effectiveness of packages of interventions for maternal health across a wide range of settings especially when these are integrated. Findings from previous systematic reviews on maternal health interventions complement the evidences [5,13,14]. The degree of integration of these interventions depends on the context and the determinants of maternal health in the respective communities.

This study has indicated that most programs focused generally on promoting accessibility and utilization of health facility delivery services as well as improving the quality of care. All programs which most successfully reduced maternal mortality and remarkable EmOC indicators, had established functioning maternal health care systems with access to skilled birth attendants equipped with appropriate drugs, supplies and equipments and systems of referral to higher levels of care in the event of obstetric complications. Such successes could be explained by the fact that most maternal deaths occur during the period around giving birth, and that most life-threatening obstetric complications arise suddenly without warning signs and hence require appropriate and timely management [15]. The degrees of the impacts were associated with the type of packages of interventions, degree of integration, duration and efficiency of implementation, the presence of enabling policies and the magnitude of the problem before implementation. The logic dictates that the higher the CFR and MMR, the higher are the chances of attaining greater impacts in these indicators after implementation of effective interventions.

The degree of implementation of maternal health interventions and approaches were uneven across the regions. While the programs in Asia and North Africa tried to cover wide areas and range of interventions, those from Sub Saharan Africa were mostly confined to one or few health facilities and the surrounding communities. These findings can partly explain huge disparities in the progress achieved in reducing maternal mortalities among regions [8,16].

On the other hand, although wealth was one of the factors for maternal health care and hence MMR at the country level, it has been reported that, there is no straightforward relationship between the two, and that health system responsiveness has an explanatory power that is significantly superior to most other factors [17,18]. Huge disparities of MMRs exist even among countries with similar low economic powers. For instance, from 1980 to 2008 with the GNI per capita of 1,000 US\$ Lesotho and Ivory Coast had increased MMR

from 590/100,000 live births to 964 - 994/100,000 live births, while Bangladesh with even less income (520 US \$) decreased MMR from 1329/100,000 live births to as low as 338/100,000 live births. Similarly, between 1980 and 2008 with GNI per capita between 200 US\$ and 400 US\$, Nepal successfully reduced MMR from 864/100,000 live births to 240/100,000 live births, but MMR remained almost unchanged in Sierra Leone (1240 to 1033/100,000 live births) and remarkably increased in Malawi from 632/100,000 live births to as high as 1140/100,000 live births [5,7].

Quite often lack of good quality leadership within the public service has been more closely linked to poor performance of the public sectors than to a lack of national resources [19,20]. The under-funding of the health systems in countries whose governments signed the Millennium Declaration in 2000, committed to reduce maternal mortality with 75% by 2015, and failure of most Sub Saharan African countries to meet the Abuja Commitment to allocate at least 15% of the national budget to the health sector reflect irresponsible commitments of these states' leaders. The problem of irresponsible commitments and lack of accountability can be tracked from the states' leaders and key health managers down to the care providers' level [21]. As a central factor, the health sectors in resource limited countries particularly in Sub Saharan Africa require more proactive leaders with stronger internal desire for change to turn commitments and promises into resources and actions in order to reduce maternal mortality. Leadership is a change agent, is all about getting things done and taking on the responsibility to influence others [22].

Based on these findings, a list of short and medium term strategies for action is proposed for countries with insufficient implementation of maternal health interventions. These include mobilizing political will and commitment, leadership development strategies, establishment of performance management and appraisal systems to enhance creativity and innovations in the domain of reproductive health, strengthen community participation, integrating non-governmental organizations into motherhood programs, sharing information within and among countries and empowering women with education, autonomy and economy [23-25].

Potential limitations of the study

The increased possibility of publication and selective outcome reporting biases found in this study pose a great challenge, not only to the validity of the results of this review but also to investigators and editors of journals. Such biases indicate that only positive findings are reported and/or published. This may be misleading the global community with regards to policy and decision making on what interventions are effective for maternal

health. The small number of articles reporting on the impacts of maternal health interventions using the stated indicators might have been contributed by language limitation (English). However, attempts were made to identify reports through a comprehensive literature search of relevant articles although some reports may have been missed. The fact that this review was limited to health sector interventions poses another limitation to this study.

Conclusions

Success stories in the context of maternal mortality reduction exist around the world even in countries with limited resources. The compiled evidences in this article strongly suggest that it is possible to reduce maternal mortality in the circumstances of resource limited countries if the state and health sectors' key actors realize their commitments and responsibilities, embark upon the underlying factors and intensify efforts to implement the evidence-based interventions. These findings indicate that no single magic bullet intervention exists for reduction of maternal mortality and that all interventional programs should be integrated in nature in order to bring significant changes. This article presents a list of the evidenced-based packages of interventions, the context of leadership in healthcare today and proposes to the local governments, intergovernmental agencies, donors and the international community an evidence-based approach for effective change in the health sectors in resource limited countries in order to achieve the goal set for maternal survival.

Additional material

Additional file 1: Detailed search strategies for each database involved in the systematic review. The detailed search strategies specific for each database involved in the systematic review.

Additional file 2: Quality assessment tool for included articles. A detailed structure of the tool used to assess the quality and risks of biases for included articles in the systematic review.

Additional file 3: Characteristics of all studies included in the systematic review: supplementary material. This table is a supplementary material with a detailed account of the characteristics of all studies included in this systematic review. These characteristics include the study population, setting, sample size, intervention and outcomes.

Abbreviations

AIDS: Acquired Immunodeficiency Syndrome; CI: Confidence interval; CFR: Case fatality rate; CSR: Caesarean section rate; EmOC: Emergency obstetric care; HIV: Human immunodeficiency virus; IEC: Information, education and communication; MMR: Maternal mortality ratio; OR: Odds ratio; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; RCT: Randomized controlled trials; TBA: Traditional birth attendant.

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Authors' contributions

ASN participated in design of the study, searched the literature, reviewed the papers and drafted the manuscript. DPU participated in design of the study, reviewed the papers and contributed to writing of the manuscript. JvR participated in design of the study, advised on content and contributed to writing of the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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**FORMULATION OF MODELS, MODEL
SOLUTIONS, AND VALIDATION
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CHAPTER 8

Using audit to enhance quality of
maternity care in resource limited countries:
lessons learnt from rural Tanzania

(BMC Pregnancy Childbirth 2011; 11: 94)

RESEARCH ARTICLE

Open Access

Using audit to enhance quality of maternity care in resource limited countries: lessons learnt from rural Tanzania

Angelo S Nyamtema^{1*}, Alise Bartsch de Jong², David P Urassa³ and Jos van Roosmalen^{2,4}

Abstract

Background: Although clinical audit is an important instrument for quality care improvement, the concept has not yet been adequately taken on board in rural settings in most resource limited countries where the problem of maternal mortality is immense. Maternal mortality and morbidity audit was established at Saint Francis Designated District Hospital (SFDDH) in rural Tanzania in order to generate information upon which to base interventions.

Methods: Methods are informed by the principles of operations research. An audit system was established, all patients fulfilling the inclusion criteria for maternal mortality and severe morbidity were reviewed and selected cases were audited from October 2008 to July 2010. The causes and underlying factors were identified and strategic action plans for improvement were developed and implemented.

Results: There were 6572 deliveries and 363 severe maternal morbidities of which 36 women died making institutional case fatality rate of 10%. Of all morbidities 341 (94%) had at least one area of substandard care. Patients, health workers and administration related substandard care factors were identified in 50% - 61% of women with severe morbidities. Improving responsiveness to obstetric emergencies, capacity building of the workforce for health care, referral system improvement and upgrading of health centres located in hard to reach areas to provide comprehensive emergency obstetric care (CEmOC) were proposed and implemented as a result of audit.

Conclusions: Our findings indicate that audit can be implemented in rural resource limited settings and suggest that the vast majority of maternal mortalities and severe morbidities can be averted even where resources are limited if strategic interventions are implemented.

Background

Every year worldwide there are 358,000 maternal deaths; 99% of these take place in resource limited countries and 65% of the total deaths is contributed by only eleven countries from East Asia and sub-Saharan Africa including Tanzania [1]. On the other hand, evidence indicates that most (74-98%) maternal deaths and severe disabilities can be averted even where resources are limited but, in order to do so, the right kind of information is needed upon which to base interventions [2-5]. Maternal death and severe morbidity audit is one of the ways of generating this kind of information about causes, underlying

substandard care and how they can be averted [5-7]. Substandard care could be related to the patient: where a woman or her relatives caused delay that contributed to death or severe morbidity; or health care provider by delaying or mismanaging the case; or administration: where something that is the responsibility of the health authority was not available [8,9].

Although the effectiveness of audit in reducing adverse maternal outcome remains a matter of debate, it is widely practiced in the West and less frequently reported in resource limited countries particularly in rural settings [10-12]. In an attempt to improve the quality of care in rural Tanzania, an audit system for maternal mortality and severe morbidity was established at Saint Francis Designated District Hospital (SFDDH)

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and as a result focused interventions were developed and implemented.

Methods

Study area

Saint Francis Designated District Hospital is located in Kilombero, one of the rural districts in South-east Tanzania. The district has a total area of 14,018 km² and a population of 331,167 with an annual population growth rate of 2.6%. The district has only two non-governmental hospitals with comprehensive emergency obstetric care (CEmOC) services both located around 75 km apart in the northern part of the district. Because of the geographical locations of these hospitals patients requiring CEmOC services from the most southern part of the district need to travel up to 200 km to reach the closest hospital (SFDDH). SFDDH has a capacity of 372 beds and provides services to patients not only from Kilombero district but also to those from the neighboring districts, Ulanga, Kilosa and Morogoro rural. The average annual delivery rate was 4987 between 2006 and 2008.

Study design

Methods are informed by the principles of operations research. The purpose of using principles of operations research was to apply scientific methods, techniques and tools to problems involving the operations of a health system in Tanzania so as to provide those in control of the system with optimum solutions to problems. The principles applied included (1) formulation of the problem; (2) construction of a model of the audit system; (3) selection of a solution technique; (4) obtaining a solution to the problem; (5) establishing controls over the system; and (6) implementation of the solutions [13].

Development and validation of audit record form

The audit record form was developed and terms (severe maternal morbidities) were defined. At the time when an audit system for maternal mortality and severe morbidities was introduced in this hospital, there was no internationally accepted standard definition and uniform case-identification criteria for severe maternal morbidity [14]. Factors associated with maternal mortality and morbidities were extracted from literature. A panel of 2 experts (obstetricians) reviewed the form for relevance and clarity. Items regarded as relevant for inclusion by both experts were retained in the form. Inappropriate items were either removed or modified based on discussion. The form was piloted on 48 cases of maternal mortality and severe morbidity from May to September 2008. More revisions were made during this period based on the feedback from the team administered the audit record form and those reviewed the data collected.

Data collected during this period was not included in this article. The final version of this form had several sections including: background information, socioeconomic status, antenatal care history, previous obstetric history, intrapartum care and areas of substandard care.

Definition of terms and inclusion Criteria

Inclusion criteria were: all maternal deaths, eclampsia, severe obstructed labour (defined as those presenting with (impending) rupture of uterus, haematuria or obstetric fistula), severe obstetric haemorrhage (defined as patients who received at least one pint of blood or estimated blood loss of more than 1000 ml), severe anaemia (Hb \leq 6 g/dl), puerperal sepsis, severe complications of abortion (defined as perforation of viscera or haemorrhage necessitating transfusion) or severe sepsis [defined as sepsis associated with organ dysfunction, hypotension, or hypoperfusion abnormalities including oliguria or alteration in mental status]), ruptured ectopic pregnancy and any other obstetric complications which the doctors were convinced to be severe maternal morbidities. All patients fulfilling the inclusion criteria were reviewed and selected cases were audited.

Data Collection

Data collection was done in blocks for 491 days from October 6th 2008 until July 8th 2010 using a semi-structured audit record form. While the forms for maternal mortality were completed on the day of the event, those for severe morbidities were completed on the day of discharge. In both cases (mortality and morbidity) copies of the case files and partograms (whenever applicable) were attached.

All cases were discussed in the first place by the senior obstetrician, intern doctors and the medical students involved in the data collection, to establish the cause of severe morbidity or mortality and the related substandard care. The management of the case was assessed and judged against the national guidelines for management of emergency obstetric conditions. In case of missing information in case files the staff who attended the patient and whenever the patient was still in the ward were asked for clarification. All maternal mortalities and selected severe morbidities were discussed in regular audit meetings. Selection of severe morbidity cases for audit was based on the presence of gross substandard care. In these meetings the audit team critically reviewed cases, established the cause of mortality or severe morbidity, underlying substandard care and developed strategic action plans for future improvement.

In order to reach consensus the facilitator involved as many members of the audit team as possible to give their opinions and suggestions about the case. The

input and ideas of all participants were gathered, synthesized and the facilitator tested the panel to see if the listed causes, areas of substandard care and interventions were acceptable to all. Although anonymity was emphasized during audit meetings, feedback was provided later by more senior staff in case of health workers related substandard care in order to improve the future management of patients.

Audit team

The audit team was formed based on the recommendations of the national guidelines for audit team formation at the district hospital. These constituted the hospital medical director, head of department of obstetrics and gynaecology, nurse in-charge of the maternity block, district nursing officer, district reproductive and child health (RCH) coordinator, obstetricians, representatives from RCH clinic, pharmacy, laboratory and operating theatre, and other health care providers from the maternity blocks. The health care providers in this department included 2 obstetricians, 2 generalist doctors (medical doctors not yet specialized), 2 assistant medical officers, 14 midwives. The district medical officer did not take part although he was supposed to do so by the guidelines.

Evaluation of the auditing process

In addition to the routine evaluation of the auditing process that was carried out during every audit meeting, a summary of findings was discussed to evaluate the audit process including implementation of recommendations at the end of every two months.

Data analysis

Data was extracted from the audit record form and entered into Access database and then transferred to the SPSS software for analysis. The characteristics and substandard care of maternal mortalities and severe morbidities were analyzed and compared within the group. The principal summary measures were case fatality rates (a widely accepted indicator for quality care [15]), proportions of the causes and substandard care as well as mortality risk ratios (RR). The corresponding 95% confidence intervals (95%CI) were also calculated. Statistical significance of the results was estimated using p-value (with a significance level, ' α ', of 0.05) and 95%CI. Ethical clearance for the study was obtained from SFDDH Research and Publication Committee. The permission to conduct this audit was obtained from the district and hospital management. Verbal consent was obtained from all women included in the audit process.

Results

Background information

During the study period the total number of institutional deliveries at SFDDH was 6572 and there were 363 severe maternal morbidities, giving an incidence of 55 per 1000 births. Of all mothers presenting with severe morbidities 265 (73%) were married or living with their partners and 252 (78%) were primary school leavers. Adolescent (under 20 years of age) pregnancy was the most common risk factor found in nearly one third (28%) of those with severe maternal morbidities (Table 1).

Table 1 Risk factors among women with severe maternal morbidities admitted at SFDDH, October 2008 to July 2010

Domain	SFDDH Total Deliveries n = 6572	Maternal Morbidities n = 363
Age distribution		
< 20 years	1577 (24%)	102 (28%)
20 - 35 years	4403 (67%)	231 (64%)
36 years and above	526 (8%)	30 (8%)
Missing or did not know their age	66 (1%)	0 (0%)
Distance of village of residence from SFDDH		
Within 50 km	4075 (62%)	243 (67%)
51 - 100 km	1643 (25%)	72 (20%)
101 - 150 km	592 (9%)	14 (4%)
151+ km	131 (2%)	34 (9%)
Residential village/street not recognized*	131 (2%)	0 (0%)
Parity 5 and above	523 (9%)	32 (9%)
HIV status		
HIV positive	270 (5%)	8 (2%)
Not known (not checked)	1383 (25%)	53 (15%)

*This group included women who had registered themselves that they were coming from the regions which are far away from Ifakara. Based on the local culture it was assumed that they had come back to their parents to the nearby villages to wait for delivery. Others registered streets (instead of villages) which could not be recognized during the analysis.

Characteristics of maternal mortalities and morbidities

Of all severe morbidities 36 mothers died, making an institutional case fatality rate of 10%. Specific case fatality rate was as high as 16% found among patients with severe abruptio placentae (Table 2). The major causes of maternal deaths were eclampsia, complications of abortion, severe anaemia in pregnancy and ruptured uterus contributing to almost two thirds (64%) of all deaths. Half (3) of all deaths caused by severe abortion complications were unsafely induced. Of all deaths, 29 (81%) developed severe complications before arrival at the hospital and almost two thirds 17 (63%) of them were admitted from home or health facilities located beyond 50 km from the hospital (SFDDH).

Of all severe morbidities 149 (41%) occurred during hospital stay at SFDDH and this included 42% (16) of ruptured uterus, 48% (18) of severe obstructed labour and 63% (42) of severe postpartum haemorrhage. Development of severe complications before arrival at the hospital increased the risk of maternal death by almost three times (RR 2.9; 95% CI: 1.3 - 6.3) (Table 3). Although, not statistically significant, the use of first level health facilities after onset of obstetric complication before going to the first referral hospital reduced chances of death by 16% (RR 0.84; 95% CI: 0.44 - 1.63). The review indicated that 15% (8) of mothers living in villages located between 51 - 100 km who developed complications before arrival to SFDDH bypassed the nearby first level health facilities (dispensaries and health centres) which could have provided first line management and probably refer them for definitive

Table 2 Specific case fatality rates among patients with severe maternal morbidities at SFDDH, 2008 - 2010

Severe morbidity/mortality	Total morbidities (judged as primary causes)	Number of maternal deaths	Specific case fatality rate (%)
Abruptio placenta	19	3	16
Placenta praevia	16	0	0
Postpartum haemorrhage	67	2	3
Eclampsia	101	9	9
Severe obstructed labour	37	0	0
Ruptured uterus	38	4	11
Complications of abortion	25	6	24
Severe anaemia in pregnancy	30	4	13
Puerperal sepsis	15	2	13
Other severe morbidities	15	6*	40
Total	363	36	10

Note: *Other causes of maternal deaths were complications of HIV/AIDS in pregnancy (3), ruptured ectopic pregnancy (1), amniotic fluid embolism (1) and cardiac arrest during surgery (1).

Table 3 The association between maternal deaths and health care seeking behaviour among patients with severe morbidities at SFDDH.

Factors (exposure/control)	Total severe maternal morbidities [†] n = 363	Maternal deaths n = 36	Risk Ratio (95% CI)
Places where the morbidity developed			
Before arrival at SFDDH	214 (59%)	29	
During hospital stay	149 (41%)	7	2.9 (1.3 - 6.3)
Where the patients sought care in the first place after onset of complication(s)			
Traditional birth attendants	5 (1%)	1	-
Dispensary/Health centre	137 (38%)	12	
Hospital (SFDDH)*	221 (61%)	23	0.8 (0.4 - 1.6)

[†]Severe morbidities include maternal deaths

management. Of the total patients with severe maternal morbidities 329 (91%) had only one severe morbidity, 29 (8%) had two and 5 (1%) had three severe morbidities.

Means of transport for patients with obstetric complications

The majority of patients whose complications occurred before arrival at SFDDH used hired taxi/car (32%), ambulance (27%) and public transport (24%). Others used bicycle (11%), motorcycle (2%), and walking on foot (3%). The mean time spent waiting for transport to SFDDH from either home or the referring health facility was 83 minutes, the mean duration of transport was 128 minutes and the duration could be as long as 540 minutes i.e. almost 9 hours.

Areas of substandard care

Of all maternal mortalities and severe morbidities 341 (94%) had at least one area of substandard care. Patient's related substandard care was identified in as many as 180 (50%) patients with severe morbidities. The most common patient's related substandard care was delay to seek treatment identified in 111 (31%) patients (Table 4). Health workers' related substandard care were found in 221 (61%) mothers with severe morbidities at SFDDH and 94 (69%) of those using the first level health facilities in the first place after onset of complications (Table 5). The most common health worker's related substandard care were delayed referral identified in 33 (24%), and delayed treatment within the facility found in 104 (29%) patients. Proportionally, delayed treatment within the facility ($p < 0.001$) and inadequate treatment or monitoring of labour ($p < 0.05$) were statistically significantly higher at SFDDH than in the first level health facilities. There was no MgSO₄ in all dispensaries and health

Table 4 Patient and administration related substandard care for maternal mortalities and severe morbidities at SFDDH, 2008 - 2010

Substandard Care	Proportions n = 363
Patient-related factors	
Presence of at least one substandard care	180 (50%)
Never/Poorly attended ANC	52 (14%)
Delayed to seek treatment	111 (31%)
Intoxication by local herbs	3 (1%)
Others	31 (9%)
Administration related substandard care	
Presence of at least one area of substandard care	219 (60%)
Absence of essential drugs, supplies and equipment	22 (6%)
Absence of/inadequate blood for transfusion	10 (3%)
Long distance from where the complications started to SFDDH (>50 km)	32 (9%)
Poor ANC, but difficult to judge whether care provider's or administration related factors.	52 (14%)
Lack of ambulance	24 (7%)
The facility had ambulance but was not readily available	21 (6%)
Others	12 (3%)

Note: ANC = antenatal clinic care

centres. Patients with eclampsia referred from these first level health facilities were given diazepam bolus to control fits.

More than half (59% i.e. 214) of severe maternal morbidities occurred before arrival at SFDDH and 44% of these were judged to be contributed by transport problems. It was also noted that even when ambulances were available sometimes women preferred to use public transport or hired vehicles because these were considered to be cheaper.

Successes of the audit

A list of strategic interventions for quality care improvement were proposed and implemented as a result of audit. These included improvement of responsiveness to

obstetric emergencies, workforce development, referral system improvement and advocacy on upgrading of the most remote health centres to provide CEmOC. A policy was developed to ensure readily availability of staff by identifying rooms within the hospital where doctors spend their nights when they were on call. This recommendation was implemented in an attempt to ensure prompt intervention to reduce delay to provide care within the health facility.

In addition to feedback to staff involved in care, weekly education meetings were carried out with intention to update the knowledge and skills of care providers. The main emphasis was put on management of specific obstetric conditions repeatedly identified with substandard care during audit. The training followed the national guidelines for management of obstetric complications. In addition, the district authority posted more midwives to support services provision in the labour ward. In an attempt to improve the referral system the district authority started to provide fuel for all institutional ambulances for all women with obstetric complications referred from the dispensaries and health centres. Before that, mothers requiring referral had to pay for fuel for the ambulance as much as 150 USD. Considering the poverty of most people in the catchment area and the fact that they had poor birth preparedness and readiness for complications, the previous practice delayed patients to reach the first referral district hospital (SFDDH). Equally important the audit team provided feedback to referring health facilities whenever the referral norms were grossly not adhered to.

The audit team recommended to the district authority to upgrade the most remote health centres to provide CEmOC services. As a result two health centres (Mlimba and Kibaoni) were upgraded in Kilombero district. Mlimba health centre is located 150 km from SFDDH and the upgrading was financially supported jointly by the government and the World Lung

Table 5 Health worker-related substandard care for maternal mortalities and severe morbidities at the health facility level

Areas of substandard care	First level HF* n = 137	SFDDH n = 363	Chi-squared test (P value)
Presence of at least one area of substandard care	94 (69%)	221 (61%)	2.6 (0.11)
Delayed treatment within the facility	15 (11%)	104 (29%)	17.2 (0.00)
Delayed referral to hospital with CEmOC services	33 (24%)	NA	NA
Referred while not on appropriate treatment	27 (20%)	NA	NA
Inadequate treatment or monitoring of labour	17 (12%)	77 (21%)	5.0 (0.03)
Wrong diagnosis	6 (4%)	22 (6%)	0.66‡
Wrong treatment with a correct diagnosis	7 (5%)	36 (10%)	0.11‡
Others	1 (1%)	26 (7%)	0.00‡

Note: *First level HF refers to dispensaries and health centres; HF = health facility; NA = Not applicable; ‡ Used Fisher's exact test.

Foundation. CEmOC services were launched at Mlimba in July 2010 and remarkable results on the performance have been documented elsewhere [16]. Upgrading of the most remote health centres to provide CEmOC services was intended to reduce phase two delays (delays to reach care).

Barriers to successful audit

The main problems which were encountered during this period included shortage of staff complemented by high attrition rates of labour ward midwives and weak feedback. High attrition rate was linked to increased salaries in the government health sector. A remarkable number of these staff opted to join the government and were posted to other areas where the local government had also shortage of staff. Attrition of staff complemented the shortage of care providers and this necessitated hospital administration to regularly look for new staff. Most of these were new graduates, less experienced and less skilled contributing to increased substandard care. Acute shortage of skilled staff in the maternity block was complemented by internal transfer of nurse-midwives to other departments within the hospital. In an attempt to address staff attrition, the hospital management successfully convinced the government to include the staff in the government payroll and second them to this hospital. Other barriers included lack of funds for on job training in emergency obstetric care, inconsistent replacement of drugs and essential supplies as well as inadequate participation of hospital and district decision makers in the audit meetings. Despite such irresponsiveness, regular reminders were made for them to take part in the audit process.

Discussion

This study indicates that audits for maternal mortality and severe morbidity can be implemented even in rural resource limited settings where the magnitude of maternal mortality is immense [1,4,7,12]. Like many other reports a wide range of benefits of audit in maternity care have been demonstrated here including improved patient care, knowledge and behavioural change in patient care and cost-effective use of resources [17-20]. Our experience indicates that audit has a great potential to bring change by continuous identification of adverse maternal outcome, underlying factors, implementation and evaluation of interventions for the purpose of improving care.

Audit identified a wide range of substandard care for severe maternal morbidities in rural Tanzania. Although it is impossible to state with certainty how many severe maternal morbidities might have been saved through focused courses of action, the presence of at least one category of substandard care in 94% of all severe

morbidities suggests that the vast majority of these in resource limited countries are preventable if more investment for maternity care is made [4,5]. The presence of at least one health workers' related substandard care in 61% - 69% of patients with severe morbidities in these health facilities suggests inadequate knowledge, skills, attitude, morale and responsiveness to obstetric complications. On the other hand, the presence of at least one administration related substandard care in 60% of the cases suggests serious weakness of the health care systems, contributing to the burden of adverse maternal outcome in resource limited countries.

The fact that patients had to travel long distances (up to 200 km) from home villages to SFDDH complemented by poor transport infrastructure and unready availability of transport in case of referral, suggests inequitable geographical distribution and poor accessibility of CEmOC services in remote rural Tanzania where the majority (77%) of Tanzanians live [21]. Inequitable distribution of EmOC services has been also reported in other resource limited countries with sparsely populated sub-national geographical areas [15]. These findings suggest the need to map the geographical distribution of EmOC services in resource limited countries and draw attention to underserved areas. In such places where there is limited access to CEmOC services, resulting in a delay to treat life threatening childbirth complications, maternity waiting homes (MWH) may be an intervention to consider [22,23].

Failure of the hospital decision makers to implement audit recommendations is worrisome and could be associated with demoralization of staff and failure to improve the quality of care as reported in other places [17,24,25]. In places where establishment of maternal mortality audits has led to improved quality of obstetric care, the success has been particularly attributed to strong leadership and accountability of both health providers and key decision makers [7,11,25,26]. Our findings recommend a more responsive health system from the level of the ministry of health down to the grass root levels. The key actors in the health sector in Tanzania are proposed to translate the lessons learnt into actions and intensify efforts to replicate the practice (audit) even in public hospitals where such interventions are uncommonly implemented [24].

Limitations of the study

Maternal deaths that occurred at home after women had left the hospital were not included. This could have led to underestimation of maternal deaths. However, this was thought to be low and could not have changed significantly the results. The impact of audit on maternal mortality and morbidity was not carried out because of lack of baseline data due to poor record keeping and the

fact that there was no observation period before it was introduced. There was no quantitative or qualitative analysis to ascertain whether the substandard care identified in the beginning of audit did not repeat significantly in the latter half of the study period. The fact that substandard care was taken to be the reason for potentially avoidable severe morbidities, while the same type of substandard care could have been also found in cases without adverse outcome posed a great challenge to the verdict [27].

Conclusions

The findings resulting from introduction of audit in this rural district hospital strongly indicate that audit can be implemented even in rural settings in resource limited countries. Evidences from this study suggest that the vast majority of maternal deaths and severe disabilities are preventable even where resources are limited. Audit is an important keystone for maternity quality care improvement. Its success, however, depends on the commitment of all stakeholders including care providers and relevant decision makers to implement audit recommendations. Introduction of such audits is proposed even in rural settings in resource limited countries in order to improve the quality of maternity care.

Abbreviations

CEmOC: Comprehensive Emergency Obstetric Care; CI: confidence intervals; MWH: maternity waiting homes; RCH: reproductive and child health; SFDDH: Saint Francis Designated District Hospital.

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Authors' contributions

ASN participated in design and took part in the audit process, wrote the manuscript. ABJ took part in the audit process and analysis and contributed to writing of the manuscript. DPU contributed to writing of the manuscript, JvR participated in design of the audit process and contributed to writing of the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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CHAPTER 9

The quality of antenatal care in rural Tanzania:
what is behind the numbers of visits?

(submitted)

(East Afr J Public Health 2008; 5: 17.21)

The quality of antenatal care in rural Tanzania: what is behind the number of visits?

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Abstract

Background

Antenatal care (ANC) provides an important opportunity for pregnant women with a wide range of interventions and is considered as an important basic component of reproductive health care.

Methods

In 2008, severe maternal morbidity audit was established at Saint Francis Designated District Hospital (SFDDH), in Kilombero district in Tanzania, to ascertain substandard care and implement interventions. In addition, a cross-sectional descriptive study was carried out in 11 health facilities within the district to assess the quality of ANC and underlying factors in a broader view.

Results

Of 363 severe maternal morbidities audited, only 263 (72%) ANC cards were identified. Additionally, 121 cards (with 299 ANC visits) from 11 facilities were also reviewed. Hemoglobin and urine albumin were assessed in 22% – 37% and blood pressure in 69% - 87% of all visits. Fifty two (20%) severe maternal morbidities were attributed to substandard ANC, of these 39 had severe anemia and eclampsia combined. Substandard ANC was mainly attributed to shortage of staff, equipment and consumables. There was no significant relationship between quality of ANC at first visit and total number of visits made (Spearman correlation coefficient, $r = 0.09$; $p = 0.13$). Several interventions were implemented and others were proposed to those in control of the health system.

Conclusions

This article reflects a worrisome state of substandard ANC in rural Tanzania resulting from inadequate human workforce and material resources for maternal health, and its adverse

impacts on maternal wellbeing. These results suggest urgent response from those in control of the health system to invest more resources to avert the situation in order to enhance maternal health in this country.

Background

Antenatal care (ANC) provides an important opportunity for pregnant women with a wide range of interventions including education, counseling, screening, treatment, monitoring and promoting the well-being of the mother and fetus [1-3]. Evidence of the effectiveness of ANC interventions exists around the world when sought early in pregnancy and quality care continues until delivery [2, 4, 5].

Tanzania has adopted the World Health Organization (WHO) recommendation of a minimum of four goal-oriented ANC visits during a woman's pregnancy [6, 7]. At minimum blood pressure (BP), hemoglobin (Hb) estimation, weight gain, testing of urine for albumin and sugar, fundal height, fetal lie and movements/ or heart rate assessments are recommended in every ANC visit. Tests for syphilis, HIV status, blood group and Rhesus factor as well as maternal height measurement are recommended at least once. Other ANC services include preventive strategies for tetanus, malaria, anemia and mother to child HIV-transmission, education (birth preparedness and complications readiness, care of newborn, family planning as well as treatment of detected ill health.

Although the majority (94%) of pregnant women in Tanzania attend ANC at least once, the quality of care has been of great concern [8]. Maternal mortality and maternal morbidity audit (4M study) was established at Saint Francis Designated District Hospital (SFDDH) in 2008 aimed to improve service delivery and utilization, and recommend relevant policies [9]. A second phase was carried out to assess in a broader view the quality of antenatal care services and underlying factors in Kilombero district, Tanzania.

Materials and Methods

Study area

Kilombero is a rural district located in the south-western part of Tanzania. In 2002 it had a total population of 321,661 people with annual population growth rate of 2.6% [10]. Antenatal care services are offered in 44 health facilities including a 372-bed SFDDH (including maternity waiting home services), a 120 bed capacity Illovo (parastatal) hospital, 4 public health centers and 38 private and public dispensaries scattered around the district.

Sample size and sampling technique

The first phase of the 4M study involved audit of all mothers with severe maternal morbidities and mortalities at SFDDH. The inclusion criteria and the auditing process have been described elsewhere [11]. The second phase of the study involved stratified sampling technique to obtain 11 health facilities out of 44 health institutions in Kilombero district (25% representation). These included 2 hospitals, 2 health centers and 7 dispensaries. All clients who came for antenatal clinics on the day of study were included in this study.

Data collection

Data of the first phase (severe maternal morbidities audit) was collected and entered in Access database. The second phase (cross-sectional descriptive study) involved a review of ANC cards for completeness of parameters, routinely assessed during ANC visits. These parameters included weight, maternal height, blood pressure, hemoglobin estimation, glucose in urine, albumin in urine, VDRL test, HIV test, blood group and rhesus status, provision of hematenics (iron and folate) and mebendazole. The research team also reviewed the presence of risk factor(s) which are routinely recommended on the ANC card. These include history of Caesarean section, age below 20 years, primigravida at age above 34 years, grand multiparous (more than 5 previous deliveries) and stature less than 150

cm. The ANC guideline in Tanzania recommends that women with these risk factors deliver in a hospital with comprehensive emergency obstetric services. Thus, ANC clients were interviewed whether they were advised on delivery and if they were satisfied with the quality of service they received. A second semi-structured instrument was used to assess the staffing level, availability of essential equipment, medical supplies and drugs necessary for provision of ANC services. This instrument was also used to interview in-charges of health facilities about the factors that affected the quality ANC service.

Permission to conduct the study was obtained from the office of the District Medical Officer and the respective in-charges of the selected health facilities. Verbal informed consent was obtained from the clients whose ANC cards were reviewed. Confidentiality and cultural values were also taken into consideration.

Data analysis

Data was analyzed using SPSS software. The principal summary measures were proportions of essential parameters assessed during ANC visits and the corresponding 95% confidence intervals (95%). The relationship between the quality of ANC at first visit and the total number of visits made was determined using correlation analysis. The quality of ANC at first visit was determined by scoring the assessment of BP, Hb and albumin in urine, each parameter was given one point, making a maximum score of 3. The authors hypothesized that by assessing these parameters, involving her blood sample, urine sample and physique, a woman would feel adequately assessed and hence motivated to make more visits. Although blood and urine samples are also used for other tests, it was logically assumed that these tests may not have changed in the way how a woman felt to be assessed. Mothers with complications of abortion, ectopic pregnancies and those who

started ANC visits after 20 weeks of gestation were excluded from this analysis because they were not expected to make a recommended minimum of four visits.

Results

Findings from the audit phase

Of all 363 women with severe maternal morbidities admitted at SFDDH from October 2008 to July 2010, ANC cards were found in only 263 (72%). Of the women without ANC cards some left them at home, others had not started ANC visits and the rest were misplaced within the hospital. Out of the total 754 ANC visits made by these 263 women with antenatal cards, BP, Hb and albumin in urine were assessed in only 69%, 25% and 22% respectively. The audit team attributed 52 (20%) of the 263 mothers with ANC cards to substandard antenatal care. Of these 39 (75%) were mothers presenting with severe anemia in pregnancy and eclampsia combined who had attended ANC clinics regularly but the respective parameters were never checked. During audit it was not clear whether the substandard assessment of these parameters was due to poor supply of essential ANC equipment, drugs and consumables or because of poor performance of care providers. Correlation analysis indicated that there was no significant relationship between the quality of ANC at first visit and the total number of ANC visits made by 63 women who qualified for analysis (Spearman correlation coefficient, $r = 0.09$; $p = 0.13$).

Findings from cross sectional descriptive study

Antenatal cards belonging to 121 pregnant women attending in 11 antenatal clinics in Kilombero district were reviewed with an average of 11 (ranging from 4 – 35) cards from each facility. Of these cards, 95 (79%) belonged to women with primary education, only

one belonged to a client with post secondary education. Of all mothers 107 (88%) were peasants, 7 (6%) petty businesswomen and 7 (6%) were either employee in the public or nongovernmental institutions. More than a quarter (26%) of these women were primigravida, 51% were gravida 2 - 4 and 92% were married.

Out of the total 299 ANC visits made hemoglobin estimation, glucose and albumin in urine were assessed in almost one third (27% - 37%) of the visits (Table 1). Although majority (83%) of mothers had made at least 2 ANC visits, blood group and rhesus status, and VDRL were tested in only 7% and 48% respectively (Table 2). With exception of Hb estimation, HIV test, blood grouping and rhesus status, and provision of mebendazole, the rest of the routine services recommended for ANC in Tanzania were statistically significantly more checked / provided in the hospitals than in lower health facilities.

Of all women 63 (52%) had at least one risk factor. Of women with risk factors 27 (42%) were under 20 years of age, 12 (19%) had short stature less than 150 cm and 11 were grand multiparous. Delivery advice was provided to only 40 (33%) women attending ANC on the day of study. The most frequent delivery advice (93%) given to women with risk factors was hospital delivery, when to go and use of maternity waiting home. On the other hand, 25 (40%) women with risk factors reported that they did not receive any advice on the delivery plan. On the contrary, 93 (77%) women reported that they were satisfied with the ANC services they received in these facilities. This number included women who had a risk factor but never received any delivery advice.

Factors affecting the quality of ANC services

BP machines, stethoscopes, weighing scales, HIV test kits, folic acid, mebendazole and SP drugs for IPT were available in nearly all (91% – 100%) facilities during the period of this study. Hb estimation machines were available in less than two thirds (64%) of the health facilities. The respondents (in charge of health facilities) reported that some essential equipment like BP machines were of poor quality leading to short durability contributing to the shortage. Glucostik and albustik kits were available only in 18% and 27% of all health facilities respectively. Hb estimation machines, Glucostik and albustik kits were completely unavailable in these facilities for up to 12 months before the study. Generally, there was severe shortage of staff for antenatal care in all dispensaries and health centers. Shortage of qualified staff and irregular supply of essential equipment, drugs and consumables were considered by 91% and 64% of the respondents respectively as the major underlying factors for substandard ANC (Table 3).

Interventions

A list of strategic interventions for quality ANC improvement in the district were proposed and implemented as a result of audit. These included regular feedback to ANC providers, recommendations were shared with the regional and district health authorities to improve staffing levels, essential supplies and equipment, and supportive supervision for quality antenatal care. The Medical Store Department (MSD), the central government supplier of medical equipment, drugs and consumables, was also contacted through a series of meetings and advised to improve the ordering and supply mechanisms to enhance quality and availability of essential supplies.

Discussion

This article reveals a state of poor quality of antenatal care in rural Tanzania despite adoption of goal-oriented ANC with a limited number of visits. Despite the complexity of interacting factors, antenatal education, screening and treatment of common causes of maternal and perinatal mortalities and morbidities such as pre-eclampsia and anemia constitute a body of benefits of ANC interventions [5, 12, 13]. The effectiveness of such ANC interventions has been linked to its quality, access and coverage [13]. The fact that comparable findings indicating substandard provision of vital ANC services have been repeatedly reported in rural sub-Saharan Africa since the last decade, suggest dormant health systems, an alarming state of inadequate utilization of research findings in these countries and the urgent need for improvement [14-18].

The fact that 20% of severe maternal morbidities were attributed to substandard ANC suggests a remarkable proportion of adverse pregnancy outcome that could be reduced by improving this program. These findings suggest also that women from rural Tanzania belong to a group that would need quality ANC the most in the world [12]. The high prevalence of ANC attendance in sub-Saharan Africa [8, 19] and positive attitude about antenatal care despite its poor quality [20], offer an important opportunity for quality maternal care improvement. These findings pose a great challenge to those in control of health systems in sub-Saharan Africa to invest more resources in antenatal care in order to accelerate maternal health in rural areas.

As opposed to the authors' hypothesis there was no significant relationship between the quality at the first ANC visit and total number of visits. These results could partly be explained by lack of alternative and the presence of high degree of ignorance which was manifested by high satisfaction in the circumstance of poor quality of ANC services. These

findings suggest also that improvement of ANC may not necessarily improve attendance in this region.

Although the health care providers attributed substandard ANC to irregular supply of essential equipment and drugs, poor infrastructure for ANC and shortage of staff, Hb was estimated in only 37% of ANC visits despite Hb estimation machines being available in 64% of health facilities. These findings raise questions on the performance, accountability, commitment of health care providers and supervisors in the health sector. Our findings recommend more resources to ensure regular essential supplies, drugs and equipment, train more skilled staff and carry out supportive supervision in order to improve ANC services [12, 14].

Limitations

The statistical analysis assumed that all observations were independent. However, in a first level health facility (dispensary or health center) there are usually few health workers who perform ANC. These are likely to repeat mistakes or deliver good care on all mothers they attend in ANC. Thus, consultations by the same health worker may not necessarily be independent from each other, and even more so if some equipment is missing. *Validity of ANC card data:* it was assumed that all data in the ANC cards were true. However, some tests may have been done, but not recorded; some tests may have been recorded, but not done. It was not possible to cross-check through the interview with mothers whether all these parameters were performed or not.

Conclusions

This article reflects a worrisome state of substandard antenatal care in rural Tanzania resulting from complex interacting factors including persistent lack of skilled human and

material resources as well as irresponsible leadership in the health sectors. Findings from this audit program suggest substantial adverse impact on maternal wellbeing resulting from poor quality of ANC. These results suggest urgent response from those in control of the health systems to invest more resources in antenatal care to avert the situation in order to enhance maternal health in Tanzania.

Abbreviations

ANC: Antenatal care; CI: confidence intervals; SFDDH: Saint Francis Designated District Hospital.

Competing interests

The authors declare that they have no competing interests.

Authors' Contributions

ASN, ABJ, JP and JvR designed and took part in the audit process and data analysis. DPU contributed to writing of the manuscript, All authors read and approved the final manuscript.

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Table 1: Proportions of check ups of parameters and prophylactic drugs recommended for every ANC visit

Parameters	Hospitals* (ANC visits = 127)		First Level Health Facilities (ANC visits = 172)		Total % (visits = 299)
	%	95% CI	%	95% CI	
Weight	89	84 - 94	74	67 - 81	80
Blood pressure	98	96 - 99	78	72 - 84	87
Hb estimation	45	34 - 54	32	25 - 39	37
Albumin in urine	47	38 - 56	20	14 - 26	32
Glucose in urine	42	33 - 51	15	10 - 20	27
Iron tablets	77	70 - 84	45	38 - 54	59
Folate tablets	71	63 - 79	45	38 - 54	56

NB: *Only data from the second phase of the study (cross sectional descriptive study) is included here; First Level Health Facilities = health centers & dispensaries

Table 2. Proportions of check ups of parameters and prophylactic drugs recommended at least once during ANC period.

Parameters	Hospitals*		First Level Health Facilities		Total clients n = 121
	Clients = 43		Clients = 78		
	%	95% CI	%	95% CI	
Height	93	88 - 99	56	45 - 67	69
HIV Test	91	82 - 99	74	64 - 84	80
VDRL Test	67	53 - 81	37	26 - 48	48
Blood group &					
Rhesus factor	5	1 - 12	9	3 - 15	7
Mebendazole	77	64 - 90	54	43 - 65	62

NB: * Only data from the second phase of the study (cross sectional descriptive study) is included; First Level Health Facilities = dispensaries and health centers

Table 3. Factors affecting quality antenatal care in Kilombero district

Factors affecting quality antenatal care	Proportions of respondents n = 11
Shortage of qualified staff	91%
Irregular supply of ANC equipment and drugs	64%
Regular but inadequate supplies	45%
Cultural factors and ignorance among pregnant women	36%
Lack of staff motivation	27%
Poor infrastructure for ANC	18%
Long distance to the health facility with ANC services	9%

CHAPTER 10

Barriers to conducting effective obstetric audit in Ifakara: a qualitative assessment in an under-resourced setting in Tanzania

(Trop Med Int Health 2012; epub ahead of print)

Barriers to conducting effective obstetric audit in Ifakara: a qualitative assessment in an under-resourced setting in Tanzania

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Abstract

Objective: To explore the background of encountered barriers and identify possible solutions for effective implementation of obstetric audit at Saint Francis Designated District Hospital (SFDDH) in Ifakara, Tanzania, where results of audit have been disappointing two years after its introduction.

Methods: A qualitative study was conducted in SFDDH involving participative observation of audit sessions, followed by 23 in-depth interviews with health workers and managers. Knowledge and perceptions of audit were assessed and suggestions for improvement of the audit process explored.

Results: During the observational period, audit sessions were held irregularly and only carried out when the head of department of obstetrics and gynaecology was available. Cases with evident substandard care factors were audited. The in-depth interviews revealed inadequate knowledge of the purpose of audit, despite the fact that participants regarded obstetric audit as a potentially useful tool. Insufficient availability of prerequisites, including staff commitment, managerial support and human and material resources, was mentioned to contribute to low involvement of health workers and poor implementation of recommendations resulting from audit. Suggestions for improvement included enhancing feedback to all staff, and for managers to attend sessions and assist with the effectuation of audit recommendations.

Conclusion: Obstetric staff in Ifakara see audit as an important tool for quality improvement. They recognise, however, that in their own situation insufficient staff commitment and poor managerial support are barriers to successful implementation. They suggested training in concept and principles of audit as well as strengthening feedback of audit outcomes, to achieve structural health care improvements through audit.

Keywords: clinical audit, Tanzania, health care quality assurance, maternal mortality, perinatal mortality, obstetrics.

Introduction

Complications of pregnancy and childbirth still pose enormous threats to mothers and their children, especially in low-income countries (WHO 2005). Tanzania is among the sub-Saharan African countries with high numbers of maternal and perinatal deaths, with a maternal mortality ratio (MMR) of 449 per 100,000 live births (Hogan *et al.* 2010) and a perinatal mortality rate of 59 per 1,000 live births (WHO 2007). Obstetric audit is a tool for quality insurance, which is seen as a simple and cost-effective strategy to improve obstetric care at facility level (Nyamtema *et al.* 2010; van den Akker *et al.* 2009, 2011).

There are different forms of obstetric audit (WHO 2004). An example is 'critical incident audit', a comprehensive facility-based case review of individual cases of maternal and perinatal deaths, or maternal near-miss events (Muffler *et al.* 2007). An effective obstetric critical incident audit consists of a repetitive cycle of five steps: identifying cases, collecting information, analysing the results by comparing with standards of care and formulating recommendations for change, making effort to implement change and re-evaluating practice (Drife 2006; WHO 2004).

Literature about audit prerequisites, facilitating factors and barriers, is mostly limited to high-income settings (Jamtvedt *et al.* 2006; Johnston *et al.* 2000; Lord & Littlejohns 1996; Pattinson *et al.* 2005). These reviews show a moderate positive effect of audit on the quality of care, and emphasize the need for more research in this area. Knowledge about the performance of audit in low-income settings has increased in recent years. Both successful (van den Akker *et al.* 2009, 2011) and unsuccessful (Muffler *et al.* 2007; Richard *et al.* 2009) attempts of implementing audit have been described. Requirements for audit include managerial and government support, a blame-free environment without fear of repercussions, proper documentation and sufficient staffing. Failure to meet these requirements has been seen to inhibit the successful implementation of audit (Kongnyuy & van den Broek 2008; Richard *et al.* 2009; Weeks *et al.* 2003). In addition, commitment of staff towards conducting audit themselves and their acceptance of being evaluated by peers are of vital importance (Bakker *et al.* 2011; Johnston *et al.* 2000; Nyamtema *et al.* 2010; Pattinson *et al.* 2005; Richard *et al.* 2009).

To reduce maternal and perinatal mortality and morbidity, obstetric audit was introduced in Ifakara, Tanzania in 2008. However, barriers to effective audit were encountered, including inadequate managerial support and shortage of staff (Nyamtema *et al.* 2011a). In order to increase the impact of local audit, these barriers and the perceptions held by health workers about the local audit process were further explored in this present study.

Methods

Study setting

This study was conducted in 2010 in St. Francis Designated District Hospital (SFDDH) in Ifakara, Kilombero district, one of the rural districts in Morogoro region in the Southeast of Tanzania. The hospital serves an area with a population of 600,000. Around 5000 deliveries are conducted at the facility every year (Schennach 2010). The facility is run by the Catholic Diocese of Mahenge, together with the Ministry of Health.

Because of a critical shortage of skilled health care personnel, the government of Tanzania, that had only one physician per 100,000 people in 2010 (WHO 2011), has allowed non-physician clinicians to provide more advanced emergency obstetric care (McCord *et al.* 2009). A wide range of staff categories provide obstetric care in this hospital, including two obstetricians, two general doctors, several intern doctors, fourteen midwives and one non-physician clinician (assistant medical officer). During the study period, the hospital suffered a high turnover of staff. A considerable proportion of experienced midwives left because of a salary increase in the government health sector, forcing the hospital to hire relatively young and inexperienced midwives.

Audit sessions were planned on a weekly basis. Approximately an hour and a half was scheduled for these sessions that took place during working hours. Audit sessions were supposed to be attended by hospital and district management as recommended by national guidelines (Nyamtema *et al.* 2010) and by all staff providing obstetric care who were available on the day of audit. The head of the obstetric department chaired the sessions. After presenting a case summary, areas of mismanagement or missed opportunities were discussed using a gate-to-gate approach, meaning that the review concerned events from admission to discharge or death (Filippi *et al.* 2004; Muffler *et al.* 2007). The implementation of recommendations emerging from audit were assigned to specific individuals at the end of each session

Data collection

This qualitative study involved participative observation of audit sessions followed by in-depth interviews (all performed by the first two authors) using a semi-structured interview guide based on earlier studies [courtesy of F. Richard, Institute of Tropical Medicine, Antwerp, Belgium (Bakker *et al.* 2011; Richard *et al.* 2009)]. Twenty-three participants were conveniently selected for in-depth interviews. Inclusion criteria were health workers in the obstetrics and paediatrics departments as well as hospital and district managers, as these were the intended attendees of the audit meetings. Study participants included one obstetrician, two paediatricians, four general doctors (two from both departments), one assistant medical officer, one intern doctor, six midwives, four nurses, the medical officer in-charge, the matron, the district medical officer and the district nursing officer.

The in-depth interviews explored their knowledge about audit, perceptions about the conduct of audit (proceedings and staff participation), perceptions of the effects (implementation and follow up of

recommendations, benefits and disadvantages) and ideas about how audit could be improved. Some of the selected participants could not easily express themselves in English. Therefore seven of the interviews were conducted in Swahili (by EHM). Participants' informed verbal consent was obtained for each interview and for the use of a tape recorder. Two interviews were not recorded at participants' request, which meant that only written notes were taken. Participants' anonymity was protected by keeping the tape records and written information confidential by storing the data encrypted and only accessible for the first two authors. Permission to conduct this study was obtained from the hospital and district administration as part of a larger study (Nyamtema *et al.* 2011a).

Data analysis

The recordings were transcribed manually and then analysed by using inductive coding. All interviews in Swahili were recorded, transcribed and translated into English. During the study period, points of key-interest were analysed and used to refine questions and elaborate on certain areas while maintaining the structure of the interview guide. Further analysis grouped the codes into categories and cross-links within the data as well as between data and literature were identified (Hardon *et al.* 2001). The first two authors independently analysed the data, after which results were compared to increase reliability.

Results

Observation findings

During nine weeks of observation, four audit sessions were held. When the head of department was absent or there was no case prepared, there was no meeting. The head of obstetrics and gynaecology was present at all four, other members of staff including doctors, intern doctors, managers, nurses and nursing students attended irregularly. The number of audit attendees ranged from 9 to 23. Of all attendees the doctors, managers and head nurses participated actively while other nurses and nursing students were less active, despite having their opinions asked. The head of obstetrics and gynaecology organised the meetings, invited other health workers to come and selected the cases or delegated this task to other doctors. There were no strict criteria for selection, though attempts were made to address subjects where staff was known to have gaps in knowledge and skills. In three of the sessions, a single case was reviewed each time regarding malaria during pregnancy, uterine rupture, and birth asphyxia. The remaining session was used to assess the management of birth asphyxia by assessing nine cases of perinatal mortality.

Barriers to quality care identified during audit included lack of staff, poor availability of equipment, insufficient record keeping, referral-related factors (transport delays, insufficient treatment at the periphery and poor monitoring during transport) and individual patient-related factors (delay in seeking treatment), for which workable solutions were sought. For example, with regard to record keeping, training in partograph filling was proposed. Although no minutes were kept during the audit session, some recommendations were written down in an attempt to establish an action plan, while others were only formulated verbally.

The analysis categorized the results of the in-depth interviews into three subjects: (1) general knowledge of audit; (2) perception of the effects of audit; and (3) perception of audit requirements.

General knowledge of audit

Responding to questions about the purpose of audit, interviewees mentioned that it is *'to know where our gaps are'* or to find out *'how to solve those gaps which are occurring'*, or gave similar explanations. At least half of the participants only recognized direct benefits of a single session, such as *'learning'*, *'improving my skills'* or *'know how to manage the patient'* as the purpose for audit. Only four participants, including two of the managers, specifically mentioned that the purpose was to collect data and analyse these for evidence-based policy improvement to benefit quality of care in the longer run.

Other participants saw inadequate knowledge of the purpose of audit among health workers as one of the explanations for their poor attendance. One participant said: *'People are not motivated to come because they don't know what they are doing there. If you know then you wouldn't want to miss this*

session.’ Many interviewees suggested offering training to enhance knowledge of audit: *‘People should be trained on how to conduct and the importance of audit meeting. Therefore after the training they will get the concept.’*

Perception of the effects of audit

The most positive effect, as perceived by the participants, was learning during the sessions: *‘you know, medicine is a daily learning process, in the audit sessions you get new inputs.’* Education was said to be the biggest motivator to attend sessions and continue the audit process. Another advantage of audit that was mentioned was the possibility for communication between different cadres of health workers within a department. It was noticed by nurses that since the onset of the audit sessions, cooperation between nurses and doctors improved. Lastly, the increase in the monitoring of staff performance resulting from audit was primarily considered an advantage. One nurse explained: *‘I think it is good, because it gives us a good challenge, that we have to be careful when we work.’* Only one doctor admitted that monitoring of daily practice through audit made him feel uncomfortable.

In contrast with these possible benefits of audit, many interviewees expressed dissatisfaction with the limited implementation of audit recommendations, particularly those that required managerial support. Interviewees felt that this was due to poor attendance of managers (*‘The administrators should be there because we need to get their response right there’*), lack of feedback to the managers of the suggested recommendations so they can act on them (*‘So we find ourselves repeating the same things again and again, you start wondering whether they get this information or not’*) and lack of funds (*‘You can recommend something, but if the administrators say they don’t have that fund, it dies right away’*).

Inadequate feedback to members of the audit team about the implementation of recommendations was also reported, as most of the participants did not know if the suggested recommendations were worked on or not; nor who was responsible for implementation (*‘All the outcome feedback should be open for all’*). One nurse suggested a more structural follow-up: *‘When we are in the meeting, before starting, we should quickly go back to what we discussed in a previous meeting.’*

Many suggestions were made for improvement, including proper use of action plans, writing the recommendations on notice boards, assigning a key-person to monitor progress and to have the nurse-in-charge give feedback to all other nurses. Despite the problems with implementation, all participants responded positively to the question if audit should be continued.

Perception of audit requirements

Inadequate staff commitment to audit was manifested by low attendance and participation in audit meetings, though none admitted to having low commitment him/herself. As one participant said: *‘They (staff members) don’t feel to be questioned. They want to skip them and find excuses.’* Lack of staff

commitment also became apparent when discussing absenteeism. It was revealed that audit depended too much on the head of department: when he is not there, most of the time no one else took the initiative to organize an audit meeting. Considering its importance, delegation of organizing audit was suggested.

Low participation in the audit discussion was said to be caused by personnel not being used to speak in public, fear of people higher in rank and inadequate medical knowledge. Despite efforts to maintain anonymity, blaming and using harsh language were also mentioned, as inhibiting participation, attendance and staff commitment. Another problem was that people '*prolong on matters, other than the main points*', causing the discussion to be '*not focussed to the point.*' It was suggested that staff should be skilled in using a blame-free and efficient manner in order to improve discussion.

Many participants saw shortage of human resources as one of the major factors inhibiting successful audit. The high workload often prevented staff from attending because they felt like they could not leave their daily work. Employing more staff in order to reduce the workload was suggested as a way to increase attendance and staff motivation for audit. Different types of material resources, such as a less distracting and uncomfortable venue and incentives for participation were suggested as areas for improvement. Others, however, considered this undesirable. The audit requirements and proposed improvements given by the interviewees are summarized in Box 1.

--- Box 1 ---

Discussion

Audit has been described in the literature as an effective tool in some settings, yet in other settings the cycle has been seen to “all too easily lose its shape, stop short or simply vanish” (Berger 1998). Our findings indicate insufficient health care providers’ and managers’ commitment to audit in Ifakara. This lack of commitment was never described by participants as pertaining to themselves, it was all too often about others.

Our findings suggest that organizational changes are required in order to overcome these barriers and enhance the impact of audit. These include involving a variety of staff and managers in all stages of audit, training of staff and managers on the principles and importance of audit, and strengthening feedback and transparency about implementation of audit recommendations.

Failure of decision makers (hospital and district health managers) to attend audit meetings could lead to inadequate implementation of recommendations. Leadership irresponsiveness has been reported to have higher explanatory power for lack of quality improvements compared to financial limitations (Nyamtema *et al.* 2011b; Van Lergberghe & De Brouwere 2001). In places where establishment of obstetric audits has led to improved quality of care, the success has been attributed to the accountability of both care providers and decision makers (Kongnyuy & van den Broek 2008; van den Akker *et al.* 2009). Although hospital and district managers may not be clinical experts, they have a big role to play when it comes to implementation of key recommendations resulting from clinical reviews.

The importance of training staff on a regular basis in audit methodology has been described as a necessary, but ignored investment (Johnston *et al.* 2000; Muffler *et al.* 2007). Skills regarding teamwork and dealing with criticism (Johnston *et al.* 2000), as well as a basic understanding of audit principles must be present in all staff members involved in audit. The ability to challenge superiors and a blame-free environment should be guaranteed. Audit ought to be conducted in a blame-free manner, to ensure that substandard care factors do not remain hidden and in order to prevent animosity among staff (Kongnyuy & van den Broek 2008; Nyamtema *et al.* 2010). Fear of ‘blame and shame’ in Ifakara audits may have contributed to low staff involvement. Training staff on audit methodology and principles might diminish this fear. Since St. Francis Hospital is a training school for nurse midwives, assistant medical officers and intern doctors, one of the objectives of this training would be to make these young members of staff familiar with the concept and principles of audit. This can have a considerable spin-off in the different health facilities to which these health workers will be posted.

Staff mentioned a serious lack of feedback of the audit outcomes to participants and other health personnel. Structured and regular feedback to staff was mentioned as a solution to break the pattern of repeating recommendations over and over again without perceivable impact. Due to this lack of impact, many staff members perceived direct learning from audit as its major effect, rather than structural health care improvements resulting from audit. While most authors consider this direct effect inferior

to implementing structural change (Drife 2006; WHO 2004), the educational value of audit has also been described as the primary outcome, particularly beneficial in settings where young and inexperienced health workers are eager to learn (Bakker *et al.* 2011).

Our findings suggest that in order to achieve structural health care improvements, greater efforts are required to guarantee audit prerequisites. These were identified by health workers as staff commitment, managerial support, adequate human and material resources, proper documentation, structured action plans to implement audit recommendations and transparent feedback to all staff members. For the moment, audit in Ifakara does not yet form an integrated part of the work routine necessary to acquire a group mentality allowing a change of practice (Bakker *et al.* 2011; Healy 1998).

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Author contributions

Conceptualized this study: ASN, TvdA, MvE, JvR. Contributed to study design and took part in data collection: KTvH, EdB, ASN, TvdA, EHM. Performed the analysis: KTvH, EdB. Wrote the first draft of the manuscript: KTvH, EdB. Reviewed the manuscript: ASN, TvdA, JvR. All authors contributed significantly to the intellectual content of this paper and approved the last version.

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Competing interests

The authors have declared that no competing interests exist.

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Box 1. Audit requirements and solutions proposed by staff

<ul style="list-style-type: none">• Staff commitment: motivate staff to organize and attend the meetings
<ul style="list-style-type: none">• Support of managers to attend and implement recommendations under their supervision, as well as to give feedback to all staff
<ul style="list-style-type: none">• Adequate resources: human resources (reduce workload to be able to prepare and attend sessions); material resources (a conducive venue and funds for implementation of recommendations)
<ul style="list-style-type: none">• Educate staff on the principles and importance of audit to increase motivation
<ul style="list-style-type: none">• Promote good documentation: training in partograph completion
<ul style="list-style-type: none">• Emphasize the importance of a blame free environment
<ul style="list-style-type: none">• Promote proper communication skills, keeping the discussion focussed

CHAPTER 11

Tanzanian lessons in using non-physician
clinicians to scale up comprehensive
emergency obstetric care in remote and
rural areas

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RESEARCH

Open Access

Tanzanian lessons in using non-physician clinicians to scale up comprehensive emergency obstetric care in remote and rural areas

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Abstract

Background: With 15-30% met need for comprehensive emergency obstetrical care (CEmOC) and a 3% caesarean section rate, Tanzania needs to expand the number of facilities providing these services in more remote areas. Considering severe shortage of human resources for health in the country, currently operating at 32% of the required skilled workforce, an intensive three-month course was developed to train non-physician clinicians for remote health centres.

Methods: Competency-based curricula for assistant medical officers' (AMOs) training in CEmOC, and for nurses, midwives and clinical officers in anaesthesia and operation theatre etiquette were developed and implemented in Ifakara, Tanzania. The required key competencies were identified, taught and objectively assessed. The training involved hands-on sessions, lectures and discussions. Participants were purposely selected in teams from remote health centres where CEmOC services were planned. Monthly supportive supervision after graduation was carried out in the upgraded health centres

Results: A total of 43 care providers from 12 health centres located in 11 rural districts in Tanzania and 2 from Somalia were trained from June 2009 to April 2010. Of these 14 were AMOs trained in CEmOC and 31 nurse-midwives and clinical officers trained in anaesthesia. During training, participants performed 278 major obstetric surgeries, 141 manual removal of placenta and evacuation of incomplete and septic abortions, and 1161 anaesthetic procedures under supervision. The first 8 months after introduction of CEmOC services in 3 health centres resulted in 179 caesarean sections, a remarkable increase of institutional deliveries by up to 300%, decreased fresh stillbirth rate (OR: 0.4; 95% CI: 0.1-1.7) and reduced obstetric referrals (OR: 0.2; 95% CI: 0.1-0.4). There were two maternal deaths, both arriving in a moribund condition.

Conclusions: Tanzanian AMOs, clinical officers, and nurse-midwives can be trained as a team, in a three-month course, to provide effective CEmOC and anaesthesia in remote health centres.

Background

In Tanzania, 47% of pregnant women deliver in health facilities and only 46% of deliveries are assisted by skilled personnel [1,2]. The met need for emergency obstetric care, at 15-30%, and the caesarean section rate (CSR) of 3% are still below ideal levels and constitute the lowest rates in the world [1,3]. The majority of these health facility deliveries and caesarean sections are for women in urban areas, where services are more

accessible. Such low CSR indicates that a significant number of mothers is denied the service which is quite often a life-saving option for failed and/or high-risk vaginal delivery. The above figures can partly explain the unacceptably high maternal mortality ratio (449/100 000 live births) in the country [4]. This can be linked to the existing shortage of skilled staff and inadequate health facilities with comprehensive emergency obstetrical care (CEmOC).

The shortage of human resources for health in Tanzania is one of the most severe in Africa [3-6]. The available skilled workforce is only 32% of that recommended [5]. The Government of Tanzania began training

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assistant medical officers (AMOs) in the early 1960s. These are non-physician clinicians (NPCs) selected from a lesser-trained cadre of clinical officers (COs) for a 2-year programme, which includes three months of surgery and three months of obstetrics. They are meant to be general practitioners, but are licensed to perform major surgery independently, including caesarean section. There is no provision for internship, residency, or other formal post graduate training for AMOs. Most have done fewer than the required five caesarean sections at the time of graduation. The need for more hands-on experience is met by informal training with more experienced staff at the hospitals where they are sent to work. Usually AMOs do not operate independently until after six months on duty with other staff. Outside of cities, 85% of emergency obstetric surgery is performed by AMOs, both working in government and mission hospitals [6]. There are only 1600 doctors, mostly concentrated in the biggest cities, 2000 AMOs, 8000 COs and 15,000 nurse-midwives (NM) in the work force in Tanzania, a country with an estimated population of 40 million people [7].

Recently, the government of Tanzania revised the National Health Policy with a goal to improve the health and well being of all Tanzanians with a focus on those most at risk, and to encourage the health system to be more responsive to the needs of the people [8]. One of its strategies is to upgrade health centres and use NPCs to improve accessibility to CEmOC in remote rural areas where the majority (77%) of Tanzanians live [1,5]. It is with this background that we took up the challenge to develop and launch three months postgraduate training programmes for AMOs in CEmOC, and for CO and NM in anaesthesia. Our research questions were: does this three months training of AMOs in CEmOC better address workplace needs compared to current training, and can a three months comprehensive training of NM and COs in anaesthesia result in acceptable quality of care?

Methods

Settings

While there are seven AMO schools with an average annual output of 200 there is only one medical school in the country where graduate doctors are trained to specialize in anaesthesia. Currently, there are only 17 specialists in anaesthesia in the whole country. The majority (14) work in Dar es Salaam hospitals. There is one institution where AMOs specialize in anaesthesia and another one where NM and COs are trained as anaesthetic nurses (anaesthetic assistants). These AMO and nurse anaesthetists only partially relieve the shortage. To meet the need for the upgraded health centres, AMOs were trained in comprehensive emergency

obstetrical care while COs and NMs, as anaesthetic assistants, were trained to give spinal anaesthesia and ketamine general anaesthesia. The trainees were recruited in teams which comprised of at least one AMO and two NMs or COs from the same facility. The concept of team training was devised in order to ensure inclusion of key categories of staff able to perform obstetric surgeries and anaesthesia.

Training venue and capacity

The training took place in two collaborating institutions: Tanzanian Training Centre for International Health (TTCIH) and Saint Francis Designated District Hospital (SFDDH). TTCIH is a non profit semi-autonomous institution that offers short international courses in health and a long course for AMOs. The two institutions (TTCIH and SFDDH) have had long experiences in health related training and health care service delivery. SFDDH, a hospital with a 372-bed capacity, receives referred patients from primary health facilities (dispensaries and health centres) in Ulanga and Kilombero districts. The mean annual delivery and caesarean section rates from 2005 to 2008 were 4,987 and 25% respectively. The key technical staff for the programmes included one medical curriculum expert, two obstetricians, one paediatrician, two generalist doctors and one senior AMO - all with vast experience in maternal and perinatal care. The training in anaesthesia was conducted by a consultant anaesthetist from Muhimbili National Hospital (MNH), one AMO specialized in anaesthesia and two senior anaesthetic nurses from SFDDH. The training programmes were built on the framework of human resources, pedagogical and technological materials available in the two institutions.

Teaching and learning processes

Competency-based training curricula for CEmOC and anaesthesia were developed. The process of curriculum development included: occupational profiling, assessment of the employers' needs in maternal health, clarification of objectives including required competencies, description of the methodology for implementation of the curricula, establishment of financial implications and documentation of the human and physical resources needed for effective learning and teaching.

The main emphasis of both training curricula included the underlying principles in obstetric and anaesthetic care; appropriate decision making and clinical reasoning skills, and acquisition of clinical management skills. The training in CEmOC required the trainees to attain the following key competencies by the end of the training:

- Ability to diagnose and manage uncomplicated labour and recognize complications arising during labour;

- Ability to determine when operative vaginal or abdominal delivery is indicated and be able to perform such procedures;

- Ability to diagnose and treat problems of the newborns (selected conditions).

The training programmes took three months and involved both hands-on and theory. All trainees for both (CEmOC and anaesthesia) programmes were included in night duty rosters in groups of two attached to more experienced hospital staff. The scope of working activities under supervision was outlined. The CEmOC trainees were also included in the day-time labour ward duty roster and were also involved in routine teaching ward rounds in the maternity which were carried out by the hospital obstetric team thrice a week. During these ward rounds and when they were on call, the CEmOC programme participants were included in the decision making for patients requiring surgical interventions. They were also involved in elective and emergency obstetric surgeries, either as assistant or operating independently. Elective obstetric surgeries were performed twice a week. Participants for the anaesthesia programme took part in all surgical, obstetric and gynaecological elective and emergency operations, either as assistant to a qualified anaesthetist or giving anaesthesia under supervision.

Demonstrations of procedures were made during actual performance as well as using available manikins and video films at TTCIH's Clinical Skills Laboratory with ample opportunity to practice these using the manikins. Procedures were supervised and candidates reached the level of proficiency before they were allowed to manage patients. These included resuscitation of the newborn, vacuum extraction, caesarean section, abdominal aorta compression and condom tamponade for management of postpartum haemorrhage and intubation. Interactive lectures were conducted on every working day (five days a week) for at least 2 hours, from 14:00 to 16:00. Teaching emphasis for AMOs was put on all elements of CEmOC; clinical presentations; diagnosis; complications; and treatment and prevention of complications of pregnancy and childbirth. Other areas included peri-operative care, resuscitation and infection prevention. The training in anaesthesia emphasized the use of spinal anaesthesia and ketamine, and covered a wide range of topics including classification, methods, indications, contraindications, potential complications and management. Various available anaesthetic drugs were discussed. Problems unique to anaesthesia in obstetrics - along with medical conditions related to obstetrics, including haemorrhage, anaemia, (pre) eclampsia and respiratory diseases - were dealt with. Other areas included resuscitation, oxygen therapy, peri-operative care, sterilization, infection prevention and

operating room etiquette (scrubbing, masks, gloving and catheterization). Adult learning and teaching methods were encouraged to improve the learning processes for both programmes.

Assessment of teaching and learning processes

Each trainee was given a logbook at the start of the training. Lists of obstetric and anaesthetic procedures were developed, and the minimum targets (numbers) required for each course participant were indicated in the logbooks. Procedures required for CEmOC programme participants included spontaneous vertex deliveries, assisted breech deliveries, repair of cervical and perineal tears, vacuum deliveries, caesarean sections, laparotomy for ruptured uterus (repair or subtotal hysterectomy), laparotomy for ruptured ectopic pregnancy, manual removal of placenta and evacuation of inevitable, evacuation of incomplete or septic abortions. Anaesthetic procedures included spinal anaesthesia, intubation of adults for general anaesthesia, administration of general anaesthesia using ketamine and resuscitation of newborns. All procedures performed by the trainees were documented in the logbooks and countersigned by their supervisors. Outcomes for mother and infant were recorded. All surgical procedures were also documented in the operating theatre record books.

End of course assessment was carried out using Objectively Structured Clinical Examinations (OSCE) as well as written examinations. In addition, the funder of the first batch contracted a team for mid-evaluation and gave feedback in writings to the course coordinator who further shared the findings with other facilitators. This evaluation involved interviews with the course coordinator, facilitators and participants on several occasions.

Performance of upgraded health centres

The World Lung Foundation (WLF) upgraded CEmOC services in four health centres between March and June 2010. The first author of this paper was appointed by WLF to follow up the course by carrying out monthly supportive supervision and to report on the performance of the three upgraded health centres, located in Ulanga and Kilombero districts in Morogoro region, i.e. Mwaya, Mtimbira and Mlimba. During the visits, for 2-3 days in each health centre the team conducted training sessions in obstetric care, took part in management of in- and out-patients and reviewed data on obstetric care and outcome. Institutional maternal mortalities and fresh stillbirths were used as indicators for assessing the quality of obstetric outcome in these centres. Referred obstetric cases were also documented. The plan was to establish a supervisory system that will become less intensive, but will continue indefinitely from the district hospitals related to these health centers. The same

procedure has been established in the two other regions served by the WLF program. Data was entered into excel and analyzed using Stata software.

Results

Number of trained NPCs

Three batches with a total of 45 participants for both programmes were trained from June 2009 to April 2010. The first batch had 10, second had 23 and third had 12 participants. Thirteen participants were sponsored by the World Lung Foundation through Ifakara Health Institute, 20 by UNFPA through the Ministry of Health, 10 by Lions Club International (Sweden) and two were participants from Somalia sponsored by Trocaire Somalia Programme. A total of 14 AMOs were trained in CEmOC and 31 (clinical officers and nurse/midwives) were trained in anaesthesia. Participants were trained in teams from 12 health centres located in Morogoro, Dodoma and Coastal regions, where the funders in collaboration with the respective 11 district health authorities had planned to extend CEmOC services. Of these health centres, 11 were located in rural districts which were as far as 150 km (Mlimba health centre) from the nearest referral hospital, to which they referred complicated obstetric cases. One CEmOC programme participant dropped out because of social problems and his performances were not included in this report.

Performances of the course participants in the training centre

A total of 278 major obstetric surgeries (C-sections, laparotomies for ruptured uterus and ectopic pregnancies) were performed under supervision by the CEmOC trainees. On average each participant performed more than three quarters of the minimum targets for uncomplicated deliveries, caesarean sections, repair of cervical and perineal tears and evacuation of inevitable, incomplete and septic abortions. Because of the relatively

small number of cases of ruptured uterus during the three months (even in a very busy district hospital), the participants were exposed to only 33% of the minimum targets for surgeries on ruptured uterus (Table 1).

A total of 1161 anaesthetic procedures were performed by the trainees in anaesthesia. On average each participant performed all (100% to 110%) minimum targets of procedures for spinal anaesthesia and administration of anaesthesia using bolus ketamine. However, there were very few patients who were operated using general anaesthesia who needed endotracheal intubation. In this case participants were exposed to as low as 23% of the minimum targets (Table 2). Anaesthetic assistants were also trained on how to resuscitate a newborn baby and how to assist the surgeon during operations.

With the exception of one CEmOC trainee, all successfully passed both OSCE and written examinations which were conducted at the end of the training period. Written examinations for both programmes were composed and based on the format for national final qualifying examinations for the AMOs and included questions from topics that were considered as 'must know'. The OSCE for the CEmOC trainees was set to test the competencies to perform various important obstetric procedures which included vacuum deliveries, resuscitation of newborn babies and condom tamponade for management of postpartum haemorrhage.

The decision for either vaginal, operative vaginal or abdominal delivery was made by a team composed of all health care providers in the labour ward (midwives and doctors including the trainee). Individuals' ability for appropriate decision making for both training programmes were continuously assessed during the course and were at the end generally qualitatively judged to be satisfactory for all participants. The review team identified only one case with a major complication (severe postpartum haemorrhage) out of all procedures performed by the CEmOC trainees. This was judged to

Table 1 Proportions of obstetric procedures performed during training by Assistant Medical Officers trained in Comprehensive EmOC

Category of procedures	Total number of procedures performed	Minimum target set per course participant	Proportions performed per participant
Normal deliveries	207	15	107% (15)
Breech delivery assisted	35	5	60% (3)
Repair of cervical and perineal tears	111	11	81% (8)
Caesarean sections	208	15	107% (15)
Vacuum deliveries	20	5	40% (2)
Operation on ruptured uterus (repair or subtotal hysterectomy)	26	6	33% (2)
Laparotomy for ruptured ectopic pregnancy	44	7	43% (3)
Manual removal of placenta	38	5	60% (3)
Evacuation of inevitable, incomplete and septic abortions	103	10	80% (7)

Table 2 Proportions of anaesthetic procedures performed during the training by clinical officers and nurse-midwives trained in anaesthesia

Category of procedures	Total procedures performed	Minimum targeted per candidate	Proportions performed per candidate
Spinal anaesthesia	625	20	100% (20)
Intubation of adult for general anaesthesia	107	13	23% (3)
Administration of anaesthesia using bolus ketamine	336	10	110% (11)
Administration of anaesthesia using ketamine drip	93	10	30% (3)
Resuscitation of newborn	344	10	110% (11)

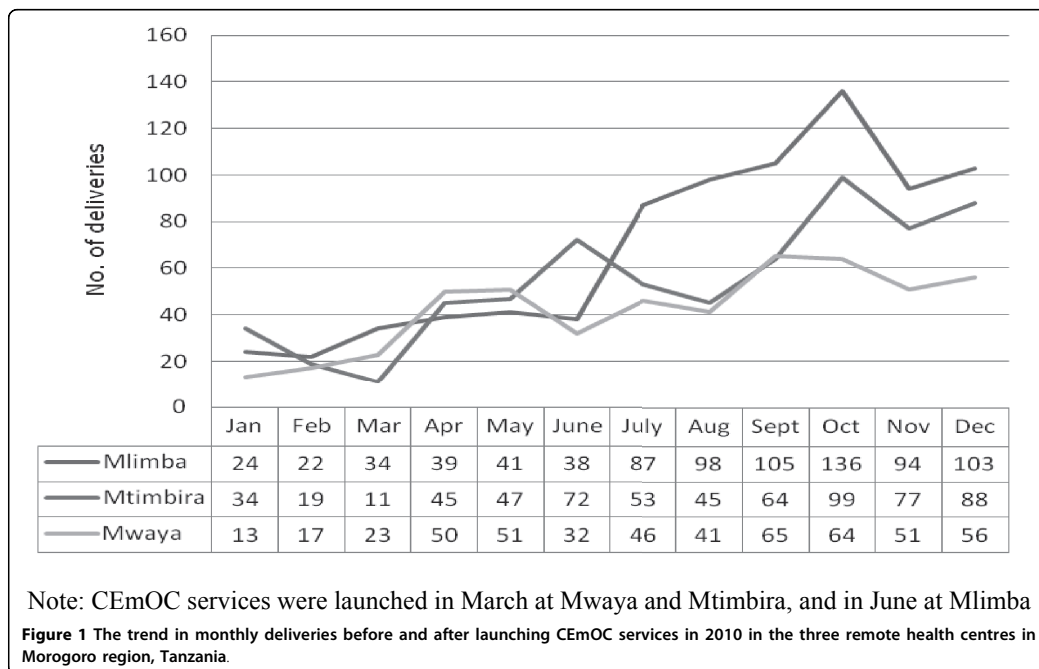
be due to retained products of conception after caesarean section. There was no mortality, sepsis, burst abdomen or any anaesthetic complications out of the cases performed by the trainees during the training period.

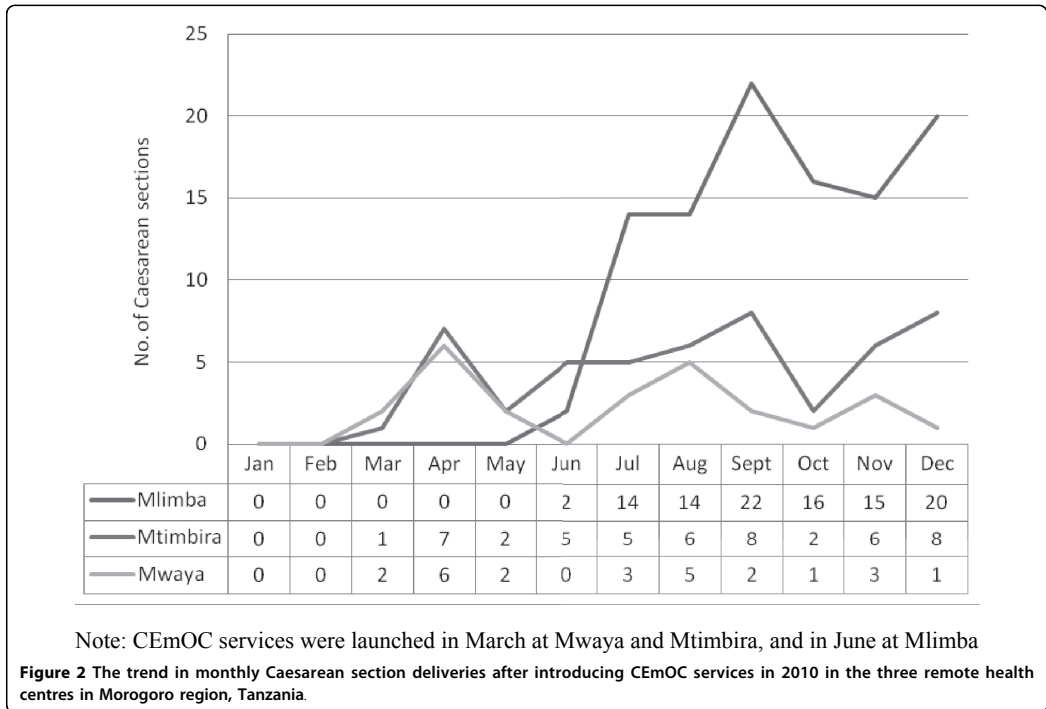
Performances in the health centres

Following introduction of CEmOC services the trends of total deliveries and caesarean sections increased remarkably in all three health centres, Mlimba, Mtimbira and Mwaya (see Figure 1 and 2). On average, monthly deliveries increased by as much as 300% at Mlimba health centre. Mtimbira and Mwaya health centres had less dramatic increases: these centres had had only one

AMO each and the number of caesarean deliveries decreased whenever these AMOs were absent from their stations because of other obligations, illness, or training sessions required by the district administration.

Two maternal deaths were reported in two upgraded health centres (Mwaya and Mtimbira) after CEmOC services were introduced. These deaths were due to severe postpartum haemorrhage and puerperal sepsis following prolonged obstructed labour at home. Although statistically not significant fresh stillbirth rates declined by 60% after introduction of CEmOC services (July to December 2010) despite increased institutional deliveries (OR = 0.4; 95% CI: 0.1-1.7) compared to before (January-February). The number of referred obstetric cases declined





significantly after introduction of CEmOC services (OR = 0.2; 95% CI: 0.1- 0.4) (Table 3).

Discussion

Strengthening human resources for health is a central denominator for combating health crises and building sustainable health systems in resource limited countries

[9-11]. The training of NPCs in Tanzania for maternal health care is one of the regional innovations based on local realities of high maternal and perinatal deaths and low met needs linked to severe shortage of qualified staff. The initiative applied the concept of ‘task shifting’ which has been advocated and proved useful for maternal health care in sub-Saharan Africa, where severe

Table 3 Proportions of fresh stillbirth and obstetric referrals before and after introducing CEmOC services in 2010 in three remote health centres in Morogoro region, Tanzania

	Before CEmOC services (Jan-Feb)	After CEmOC services (July-Dec)	OR (95% CI)
Fresh stillbirths			
Mtimbira	4	5	
Mlimba	0	4	
Mwaya	0	2	
Total SBF/total births	4/202	11/1372	0.4 (0.1-1.7)
Fresh stillbirth rate/1000 births	20	8	
Obstetric referrals			
Mtimbira	3	14	
Mlimba	5	3	
Mwaya	9	8	
Total	17	25	
Referral rate	8%	2%	0.2 (0.1-0.4)

Note: CEmOC services were launched in March 2010 at Mwaya and Mtimbira, and in June at Mlimba

depletion of qualified staff exists [6,12]. These findings indicate that such training programmes can improve the knowledge and clinical management skills of NPCs and may subsequently improve the quality of maternal health care [13,14]. Considering that at least 5% of all pregnant women experience life-threatening complications possibly requiring caesarean section, and therefore anaesthesia, and the fact that tens of thousands of women die every year because of lack of these services [12,15], the training was crucial and may contribute to reduction of maternal and perinatal mortality and morbidity in 11 beneficiary districts with a total population of 2.6 million people [16].

Deeming the quality of the performances of these NPCs as acceptable following introduction of CEmOC services in the upgraded health centres is suggested by: the presence of only one severe complication out of 278 major obstetric surgeries and 1161 anaesthetic procedures performed during training; the small number of maternal deaths; and a reduced fresh stillbirth rate. Similar findings, regarding the quality of care and outcomes for major obstetric surgeries performed by NPCs, have been reported from within and outside the country and are comparable to those performed by graduate medical officers [6,17-20]. The increase of deliveries and caesarean sections in these health centres suggests improved accessibility to CEmOC services and possibly also improved pregnancy outcomes in the catchment areas.

The process for selecting trainees took into consideration the geographic distribution of the health facilities, an important UN process indicator for EmOC services [3]. Upgrading these facilities to provide CEmOC will significantly shorten the time wasted when referring women with obstetric complications. Successful reduction of maternal mortality in resource limited countries (such as Bangladesh, Bolivia and Honduras) has been linked to improved accessibility to health facility delivery services as well as improved quality of care during pregnancy, labour and the period immediately after birth [21,22]. These countries strategically targeted remote rural areas with high ratios of maternal mortality. This innovation calls for the global community to consider scaling up training and use of teams of NPCs for CEmOC and anaesthesia.

Limitations of the training

Trainees had limited exposure to certain important obstetric and anaesthetic procedures, including vacuum delivery, surgeries for ruptured uterus and intubation for general anaesthesia. This could have been contributed by large groups of participants. Intubations for general anaesthesia were limited because of the costs involved for the drugs as compared to those for spinal anaesthesia. In an attempt to bridge these gaps,

participants were also trained using models (available in clinical skills laboratory) for vacuum extraction and intubation. The authors also recommended technical support at the beginning and regular supportive supervision afterwards by more experienced staff. While still gaining confidence, trainees were advised to start with obstetric surgeries which are considered to be uncomplicated, such as straight forward caesarean section, and continue to refer complicated ones.

Conclusions

Our findings indicate that health centres can be upgraded and NPCs trained to provide comprehensive EmOC. Considering that most Sub-Saharan countries are already off-track in their attempts to achieve the MDGs for maternal and perinatal survival, evidence resulting from the current training programmes calls for urgency to scale up the application of the concept of 'task shifting' with the use of NPCs for CEmOC services provision and anaesthesia.

List of abbreviations

AMO: assistant medical officer; CEmOC: comprehensive emergency obstetric care; CO: clinical officer; MDG: Millennium Development Goals; NM: nurse-midwife; NPCs: Non-physician clinicians; OSCE: objectively structured clinical examination; SFDDH: Saint Francis Designated District Hospital; TTCIH: Tanzanian Training Centre for International Health; UNFPA: The United Nations Population Fund.

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Authors' contributions

ASN participated in curriculum development and implementation, data collection, analysis and wrote the manuscript. SKP participated in curriculum development and implementation and wrote the manuscript. GM reviewed the curriculum and contributed in manuscript writing. FDR contributed in curriculum implementation and reviewed the manuscript. JvR contributed in curriculum implementation and reviewed the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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CHAPTER 12

General Discussion

Conclusions and Recommendations

References

Summary (in English and Dutch)

Chapter 12

GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

GENERAL DISCUSSION

This thesis comprises of study findings revealing a worrisome state of substandard care for maternal health in both rural and urban Tanzania at all stages of pregnancy (from antepartum to postpartum period). Areas of substandard care included inadequate monitoring of essential parameters during ANC, substandard plotting of partograms during labour [27], inadequate use of referral norms, delays and inappropriate management of complications of pregnancy and childbirth [28], a state of poor health data collection leading to lack of informed decision-making from the facility level up to the national level [29]. Like many other studies in resource limited countries substandard care was strongly implicated to contribute a large proportion of maternal mortality and severe morbidities [30-33].

Like in many other places where the problem is immense, the state of substandard care for maternal health care in Tanzania is linked to a wide range of factors related to patients, health care providers and administrations (leadership) in the health sector [31, 34]. Our findings indicated that 94% of those women who died and those presenting severe morbidities at the hospital had at least one of these underlying factors [28]. Almost one third (31%) of maternal mortality and severe morbidities in rural Tanzania was linked to delay to seek treatment. Evidences indicate that maternal mortality and severe morbidities can be significantly reduced by addressing the underlying factors for substandard care [7, 18, 30, 35-38].

Although antenatal care is considered an important opportunity for pregnant women with a wide range of interventions [39-41] our findings suggest that its quality is at the critical level in rural Tanzania. The fact that blood pressure, haemoglobin and albumin in urine were assessed in only 69%, 25% and 22% of the antenatal clinic visits respectively suggests severe substandard monitoring of essential parameters of pregnancy. Our audit reviews indicated that one fifth (20%) of women presenting with obstetric complications in rural Tanzania had factors

related to substandard antenatal care. These findings suggest change in order to achieve the goals for ANC interventions [42, 43].

The fact that assessment of cervical dilation and fetal heart rates during labour was judged to be substandard in 63% and 91% of the reviewed partograms respectively, and the failure to record Blood pressure, temperature, and pulse rates in 47%–76% of partograms [27] suggest a serious substandard monitoring of labour. Our findings show that of all patients with severe maternal morbidity in rural health facilities in Tanzania, 61%–94% have at least one area of substandard care related to health workers [28]. These areas include delaying referral, failure to follow referral norms, delaying treatment and inappropriate treatment. All these findings reflect enormous substandard management of labour and suggest urgent interventions. In order to bridge these gaps, on-job hands on training in use of the partogram, supervisory mechanisms, use of a simplified WHO partogram prototype, and introduction of clinical obstetric audit are recommended in all health facilities where women give birth in Tanzania [44, 45].

The fact that 60% of severe maternal morbidities and mortalities at the health facility level in rural Tanzania are linked to administration and leadership factors in the health sector [28], needs special attention. These factors include inadequate coverage for health infrastructure, poor utilization of available resources for maternal care e.g. presence of hospitals and first level health facilities (health centers and dispensaries) which do not provide comprehensive and basic emergency obstetric care services [28, 46]. Others include inadequate essential equipment, drugs and supplies for maternal health care, severe shortage of essential categories of health staff for maternal care in most health institutions. The fact that WISN ratio for nursing staff working in Dar es Salaam municipal hospitals' labour wards was as low as 0.09 [47] reflects extremely huge maternal care workload pressure and suggest the urgent need for more staff in order to improve the quality of care. Several reports indicate that inadequate health system responsiveness to maternal health at country level has an explanatory power that is significantly superior to most other factors including national resources [48-51]. Successes in reducing maternal mortality in China, Egypt, Honduras,

Bangladesh and Bolivia have been attributed to strong political commitment, good leadership in reproductive health and presence of enabling policies [7]. Our findings suggest that lack of good quality leadership can partly explain the alarmingly high MMR and severe maternal morbidity in Tanzania. Leadership is a change agent, it is all about getting things done. Moreover, a major investment is needed to establish new infrastructure for maternal health care, upgrade and optimize use of the existing ones, and improve supply of essential material resources in order to improve pregnancy outcome in Tanzania.

While substandard care for maternal health is immense in Tanzania, our systematic review has revealed a long list of success reports in resource limited countries around the world [52]. The most frequent interventions (integrated in 52% - 65% of programs) were training in emergency obstetric care, placement of care providers, refurbishment of existing health facility infrastructure and improved supply of drugs, consumables and equipment for obstetric care. Like many other reports our findings recommend similar interventions in places with high rates of maternal mortality and severe morbidity including Tanzania in order to improve quality of maternal health care [53-55].

These evidence-based interventions were replicated in our two models which were designed and tested for their feasibility and effectiveness to improve the quality of maternal health services in rural settings. Experiences from the first model of audit for maternal mortality and severe morbidity indicate that this tool can also be implemented in resource limited rural settings [28]. Although audit of maternal mortality and severe morbidity may sound to be like to evaluate the outcome, if well structured and organized, it may improve quality of care through systematic and critical analysis of quality of medical care (against defined standards) including procedures used for diagnosis and treatment, the use of resources and the resulting outcome and quality of life of the patient [56]. In principle the analysis is always carried out with a view to recommending and implementing measures to address specific deficiencies in care. Like many other reports, results from this audit model suggest improved knowledge (educational value), performance, motivation and rational use of limited resources after it was introduced in the facility [57-59]. Like in many other places in resource limited countries our

experiences indicate that this tool is useful for quality maternal health care improvement, and is recommended in all places where maternal mortalities and severe morbidities are high [30, 60-62]. However, our experiences also show that health facility audit is only likely to result in care improvements if it is conducted in a structured and culturally sensitive way, involves all levels of staff in reviewing activities and in formulating recommendations, and if all factors which determine the effectiveness and sustainability of audit are identified and addressed [63].

The second model involved scaling up of CEmOC services in health centres located in hard to reach rural areas [64]. The model applied the concept of "task shifting" in an attempt to address the problem of acute shortage of workforce for maternal health in Tanzania, currently operating at 32% of the required skilled workforce. Our experiences from this model suggest that Tanzanian assistant medical officers, clinical officers, and nurse-midwives can be trained as a team, to provide effectively CEmOC and anaesthesia in remote health centres. Evidences from our findings indicate that introduction of CEmOC services in health centres in hard to reach areas is more likely to be associated with remarkable increase of institutional deliveries, reduced obstetric referrals and improved pregnancy outcome. Similar successes have been reported elsewhere around the world in rural areas after implementation of almost similar interventional approaches [65-67].

The principal findings from these two models suggest that quality of care can be improved and the vast majority of maternal mortalities and severe morbidities can be averted in resource limited rural settings if these strategic interventions are replicated and scaled up. Findings resulting from our two models constitute the body of evidence-based solutions to the problem of maternal health and are proposed to those in control of the health system in resource limited countries including Tanzania.

Lessons learnt from these studies indicate that reduction of maternal mortality and severe morbidities in resource limited countries is one of the most ambitious but complex undertakings in public health history. In view of these experiences, operations researches are needed to expand our knowledge and understanding of how to scale up maternal health

programmes effectively, efficiently and equitably. Our experiences documented in this thesis indicate that even simple applications of operations research enable care providers, managers and policy makers to “learn by doing”, identify solutions to problems that limit programme quality, efficiency and effectiveness; and use the evidence generated to refine programmes for better outcomes. Evidences resulting from simple applications of operations research for quality maternal health care improvement suggest the approach to be superior than the formative types of researches which are usually costly because of the process of trial-and-error. Like many other reports, this thesis strongly recommends scaling up application of operations research in order to accelerate maternal health services in resource limited countries [23, 68-70].

CONCLUSIONS AND RECOMMENDATIONS

The pre-test and post-test results summarized in this thesis from the study designs of this operations research, demonstrate a worrisome state of substandard care in maternal health care in Tanzania, a complex picture of interlinked underlying factors and a list of evidence-based solutions. The implementation of the two models of this operations research i.e. introduction of obstetric audit in a rural district hospital and CEmOC services in health centres located in hard to reach remote areas, led to remarkable improvements in the quality of maternal health services, CEmOC services accessibility and utilization. Evidences compiled in this thesis (from a systematic review of maternal health interventions and the two models) strongly suggest that it is possible to improve the quality of maternal health care in resource limited countries if key actors in the health sector realize their commitments and responsibilities, embark upon the underlying factors and intensify efforts to implement the evidence-based interventions. These successes contribute to the body of evidence-based solutions to the problem of maternal health in resource limited settings. These lessons challenge health care providers, administrators and policymakers in resource limited settings and all other stakeholders across the world to adopt and scale up the means in order to accelerate and get back on-track the initiatives to improve care and reduce maternal mortality and morbidities.

In order to achieve this, the following specific recommendations are proposed to those in control of the health system and care providers in Tanzania; to:

1. Invest more resources for new public infrastructure for maternal care, upgrade and optimize use of the existing ones, and improve supply of essential material resources for antenatal, intrapartum and postnatal care.
2. Introduce/strengthen competency-based pre-service and on-the-job training in maternal health care including use of the partogram and Health Management Information System, and improve supervisory mechanisms.
3. Introduce and monitor audits for maternal mortality and severe morbidity in all hospitals in order to improve the quality of maternity care.
4. Employ the concept of "task shifting" to address the acute shortage of skilled workforce for maternal health and scale up CEmOC services in hard to reach rural areas.

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Summary

The studies presented in this thesis were designed to apply the principles of operations research to develop a set of sound and scientifically derived solutions for maternal health care in Tanzania. This thesis describes the results of studies carried out in Dar es Salaam and Kilombero district in Tanzania from 2005 to 2010.

Chapter 1 is a general introduction which describes the magnitude of the problem of maternal health, factors for change and the application of the concept of operations research in an attempt to test the feasibility and effectiveness interventions for maternal health in Tanzania. It highlights poor maternal health indicators in Tanzania; maternal mortality ratio 449/100,000 live births, health facility delivery 47%, met need for EmOC 15-30% and caesarean section rate 3%.

Chapters 2 – 6 describe definition of the problem of maternal health care in Tanzania. Findings from these studies indicate that during the study period the majority (72%) of all deliveries in Dar es Salaam took place in the four available public hospitals. Two of these hospitals did not provide theatre and blood transfusion services for 24 hours per day. Two public health centres did not provide delivery services at all and 83% of the dispensaries had poorly established obstetric services. There was only one public neonatal unit that served as a referral institution for all sick newborns delivered in public health institutions in the region. On the other hand, there was a severe shortage of essential categories of health staff for perinatal care in all institutions. The ranges of WISN ratios for nursing staff working in the municipal hospitals' labour wards were; nurse officers 0.5 – 1, trained nurses/midwives 0.2 - 0.4 and nurse assistants 0.1.

This section indicates also that of all partograms reviewed, 50% had no records of duration of labour. Although cervical dilation and fetal heart rates were recorded in 97% and 94% of the partograms respectively, 63% and 91% of these were judged to be substandard. Substandard monitoring of fetal heart rates was strongly associated with poor fetal outcome (p-value

0.001). Blood pressure, temperature, and pulse rates were not recorded in 47%–76% of partograms.

The study on Health Management Information System for maternal health care in Tanzania indicated that of all respondents, 81% had never been trained on HMIS, 65% did not properly define this system, 54% didn't know who is supposed to use the information collected and 42% did not use the collected data for planning, budgeting and evaluation of services provision. Although the attitude towards the system was positive among 91%, the reviewed HMIS booklets were never completed in 25% - 55% of the facilities. The gaps in the current HMIS were linked to lack of training, inactive supervision, staff workload pressure and the lengthy and laborious nature of the system.

The section indicates that out of 8 major hospitals in Dar es Salaam maternal and perinatal systems only existed in 4 and 3 hospitals respectively, and key decision makers did not take part in audit committees. Sixty percent of care providers in the study area were not aware of even a single action which had ever been implemented in their hospitals because of audit recommendations. There were neither records of the key decision points, action plan, nor regular analysis of the audit reports in any of the facilities where such audit systems existed.

A systematic review of maternal health interventions in resource limited countries revealed that programs integrating multiple interventions were more likely to have significant positive impacts on maternal outcomes. Training in EmOC, placement of care providers, refurbishment of existing health facility infrastructure and improved supply of drugs, consumables and equipment for obstetric care were the most frequent interventions integrated in 52% - 65% of all 54 reviewed programs. Statistically significant reduction of maternal mortality ratio and case fatality rate were reported in 55% and 40% of the programs respectively. Insufficient implementation of evidence-based interventions in resources limited countries was closely linked to a lack of national resources, leadership skills and end-users factors.

Chapters 8 – 11 form a section describing the formulation of models, model solutions, and validation and analysis. The first model was on introduction of audits for maternal mortality and severe maternal morbidity in a rural district hospital in Tanzania. The audit results indicated that 94% of all severe morbidities had at least one area of substandard care. Patients, health workers and administration related substandard care factors were identified in 50% - 61% of women with severe morbidities. Improving responsiveness to obstetric emergencies, capacity building of the workforce for health care, referral system improvement and upgrading of health centres located in hard to reach areas to provide CEmOC were proposed and implemented as a result of audit.

Studies on antenatal care services delivery in rural Tanzania indicated that essential parameters like hemoglobin and urine albumin were assessed in 22% – 37% and blood pressure in 69% - 87% of all ANC visits. Fifty two (20%) severe maternal morbidities were attributed to substandard ANC, of these 39 had severe anemia and eclampsia combined. Substandard ANC was mainly attributed to shortage of staff, equipment and consumables.

This section presents also results from a second model of introduction of CEmOC services in remote health centres in Tanzania following training of Non-Physician Clinicians in CEmOC and anaesthesia. It shows that the first 8 months after introduction of CEmOC services in 3 health centres resulted in 179 caesarean sections, a remarkable increase of institutional deliveries by up to 300%, decreased fresh stillbirth rate (OR: 0.4; 95% CI: 0.1-1.7) and reduced obstetric referrals (OR: 0.2; 95% CI: 0.1-0.4)). There were two maternal deaths, both arriving in a moribund condition.

Chapter 12 presents the general discussion, conclusions and recommendations of this thesis. It indicates that the pre-test results summarized in this thesis from the study designs of this operations research, demonstrate a worrisome state of substandard care in maternal health care in Tanzania and a complex picture of interlinked underlying factors. The successes of post test of the two models of this operations research (i.e. introduction of obstetric audit in a rural

district hospital and CEmOC services in health centres located in hard to reach remote areas) contribute to the body of evidence-based solutions to the problem of maternal health in resource limited settings.

Samenvatting

Dit proefschrift beschrijft de resultaten van studies verricht in Dar es Salaam en Kilombero district in Tanzania tussen 2005 en 2010. Het betreft "operations research" met als doel de ontwikkeling van evidence-based interventies voor een adequate verloskundige zorg in Tanzania.

In hoofdstuk 1 wordt de ernst van het probleem omtrent maternale gezondheid in beeld gebracht. Tevens wordt het concept van "operations research" geïntroduceerd. De slechte staat van de maternale gezondheid in Tanzania wordt gekenschetst door een maternale sterfte ratio van 449 per 100.000 levendgeborenen, 47% bevallingen in gezondheidsfaciliteiten, een "met need" voor acute verloskundige zorg van 15-30% en een populatie sectio-percentages van 3%.

De verloskundige zorg in Tanzania is onderwerp van de hoofdstukken 2-6. In Dar es Salaam vond 72% van de bevallingen plaats in de vier grote overheidsziekenhuizen. Twee hiervan beschikten echter niet over operatiekamer en bloedtransfusie-faciliteiten gedurende 24 uur per dag. Twee openbare "health centres" beschikten niet over verloskamers en in 83% van de "dispensaries" was er sprake van slechte voorzieningen voor verloskundige zorg. In de stad is slechts een openbare afdeling voor intensieve neonatale zorg, waar alle zieke pasgeborenen terecht kunnen. In alle eenheden is ernstig tekort aan voldoende opgeleid personeel voor de perinatale zorg.

De duur van de bevalling was slechts gedocumenteerd in 50% van de partus. In 63% waar het de ontsluiting van de cervix betrof en in 91% van de registratie van de kinderlijke harttonen bleek sprake van substandaard documentatie. Dit laatste was statistisch significant gerelateerd aan een slechte perinatale uitkomst. Bloeddruk, polsfrequentie en temperatuur werden niet gedocumenteerd in 47-76% van de partogrammen.

Respondenten in de studie over het "Health Management Information System" voor de verloskundige zorg in Tanzania bleken in overgrote meerderheid (81%) niet te zijn opgeleid in het gebruik ervan, 65% kon het niet goed definiëren, 54% wist niet wie de gegevens verzameld door HMIS moesten gebruiken en 42% gebruikten de gegevens niet voor het organiseren en bijsturen van de zorg. Hoewel 91% positief was gestemd over HMIS, werden de HMIS formulieren niet compleet ingevuld in 25-55% van de gezondheidinstellingen. Dit alles werd geweten aan een gebrek aan training, te weinig supervisie, te hoge werkdruk en de ingewikkeldheid en gebruikersonvriendelijkheid van het systeem.

In de 8 grote ziekenhuizen in Dar es Salaam waren maternale en perinatale audit systemen slechts aanwezig in 4 en 3 daarvan en er werd niet aan deelgenomen door de belangrijkste beleidsmakers. In het studie gebied kon 60% van de gezondheidswerkers zich niet herinneren dat ooit vanwege een aanbeveling voortkomend uit een audit-bijeenkomst een verandering had

plaatsgevonden. Er waren ook geen verslagen van dergelijke bijeenkomsten in de verschillende zorginstellingen.

Een systematisch review van interventies op het gebied van de verloskundige zorg in lage lonen landen gaf te zien dat het integreren van verschillende interventies in een allesomvattend programma de meeste vruchten zou afwerpen op de maternale uitkomsten. De interventies die het vaakst werden genoemd in 52-65% van de 54 onderzochte programma's waren: training van acute verloskundige complicaties, het recruterende van voldoende hulp personeel, het opknappen van de infrastructuur van de gezondheidsvoorzieningen alsmede een verbeterde aanvoer van geneesmiddelen, materialen en equipment voor verloskundige zorg. In 55% en 40% werd een statistisch significante daling van de maternale sterfte alsmede van de "case fatality rate" gerapporteerd.

In de hoofdstukken 8-11 worden model-oplossingen beschreven en geanalyseerd. Het betrof in de eerste plaats de introductie van audit van maternale mortaliteit en ernstige morbiditeit in een ruraal districtsziekenhuis in Tanzania. Er was sprake van tenminste één substandaardzorgfactor in 94% van alle gevallen van ernstige morbiditeit. Deze factoren waren patiënt-, of gezondheidswerker-gerelateerd of hadden te maken met de organisatie van de zorg in 50-61% van de vrouwen met ernstige morbiditeit. De belangrijkste aanbevelingen bestonden uit het verbeteren van de acute verloskundige zorg en teambuilding en het verbeteren van het verwijssysteem. Ook werden verafgelegen health centers van zodanige extra voorzieningen voorzien dat ter plekke bijv. sectio caesarea kon worden verricht in plaats van een verwijzing naar het verafgelegen ziekenhuis. Uit de audit bleek dat de kwaliteit van de antenatale zorg verbeterd dient te worden. Hemoglobine werd slechts in 22%, eiwit in de urine in 37% en de bloeddruk gemeten in 69-87% van de antenatale bezoeken. Substandaard antenatale zorg werd geïdentificeerd in 52 (20%) van de gevallen van ernstige maternale morbiditeit. Ernstige anemie en eclampsie trad op in 39 van hen.

In Ifakara werden non-physician clinicians getraind in acute verloskundige operatieve zorg. In de eerste 8 maanden na deze training verrichtten deze gezondheidswerkers in een drietal health centers 179 keizersnedes, terwijl het aantal bevallingen met 300% toenam. Dit leidde tot een vermindering van het aantal doodgeboren kinderen (OR: 0.4; 95% CI 0.1-0.7) en een vermindering van het aantal verwijzingen naar het ziekenhuis (OR 0.2; 95% CI 0.1.-0.4).

In hoofdstuk 12 volgt de algemene discussie, waar de nadruk wordt gelegd op de slechte staat waarin de verloskundige zorg in Tanzania zich bevindt. Audit en het verplaatsen van de acute verloskundige zorg van het ziekenhuis naar een extra daartoe toegerust gezondheidscentrum zijn enkele van de mogelijke oplossingen die kunnen leiden tot het verbeteren van de verloskundige zorg.

CURRICULUM VITAE

Angelo Sadock Nyamtema was born in Kigoma, Western Tanzania.

He studied medicine (1992-97) and specialized to become a gynaecologist (2000-3) in the Muhimbili University College of Health and Allied Sciences, Dar es Salaam Tanzania.

He has been medical officer in charge of Nkoaranga Lutheran Hospital/ Diocese of Meru Lutheran Evangelical Church from 1999-2000.

He has been clinical study coordinator of HIVIS Project (HIV Vaccine Immunogenicity Study) of the Muhimbili University of Health and Allied Sciences (MUHAS). This was a European Union funded project and a collaborative project between (MUHAS), as a lead institution, and the Karolinska Institute in Sweden from September 2003 to October 2005.

He was involved in the development of the proposal and implementation of the Dar es Salaam Region Perinatal Care Need Assessment Program (AXIOS Foundation funded study). This study was conducted from January to May 2005. Some of the papers in this thesis originate from this project.

From March – July 2005, he worked on contract basis with National AIDS Control program and WHO country office in collaboration with WHO Geneva in developing a proposal of the project that aimed at developing a tool (quantitative phase) that will be used to assess adherence to antiretroviral therapy in low-income countries. The project also aimed at determining factors affecting adherence in Tanzania (qualitative phase of the study).

He has been Assistant Director and Head of the Department of Clinical Medicine of the Tanzanian Training Centre for International Health Ifakara, Tanzania from 2005-2011.

Since 2011 he is the director of St Francis Designated District Hospital, Ifakara, Tanzania. From 2005 up till now he is Head of department of Obstetrics and Gynaecology. This is the place where the other papers in this thesis have been prepared.

List of Publications

1. **Nyamtema AS**, Mgaya HN, Hamudu NS. Obstetric Care, Factors Affecting Provision of Care and Pregnancy Outcome in Dar es Salaam District Hospitals – 2002. *Tanzania Med J* 2003; 18: 36-9
2. S Aboud, M Bakari, **A Nyamtema**, F Mugusi, R Josiah, E A Aris. Immunological responses to antiretroviral therapy in HIV-1 Infected Patients at Muhimbili National Hospital in Dar es Salaam, Tanzania. *Tanzania Med J* 2007; 22:1-4
3. **Nyamtema A**, Urassa D, Massawe S, Massawe A, Lindmark G, van Roosmalen J. Staffing needs for quality of perinatal care in Tanzania. *Afr J Reprod Health* 2008; 12: 113-24
4. **Angelo S. Nyamtema**, David P.Urassa, Siriel Massawe, Augustine Massawe, Deo Mtasiwa, G. Lindmark, J. van Roosmalen. Dar Es Salaam Perinatal Care Study: Needs Assessment for Quality of Care. *East Afr J Public Health* 2008; 5: 17-21
5. **A.S. Nyamtema**, D.P. Urassa, S. Massawe, A. Massawe, G. Lindmark and J. van Roosmalen. Partogram use in the Dar es Salaam perinatal care study. *Int J Gynecol Obstet* 2008; 100: 37-40
6. **Angelo S. Nyamtema**. Bridging the gaps in the Health Management Information System in the context of a changing health sector. *BMC Med Inform Decis Mak* 2010; 10: 36
7. **Nyamtema AS**, Urassa DP, Pembe AB, Kisanga F, Jos van Roosmalen. Factors for change in maternal and perinatal audit systems in Dar es Salaam hospitals, Tanzania. *BMC Pregnancy Childbirth* 2010; 10:29
8. **Angelo S Nyamtema**, David P Urassa and Jos van Roosmalen. Maternal health interventions in resource limited countries: a systematic review of packages, impacts and factors for change. *BMC Pregnancy Childbirth* 2011: 11: 30
9. **Angelo S. Nyamtema**, Senga K Pemba, Godfrey Mbaruku, Fulgence D. Rutasha, Jos van Roosmalen. Tanzanian lessons in using non-physician clinicians to scale up comprehensive emergency obstetric care in remote and rural areas. *Hum Resour Health* 2011; 9: 28
10. **Angelo S. Nyamtema**, Alise Bartsch-De Jong, David Urassa, Jos van Roosmalen. Using audit to enhance quality of maternity care in resource limited countries: lessons learnt from rural Tanzania. *BMC Pregnancy Childbirth* 2011; 11: 94
11. Van Hamersveld KT, den Bakker E, Nyamtema AS, van den Akker T, Mfinanga EH, van Elteren M, van Roosmalen J. Barriers to conducting effective obstetric audit in Ifakara: a qualitative assessment in an under-resourced setting in Tanzania. *Trop Med Int Health* 2012, in press
12. **Nyamtema AS**, Bartsch-de Jong A, Urassa D, Hagen JP, van Roosmalen. The quality of antenatal care in rural Tanzania: what is behind the number of visits? Submitted

Safe motherhood proefschriften

- 1995: Safe motherhood: The role of oral (methyl)ergometrin in the prevention of postpartum haemorrhage. (Akosua N.J.A. de Groot), Nijmegen
- 1995: Safe motherhood: Perinatal assessment in rural Tanzania. (Gijs E.L. Walraven), Nijmegen
- 1998: Safe motherhood: Confidential enquiries into Maternal Deaths in the Netherlands, 1983-1992. (Nico W.E. Schuitemaker), Leiden
- 1999: Safe motherhood: Confidential enquiries into Maternal Deaths in Surinam. (Ashok S. Mungra), Leiden
- 2003: Safe motherhood: Reproductive health matters in rural Ghana. (Diederike W. Geelhoed), Leiden
- 2004: Safe Motherhood: Vaginal birth after caesarean section in Zimbabwe and The Netherlands (Wilbert A. Spaans), Amsterdam AMC
- 2004: Safe Motherhood and Health systems research: Health care seeking behaviour and utilisation of health services in Kalabo District (Jelle Stekelenburg), VU University Medical Centre, Amsterdam
- 2005: Safe Motherhood. Enhancing survival of mothers and their newborns in Tanzania (Godfrey Mbaruku), Karolinska Institute, Stockholm, Sweden
- 2008: Safe Motherhood. Beyond the numbers: confidential enquiries into maternal deaths in Accra-Ghana (Afishah Yakubu Zakariah, Accra, Ghana), Vrije Universiteit Brussel, België
- 2009 Safe Motherhood. Severe maternal morbidity in the Netherlands: the LEMMoN study (Joost Zwart), Leiden University Medical Centre, the Netherlands
- 2009 Safe Motherhood. Obstetric audit in Namibia and the Netherlands (Jeroen van Dillen), VU University Medical Centre, Amsterdam, the Netherlands
- 2010 Safe Motherhood. Confidential enquiries into maternal deaths in the Netherlands 1993-2005 (Joke Schutte), VU University Medical Centre, Amsterdam, the Netherlands
- 2011 Delay in Safe Motherhood (Luc van Lonkhuijzen), University Medical Centre Groningen, the Netherlands
- 2012 Safe Motherhood: Medical Mirrors: Maternal care in a Malawian district (Thomas van de Akker), VU University Medical Centre, Amsterdam, the Netherlands