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'What about the Mother?'

*Rising Caesarean Section Rates and their
Association with Maternal Near-Miss Morbidity and
Death in a Low-Resource Setting*

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Abstract

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In recent decades, there has been a seemingly inexhaustible rise in the use of caesarean section (CS) worldwide. The overall aim with this thesis is to explore the effects of and reasons for an increase in the CS rate at a university hospital in Dar es Salaam, Tanzania.

In *Study I*, we analysed time trends in CS rates and maternal and perinatal outcomes between 2000 and 2011 among different obstetric groups. In *Study II*, we documented the occurrence and panorama of maternal 'near-miss' morbidity and death, and analysed their association with CS complications. We also strived to determine if women with previous CS scars had an increased risk of maternal near-miss, death, or adverse perinatal outcomes in subsequent pregnancies. *Studies III and IV* explored women's and caregivers' in-depth perspectives on CS and caregivers' rationales for their hospital's high CS rate.

During the study period, the CS rate increased from 19% to 49%. The rise was accompanied by an increased maternal mortality ratio (odds ratio [OR] 1.5, 95% Confidence Interval [CI] 1.2–1.8) and improved perinatal outcomes. CS complications accounted for 7.9% (95% CI 5.6–11) of the maternal near-miss events and 13% (95% CI 6.4–23) of the maternal deaths. Multipara with previous CS scars had no increased risk of maternal near-miss or death compared with multipara with previous vaginal deliveries, and a lower risk of adverse perinatal outcomes (adjusted OR 0.51, 95% CI 0.33–0.80). Both women and caregivers stated they preferred vaginal birth, but caregivers also had a favourable attitude towards CS. Both groups justified maternal risks with CS by the need to 'secure' a healthy baby. Caregivers stated that they sometimes performed CSs on doubtful indications, partly due to dysfunctional team-work and a fear of being blamed by colleagues.

This thesis raises a concern that maternal health, interests, and voices are overlooked through the CS decision for the benefit of perinatal outcomes and caregivers' liability. An overuse of CS should be seen as a sign of substandard care and preventing such overuse needs to be among the key actions when formulating new targets for the post-2015 era.

Keywords: caesarean section, complications, attitudes, women, caregivers, low-income countries, Tanzania

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Women should not be denied access to caesarean delivery when needed, for want of funds or infrastructure; neither should they be placed under pressure to have a caesarean birth because of lack of professional care to support normal labour and delivery.

‘Statement on Caesarean Section’
Executive Board of the
International Federation of Gynecology and Obstetrics (2007)

List of Papers

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

- I Litorp, H., Kidanto, H. L., Nystrom, L., Darj, E., & Essén, B. (2013). Increasing caesarean section rates among low-risk groups. A panel study classifying deliveries according to Robson at a university hospital in Tanzania. *BMC Pregnancy and Childbirth*, 13: 107.
- II Litorp, H., Kidanto, H. L., Roost, M., Abeid, M., Nystrom, L., & Essén, B. (2014). Maternal near-miss and death and their association with caesarean section complications: a cross-sectional study at a university hospital and a regional hospital in Tanzania. *BMC Pregnancy and Childbirth*, 14: 244.
- III Litorp, H., Mgya, A., Kidanto, H. L., Johnsdotter, S., & Essén, B. (2014). 'What about the mother?' Women's and caregivers' perspectives on caesarean birth in a low-resource setting with rising caesarean section rates. *Submitted*.
- IV Litorp, H., Mgya, A., Mbekenga, C. K., Kidanto, H. L., Johnsdotter, S., & Essén, B. (2014). Fear, Blame and Transparency. Caregivers' rationales for high caesarean section rates in a low-resource setting. *Submitted*.

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Cover: Painting by 'Bwango', tinga-tinga artist working along the Dar es Salaam coastline.

Contents

Abbreviations.....	9
Glossary and definitions of variables.....	10
Preface	11
Introduction.....	13
The global burden of maternal ill-health and death.....	13
International efforts to reduce maternal death	13
The maternal near-miss concept	14
Caesarean section	15
CS rates and indications.....	15
The Robson classification.....	15
Short-term risks with CS	16
Risks in subsequent pregnancies	17
Economic implications of high CS rates.....	17
Maternal characteristics and women’s CS attitudes	18
Obstetrical practices and caregivers’ CS attitudes.....	18
Conceptual frameworks	20
FIGOs ‘Ethical Issues in Obstetrics and Gynaecology’	20
Blame avoidance and defence strategies	22
Transparency and reactivity mechanisms.....	22
Rationale for the thesis: <i>What is the riddle?</i>	23
Aim	24
Methods	26
Study setting.....	26
Study I.....	31
Study IIa.....	33
Study IIb.....	36
Data quality check of the obstetric database at MNH	37
Studies III and IV	38
Ethical considerations	42
Results.....	44
Study I.....	44

Study IIa	46
Study IIb	47
Data quality check of the obstetric database at MNH	50
Study III	51
Study IV	54
Participant observations and reflections	58
Discussion	61
<i>What are the effects of a high CS rate in a low-resource setting?</i>	61
<i>What are the reasons for a high CS rate in a low-resource setting?</i>	65
<i>What can be done?</i>	72
Methodological considerations	74
Quantitative data collections	74
Qualitative data collection	76
Conclusion	79
Clinical recommendations	80
Summary in Swedish/Sammanfattning på svenska	84
Summary in Kiswahili/Muhtasari kwa Kiswahili	87
Summary in English	90
Acknowledgements	93
References	95
Appendix	111

Abbreviations

CI	Confidence Interval
CS	Caesarean Section
FGD	Focus Group Discussion
FIGO	International Federation of Gynecology and Obstetrics
MNH	Muhimbili National Hospital
MNM	Maternal Near-Miss
MMR	Maternal Mortality Ratio
OR	Odds Ratio
PMR	Perinatal Mortality Ratio
TH	Temeke Hospital
WHO	World Health Organization

Glossary and definitions of variables

Absolute contribution of the Robson group to the total caesarean section rate: the number of caesarean sections in each group divided by the total number of deliveries.

Apgar score: score ranging from 0–10 based on a newborn's tone, colour, respiration, pulse rate, and responsiveness at 1, 5, and 10 minutes.

Caesarean section rate: the number of caesarean sections divided by the total number of deliveries.

High- middle- and low-income countries: a World Bank classification of countries depending on their gross national income.

International Federation of Gynecology and Obstetrics: professional organisation including obstetrical and gynaecological associations worldwide dedicated to the improvement of women's health and rights.

Intra-partum stillbirth: stillbirth with recorded foetal heart beats on arrival to hospital.

Maternal death: the death of a woman while pregnant or within 42 days after termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management.

Maternal mortality ratio: number of maternal deaths per 100,000 live births.

Maternal near-miss: a woman who almost dies but survives a complication during pregnancy, childbirth, or within 42 days after termination of pregnancy.

Maternal near-miss ratio: number of maternal near-miss events per 1,000 live births.

Millennium Development Goals: eight global targets adopted by the United Nations in 2000 to improve global health. The fifth goal states that maternal mortality should be reduced by 75% in 2015 compared to the 1990 level.

Mortality index: number of maternal deaths divided by the total number of maternal near-miss events and maternal deaths.

Neonatal distress: number of live births with Apgar score < 7 at 5 minutes divided by the total number of live births.

Perinatal death: stillbirth or neonatal death within seven days after birth.

Perinatal mortality ratio: number of perinatal deaths per 1,000 deliveries.

Relative size of the Robson group: total number of deliveries in each group divided by the total number of deliveries at the facility.

Stillbirth: newborn with no signs of life at or after 28 weeks' gestation.

Preface

It is early morning. After leaving my daughter at her pre-school and finally getting through the Dar es Salaam traffic jams, I jump out of the car and say goodbye to Herman. The sun is still mild; there is water left in the road pot-holes outside the hospital after yesterday's rain. I start the day at ward six, and go through the patients at the gynaecological, Eclampsia, and post-op wards. Only a few new cases today. After reaching the labour rooms, I can immediately tell today is a crowded day. Carefully I pad through the intake hall, trying to avoid stepping on any of the women sitting or sleeping on the floor. I exchange the usual greetings with one of the midwives; yes, my family is fine; work today is apparently good. I go to get an apron and ask the in-charge where she wants me.

A few hours later I realise something is happening in the intake hall. A woman sits on a stretcher. Three midwives try to arrange an oxygen tube while two others are shuffling a box underneath the foot of the bed. A junior doctor stands nearby, apparently stressed and frustrated, sounding upset as she speaks on her phone. She hangs up and I ask her what is going on. 'She's para three, came in this morning. She's taken local herbs to augment labour. She shouldn't have done it! Now the uterus is rupturing! I've tried to get the senior, but no-one's answering! And there are no sterile packs in the operating theatre'. Suddenly the woman on the stretcher collapses. One of the nurses approaches her and hammers her chest a few times. The junior doctor sits down at one of the chairs, swears to herself. I try to say that we have to do something, we have to do a proper resuscitation, we have to do a perimortem – anything! 'I'll go and see if there is some adrenalin!' she says and disappears into the other hall. Another midwife approaches the woman, hammers the chest a few times, and gives up. The resident comes back. There was no adrenaline. There was no sterile-pack. And the senior cannot be reached. And it does not matter anymore, because everything is already too late. So we all just stand there, doing nothing. After some time, people start dropping off, resuming their other working activities. And someone goes to get another white sheet.

Introduction

The year this thesis is published, 2015, is the final deadline for the eight Millennium Development Goals declared by the United Nations, including goal number five – to reduce maternal mortality by 75% compared to the 1990 level. At present it seems, however, unlikely that this global target will be attained, especially in Sub-Saharan Africa. One of the main challenges to improve maternal health is universal access to comprehensive emergency obstetric care, including life-saving procedures such as caesarean section (CS). In recent years, the use of this procedure has progressively increased, to the point where it has become a medical, economical, and inequity problem. Despite extensive research, the main drivers for this trend, especially in low-resource settings, are still unclear [1].

The global burden of maternal ill-health and death

Although pregnancy and childbirth is a normal event, up to 7.3% of women develop a life-threatening complication [2]. Globally, an estimated 289,000 maternal deaths occurred in 2013, with Sub-Saharan Africa accounting for 62% of these [3]. The most recent estimate of maternal mortality ratios (MMR) show that the MMR in developing regions is 14 times higher than the MMR in developed regions, with Sub-Saharan Africa having the highest estimate worldwide (510 per 100,000 live births, 95% confidence interval [CI] 380–730) [3].

International efforts to reduce maternal death

For a long time, maternal ill-health and death was a ‘non-issue’ to the international medical society. Not until 1985, when Rosenfield and Main published their classic paper, ‘Where is the M in Maternal and Child Health?’ [4], and the World Health Organization (WHO) announced that half a million women die each year from complications related to pregnancy and childbirth, was attention focused on maternal health. The Safe Motherhood Initiative launched in 1987 after the Nairobi conference made maternal survival a global public health priority, but suggested a number of actions which were later proven ineffective to reduce maternal mortality or were extremely complex, such as the training of traditional birth attendants, strong

focus on risk-pregnancies, and improving women's socio-economic status [5]. Later efforts instead focused on women's access to professional medical care and adopted the approach that 'every woman is at risk' [6].

The urgency to reduce maternal mortality was further restated in the Millennium Development Goals adopted in 2000 [7]. Despite the global attention resulting from this declaration, it is now apparent that the international community has failed to reduce maternal mortality in the most vulnerable countries. Among nations with MMRs > 100 per 100,000 live births, only 11 are 'on track', 63 are 'making progress', and 13 are 'making insufficient progress' to accomplish the fifth Millennium Development Goal. Hence, in the post-2015 discussions, new targets and agendas are now being proposed. While social and economic changes take time [8], many stakeholders argue that one of the most urgent and cost-effective ways to reduce maternal mortality is to upgrade and improve the quality of emergency obstetric care within the existing health care systems [2, 3, 6, 9-11]. Some also argue that because mortality rates are declining in many countries, focus needs to be directed towards the causes and prevention of maternal morbidities, an equally important aspect of maternal ill-health [10].

The maternal near-miss concept

The maternal near-miss (MNM) concept has received growing attention in recent years as a way to assess severe maternal morbidity potentially leading to death. According to the WHO, an MNM refers to 'a woman who almost dies but survives a complication during pregnancy, childbirth, or within 42 days after termination of pregnancy' [12]. Until recently, different criteria have been used to define MNM [13], but in 2009, the WHO presented new criteria for MNM in order to facilitate comparisons between different studies [12]. The new criteria have been explicitly developed to represent aspects of organ dysfunction, and thereby reflect true critical illness [14].

Although survival after MNM is sometimes portrayed as a success story, being the result of proper and timely health care interventions, women might suffer from a range of short- and long-term complications after an MNM event. Costs related to care and loss of workforce often means that a large proportion of the household resources have been mobilised and consumed, which may have economic impact on the whole family [15, 16]. A study from Burkina Faso reported that women who survive an MNM event have an increased risk of all-cause, as well as pregnancy-related, death in the ensuing four years [17]. Although a living child is a protective factor, experiencing an MNM event can lead to disruption of social identity and stability [16]. Thus, providing optimal care is crucial, not only to prevent maternal deaths, but also to avert pregnancy-related morbidities and disabilities [18, 19].

Caesarean section

CS, that is, the delivery of a foetus through a woman's abdominal wall, is a surgical procedure traditionally performed for a range of medical reasons, such as obstructed labour and malpresentation. Ecological studies have reported an inverse relationship between low CS rates and high MMRs [20-22]. On the other hand, CS rates above a certain level do not demonstrate any additional benefits for mothers or babies, and might even be harmful [23].

CS rates and indications

Much has happened with the CS rates since the WHO published its recommendation in 1985; that CS rates should not exceed 15% [24]. Although more recent publications support the WHO's recommendation and state that CS rates above 10% do not reduce maternal or neonatal mortality [21, 25], CS rates have continued to climb worldwide. Currently, over a third of deliveries in the U.S. are CSs [26], and half of women in Iran, China, and Brazil deliver by CS [27, 28]. Many European countries also show a steady upward trend, with countries such as Italy and Portugal reaching 35% CSs [29]. Although the most urgent problem in most developing countries is an unmet need for CS, and there are extreme variations between and within countries [22, 30], reports of climbing CS rates are increasingly coming from urban institutions in the developing world, including from Africa; 22–28.9% in northern Tanzania [31, 32], 24.4% in Ethiopia, 34.5–40.1% in Nigeria [33, 34], 38.1% in Kenya [35], and 60.4% in South Africa [36].

Even though most authors argue that an optimal CS rate does not exist [30, 37] and that CS rates should vary between different delivery units depending on their obstetric populations [38], an extremely high CS rate suggests that CS is inadequately used [37]. With such inadequate use, or 'over-use', it often means that CSs are performed on dubious indications, that is, that the CS indication does not meet commonly accepted standards or criteria. Over the years, various classification systems for CS indications have been suggested to monitor and evaluate CS rates, with absolute maternal indications such as obstructed labour being prioritised over non-absolute indications such as foetal distress [37, 39]. CS indications are, however, subjective, and reports from low-income countries suggest that CS indications are often inaccurate or improperly recorded [31, 40-42].

The Robson classification

Since its publication in 2001, the Robson classification has been accepted as a means of analysing and comparing CS rates throughout the world [43]. Compared to CS indications, the classification system objectively assesses

CS rates among women with different obstetric characteristics. The classification is founded on four concepts (previous obstetric history, number of fetuses and their presentation, start of labour, and gestational age), and by applying these concepts women are divided into ten groups. The Robson classification has been used in several studies in high- and middle-income countries [1], and because it requires minimal resources, it might also be valuable in low-resource settings [44, 45].

Short-term risks with CS

Assessing the intrinsic risks with CS compared with vaginal birth is complex and often confounded by the indication that led to the operation. Despite extensive research on risks associated with CS, there are no randomised controlled trials with singleton pregnancies in a vertex position to provide evidence of whether or not planned CS for non-medical reasons is more hazardous than vaginal delivery [46]. To overcome the risk of indication bias, most observational studies have excluded women with severe pre-existing conditions, adjusted for potential confounders using regression models, or applied an ‘intention-to-treat’ approach, where emergency CSs are allocated to the vaginal group. A recent review statement from the American College of Obstetrics and Gynecology comparing planned CS with planned vaginal delivery found planned CS to be associated with longer maternal hospital stay, higher risk of infection, and more anaesthetic complications [26] than planned vaginal delivery. On the other hand, planned CS was associated with lower risk of postpartum haemorrhage, blood transfusion, and surgical complications. For neonates, planned CS was associated with higher risks of respiratory morbidity, but lower risk of foetal mortality, neonatal asphyxia, and birth trauma [26, 47]. To women with previous scars, planned CSs have been reported as being favourable in terms of neonatal outcomes compared to making an attempt at vaginal delivery [47].

Risks with CS must, however, be assessed within the context where they are performed. In low-income countries, proper anaesthetic services, timely and adequate blood supply, and proper aseptic measures are often lacking, which may increase the risks with CS [48, 49]. A multicentre study from Senegal and Mali including more than 78,000 women and applying the intention-to-treat approach, found that women who underwent planned CSs versus planned vaginal deliveries had similar risks of severe maternal morbidity and death, but planned CS was associated with lower risk of foetal loss compared to planned vaginal birth [50]. On the other hand, intra-partum CS was associated with higher risks of maternal morbidity and death compared to spontaneous vaginal birth, even after excluding women with pre-existing conditions. Another large study on CSs performed on non-medical indications in Africa, Asia, and Latin America concluded that both antepartum and intra-partum CSs increased the risk of maternal death, admission to

intensive care unit, blood transfusion, and emergency hysterectomy, and found this association stronger in Africa than in Asia and Latin America [51]. Increased risk of maternal death after CS, especially when performed intra-partum, has also been reported from a study in India, where women with medical and obstetrical co-morbidities were excluded [52]. In a recent WHO multicounty survey on MNM and death, CS was associated with higher risk of postpartum haemorrhage, however, the authors did not exclude or adjust for pre-existing conditions [53]. To summarise, there seems to be evidence that emergency CS, the dominant form of CS in most low-income countries [50], poses an intrinsic risk of maternal morbidity and death compared with vaginal birth.

Risks in subsequent pregnancies

With the current trend, the proportion of women with scarred uteri is inevitably on the rise. Compared to women with previous vaginal deliveries, women with CS scars have an increased risk of placenta previa [26, 54, 55], placenta accreta [26], and uterine rupture [26, 56, 57] in subsequent pregnancies. Repeat CSs have also been reported to involve increased risks of adhesion development [58], long operation time [58], injuries to bladder and bowel, and blood transfusion [55, 56, 59, 60] compared to primary CSs. Women with previous CSs also seem to have an increased risk of MNM events [2, 61]. Although adverse perinatal outcomes might be associated with the maternal morbidity that lead to the first CS [62], some studies have tried to address this problem and still report a higher risk of adverse perinatal outcomes among multipara with previous CSs compared with multipara with previous vaginal deliveries [63, 64]. In a recent meta-analysis, the risk of stillbirth was estimated to be 23% higher among women who had undergone CS in their last pregnancies (pooled OR 1.23, 95% CI 1.08–1.40) [65].

Economic implications of high CS rates

Because CS usually entails higher costs than vaginal delivery [66], CSs done routinely without medical indication may lead to unnecessary expenses. Conrad et al. estimated costs for ‘medicalised’ conditions in the U.S., and found normal pregnancy and childbirth, including CSs without medical indications, to be the biggest contributor to such expenditures [67]. Globally, the WHO has estimated that the overuse of CS could finance the underuse of CS more than five times over [37]. Also in low-resource settings, attention is growing to the costs related to medically unjustified CSs [28], as this practice may drain national and institutional resources and lead to health inequity [22, 37]. Moreover, CS often involves more costs to the individual women and their families than vaginal delivery [68, 69].

Maternal characteristics and women's CS attitudes

During past decades, birthing women in high- as well as low-income countries have become both older and heavier [70-73], and it has been reported that a high maternal age or body mass index independently increases the likelihood of CS [74, 75]. The CS trend does not, however, appear to be influenced by only maternal characteristics [76]. In many developed countries, a widespread media rhetoric has declared women 'too posh to push', implying that women want CS in order to avoid labour pains and have an 'easier' birth [77]. Although some mothers do prefer CS, and CS preferences vary widely between countries [47], much of the literature on women's CS beliefs and perceptions conclude that women who request CS comprise a small minority [77-81]. When women do request CS, it is often due to a perception that CS will guarantee a safer birth for them or their fetuses [47, 79, 81-84].

In Sub-Saharan Africa, cross-sectional studies have reported that most women prefer vaginal delivery [83, 85-87]. Surveys are, however, unable to capture complex explanations for women's birth preferences [68]. Because women's individual experiences and perceptions are largely influenced by social norms and expectations, preferences of birth must be understood within women's socio-cultural contexts [68, 88-91]. Care provision that is misaligned with local contextual beliefs is likely to be underused and might create barriers to choosing a facility birth [68, 69, 92].

Obstetrical practices and caregivers' CS attitudes

As maternal demand might not be the main driver for the CS rise, many authors argue that one explanation can be that that caregivers have lowered the threshold for performing CS [47, 93, 94]. Because CS can be scheduled during the daytime, and a drawn-out vaginal delivery can be avoided, some doctors prefer CS for their own and their patients' convenience [94-96]. Economic incentives and private practice have also been suggested to influence CS rates [80, 95-98], and in countries where lawsuits and litigation are practiced, caregivers might fear legal consequences after vaginal deliveries and opt for CS [95, 99-101]. Likewise, when the on-call obstetrician or anaesthesiologist are at home instead of at the hospital [102, 103], and when caregivers make CS decisions solo instead of in a group [104], CS rates are reported to be higher.

Generally, doctors are portrayed as being more positive towards CS than midwives [27, 28, 105], but both groups seem to perceive CS as the safest route for the baby [95, 105]. There are also reports that the sex, age, and working experience of the obstetrician influences their likelihood to perform CS [103, 106, 107]. In a survey from Canada, a larger proportion of young obstetricians (≤ 40 years) considered CS a safe procedure compared to their

older colleagues [107]. The way in which practices, indications, and perceptions of risks have changed over time illustrates that birth procedures are not only shaped by biomedical facts, but they are also culturally and socially situated [92].

Conceptual frameworks

For the overall discussion in this thesis, I will conceptualise my findings by using FIGO's (International Federation of Gynecology and Obstetrics) 'Ethical Issues in Obstetrics and Gynaecology' framework and I will specifically focus on the potential tension between the prioritising of maternal and newborn health. I will also situate my discussion within the debate on blame avoidance, defence strategies, and how transparency and auditing can have unintended and counterproductive effects.

FIGO's 'Ethical Issues in Obstetrics and Gynaecology'

The topic CS, whether it should be performed on maternal request or not, and to whose benefit interventions should be done, are under constant debate [4, 26, 47, 108, 109]. FIGO's 'Ethical Issues in Obstetrics and Gynecology' is a set of ethical recommendations and frameworks developed by FIGO's Committee for the Study of Ethics in Human Reproduction and Women's Health to guide and stimulate discussions among caregivers working with gynaecological and obstetric care [110]. For the purpose of this thesis, I will focus on selected recommendations from the following sections; 'Ethical framework for gynaecological and obstetric care', 'Safe motherhood', 'Ethical aspects regarding caesarean delivery for non-medical reasons', 'Ethical guidelines regarding interventions for foetal wellbeing', 'Task shifting in obstetric care', and 'The ethical aspects of sexual and reproductive rights'. Although many of these recommendations might seem uncontroversial, they provide a framework from which to approach issues related to CS, as well as women's right to maternity health care, as follows;

Justice requires that all be treated with equal consideration, irrespective of their socioeconomic status.

The principle of autonomy emphasises the important role women should play in decision-making in respect to their health care. Physicians should (...) expressly seek women's choices and respect their views.

Maternity is a social function and not a disease. Societies have an obligation to protect women's right to life when they go through pregnancy and child-birth.

Prevention of maternal death should be considered worldwide as a public health priority. Maternal mortality is a violation of women's rights, and not just as a health problem.

Antenatal and intra-natal care should be organised so that every woman with an obstetric life-threatening complication can be transferred without delay to a medical centre providing the human and technical resources required for emergency obstetrical care, including CS and blood transfusion.

CS is a surgical intervention with potential hazards for both mother and child. It also uses more health care resources than normal vaginal delivery.

Physicians have a professional duty to do nothing that may harm their patients. They also have an ethical duty to society to allocate health care resources wisely to procedures and treatments for which there is clear evidence of a net benefit to health.

Performing CS for non-medical reasons is ethically not justified.

Physicians are not obliged to perform an intervention for which there is no medical advantage.

While the majority of women (...) are usually ready to take risks on behalf of their foetuses, there may be situations where their interests do not coincide.

No woman who has the capacity to choose among health care options should be forced to undergo an unwished medical or surgical procedure in order to preserve the life or health of her foetus, as this would be a violation of her autonomy and fundamental human rights.

Health care providers should act in the best interests of the woman first and her foetus second.

Implementation of a task-shifting strategy requires ongoing training, monitoring, and evaluation of the providers.

Women and men have the right to make choices with their partners about whether or not to reproduce.

For a mother, the newborn child is often a precious and indissoluble part of her life and future, and the health needs of mothers and children are largely inseparable [19, 111, 112]. There might, however, be situations where maternal and newborn interests compete with each other for policy attention and finite resources, or where treatments and interventions that benefit one part might be unfavourable for the other [4, 109, 111, 113]. Such situations might present caregivers with difficult dilemmas. FIGO's ethical recommendations clearly state that when such events occur, maternal interests should be prioritised.

Blame avoidance and defence strategies

Blame avoidance is typically discussed as part of political and bureaucratic behaviour, and can involve strategies such as limiting blame (excuses) or turning blame into credit (justifications) [114]. Strategies for avoiding blame have, however, also been described among health care staff. Junior medical doctors have been reported to use coping mechanisms such as denial (the re-definition of a mistake to a non-mistake), discounting (externalising blame), and distancing (mechanisms for dealing with the imperfectability of human beings) to cope with medical mistakes [115]. Similar defence strategies have been described among specialists confronted with formal complaints and investigations [116, 117]. Given medical professionals' responsibility for life-and-death decisions, and the way in which wrong decision might have catastrophic consequences for their patients, these strategies can act as a way to lessen feelings of guilt, maintain a sense of control, and reinforce professional identity [115, 116].

Transparency and reactivity mechanisms

Transparency has been described as fixed and published rules within a clearly demarcated field of activity that are accessible to everyone [114]. It advocates openness, independent scrutiny, and accountability, and makes activities visible to the public [118]. Transparency can, for example, include rankings [119] or auditing, of which the latter has become widespread both inside and outside medical practice [120-123]. The word 'audit' is used to describe a range of methods for monitoring, investigating, and reporting [122], and the use of audits is currently increasing in many developing countries, especially within obstetric care [124]. In a medical audit cycle, care is critically analysed and measured against standards, and feedback is continually provided to the staff [125].

The idea with auditing is that in order to reduce the number of adverse outcomes, stakeholders and caregivers need to understand the underlying causes of the events [123]; however, audits may be time-consuming and create conflicts [122]. Transparency can also have other unintended, and even counterproductive, effects [118, 121]. The notion among professionals that they are continually observed, evaluated, and measured, can induce fear, anxiety, and guilt, feelings that have been labelled 'reactivity mechanisms' [118, 119]. Because knowledge and practices are partly socially constructed, and staff share narratives and notions with each other, new truths, norms, and customs can develop [92, 126, 127]. These reactions may alter behaviour, which can lead to defensive practice and a shift in focus where the outcome of the evaluation becomes more important than the outcome of the client [118, 119, 128].

Rationale for the thesis: *What is the riddle?*

This thesis originated from what we conceived as a paradox; an extremely high use of CS, an expensive and potentially hazardous mode of delivery, in settings with limited resources. Because this problem had been mostly a concern to high- and middle-income countries, most research originated from such settings. It was unclear – and even unlikely – that the same factors, such as maternal demand or fear of lawsuits, would apply in low-resource settings.

Although the Robson classification could provide a valuable tool to monitor CS rates in developing countries, there were no publications from low-resource settings using the Robson classification when we started the project. Neither were there any publications applying the new WHO MNM criteria. Many studies had presented case fatality rates for CS, and explored risks with CS compared to vaginal delivery, but there were few estimates of maternal morbidities and deaths directly attributed to CS complications [44, 129]. Most CS studies had focused on complications such as haemorrhage or thrombosis, and only a few had assessed life-threatening events in relation to CS [51, 130], none of which had used the new WHO MNM criteria. Risks in subsequent pregnancies had, with few exceptions [55, 131], mostly been studied in high-resource settings. Considering the high fertility rates and limited access to monitoring in low-resource settings, we hypothesised that complications of a CS scar could be more devastating in low-income countries and might even lead to a life-threatening condition. At the time we started the project, there was only one study that had explored a potential association between MNM and previous CS scar [61], in which MNM had not been defined according to the new WHO criteria.

Studies from Sub-Saharan Africa on women's CS attitudes had been mainly cross-sectional [83, 85-87] and did not explore women's in-depth perspectives. Most studies had focused on pregnant women, however, women who have gone through CS have better insights regarding the procedure and can contribute to a deeper understanding of acceptance, refusal, and request [86]. There was little known about how caregivers in Sub-Saharan Africa perceived CS [132], and how women and caregivers interacted with regards to CS decisions. Because women and caregivers might view CS and its complications differently [113], we wanted to illuminate their converging and diverging perspectives on CS.

Aim

The overall aim with this thesis is to explore the effects of and reasons for a sharp increase in the CS rate in a low-resource setting. The research questions of the five studies are presented in Figure 1.

The specific objectives of the studies are:

- To analyse time trends in CS rates and perinatal and maternal outcomes among different obstetric groups using the Robson classification (Study I);
- To describe the occurrence and panorama of MNM and death, explore their association with CS complications, and provide estimates of the proportion of MNM and death attributed to CS complications and the absolute risks for such outcomes (Study IIa);
- To explore if multipara with previous CSs have an increased risk of MNM, death, or adverse perinatal outcomes compared to multipara with previous vaginal deliveries (Study IIb);
- To explore women's and caregivers' in-depth perspectives (experiences, attitudes, perceptions, and beliefs) on CS as mode of delivery (Study III);
- To explore caregivers' rationales for their hospital's high CS rate in order to identify factors that might cause an overuse of CS (Study IV).

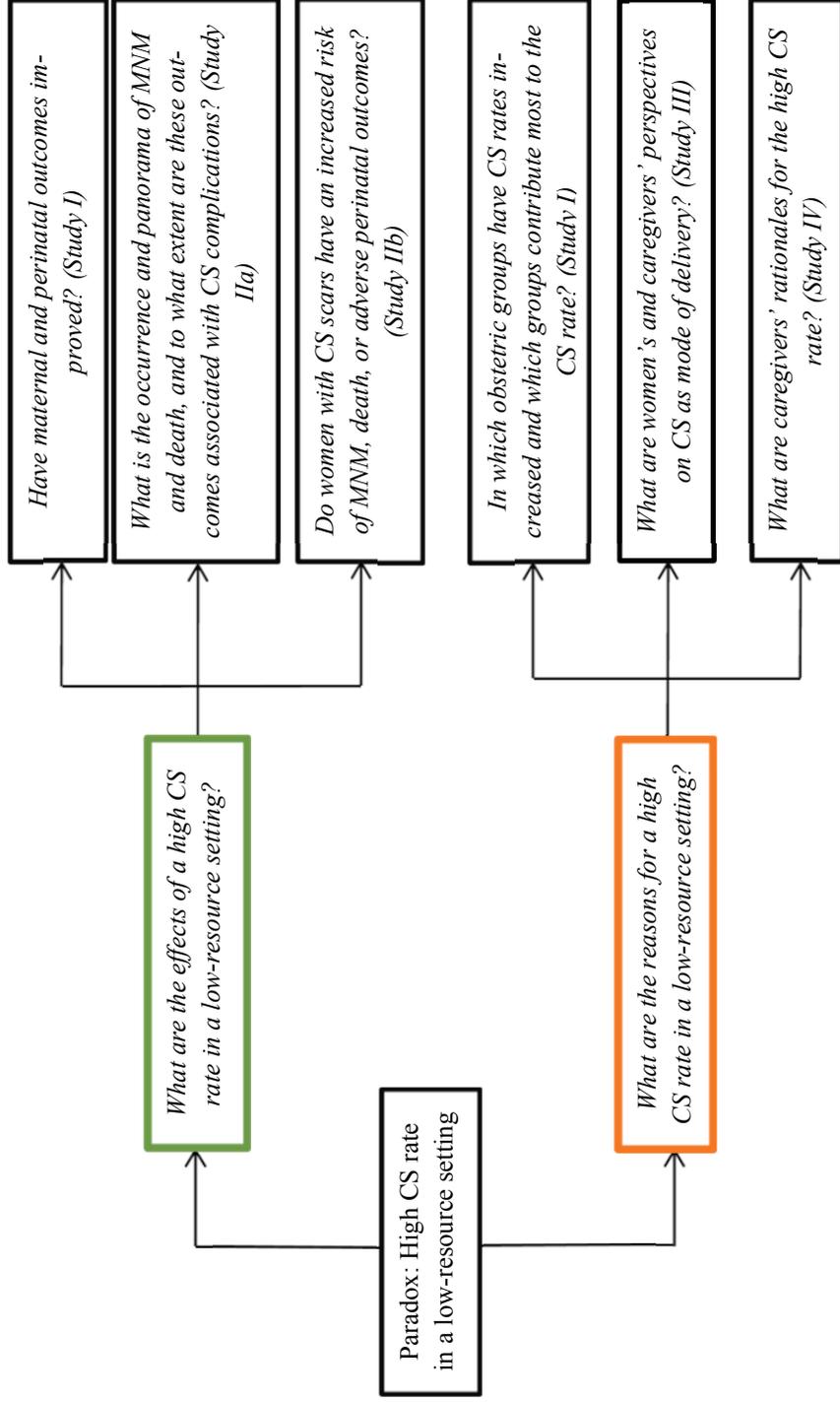


Figure 1. Research questions of the five studies, originating from the paradox of a high CS rate in a low-resource setting.

Methods

This thesis includes both quantitative and qualitative methods (Table 1). Statistical Package for Social Sciences version 20 was used for all statistical analysis. Definitions of all outcomes are defined under ‘Glossary and definitions’ (p. 10).

Table 1. *Overview of the methods used in the thesis*

Study	Design	Data collection	Participants	Analysis
I	Panel	Hospital register	137,094 deliveries at MNH, 2000 to 2011	Bivariate and multivariate logistic regression
Ila	Cross-sectional	Identification of MNM events and deaths	544 MNM events and deaths at MNH and TH, February to June 2012	Descriptive statistics. Case reviews.
Ilb	Analytical cross-sectional	Register and identification of MNM events and deaths	2,478 multipara at MNH, February to June 2012	Bivariate and multivariate logistic regression
III	Qualitative	In-depth interviews, FGDs, participant observations	13 women and 26 caregivers at MNH, May 2012 to March 2014	Thematic analysis
IV	Qualitative	In-depth interviews, FGDs, participant observations	32 caregivers at MNH, January to June 2014	Thematic analysis

Study setting

We performed our studies at Muhimbili National Hospital (MNH) and Temeke Hospital (TH), both located in Dar es Salaam, Tanzania.

The United Republic of Tanzania: Country and customs

Tanzania is, with its almost 45 million inhabitants, the largest country in East Africa in terms of both territory and population [133]. The country has been influenced by both German and English colonial rule, but gained full internal self-government in 1961. From this time until the mid-1980s, Julius Nyerere, the first president and ‘father of the nation’, ruled the country under the influence of by what has been labelled ‘African socialism’. In recent years, Tanzania has experienced rapid economic growth and increasing public investments [134]; however, with 28% of the population still living below the national poverty line, it is classified as a low-income country [135]. Although agriculture occupies almost 80% of the work force, Tanzania has undergone a rapid urbanisation process during the last decades, and currently many cities are struggling with a rapid population growth, insufficient infrastructure, and high levels of unemployment.

Tanzania is a diverse country with over 120 native ethnic groups, of which many have local languages and customs. Urbanisation has, however, partly dismantled the traditional social structures and decreased the roles of tribes and local languages [136]. Today, Tanzania’s social customs and lifestyles are widely spread on a continuum between traditional values and practices, often rooted in rural areas, and ‘modern’ influences from Europe encouraging individualism, materialism, and globalisation. To enhance inter-ethnic communication, Kiswahili and English have been appointed as the country’s official languages, of which the former is more widely spoken but the latter is the dominant language in commerce, administration, and higher education. Tanzanian worldview is, like in many other African countries, shaped largely by religion, and religion influences many Tanzanians’ daily lives as well as the political system [136]. The main regions include Christianity (60%) and Islam (30–35%); however, many followers of these religions still adhere to African Traditional Beliefs. In the community, spiritual leaders are often widely respected and held in higher esteem than other authorities. Other core values guiding social relations in the Tanzanian community are to be respectful of elders, disciplined, moral, honest, and hard-working.

Tanzanian society is largely patriarchal, with men enjoying most of the county’s socioeconomic resources and privileges. Traditionally, women and girls take care of household chores and agricultural work, while men are the main ‘bread-winners’ and ‘shelter providers’ who make important financial and political decisions. In many Tanzanian communities, women are not allowed to own or inherit property and land, and the only way to secure access to such assets is through a husband or grown-up son. As expressed by the former president Julius Nyerere, Tanzanian women ‘toil on the land they do not own, to produce what they do not control and at the end of the marriage, through divorce or death, they can be sent away empty handed’ [136]

(p. 159). Partly because of these conditions, childlessness is seen as a major personal tragedy. The traditional gender roles are, however, largely changing, and, in urban areas, division of labour is less clearly defined. The custom of women not having the right to own property has nowadays been overruled by a law that women should be able to own property, for example, land and home-based businesses, and there is a governmental goal aiming for more female leadership in the county's Parliament. In reality, however, traditions and customs have been difficult to change.

Although approximately half of the Tanzanian health budget comes from donor sources [137], it is the policy of the Tanzanian government that maternal health care should be provided free of charge. Due to an estimated 65% shortage of qualified medical staff, obstetric services in Tanzania are partly provided by non-physician clinicians; so-called assistant medical officers [137, 138]. These are secondary-school graduates who receive a total of five years' training, after which they are licensed to practice medicine and surgery. The Ministry of Health and Social Welfare has also established a 3-month course to train assistant medical officers and nurses to provide anaesthesia [70]. On a national level, 51% of births are assisted by a skilled professional and 5% are CSs [139], with large inequities in CS rates between the richest quintile and the poorest quintile [22]. Although antenatal care coverage is 96%, the proportion of women who receive the recommended four visits or more is only 43% [139]. The fertility rate has declined in recent years and displays large national variations, but remains high on a national level at 5.4 children born per woman [139].

Despite several health service programmes [70, 137] and obligatory maternal death reviews [140], Tanzania has been labelled by the WHO as 'making progress', but not 'on track', towards fulfilling the fifth Millennium Development Goal [3]. When the government, in 2010, realised that the country was lagging behind in achieving Millennium Development Goal 5, it launched a revised national target to reduce the MMR to 265 per 100,000 live births by 2015, instead of the 133 suggested by the millennium goals [137]. Still, however, the estimated MMR in 2013 (410, 95% CI 250–669) only indicates a decline of 55% compared to the 1990 level [3]. Unlike maternal mortality, the decline in child mortality has accelerated [137, 141], but the national perinatal mortality ratio (PMR) was still high at 36 per 1,000 pregnancies in 2010 [139].

Dar es Salaam

Dar es Salaam is the largest city in the country, and serves as a political, educational, and economical centre, with 4.36 million inhabitants [133]. Reproductive health indicators reflect the generally favourable socioeconomic situation in the city compared to the rest of the country; 91% of births in Dar es Salaam are assisted by a skilled professional, the antenatal care cov-

erage is 100% with 55% of the women coming for four visits or more, and the city's fertility rate is 3.7 children born per woman. On the flip-side of the economic growth, however, there is also an increasing problem of overweightness and obesity, with 45% of the population currently having such problems [139].

The city of Dar es Salaam is divided into three districts; Kinondoni, Ilala, and Temeke. In terms of health care structure, the referral system is hierarchical with the majority of births taking place at dispensaries, health centres, and peripheral hospitals. After an upgrade of the peripheral hospitals in the early 21st century, access to CS and other emergency obstetric interventions increased at these facilities. Within the public sector, CSs are currently performed at MNH, the three regional hospitals (TH, Amana Hospital, and Mwananyamala Hospital), the military hospital (Lugalo Hospital), and four health centres administratively defined as district hospitals. CSs and obstetric services are also provided by at least 10 hospitals and 16 health centres run by private establishments or non-government organisations. As in most other parts of the country, the referral system in Dar es Salaam functions improperly, with a limited number of ambulances, unreliable logistics, and poor communication systems [70].

Muhimbili National Hospital

MNH is the largest public hospital in the country and serves as a teaching and referral institution. After the peripheral hospitals were upgraded, the annual number of total births at MNH has gradually decreased from approximately 20,000 to 9,000 deliveries per year and the proportion of women referred from other hospitals has increased. The obstetric department is well-staffed with senior consultants (specialists with more than ten years of experience), specialists in obstetrics and gynaecology, residents (medical doctors doing their three-year specialist training), registrars (medical doctors working after completing their internship but before starting specialist training), interns (medical graduates doing their one-year practical training under supervision), and licenced midwives. CS decisions are formally made by a doctor, and the on-call team consists of one specialist, two residents, and one intern who are on duty for a 24-hour shift. Obstetric patients with critical conditions are admitted to the Eclampsia Ward, where staff monitor their vital signs hourly. In the hospital's central intensive care unit, treatment with vaso-active drugs and ventilation are available. Blood for transfusions is supplied through the hospital's blood bank, but the supply is sometimes insufficient and must be supplemented by the National Blood Bank. The majority of CSs are performed by a resident in obstetrics and gynaecology in one of the department's own two operating theatres. Anaesthesia is provided by nurse anaesthetic assistants (qualified nurses trained in anaesthesia) or

residents in anaesthesia. There are a few licensed anaesthesiologists, who mainly work as supervisors.

Since 2004, the obstetric department runs as a public-private partnership where costs for public patients are covered by the government and costs for private patients are debited to patients themselves or their insurance companies. Women with private status are attended by the same staff as public patients, but women with private status select a specialist whom they see continually during antenatal care and who is responsible for their delivery. During labour, women with private status are allocated separate wards located next to wards for public patients. With private patients, in comparison to public patients, the specialist is solely responsible for the birth outcome and any complaints are directed to him or her. When a private patient undergoes CS, doctors and staff at the operating theatre receive extra economic compensation. A certain percentage is also allocated to the management and is used for departmental investments. During the night, specialists can delegate the responsibility of their private patients to the residents on call.

MNH has a number of internal systems for quality check and review. At hospital level, a quality improvement section consisting of nurses and doctors perform audits every third to sixth month in order to assure proper record-keeping and management. Feed-back from these audits is provided to the staff through the nurses in charge at the respective wards. The hospital administration also has a special unit called 'KERO', where complaints from patients and relatives are handled. These complaints may lead to separate inquiries, which, after investigation, are submitted to the head of department and hospital management. At the obstetric department, a maternal mortality committee, comprised of obstetricians, midwives and nurses, and the heads of the pharmacy and the central laboratory services, meets every week to analyse maternal deaths. This committee has to comment on quality of care, identify gaps in the management, and decide if negligence, lack of resource, or understandable circumstances led to the death. All of the committee's recommendations are noted and handed to the hospital management for action. As a way to improve perinatal outcomes, audits of perinatal deaths were introduced in 2007 [142] and are currently performed every second or third month. Every week, maternal mortality meetings with the entire department staff are held, where cases with poor outcomes are presented by one of the residents and discussed without revealing patient or staff identity. As a daily routine, residents and interns in the on-call team report the night's events at the doctors' morning meeting and midwives report at the midwives' morning meeting.

Temeke Hospital

Temeke is the most rural district in Dar es Salaam. Because the district population is large enough to raise the need for a regional hospital and TH

expanded its services some years ago, the hospital was upgraded to a regional hospital in 2010. With regards to obstetric population and available resources, it is representative of the other two regional hospitals in Dar es Salaam. Every year, about 20,000 women deliver at the hospital. During the study period, two specialists in obstetrics and gynaecology, seven registrars, and eleven assistant medical officers worked in the obstetric and gynaecological wards. There is a conspicuous shortage of equipment, including gloves, syringes, and Oxytocin, and access to electricity and running water is unreliable. Therefore, women who plan to deliver at the hospital are urged to bring their own equipment. Laboratory services are rarely available. The Eclampsia Ward admits patients with eclampsia and other severe conditions, and magnesium sulphate is usually in stock. Blood for transfusions is provided by the National Blood Bank, which allocates a few units to the hospital every day. As there is only one operating theatre serving the entire hospital, the facilities cannot meet the demands for CS and patients are occasionally referred to MNH for surgery. CSs are performed by registrars or assistant medical officers. Anaesthesia is provided by nurse anaesthetic assistants or assistant medical officers.

In which obstetric groups have CS rates increased, which obstetric groups contribute most to the CS rate, and have maternal and perinatal outcomes improved?(Study I)

Study design and participants

This was a panel study conducted at MNH between 2000 and 2011. The panel consisted of repeated cross-sectional studies in which the 12 years were divided into four periods: 2000 to 2002, 2003 to 2005, 2006 to 2008, and 2009 to 2011. This was done in order to allow a more comprehensive analysis of time trends. We included all women who delivered at the hospital during the study period who had complete information on clinical characteristics and maternal and perinatal outcomes.

Data source

Data were extracted from the hospital's computerised obstetric register, which includes information on all deliveries of gestational age ≥ 28 weeks collected from women's antenatal cards and medical records regarding socio-demographic characteristics, events during antenatal care and delivery, and maternal and perinatal outcomes. The 28 weeks' gestation cut-off for

inclusion in the hospital registers is a locally set level from which a newborn can be expected to survive after birth, but is also the WHO's recommended cut-off for international comparisons of stillbirth statistics [143]. Maternal outcomes, such as maternal deaths or complications during pregnancy, labour, or postpartum period, are registered when the woman is discharged from the department. Outcomes of newborns admitted to the neonatal unit are recorded in the obstetric database for a period of up to seven days after birth. The database was established in 1999, and underwent continuous development during the study period, which affected the definitions of some of our variables.

Variables

For all deliveries, we collected data on birth-weight (< 2.5 kg or \geq 2.5 kg), parity (nullipara/multipara), previous CS (previous CS/no previous CS), plurality (single/multiple), presentation (cephalic/breech/transverse), labour (spontaneous/induced/no labour), and mode of delivery (CS/vaginal) and classified them into one of the ten Robson groups (Table 2).

Table 2. *The Robson classification system [144]*

Group	Obstetric characteristics
1	Nullipara with single, cephalic pregnancies \geq 37 weeks gestation in spontaneous labour
2	Nullipara with single, cephalic pregnancies \geq 37 weeks gestation who either had induced labour or CS before labour
3	Multipara with single, cephalic pregnancies \geq 37 weeks gestation in spontaneous labour
4	Multipara with single, cephalic pregnancies \geq 37 weeks gestation who either had induced labour or CS before labour
5	Multipara with CS scar and single, cephalic pregnancies \geq 37 weeks gestation
6	Nullipara with single, breech pregnancies
7	Multipara with single, breech pregnancies
8	Multiple pregnancies
9	Single pregnancies with transverse or oblique lie
10	Single, cephalic pregnancies \leq 36 weeks gestation

Because gestational age was based on fundal height between 2000 and 2004 and on the last menstruation period between 2005 and 2011, we decided not to use this variable. Instead, we used the WHO's definition of low birth-weight (< 2.5 kg) to separate groups one to five from group ten [145]. Although low birth-weight newborns include both preterm and growth-restricted babies, having a low birth-weight is closely associated with foetal and neonatal morbidity and mortality, thus reflects a vulnerable high-risk group [145]. Because no variable specifically described presentation, all deliveries without a diagnosis of breech or transverse lie were considered

cephalic. In the same manner, all deliveries not labelled as induced were considered to have had spontaneous labour, even if data were lacking. MMR, PMR, and neonatal distress defined as Apgar score < 7 at 5 minutes, were chosen to reflect maternal and perinatal outcomes.

Analysis

We applied one-way analysis of variance to analyse if there had been temporal changes in mean maternal age and parity during the study period. For each Robson group, the CS rate, the group's relative size, and its absolute contribution to the total CS rate were calculated. To detect temporal trends in these outcomes, as well as in MMR, PMR, and neonatal distress, we used the χ^2 test for trend. Perinatal outcomes were analysed separately in the ten Robson groups, while maternal deaths were only analysed as a total. We performed bivariate and multivariate logistic regression analyses to estimate the odds of a CS during the last time period in comparison with the first, adjusting for maternal age, referral status, and private health care insurance. These variables were included in the model as increased maternal age, being referred from another hospital, and having private health care insurance might increase the likelihood of CS [44, 74, 96]. In the multivariate analyses, we only included those variables that were significant in the bivariate analysis.

What is the occurrence and panorama of MNM and death, and to what extent are these outcomes associated with CS complications? (Study IIa)

Study design and participants

This was a cross-sectional study conducted at both MNH and TH between February and June 2012. We included MNM events based on the WHO criteria [14] and maternal deaths according to the WHO definition [146]. A near-miss criterion was considered fulfilled if stated in the medical record or if it could be observed during data collection, for example, hyperventilation, repeated fits, or jaundice in the presence of pre-eclampsia. Due to limited resources at the hospitals, some laboratory- and management-based criteria were not applicable. The definitions of the MNM criteria, their applicability in the two settings, and how we interpreted them are presented in the Appendix, Table 7. We followed women during hospitalisation until their discharge or death. Once women were discharged, they were considered to have survived. Women re-admitted to any of the study sites within 42 days after

termination of pregnancy who died were recorded as maternal deaths. Referrals from TH to MNH were presented in the data for MNH. Women who experienced two unrelated MNM events, such as eclampsia and infection, were recorded as two events.

Data sources

I visited all obstetric and gynaecological wards at the two hospitals every second day and reviewed medical records of admitted patients in order to identify cases. The record books in which midwives documented severe cases were also examined and staff were asked to alert the researcher if women with severe complications were admitted. Maternal death files routinely gathered by hospital staff were reviewed monthly. The total number of deliveries, live births, and CSs were derived from the obstetric database at MNH and the birth register at TH.

Variables

We collected data on maternal age, education, marital status, private/public status, area of residence, parity, gestational age, previous CS, chronic diseases, HIV status, complications detected at antenatal clinic, referral status, time and reason for admission, time and place of termination of pregnancy, mode of delivery, induction, CS indication, MNM criteria fulfilled and whether they were fulfilled before or after arrival to hospital, presence of foetal heart rate on arrival (yes/no), condition of the baby at birth (stillbirth/live birth), Apgar score at 1 and 5 minutes, cause of MNM or death, and any conditions contributing to the MNM or death. When the underlying cause of MNM or death was unclear, the case was discussed between three of the authors and guidance was sought in the International Statistical Classification of Diseases and Related Health Problems-Maternal Mortality [146]. As the exact chain of events was often difficult to follow due to a lack of information from referring institutions, the leading cause of MNM or death was considered to be the diagnosis that most likely had put the woman in a life-threatening condition or caused her death. Our definition thereby deviated from the international classification system of maternal deaths, where the underlying cause is defined as the disease or condition that initiated the morbid chain of events leading to a woman's death [146].

In order to determine if a MNM event or death had occurred due to a CS complication, we assessed all cases that fulfilled their first MNM criterion or died after having a CS, or had a diagnosis that implied a CS complication. All cases potentially associated with CS were reviewed by four of the authors to reach a consensus on whether they were associated with the CS or not. In the assessment, which was done after data collection had finished, the indication of CS, the timing of MNM or death, and any pre-existing condi-

tions were taken into account. The association between MNM or death and CS was graded as strong, moderate, weak, or no association (Table 3). In cases where there were disagreements among the assessors about whether the case was associated with CS or not, the case was allocated to either the ‘no association’ or ‘weak association’ groups.

Table 3. *Assessment of MNM events and deaths to determine their association with CS*

Grade of association	Definition	Example
Strong	Complications specific to surgery or anaesthesia, the complication would not have occurred if the woman had undergone vaginal delivery	High spinal anaesthesia leading to cardiac arrest
Moderate	1) Complications with an increased risk after CS 2) Complications specific to surgery or anaesthesia, but with pre-existing conditions	1) Postpartum haemorrhage leading to shock, hysterectomy, blood transfusion, or death [49-53] 2) High spinal anaesthesia leading to cardiac arrest in a woman with pre-existing eclampsia
Weak	Complications with an increased risk after CS, but presence of severe symptoms of a pre-existing condition	Postpartum haemorrhage leading to hysterectomy in a woman with pre-existing eclampsia
No	The MNM event or death was not caused by a complication of the current CS	Hysterectomy in a woman with uterine rupture

Analysis

For each of the two hospitals, we calculated the MNM ratio and MMR. As the mortality index is a useful tool to demonstrate quality of care, we also computed this index for both hospitals. The proportion of MNM and death attributed to CS complications was calculated by dividing the number of MNM events and deaths with strong or moderate association with CS by the total number of MNM events and deaths at the two hospitals. To estimate the risk of CS complications per 1,000 operations, we divided the number of MNM events and deaths with strong or moderate association with CS by the total number of CSs at the two facilities. In this estimate we also coupled MNM events and maternal deaths to reflect severe maternal outcomes and to allow a more robust analysis [2]. Finally, we computed the risk ratio of life-threatening CS complications comparing the risk at MNH with that at TH.

Do women with CS scars have an increased risk of MNM, maternal death, or adverse perinatal outcomes? (Study Iib)

Study design and participants

This was an analytical cross-sectional study conducted at MNH, in which we combined data from Study Iia with data extracted from the hospital's database during the same time period. We included all multipara with gestational age ≥ 28 weeks who were admitted to or delivered at the hospital between February and June 2012. To create comparable groups, nullipara were excluded from the analyses.

Data sources

For all women identified as MNM or deaths in Study Iia, I collected data following the study procedures described above. For all other deliveries, data were extracted from the hospital's database. Before we merged the two datasets, cases collected as MNM events or deaths were identified using their personal 'admission number' and removed from the hospital's database in order to avoid duplicates. For the same reason, cases with missing 'admission' number were also removed.

Variables

We studied four outcomes: (1) MNM or death, which were coupled to reflect severe maternal outcomes [2]; (2) stillbirth; (3) neonatal distress; and (4) a combined variable labelled 'intra-partum stillbirth and neonatal distress', which allowed a more robust analysis of perinatal outcomes and enabled us to study adverse events that had occurred during hospital stay. We regarded scar from previous CS as exposure, and women were considered to have a previous CS scar if this was indicated on their antenatal card, diagnosed at the hospital, or cited as an indication for repeat CS. If not stated among these variables, a woman was considered not to have a CS scar. For MNM cases and deaths we collected information on indications and number of previous CSs, however, this information was not available in the hospital's database for the rest of the participants and could therefore not be used in the analyses. We regarded maternal age, parity, education, area of residence, private/public status, marital status, HIV status, referral status, and mode of delivery as potential confounders, and data were therefore collected on these variables. For MNM events and deaths, we had detailed information of complications and medical conditions. Although this information was less detailed in the hospital's database, we collected data on complications regis-

tered in the hospital's database, such as uterine rupture or placenta previa, in order to get a rough estimate of complications experienced by the participants.

Analysis

We used bivariate logistic regression to compare outcomes among women with previous CSs and previous vaginal deliveries, and multivariate regression analysis to control for potential confounders. Cases with missing information on perinatal outcomes were excluded from the bivariate and multivariate analyses. After the main analyses were done, we hypothesised that at this hospital, women with previous vaginal deliveries had experienced more serious complications and more delays than women with previous CSs. Therefore, we performed a sub-analysis where we categorised women into 'referred' or 'self-referred'. This allowed us to test if referred women with previous vaginal deliveries had worse outcomes than referred women with previous CSs, and if the results from the main analyses were applicable among self-referred women.

Data quality check of the obstetric database at MNH

In Studies I and IIb we used data from the obstetric database at MNH. Because any register data might contain errors that have developed during data collection or data entry, we wanted to estimate the reliability of the MNH database. In Study IIa, data collected by me on MNM cases had simultaneously been entered into the hospital's obstetric database by hospital staff, which provided us with an opportunity to measure the inter-rater agreement between these two separate data collections. For a random sample of women with complete information on clinical and socio-demographic characteristics, we calculated the Cohen's Kappa coefficient on selected variables (HIV status, education, marital status, area of residence, Apgar score at 1 and 5 minutes, foetal heart rate on arrival, mode of delivery, private/public status, maternal age, parity, referral status, induction of labour, and previous scar). The Kappa coefficient was chosen as it is the most commonly used statistic to estimate inter-rater agreement and takes into account that observers will sometimes agree or disagree simply by chance [147]. While a Kappa coefficient of 1.0 indicates 'perfect agreement', a Kappa coefficient of 0 indicates 'agreement equivalent to chance'. The degree of agreement can therefore be estimated on a scale between 0 and 1.0 [147].

What are women's and caregivers' perspectives on CS as mode of delivery? What are caregivers' rationales for the high CS rate? (Studies III and IV)

Studies III and IV were qualitative and some parts of the dataset were used in both studies. In these studies, all participants were recruited at MNH. To obtain a deep understanding of the CS rise within the specific context where it had occurred, the data collection and analyses were inspired by naturalistic inquiry [127].

Naturalistic inquiry

The 'naturalistic paradigm' was originally presented by Guba and Lincoln in the 1980s, and describes ways of performing qualitative research in human settings [127]. Based on a simple question ('*What's happening here?*') this paradigm proposes that reality is a 'whole cloth' and that all aspects of reality are interrelated. This paradigm assumes that there is not one single objective reality, but instead, multiple subjective realities. In an organisation, these diverging realities are constructed by groups and individuals to form convergent conclusions and realities, which act as a framework for the way in which people behave. The naturalistic researcher strives to understand these constructed realities, but also to share the constructions of those under investigation. Only when the researcher and the informants have compatible constructions of the setting, can communication take place. In this way, naturalistic inquiry is heavily context-dependent, and emphasises core elements such as prolonged engagement and persistent observations.

The naturalistic paradigm affirms the mutual influence that the researcher and respondent have on each other. Although advocates for naturalistic inquiry acknowledge the risks for bias and that informants change their behaviour in response to the researcher's expectations, they argue that the human interaction is the 'heart of research' and can never be sacrificed; 'The dangers of bias and reactivity are great; the dangers of being insulated from relevant data are greater' [127] (p. 15). Consequently, the relevance of gathered data is always prioritised over the rigor of formal methods. Other important aspects of naturalistic inquiry are to treat tacit data, such as intuitions and feelings, as equally important as verbally communicated data, and that theory does not govern the data collection but is used after analysis to communicate the findings. Lastly, naturalistic inquiry emphasises that although generalising qualitative research is difficult, a deep understanding of social phenomena might guide future inquiries in similar settings.

Study procedures

We performed participant observations, individual in-depth interviews, and focus group discussion (FGDs).

Participant observations

In much qualitative research, first-hand experience is both the starting point and filter through which data are interpreted [148]. While interviews reflect the respondents' interpretations of reality, observations enable the researcher to gain a partially independent view of the phenomena under research and share the respondents' constructions of reality. Guba and Lincoln explain the power in observations;

Observation maximises the inquirer's ability to grasp motives, beliefs, concerns, interests, unconscious behaviours, customs, and the like. Observation allows the inquirer to see the world as his subjects see it, to live in their time frames, to capture the phenomenon in an on its own terms, and to grasp the culture in its own nature, ongoing environment. (...) Observation allows the observer to build on tacit knowledge, both his own and that of members of the group [127] (p. 95).

When performing observations, the researcher can locate herself anywhere on a continuum between being a complete participant, who is a full member of the group, and a complete observer, who passively notices the activities but does not become involved in them. A naturalistic researcher will typically choose a role somewhere in the middle. Wolcott and Erlandson emphasise the importance of allowing enough time for the observations so that the observer becomes integrated into the context and her presence does not affect subjects' behaviour [127, 148]. While observations can range from being very focused to completely unstructured, usually less structured observations are preferred in the early stages of an inquiry.

During this PhD project, I lived in Dar es Salaam for six months in 2012, and three weeks in 2010 and 2014. Although my 'expat' status partly isolated me from the 'real' population of Dar es Salaam, informal conversations and daily-life experiences were crucial to my general understanding of the context and culture. More specifically, I performed participant observations at the two hospitals included in our studies. The observations were done repeatedly during the three time periods mentioned above, with a continuous period of observations between January and June 2012. At MNH, I participated in a programme for Swedish resident doctors, aimed at increasing Swedish resident doctors' knowledge and awareness of global health problems. Through this programme, I was both an active and passive member of the medical team, attending meetings, rounds, antenatal clinics, assisting during CSs, and 'hanging around' [148] in the labour ward. Through my research collaboration, I also got the chance to perform participant observa-

tions at TH. Although my observations at TH included some ‘hanging around’, I soon got a more active role where I took part in the midwives’ work the labour ward; I delivered babies, sutured tears, helped out with the resuscitation of newborns, and cleaned beds. It was always clear, however, that I was a visitor and had no medical responsibility or authority.

Individual interviews

In individual interviews, the interviewer registers and interprets the meaning of what respondents say and in what way they say it [149]. We used semi-structured in-depth interviews, in which the interviewer has a sequence of topics to be covered that all reflect different aspects of the research question. The interview guide usually contains examples of suggested questions, but there is an openness to change of sequence and forms of questions, in response to the interviewees’ answers. In this manner, respondents can bring forth any dimensions of the topics that they find important.

Interviews with women

To understand women’s experiences, perceptions, attitudes, and beliefs about CS, I recruited mothers (referred to as ‘women’) who had recently undergone CS. During the women’s hospital stays, I approached them face-to-face, presented them with written information about the study in Kiswahili, and asked them to leave their phone number if they were interested in participating. When recruiting women, we tried to obtain variation in age, parity, number of CSs, area of residence, socio-economic background, and indication of CS. Two months after discharge, we contacted women by phone and interviewed them in their own or their relatives’ homes. Family members were asked to leave the room during the interviews. I performed seven interviews in May 2012 and January 2014 with the help of an interpreter, who was an external interpreter in three interviews and one of the Kiswahili-speaking research group members in four interviews. Six interviews were performed in Kiswahili during March 2014 by one of the authors who is a PhD student in the research group and an obstetrician employed at MNH. The interviews always started with the question; ‘*Can you please start by telling me about your past deliveries?*’ and were followed by follow-up and probing questions in response to the women’s statements. The interview guide and examples of questions are presented in the Appendix, Table 8.

Interviews with caregivers

Caregivers were approached face-to-face or by phone by any of the two research group members employed as obstetricians at MNH. Respondents were orally informed about the study and asked to participate. In the recruitment, we tried to obtain variation in sex, age, professional status, and working experience. I interviewed informants during January 2014 at differ-

ent private locations at their work place. Interviews with caregivers started with the question; *'Can you please start by telling me about the last CS that you did/were involved in?'* Questions posed to caregivers included both their perspectives on CS as a mode of delivery and their rationales for the hospital's high CS rate. The interview guide and examples of questions are presented in the Appendix, Table 9. In the early analysis, we saw that midwives' responses were less expansive than those from doctors, possibly resulting from language barriers and my position as a physician and 'outsider'. Therefore, additional interviews with midwives were conducted in Kiswahili in June 2014 by a PhD and midwife who was not employed by the department.

Focus Group Discussions

The interaction between participants in a FGD is used to reflect opinions in light of social norms and expectations [150]. We performed two FGDs with caregivers; one with residents and one with midwives. To initiate the discussions, we showed the participants a graph of the CS rate at MNH between 2000 and 2011 and asked them to give us their thoughts. During the discussions, we intervened as little as possible, but tried to maximise the interaction between participants by encouraging them to debate and discuss their ideas and differences in opinions.

Participants

We performed interviews until no new information was retrieved and we decided that we had met saturation [127]. After saturation was met, we did, however, perform a number of additional interviews in order to member check our data with the new respondents [127]. In total, we did 13 interviews with women, all of which were included in Study III. The women were aged between 21 and 36 years, and had undergone between one and three CSs. Most women had undergone emergency CSs, while some had undergone elective operations. Half of the women had experience of previous vaginal births. The women varied in terms of socio-economic background and five women had a private health care insurance. All but one co-habited with the father of their newborn. Some women reported that they adhered to Christian religious beliefs, while other women were Muslims. Data from caregivers were used for both Study III and Study IV (Table 1). In total, we performed 22 individual interviews and 2 FGDs with 5–6 participants in each. The age range of the respondents was 27–70 years and their working experience in obstetrics was 2–45 years. Respondents were midwives (14), residents (11), specialists (5), and senior consultants (2). All midwives and a third of the doctors were women.

Analysis

Analysis began during the early interview phase in order to develop additional questions that were incorporated into subsequent interviews [127]. Interviews and FGDs were audio recorded and lasted 35–80 minutes. I transcribed the interviews and FGDs verbatim in English shortly after they had been conducted, in order to include any non-verbal communication and field notes in the transcripts. Interviews in Kiswahili were transcribed in Kiswahili and translated into English by one of the research group members. These transcripts were analysed jointly between him, the midwife who had interviewed midwives, and me, in order to ensure that our interpretation reflected the source data. Throughout data collection and analysis, I kept a reflexive journal to note my own thoughts and reactions. Also the two other interviewers wrote down reflections from their interviews, and during analysis we discussed and compared our different interpretations. Repeated discussions were also held with the other members of the multiprofessional research team. After completing multiple readings of the transcripts, I generated a list of codes that reflected interesting aspects of the data. Together with my main supervisor, who had participated in some interviews and read some of the transcripts, repeated similarities, patterns, and differences across the respondents were identified and interpreted into candidate themes using thematic analysis [151]. Themes were then reviewed and revised repeatedly until they cohered meaningfully but with clear distinctions between them.

Ethical considerations

Clearances to conduct the studies were obtained from the Ethics Board at Muhimbili University for Health and Allied Sciences. Clearance for Study I was obtained on 25 February 2011 (reference number MU/DRP/REC/VOL.1/25), clearance for Study II and interviews with women was obtained on 23 December 2011 (reference number MU/RP/AEC/Vol. XIII), and clearance for Studies III and IV was obtained on 30 July 2013 (reference number: MU/DRP/AEC/Vol.XVI/192). As a foreign researcher, I also applied for permission to conduct the studies at the Tanzania Commission for Science and Technology, which was granted on 17 February 2012 (reference number 2012-39-NA-2011-191). Permission to collect data for all studies was obtained from the administrations at both MNH and TH.

In Study I, we worked with completely anonymous data. In Study II, data were collected from women's medical records, but were coded and rendered anonymous as to patient identity when they were computerised. Due to the extensive number of medical records that were screened, it was not feasible to attain informed consent from all patients to read their medical records, and the fact that I read women's medical records which contained confidential

information posed an ethical dilemma. However, because the study was strictly observational, did not involve any risks for the patients, and we believed the results could be of benefit to the study population, we regarded this data collection as ethically justified.

During observations, hospital staff knew that I was a medical doctor conducting a research project about CS and MNM. All participants in interviews and FGDs were informed about the professional status of the researchers and that he or she had an interest in CS. Women we interviewed were provided with oral and written information about the study in Kiswahili, and were given a small token of gratitude for participating. They were assured that any opinions they expressed would not affect their treatment when seeking health care in the future. Caregivers were informed orally about the study. All respondents were guaranteed confidentially, and we received oral informed consent before starting the interviews. Because two of the research group members were employed as specialists at the department, we were concerned that residents and midwives might feel uncomfortable about talking freely, knowing that their responses would be shared with these senior colleagues. In order to maintain the confidentiality of the respondents, me and the midwife who conducted interviews ensured that the recordings and transcripts were made anonymous before they were shared with the other research group members. Another ethical dilemma was that caregivers might feel obliged to participate as they were approached by one of their senior colleagues. There was, however, always a possibility to excuse oneself from taking part by referring to the high workload, and we did not feel that any respondents participated involuntarily.

Interviews might, especially when focusing on personal experiences and interpersonal tensions, evoke feelings of emptiness and anxiety within the respondent, who share personal information without receiving much in return [149]. In our interviews, we always rounded off by asking the interviewees if there was anything else that they wanted to share or talk about. This often led to further discussions, in which we could share experiences and I could explain more about the purpose of the study. In the case of women, we also answered any medical queries they might have regarding themselves or family members, which was much appreciated by the respondents.

Results

The results from Study I raised new research questions, which were pursued in Studies II-IV. A summary of the findings in response to the research questions is presented in Figure 2.

In which obstetric groups have CS rates increased, which groups contribute most to the CS rate, and have maternal and perinatal outcomes improved? (Study I)

There were 139,315 deliveries registered in the MNH database between 2000 and 2011. Of these, 137,094 (98.4%) had complete information on all variables required for the Robson classification and were included in the study. During the study period, mean maternal age increased from 25.2 to 27.9 years (p for trend < 0.001), mean parity rose from 2.2 to 2.3 (p for trend < 0.001), and the proportion of women referred from other hospitals increased from 7.2% to 28%. The use of vacuum extraction remained at a constant low of 0.8 % of deliveries.

The total CS rate rose from 19% during the first time period (2000–2002) to 49% in the last time period (2009–2011), and remained significantly higher in the last time period after controlling for maternal age, referral status, and private health care insurance (adjusted OR 2.7, 95% CI 2.6–2.8). Because indications of CSs were not registered in the first time period, almost a quarter (23%) of the CSs had no recorded indication. In total, the most common indications were labour dystocia (obstructed labour, cephalo-pelvic disproportion, and poor progress) (28%), previous scar (22%), and foetal distress (8.1%), of which foetal distress increased most during the study period (from 6.6% to 13%).

All Robson groups except transverse lie had increased their CS rates. One of the groups with sharpest increase in CS rate (from 12% in the first time period to 33% in the last time period) was multipara without previous scars with single, cephalic pregnancies in spontaneous labour (group 3). This group was also largest of the Robson groups throughout the study period. Except for a sharp increase in the proportion of women with previous scars, there were little changes in the relative size of the obstetric groups over time,

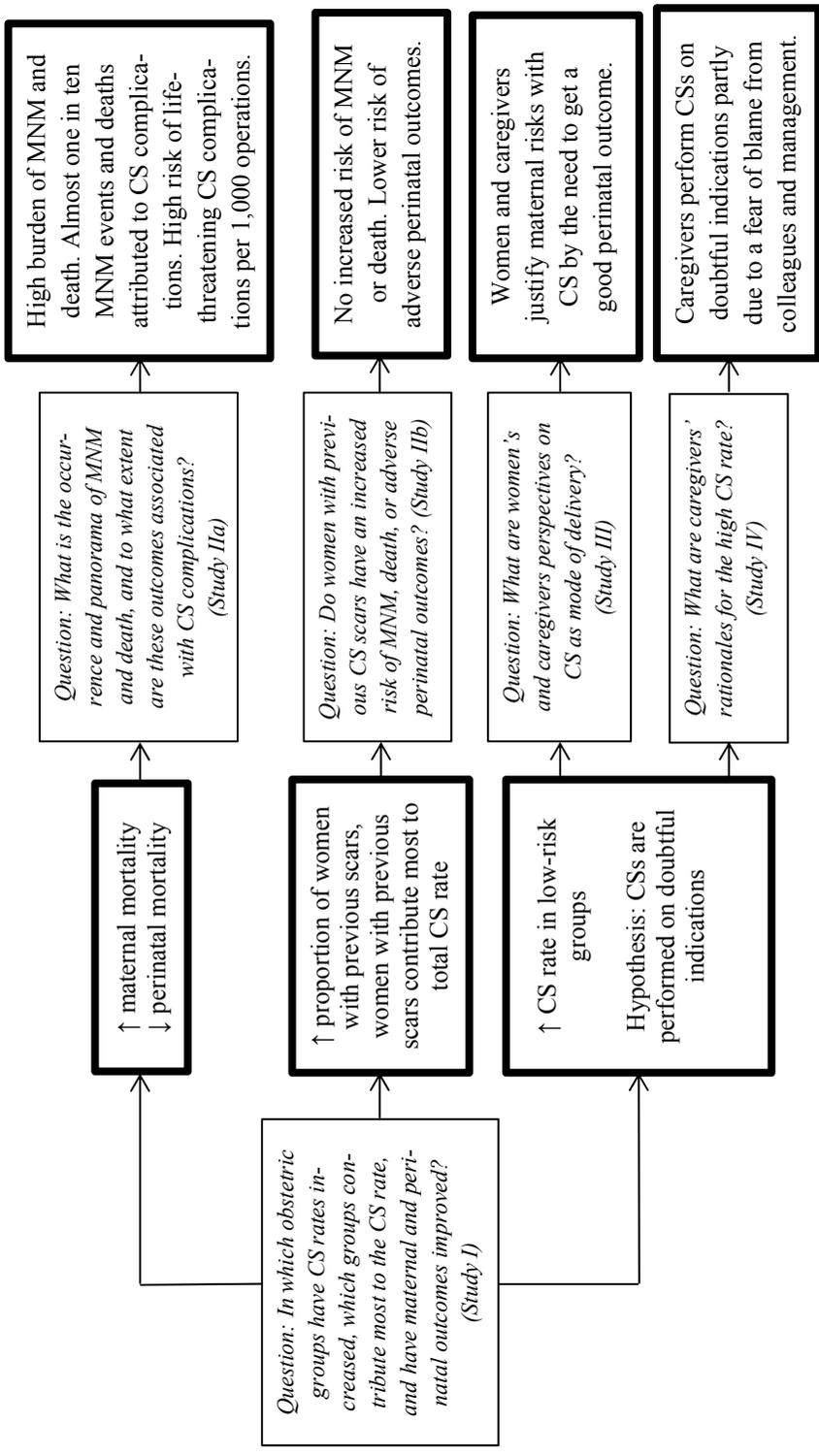


Figure 2. How the findings from Study I raised new research questions that were pursued in Studies II-IV.

but women with previous scars contributed most to the total CS rate in the last time period.

Between the first and last time period, the MMR increased from 453 per 100,000 live births to 650 per 100,000 live births (OR 1.5, 95% CI 1.2–1.8; p for trend = 0.031), while there was a total reduction in PMR (OR 0.81, 95% CI 0.77–0.85; p for trend < 0.001) and neonatal distress (OR 0.90, 95% CI 0.85–0.95, p for trend < 0.001). These improved perinatal outcomes did not, however, involve all Robson groups. Despite the sharp increase in CS rate among multipara without previous scars with single, cephalic pregnancies in spontaneous labour (group 3) there were no improved perinatal outcomes in this group.

What is the occurrence and panorama of MNM and death, and to what extent are these outcomes associated with CS complications? (Study IIa)

Between February and June 2012, we identified 467 MNM events and 77 maternal deaths among 13,121 live births. The total MNM ratio was 36 per 1,000 live births (95% CI 33–39) and the MMR was 587 per 100,000 live births (95% CI 460–730). The university hospital had a higher MNM ratio and MMR, but a lower mortality index than the regional hospital (13% vs. 18%). Most women who developed MNM or died had visited an antenatal clinic (88%), but in the majority of women (77%), no antenatal problems were detected.

The most common criteria fulfilled by women experiencing MNM events were fits (35%), shock (24%), and hysterectomy (10%). MNM criteria were fulfilled on arrival in 43% and after arrival in 56%. Most women with eclampsia met the MNM criteria on arrival (82%), while most women with uterine rupture met the criteria during hospital stay (71%). Major causes of MNM and death were hypertensive disorders (42%) and postpartum haemorrhage (13%), but we also detected several cases with iatrogenic complications. Among women who experienced MNM events or died and had a gestational age of ≥ 28 weeks, 36% delivered a stillborn baby and 21% of live births had an Apgar score < 7 at 5 minutes.

After assessing all cases who fulfilled their first MNM criterion or died after CS or had a diagnosis that implied a CS complication ($n=107$), we found that 49 MNM events and 10 deaths were associated with CS. Causes of MNM and death due to CS complications are presented in Table 4. In total, CS complications accounted for 7.9% (95% CI 5.6–11) of MNM events and 13% (95% CI 6.4–23) of maternal deaths. The risk of experiencing a life-threatening CS complication was three times higher at TH (22 per

1,000 operations) than at MNH (7.0 per 1,000 operations) (risk ratio 3.2, 95% CI 1.5–6.6).

Table 4. *MNM events and deaths associated with CS complications*

Grade of association (number of cases)	CS complication (number of cases)
Strong (20)	<ul style="list-style-type: none"> • Severe infections in the scar/burst abdomen (10) • High spinal anaesthesia causing cardiac arrest (6) • Intra-abdominal haemorrhage from the CS scar (2) • Ureter injuries (2)
Moderate (27)	<ul style="list-style-type: none"> • Postpartum haemorrhage leading to shock (12) • Postpartum haemorrhage leading to hysterectomy (7) • Postpartum haemorrhage leading to death (3) • Postpartum haemorrhage leading to massive blood transfusion (2) • High spinal anaesthesia leading to cardiac arrest, pre-existing eclampsia (2) • Intra-abdominal haemorrhage from the CS scar, pre-existing eclampsia (1)
Weak (4)	<ul style="list-style-type: none"> • Postpartum haemorrhage leading to hysterectomy or massive blood transfusion, pre-existing conditions (4)

Do women with CS scars have an increased risk of MNM, death, or adverse perinatal outcomes? (Study IIb)

A flow chart of the inclusion of participants for Study IIb is presented in Figure 3. Among the included 2,478 multipara, 820 (33%) had previous CSs. Multipara with previous CSs and previous vaginal deliveries were comparable in terms of maternal age, parity, and socio-economic status, but women with previous CSs were more often referred from other hospitals (33% vs. 23%) and more often underwent CS (92% vs. 38%). ‘Previous scar’ was the most common CS indication among women with previous CSs, while ‘obstructed labour’ was the most common indication among women with previous vaginal deliveries. Sixty-eight percent of CSs in women with previous CSs and 77% of CSs in women with previous vaginal deliveries were emergency CSs. Labour was induced in 0.6% of women with previous CSs and 1.9% of women with previous vaginal deliveries. The prevalence of any maternal complication being recorded in the hospital database was 20% among women with previous CSs as compared with 40% among women with previous vaginal deliveries (OR 0.37, 95% CI 0.30–0.45). Eleven percent of women with previous CSs had diagnoses of antenatal haemorrhage

compared to 22% of women with previous vaginal deliveries, 1.0% compared to 4.9% had a diagnosis of hypertensive disorders, and 1.2% compared to 2.1% had a diagnosis of uterine rupture.

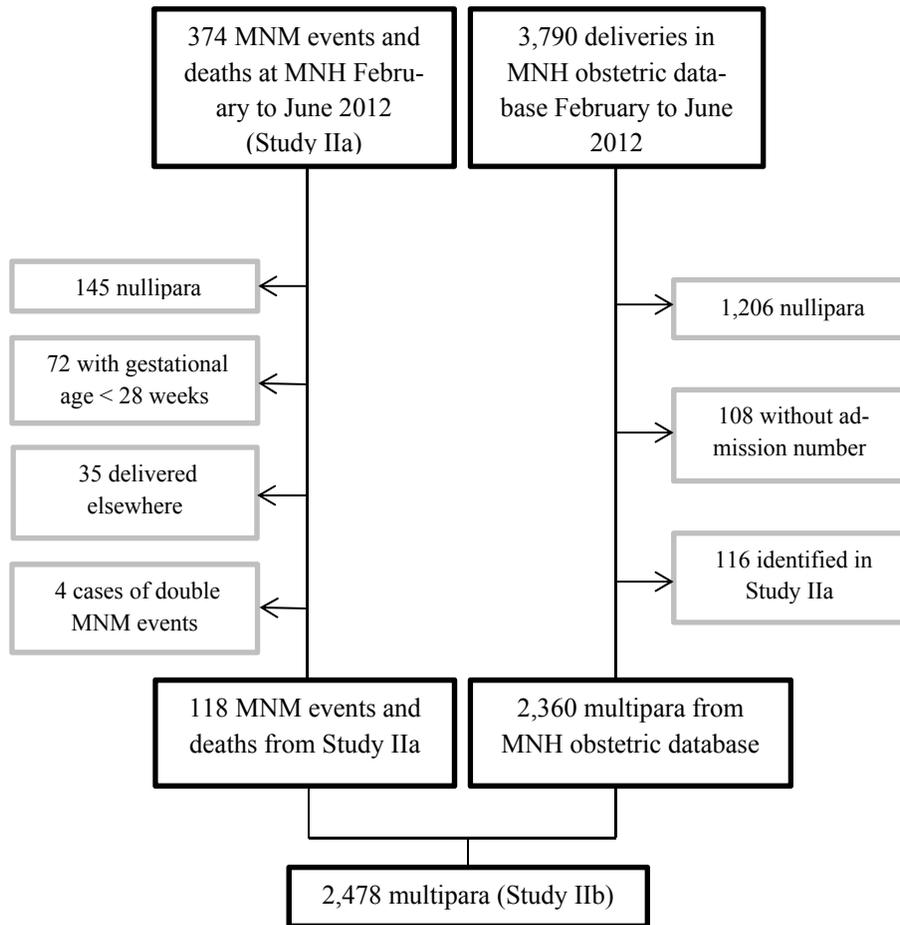


Figure 3. Flow chart of the inclusion of participants for Study IIb (grey indicates excluded cases).

We included 118 MNM events and deaths from Study IIa, and identified two additional maternal deaths in the MNH database. Among these 120 MNM events and deaths, 36 had scars from previous CSs and 84 had previous vaginal deliveries. Many women fulfilled more than one MNM criterion. The most common MNM criteria fulfilled by women with previous CSs were shock (14/45) and hysterectomy (14/45), while women with previous vaginal deliveries more often fulfilled the criterion of fits (30/130). Main causes of

MNM or death among women with previous CSs were ablatio placenta (8/36) and postpartum haemorrhage (7/36), while hypertensive disorders (34/84) dominated among women with previous vaginal deliveries.

Women with previous CSs had no increased risk of MNM or death (Table 5). On the other hand, they had a lower risk of stillbirth and ‘intra-partum stillbirth and neonatal distress’ than women with previous vaginal deliveries. The lower risk of adverse perinatal outcomes remained statistically significant after controlling for mode of delivery. As the two groups were comparable with regards to socio-demographic and clinical characteristics, we did not include any other possible confounders in the multivariate regression. Neither was referral status included in the model, as outcomes among referred and self-referred were analysed separately.

Table 5. *Bivariate and multivariate logistic regression of the likelihood of MNM, death, and adverse perinatal outcomes among multipara at MNH*

Outcome	Previous CS (n = 820)	Previous vaginal delivery (n = 1,658)	Bivariate logistic regression (95% CI)	Multivariate logistic regres- sion ^a (95% CI)
MNM or death				
No	784	1,574	1.0	
Yes	36 ^b	84 ^c	0.86 (0.58-1.3)	0.77 (0.49-1.2)
Stillbirth				
No	784	1,504	1.0	
Yes	33 ^d	150 ^e	0.42 (0.29-0.62)	0.61 (0.39-0.95)
Neonatal distress				
No	751	1,419	1.0	
Yes	29	78	0.70 (0.46-1.1)	0.58 (0.36-0.95)
‘Intra-partum stillbirth and neonatal distress’				
No	751	1,421	1.0	
Yes	33	108	0.58 (0.38-0.87)	0.51(0.33-0.80)

^a Mode of delivery included in the model

^b Among these, 13 fulfilled the criteria on arrival and 23 fulfilled the MNM criteria after arrival

^c Among these, 39 fulfilled the criteria on arrival and 43 fulfilled the MNM criteria after arrival

^d Among these, 4 had recorded foetal heart rate on arrival and 29 had no recorded foetal heart rate

^e Among these, 30 had recorded foetal heart rate on arrival and 118 had no recorded foetal heart rate

In our sub-analysis of referred patients (643), women with previous CSs had lower risk of all outcomes; MNM or death (OR 0.55, 95% CI 0.34–0.89), stillbirth (OR 0.27, 95% CI 0.16–0.43), neonatal distress (OR 0.33, 95% CI

0.18–0.58), and ‘intra-partum stillbirth and neonatal distress’ (OR 0.29, 95% CI 0.17–0.49). When we analysed self-referrals (1,835), the lower risk of stillbirth among women with previous CSs remained (OR 0.44, 95% CI 0.22–0.88) but the variable ‘intra-partum stillbirth and neonatal distress’ did not reach statistical significance (OR 0.77, 95% CI 0.41–1.47).

Data quality check of the obstetric database at MNH

We calculated the Cohen’s Kappa coefficient for 130 cases, for which data had been collected independently by me and the hospital staff at MNH. The degree of inter-rater agreement is presented in Table 6.

Table 6. Results from data quality check using the Cohen’s Kappa coefficient

Degree of agreement	Kappa coefficient	95% CI
<i>Almost perfect agreement</i>	Ref: 0.81–0.99	
Mode of delivery	0.94	0.87–1.0
Apgar score at 1 minute	0.93	0.88–0.98
Apgar score at 5 minutes	0.88	0.81–0.94
Multiple pregnancy	0.86	0.70–1.0
<i>Substantial agreement</i>	Ref: 0.61–0.80	
Parity	0.79	0.71–0.87
Referral status	0.77	0.68–0.85
Previous scar	0.72	0.57–0.88
Maternal age	0.68	0.60–0.76
<i>Moderate agreement</i>	Ref: 0.41–0.60	
Foetal heart rate on arrival	0.60	0.46–0.75
HIV status	0.55	0.22–0.87
Education	0.50	0.36–0.64
<i>Fair agreement</i>	Ref: 0.21–0.40	
Private patient status	0.23	-0.17–0.63
<i>Slight agreement</i>	Ref: 0.01–0.20	
Marital status	0.17	-0.17–0.51
Induction of labour	0.10	-0.08–0.28
<i>Less than chance agreement</i>	Ref: < 0	
Area of residence	-0.04	-0.12–0.04

What are women's and caregivers' perspectives on CS as mode of delivery? (Study III)

All women and most caregivers regarded vaginal birth to be the preferred mode of delivery in the absence of medical indications for CS, but caregivers were generally more positive towards CS than were women as both doctors and midwives sometimes advocated for CSs without strict medical indications. We identified five themes that seemed to affect or reflect women's and caregivers' perspectives on CS: events during the CS decision, perceptions of maternal complications and risks, the chance of a healthy baby, external locus of control and influence of women's peers, and socio-economic consequences for women. Examples of women's and caregivers' converging and diverging perspectives on these themes are presented in Figure 4.

Women's experiences with the care encounter diverged and did not seem to depend on whether they had private health care insurance or not. While some women had felt relieved when faced with the CS decision, most women had felt shocked and afraid. Many women experienced little control over the CS decision, and although they had been provided with an explanation to why they needed surgery, many perceived that there was a lack of indication. Several women had at first refused to undergo CS, but were later persuaded by hospital staff. Very few women stated they had asked for CS. These women actually preferred vaginal delivery, but had asked for CSs because they feared adverse outcomes related to vaginal delivery. Caregivers emphasised their efforts to counsel women on CS indications and complications, but reported difficulties, often due to the women's low educational level (Figure 4). Women with private insurance were described as well-educated and easier to counsel, but sometimes challenged the doctor's position as a decision-maker because they sometimes requested CS.

There were discrepancies in the way women and caregivers viewed maternal complications associated with CS (Figure 4). Many women stated that if complications developed during birth, CS was a life-saving procedure. On the other hand, all women associated CS with maternal death and had been afraid to die during the operation. Most women witnessed that there was an extensive exchange of information within their communities concerning potential maternal CS complications, such as severe pain and infections, problems with the belly, becoming paralyzed, or instruments being left in the abdomen. These stories led to a fear of CS that affected both theirs and others' CS attitudes. Caregivers expressed severe maternal morbidity and mortality associated with CS as troublesome but rare. More common minor complications were brought up by some, but were not given much attention when it came to decision-making. Some caregivers regarded the maternal risks with CS and vaginal delivery as equivalent, and this topic was debated in the resident's FGD. Many caregivers referred to improved safety during recent years to justify their use of CS.

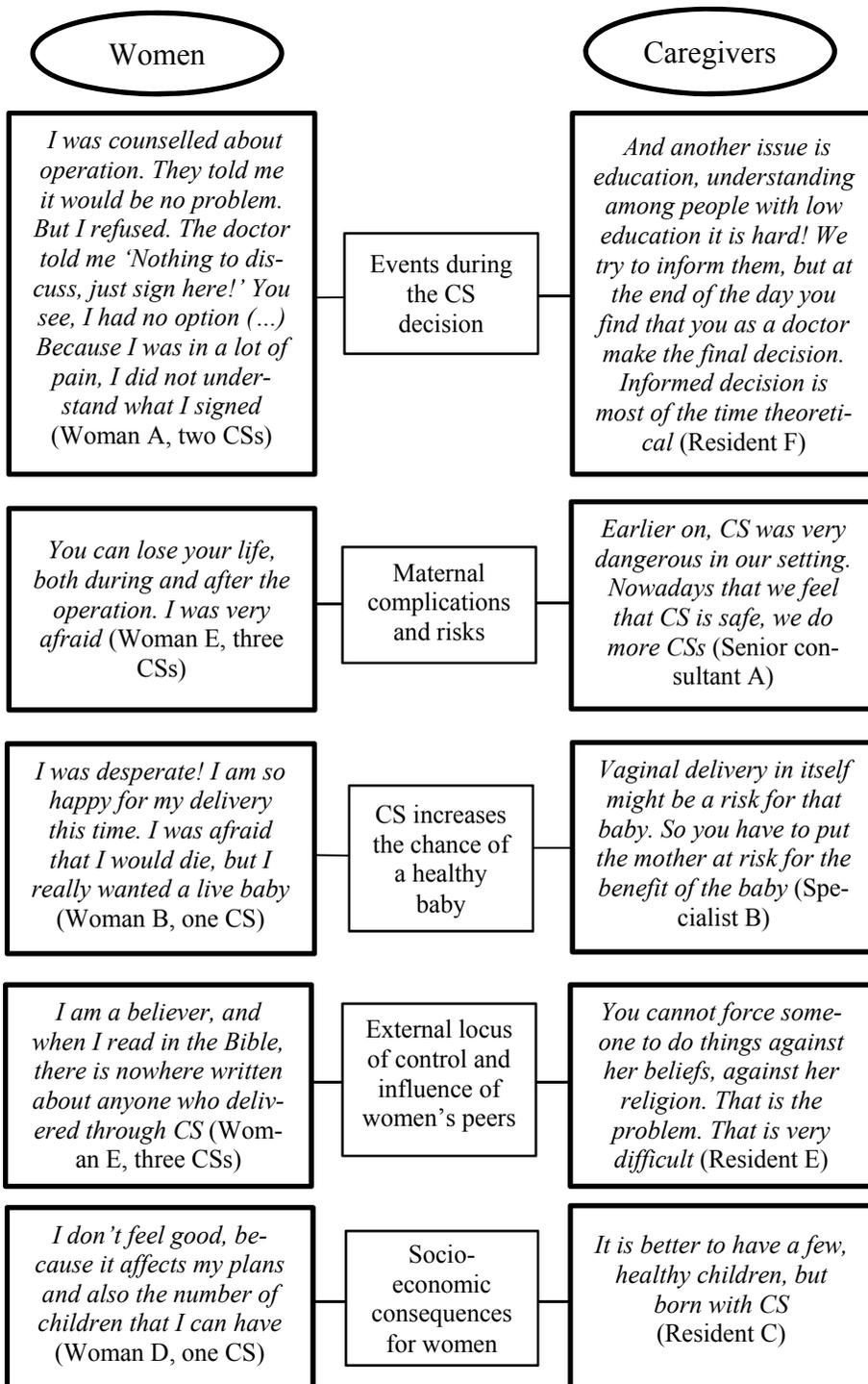


Figure 4. Women's and caregivers' converging and diverging perspectives on CS

There seemed to be a converging perception among women, community members, and caregivers that CS was safer for the baby than vaginal delivery (Figure 4). Many women had experience of losing a baby in a previous vaginal birth, or had a close relative who had had such an experience, which made them agree to undergo CS despite their fear of dying during the operation. Caregivers in both interviews and FGDs viewed vaginal birth as an unpredictable event that might jeopardise the foetus, and midwives often talked about CS as a way to ‘secure the baby’. Although caregivers were aware of the maternal risks associated with CS, they stated that they sometimes overlooked these risks in order to assure a good perinatal outcome;

Maybe someone will think ‘What about the mother?’ and even the risk of the operation (...) But I think that is not given so much consideration – they’ll think of the baby. (Specialist C)

Religious beliefs influenced some women’s CS perceptions; while a few tried to avoid CS as it was not supported by their religions, others had a fatalistic approach that CS decisions and outcomes were controlled by God and that they needed to accept whatever happened. Although some women were partly isolated from their original social contexts because they had moved from their home villages to work or stay with their partners in Dar es Salaam, they stated that CS attitudes in their current communities largely depended on the CS experiences within that particular group of friends and family members. For example, observations of good perinatal outcomes after CS often led to more positive CS attitudes. Almost all women, however, stated that vaginal birth was the preferred mode of delivery among their peers, and respondents often felt ‘different’ because they had undergone CS. Caregivers emphasised that women’s CS attitudes depended on their social positions, education, economic backgrounds, and tribe belongings. Although CS refusal was stated as mostly being a result of influence from women’s peers, one of the residents shared an experience when a religious leader had influenced a woman to refuse CS, a situation that seemed to have been very frustrating and traumatising to the respondent;

She refused. Completely. She said she was from ... which church? I don’t remember, a certain church where they had told her that CS is not allowed. So she said ‘I’ll talk to the Pastor. If the Pastor agrees, then I will do the CS.’ We told her ‘You are talking to the Pastor who is there, but you are here! The baby is going to die. How will the Pastor help you when the baby is dead?’ She said ‘Maybe that is God’s plan’ (...) And we stayed with her the whole night. We cannot do the CS if the mother has not consented. I was all alone. Just called the specialist, called everyone ... And I convinced and convinced. The husband came, the foetal heart rate was still there, very distant, at 6 am. We told the husband ‘Please tell her to sign the consent form so that we can save the baby.’ The husband said ‘The woman has said no. We cannot listen to you, we listen to the Pastor. Because the Pastor is the one who is the sec-

ond God to me – not you!’ So that was that. We ended up getting a fresh stillbirth. (...) It was really bad. Because you see the baby dying – unnecessarily! But when it is somebody’s beliefs ... You cannot force someone to do things against her beliefs, against her religion. That is the problem. That is very difficult. [pause] What would you have done if you were in my shoes? (Resident E)

Many women stressed that costs related to the operation and their inability to resume their work and chores afterwards put strains on the family economy and made them dependent on others. Women also realised that CS put restraints on the number of children they could have, and although some felt they had completed their families, many grieved that their family size would be limited because of the CS (Figure 4). Socio-economic problems following CS, such as financial difficulties or that the husband would want to divorce a woman who had undergone CS, were recognised by some caregivers, however, these seldom affected their decisions. Some caregivers reflected on the limitation that CS would put on women’s future reproduction, but justified CS by stating that women could deliver vaginally next time or that most women nowadays wanted only two or three children. Few considered that the woman might lose the newborn delivered by CS, and would then remain with fewer tries to have a living child.

What are caregivers’ rationales for the high CS rate? (Study IV)

Caregivers had diverging opinions on reasons for the hospital’s high CS rate and whether it was a problem or not, but there was a consensus that CSs were performed on doubtful indications among private patients. Among public patients, most CSs were seen as necessary as these patients were often referred with severe complications. Some caregivers, however, stated that there were also unnecessary CSs performed among public patients, because the threshold for performing CS had become lower in a number of clinical situations; caregivers were reluctant to let women with previous scars try labour, inductions of labour were seldom practiced or were disrupted at an early stage, instrumental deliveries were seldom performed due to declining experience in its practice, and indications such as foetal distress and obstructed labour were widely overused. The following extract from the resident’s FGD illustrates how opinions diverged regarding the accuracy of ‘foetal distress’, and whether CSs were performed on doubtful indications or not. From their body language and the atmosphere in the room, we could tell, however, that B and E partly agreed with D;

Dr. D: That is why at first I said things like foetal distress. If you analyse among those, you can find that the time from diagnosis to CS is almost two hours at MNH. Almost two hours! And the [Apgar] score of the baby was 9. Do you think that this was really foetal distress? The score is 9! Or 8!

Dr. B: But you are resuscitating ...! [laughing]

Dr. D: Score 9! If you look in retrospect, this was not foetal distress! For those [foetal distress], I would expect the score to be 4. You see?

Dr. B: That is ... [laughing] Really, you should make your follow-ups; you should diagnose foetal distress early so that you intervene ...!

Dr. D: You *have* diagnosed early, you have ... What I am saying is that, just from the labour ward to the theatre, it takes almost 1 hour. But then you wait at the theatre and it takes almost 2 hours ...

Dr. B: But you are resuscitating the mother, giving fluids, you are making this woman ...

Dr. D: So what if you resuscitated that same woman with fluids, and that woman had vaginal delivery [and never went for CS] and the baby scored 9! What would you say about that? [pause, B and D both laughing]

Dr. D: That is just to challenge you, to show that I believe that most of our CSs they are not ... They are based on ...

Dr. B: [fills in] ... Yeah, because of being tired...

Dr. A: No, that is a very good challenge! Because what you are discussing here is very good! I think that early, proper diagnosis with early resuscitation is what is helping us, the whole team! So that if you have a foetal distress, yet the baby's score *should* be good!

Dr. E: Yes, to me, if you got that diagnosis [foetal distress] and you did the resuscitation, if you get a good score, then that is a good outcome of the resuscitation! It's not that ... [laughing]

Dr. A: It's not that the diagnosis was not right...!

Dr. E: It's not the outcome of the wrong diagnosis, it's success of the resuscitation! [smiling]

Some respondents, both doctors and midwives, witnessed that CS indications were sometimes made up, so that unjustified CSs could be performed without being questioned. We identified five themes that caregivers perceived were reasons for the high CS rate, or led to CSs on doubtful indications: factors outside caregivers' control, private practice, the specialist-resident interaction, the resident-midwife interaction, and fear and blame.

Factors outside caregivers' control

While a few caregivers reflected on their own role in the high CS rate, most respondents in both interviews and FGDs pointed to external factors. The most prominent reason caregivers emphasised was MNH's status as a referral institution, admitting complicated cases requiring CS. Caregivers stated that personnel at antenatal clinics were too inexperienced to detect danger signs, which caused delays, aggravation of illness, and eventually CS. Peripheral hospitals were described as overcrowded, underequipped, understaffed, and unable to provide their patients with the required CSs. Also,

maternal characteristics were mentioned as a cause for rising CS rates. Because the age for first-time mothers had increased, births had become more complicated, and changes in lifestyle had caused more obesity and ‘western diseases’. Caregivers stated that women’s low educational level made them arrive at hospital late, when complications had already arisen, leaving no other option than CS. Doctors also emphasised that their diagnoses were sometimes imprecise because they lacked adequate access to ultrasound and cardio-tochograph-machines, and shortage of staff made it difficult to monitor women in labour closely and made them choose CS instead.

Private practice

Doctors were generally outspoken regarding the economic incentives they received for CSs in private patients, but caregivers had different opinions about to what extent money affected CS decisions. Most thought, however, that the economic compensation made them do more CSs, and CS was by some considered to be faster, easier, and more convenient. Many stressed that the personal relationships they had with their private clients made them feel more responsible for delivery outcomes, which promoted CS. Decisions for private patients were taken by the specialist alone, and there was no consensus among specialists on what indications CSs in private patients should be performed. All caregivers declared maternal request among private patients to be one of the largest reasons for the high CS rate at MNH, because they believed these women wanted to assure good perinatal outcomes and avoid labour pains:

In the end of the day, when they come to deliver, they are so weak; they cannot push the babies (...) So the patients themselves are the ones requesting CS, because they cannot tolerate the labour pain. (Resident E)

The specialist-resident interaction

There was an agreement that residents could take CS decisions during calls without consulting the specialist in ‘straightforward’ cases, but that they should consult the specialist regarding complicated patients. When probed about their opinions of residents’ CS decisions, most specialists thought that decisions during calls were taken on vague indications. Specialists were concerned that residents were inexperienced, had poor skills in instrumental delivery, and either had false confidence or were too anxious when making decisions. Specialists described the residents, but also other specialists, as impatient, and that they would rather take a ‘short-cut’ than wait for vaginal delivery. All specialists wanted the residents to consult them more often during calls, and some felt confused about why they were not called. Other

specialists identified the working environment and their own attitudes as a main barrier for consultations.

Residents had diverging opinions on the support from specialists, but most stated that specialists were absent from the practical work in the labour ward. The majority of residents wanted to have closer communication with the specialists, but feared that calling the specialists would mark them as 'incompetent' and 'disturbing'. Midwives witnessed that residents were often 'put down' during rounds, and that residents were reluctant to phone their senior colleagues during calls as they might get angry.

The resident-midwife interaction

Although both residents and midwives emphasised that they worked as a team and that CS decisions were taken in consensus, there seemed to be tension between the two groups. Many residents perceived midwives as being negative towards conservative management and felt that midwives pushed them to do CS, either because they were afraid of poor outcomes or wanted to decrease their workload. According to residents, midwives had several strategies to make a woman undergo CS. One was to neglect doctors' orders of augmentation of labour, which could lead to poor progress and eventually CS. Another was to prepare women for operation without discussing this with the resident first. Residents stated that if there were disagreements around the CS decision, midwives who had opted for CS noted their standpoint in the medical record as 'to clean their hands'.

Midwives in both interviews and FGD emphasised their expertise, experience, and role in CS decisions. They often felt, however, that their competence was not recognised, and there were sometimes conflicts with the residents, especially during the residents' first years;

When residents come in, we are their teachers, you see? Many times they follow what we tell them. When these junior doctors come in, they come with an attitude (...) When we tell them stuff, they pretend they know this and that. Those who listen to us, things usually go well for them. The stubborn ones get very bad outcomes. This is why they later change and cooperate with us. (Midwife D)

Midwives confirmed that they sometimes pushed residents to do CS, but only for what they perceived were genuine indications. They rejected the idea that CS would relieve their workload, as preparing and taking a woman for CS meant more work. Midwives confirmed that they sometimes prepared the mother for operation before discussing this with the doctor, as they felt they were competent enough to make such decisions. If residents disagreed with the midwives' advice to perform CS, midwives in both interviews and the FGD stated that they called the specialist directly to get their support.

Many midwives saw documentation as a way to solve conflicts around CS decisions, as it would free them from responsibility if their CS advice was not followed.

Fear and blame

All caregivers expressed a pronounced fear of poor outcomes, which was generally more focused on poor perinatal outcomes after vaginal deliveries than maternal complications after unnecessary CSs. Some caregivers mentioned that fear of litigation or complaints from women led to medically unjustified CSs, however, most regarded this risk as low in the current Tanzanian system. On the other hand, caregivers said that the regular meetings, audits, and statements to the hospital management affected their decisions. The morning meetings, in which residents and interns in the on-call team reported outcomes during the last 24 hours, were described as ‘intense’, ‘hot’, and ‘condemning’. While a few respondents considered the weekly maternal mortality meetings as useful for pinpointing and preventing mistakes, most described them as uncomfortable. The fear of blame from colleagues was most pronounced among residents and midwives, and there seemed to be a notion that you could avoid blame by doing CS without proper indication instead of waiting for vaginal delivery and risking a poor perinatal outcome. Residents feared that if they were involved in repeated poor (perinatal) outcomes, specialists might be harder on them in the exams and having such a reputation might even force them to interrupt their studies. Specialists confirmed that residents involved in repeated adverse outcomes could be ‘put in the black book’, and that CSs without proper indications were preferred and more accepted than if a resident was ‘negligent’ and attempted vaginal deliveries resulting in poor outcomes. One resident vividly summarised how fear and blame led to CSs on doubtful indications:

Actually, as I said, why are there much [CSs]? (...) Because people are worried of bad outcome! People have good knowledge, the principles of obstetrics and management, they have very good knowledge and they also have good practice. But the big problem is the blame. The accusation. The attack. The fear that they get after they have had a low-score. (Resident F)

Participant observations and reflections

Through my everyday life in Dar es Salaam, it became clear how important it was to be a ‘Mama’. When discussing what the Kiswahili term for ‘being divorced’ was with one of my drivers, he had to think for days, but he could immediately provide me with the Kiswahili term for ‘a woman with no children’. Informal conversations almost always got onto family issues and

parenthood. I noticed that I enjoyed more respect when I told people that I was a mother or when I moved around together with my children, as compared to alone or with friends. Except for the obvious benefit that sharing personal information leads to a closer relationship, it felt as if being a mother was 'being someone' in another way than in my home country. When informally discussing modes of delivery with the hospital staff, they always assumed that I had undergone CS, as this would be an obvious and more 'modern' choice for a white doctor.

Work at both hospitals, but particularly at TH, was very difficult. But the substandard care I saw could not only be explained by shortage of staff or lack of equipment. There was often at least five or six midwives working in the labour ward, but even basic measures, such as auscultation of foetal heart rate, assessments of uterine contractions, and vaginal examinations to determine progress of labour were inadequate and sporadic. Emergency situations were unorganised and never seemed to involve senior doctors or anaesthetic staff. Although eclamptic women were provided with magnesium sulphate relatively quickly, their vital signs were often inadequately assessed and in unconscious patients the airways were not properly protected. There was a low use of alternative managements to CS, such as vacuum extraction and active management of labour, and generally long delays between decisions of treatments and actions. At both MNH and TH, women were often prepared for CSs due to cord prolapse, foetal distress, or suspected uterine rupture, but two hours later I still saw them lying on the stretcher waiting for the operation. Common notes in the medical records were repeated orders day after day, such as 'trace two units of blood' or 'consult the nephrologist', without actions ever being taken and women occasionally passing away due to severe anaemia or kidney failure. Although I knew that, for example, blood supplies were scarce, I got the impression that once the caregiver had documented an order or decision, it was out of his or her hands and he or she was not accountable for any delays or adverse outcomes.

Another observation was the subservient role women had to their caregivers. Women in labour were always admitted alone, without a family member or friend to support them. They were told to lie still on their side, and that they should not scream or make noises when in pain. To me, the relationship between women and midwives was somewhat contradictory. On one hand, midwives seemed concerned about the women's welfare and outcomes; on the other hand, they sometimes slapped or snapped at them if they did not do what they were told. Women with motor restlessness due to eclampsia or postpartum psychosis were tied to their beds. When there was a CS decision, or other unexpected, serious events, women were often sparsely counselled. Sometimes women were prepared for operation, with urine catheter and label on the arm, without being told that they were going for surgery. When women asked what was going on, they could be notified about the CS decision by a caregiver standing with their back to them. I rarely saw a woman question-

ing a caregiver's decision. Generally, inter-personal interaction and communication in the labour wards were concentrated between caregivers, and not between women and caregivers.

The hierarchical structure between caregivers followed certain principles. Because higher age equates to more respect in the Tanzanian community, junior doctors always greeted and talked to older midwives according to these standards. The working environment in the labour ward was, however, usually relaxed, with midwives and junior doctors joking with each other. Midwives seemed to have a strong team-spirit and confidence in their profession and capacity, and I observed that they sometimes prepared women for CS before consulting the doctor. Doctors were seldom present in the labour ward for longer periods, except when they were there to review a patient. There was an apparent distance between junior doctors and their senior colleagues. During rounds, residents, registrars, and interns were often interrogated. In the morning meetings, junior doctors could be scolded if they did not report in a correct way or if there had been adverse events during the night. The maternal mortality meetings sometimes developed into a hectic debate, which often shifted into Kiswahili as the tension increased, but seemed focused around the question of whether the death was avoidable or not, and if so, who was to be blamed.

Discussion

Our research findings raise many possible discussion points. In this section, I will strive to address our two original research questions; *'What are the effects of a high CS rate in a low-resource setting?'* and *'What are the reasons for a high CS rate in a low-resource setting?'* I will contextualise my discussion by using FIGO's 'Ethical Issues in Obstetrics and Gynecology' [110], and I will round off by summarising evidence that could improve the quality of care and reduce the number of medically unjustified CSs. In Figure 5, I present an overview of our interpretations of the research findings in relation to the two original research questions, and how these interpretations led to the overall conclusion of the thesis.

What are the effects of a high CS rate in a low-resource setting?

We found that a high use of CS in a low-resource setting is associated with a high risk of life-threatening maternal complications, but we found no increased risk of life-threatening complications in subsequent pregnancies. An uneven distribution of health care resources within the Dar es Salaam area is one of the reasons for the overuse of CS at MNH, and might put further strains on the health care budget in the long-term perspective.

High risk of life-threatening maternal CS complications

Physicians have a professional duty to do nothing that may harm their patients [110].

Despite caregivers' perceptions that CS was a safe procedure, we found that the increase in CS rate between 2000 and 2011 was accompanied by an increase in the MMR. We also found that almost one in ten MNM events and deaths were attributed to CS complications. That CS in low- and middle-income countries is associated with high maternal risks has been described before [50-52]. Few studies have, however, analysed complications directly attributed to CS. In a study from Mali, the authors found that 13.4% of

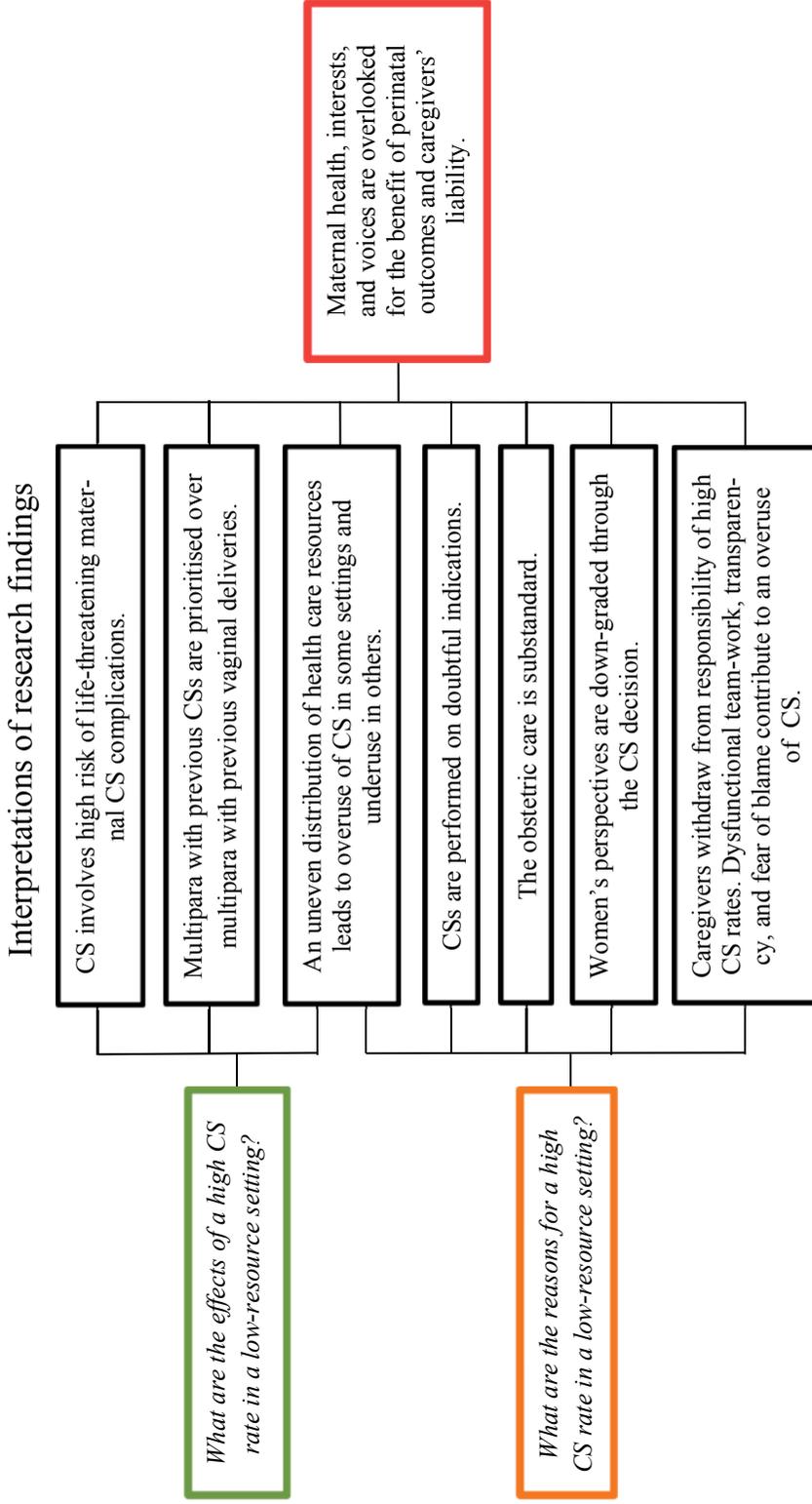


Figure 5. Our interpretations of the research findings in relation to the two original research questions and the overall conclusion of the thesis.

women who underwent CS at a tertiary hospital had intraoperative injuries such as lacerations of organs, excessive blood loss, or hysterectomy, and that 6.4% developed wound infections [44]. These figures reflect the dangers that CS might pose in low-resource settings, but are higher than ours (7–22 per 1,000 operations) as the authors included all women with complications and not only those complications that were life-threatening. They also included women with uterine ruptures, which we interpreted as a complication of labour rather than of the operation. Our estimation of maternal deaths causally attributed to CS complications (1.0–4.7 per 1,000 operations) by far exceeds figures presented in a study from the U.S. (0.02 per 1,000 operation) [129], illustrating the increased dangers of CS in low-resource compared to high-resource settings.

Women with previous scars are prioritised

Despite reports that multipara with previous CSs have higher risks of obstetric complications [54, 56-58] and MNM [2], and often have an adverse obstetric history [56], we could not detect any increased risk of MNM or death among these women in our study. Unlike other studies [62, 63, 65], we also found that women with previous CSs had better perinatal outcomes than multipara with previous vaginal deliveries. Most likely our deviant findings are not related to differences in obstetric risks, but should be interpreted as local differences between our two groups in terms of health care seeking behaviour, referral mechanisms, and clinical monitoring and decision-making.

Previous research has shown that prior contact with maternal health care is associated with earlier health care seeking when a severe complication arises [152]. In this setting, women with previous CSs are urged to come early to hospital when labour starts, and although there is sometimes a concern that they would unsuccessfully attempt home delivery [153], women with previous CSs in our study were less likely to fulfil the MNM criteria at arrival and self-referred multipara with previous scars had a lower risk of stillbirth on arrival than their self-referred counterparts. This suggests that women with CS scars follow their doctors' recommendations, while women with previous vaginal and uncomplicated deliveries may view early admission as unnecessary [68].

Based on our experience from the setting, we also believe that the absence of increased risk of MNM and death and lower risk of adverse perinatal outcomes among women with previous CSs might be due to a high awareness among caregivers that women with scars are a high-risk group. Referred women with previous CSs had lower risk of all outcomes in our study compared to referred women with previous vaginal deliveries. This might be because caregivers at health centres and peripheral hospitals are unwilling to treat women with previous scars in their facilities, where access to emergen-

cy CS is inadequate, and instead refer them to a higher level of care in an early stage of labour. Women with previous CSs had more elective CSs, and we also believe that they enjoy closer monitoring, faster emergency CS decisions, and priority in the operation queue. These assumptions are supported by the finding that uterine rupture was less common among multipara with previous CSs than among multipara with previous vaginal deliveries. Thus, the health care system seems to prioritise women with previous CS scars. Important to note is that the increasing proportion of women with CS scars and the high rate of repeat CSs (92%) in this group will most likely lead to even higher CS rates in the coming years.

Uneven distribution of health care resources

Physicians have an ethical duty to society to allocate health care resources wisely to procedures and treatments for which there is clear evidence of a net benefit to health [110].

As was emphasised by the caregivers in our studies, to understand the effects of as well as the reasons for the high CS rate at MNH, a wider discussion is needed on the distribution of health care resources within the Dar es Salaam area. In the current system, MNH's status as a national hospital makes it directly funded through the government, while funding for regional and district hospitals, such as TH, passes through several bureaucratic levels before reaching the facilities. In Figure 6, I present an illustration of how an uneven distribution of resources might lead to an overuse of CS. Because the health workforce is concentrated in urban and larger hospitals [70, 137, 138] and there is a lack of supplies and inadequate access to operating theatres at peripheral hospitals, CSs that could have been performed at lower levels are referred to MNH. Referral leads to delays, which might cause aggravation of illness, and when a patient is referred, documentation and information about events during labour often get lost [154]. This brings out a situation that might leave no other choice than CS once the woman arrives at MNH. The current trend, with an extremely high use of CS at MNH and an underuse at the peripheral hospitals, might further worsen this mismatch between need and use of CS as it draws resources from interventions that could have been more effective and provided at the facility where the woman first attended care. It is well-recognised that obstetric care needs to be organised according to an assumption that every woman is at risk of complications [6]. To improve maternal and perinatal outcomes, material and human resource need to be more evenly distributed and 'accumulation' of competence at one, or a few, hospitals must be avoided [137].

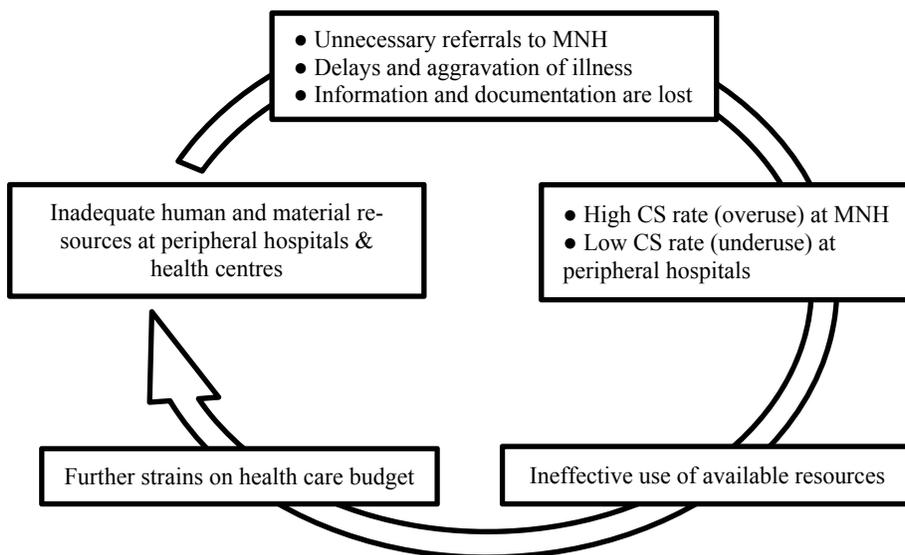


Figure 6. Illustration of how an uneven distribution of health care resources in the area contributes to an overuse of CS, how this overuse consumes available resources, and put further strains on the health care budget.

What are the reasons for a high CS rate in a low-resource setting?

Our results indicate that many CSs are performed on doubtful indications, and I will here discuss five possible explanations for this; that the obstetric care is substandard, that women's perspectives are downgraded through the CS decision, that caregivers use defence mechanisms to withdraw from their responsibility of high CS rates, dysfunctional team-work, and transparency and fear.

CSs are performed on doubtful indications

CS rates should not be discussed as being too high or too low, but whether CSs are appropriately used or not [38]. Although debated [26, 47, 108], FIGO states that performing CS for non-medical reasons is ethically not justified and should be avoided [110, 155]. Except for a sharp increase in the proportion of women with previous scars, we could, by using the Robson classification, rule out that the increase in CS rates was due to an increase in high-risk pregnancies [1], such as breech pregnancies, multiple pregnancies, or low birth-weight pregnancies. A remarkable finding was the high CS rate

among multipara without previous CSs with single, cephalic pregnancies in spontaneous labour, which by far exceeded estimates in other papers [38, 156], including studies from other tertiary facilities in low-income countries [44, 45]. As this group is typically constituted of low-risk women, we interpreted this finding as a sign of an overuse of CS.

Because the Robson classification does not provide information about whether indications are appropriate or not, relating our results to those from other studies is crucial. As in other studies [31, 33, 35, 36, 41, 44], the most common indications in our material were labour dystocia, foetal distress, and previous scar. A prior study at MNH performed in 2005 analysed these indications and found that 30% of all CSs, and up to 59% among those that were performed on foetal distress, had questionable indications [41]. Also, a more recent estimate shows that 20% (53/260) of CSs performed on obstructed labour and 46% (114/248) performed due to foetal distress do not fulfil the staff's own criteria for such diagnoses (Andrew Mgaya, unpublished 2014). Similar findings have been reported from other parts of Tanzania, where 26% of CSs performed due to prolonged labour were inadequate [40], and 84% of CSs due to foetal distress were found to have either reassuring or no documentation of foetal heart rate [31]. Concerns about improper CS indications have also been raised in publications from other low-income countries [36, 42].

One of the most convincing arguments that CSs are performed on doubtful indications is, however, that caregivers in our interviews stated that that was the case. As in other parts of Tanzania, there seemed to be inconsistent management, misinterpretation of clinical signs, and a fear of low-cost interventions such as vacuum extraction [40]. Private practice also seemed to contribute to an overuse of CS [80, 95, 96], but not only because of economic compensation. Rather, caregivers were concerned about their reputation and the personal 'guilt' that would follow if their clients had adverse outcomes. The solo decision-making in the private practice seemed to counteract adequate use of CS [104], as there was no consensus regarding what were valid indications for CS. Caregivers in our studies often emphasised that as long as everything was normal, vaginal delivery was preferred. The problem is, however, that the point where normality becomes abnormality is sometimes subjective and CS indications are, like other medical diagnoses, largely affected by the culture and social expectations at the health care facility [92]. This means that once the threshold for a CS indication has started to shift, it will soon become the new 'standard' and, consequently, will be hard to question.

The obstetric care is substandard

Figures of high antenatal care coverage and skilled birth attendance, yet high MMRs, raise questions on who provides the care and whether it is of suffi-

cient quality [2, 9]. Although this thesis does not include a systematic audit of maternal morbidity and death, our findings from the MNM study illustrate several aspects of a substandard care.

Our MNM estimate was in line with other research from Africa [157, 158], but was considerably higher than reports from middle-income countries [159, 160], as well as the WHO's survey in 29 low-and middle-income countries [2]. Substandard care has been found to be associated with between 69–74% of maternal deaths in Tanzania [125, 140, 161], and 26% of severe maternal complications in Brazil [162] and up to 70% in Mozambique [163]. In our study, a complication had been detected at the antenatal clinic in only a minority of women who later experienced MNM or died, a manifestation of the poor quality of antenatal care services reported in prior studies from Tanzania [164]. Eighty-eight percent of eclampsia patients fulfilled the MNM criteria on arrival, which stresses that these women sought health care too late, possibly as a result of poor consultations on danger signs related to hypertensive disorders [165, 166]. More than half of all MNM cases, and as many as 71% of women with uterine ruptures, did not fulfil any MNM criteria at arrival, suggesting that timely and accurate management at the hospital might have prevented some of these incidences. In line with my participant observations, an audit from northern Tanzania found surveillance during labour to be clearly inadequate [40], and a study from four public hospitals in Dar es Salaam, including MNH and TH, showed substandard recording of uterine contractions in 85% of deliveries and substandard recording of foetal heart rate in 92% [154]. Although eclampsia and postpartum haemorrhage are well-known as the main causes of MNM and death [2], and efforts are continuously made to reduce their incidence [70], they accounted for the largest proportion of severe illness in our study, indicating that these efforts have not been implemented effectively.

Low quality of care and lack of health care professionals might lead to an overuse of interventions [28, 36, 40], because if women cannot be monitored properly caregivers might perceive CS as the safest alternative. Likewise, if the operating theatre is not readily available, caregivers become reluctant to try instrumental deliveries or let women with previous scars go through labour. In a recent audit study at MNH, the mean decision-delivery time intervals were 120 minutes for CSs performed due to obstructed labour and 135 minutes for CSs performed due to foetal distress (Andrew Mgaya, unpublished 2014). Moreover, CS decisions might be impaired by deficits in the quality of medical records [42]. A study from Dar es Salaam found that more than 50% of the total partograms, and as many as 90% of partograms from peripheral hospitals, had no information about duration of labour [154], which makes clinical decision-making difficult. Lacking documentation about a previous CS might also make caregivers unwilling to try labour in women with previous scars [36]. All of these factors contribute to a set-up where women cannot be guaranteed safe vaginal deliveries and are instead

sent to the operating theatre. To improve obstetric services, adequate funding is of utmost importance. Despite the Tanzanian government's emphasis that focus needs to be directed towards women, girls, and health equity, the U.S. budgetary allocation to health in Tanzania in 2011 illustrates the neglected role maternal health still plays; while HIV/AIDS and malaria prevention were allocated \$358.0 and \$46.9 million respectively, maternal and child health allocations together amounted to \$5.8 million [137].

Women's perspectives are down-graded through the CS decision

Health care providers should act in the best interests of the woman first and her foetus second [110].

As in a study from Kenya [35], the increase in CS rate at MNH was accompanied by improved perinatal outcomes, and the CS indication that increased most was 'foetal distress'. As in other studies, both women and caregivers perceived CS as being safer for the baby [79, 81-84], and maternal risks with CS were overlooked in order to 'secure' a good perinatal outcome [95]. There seemed to be a conception that vaginal delivery was unpredictable, uncontrolled, and dangerous to the foetus, while interventions provided by the caregivers, such as CS, were safe [109, 113]. It is obvious that a majority of women worldwide have a desire to protect their offspring [79]. Nonetheless, women's unconditional acceptance to be operated on in spite of their fears of dying was somewhat surprising. As in many other low- and middle-income countries [16], being a mother is crucial for a woman in Tanzania in order to gain social status and economic security [136], which might explain women's tendency to take high risks. Caregivers' liberal use of CS might reflect a pragmatic approach to avoid adverse outcomes, as severe maternal complications after unnecessary CS are less common than poor perinatal outcomes after vaginal delivery. The mother-newborn health dyad is, and needs to be, closely interconnected [19, 111, 112], but as caregivers we need to reflect on how we prioritise our actions and ensure we do not harm. Newborns who survive the death of their mothers continue to be at higher risk of dying also after the neonatal period, possibly as a result of inadequate child-care and nutrition [19], which highlights the importance of not risking the life of the mother.

In the same way as maternal health risks were overlooked, so were other maternal interests and potential socioeconomic consequences [113]. As found in other studies from low-income countries, most women saw pregnancy and childbirth as a natural state [68, 69], and some questioned the indications for their CSs. Caregivers, on the other hand, often regarded CS as a modern and convenient procedure [31]. Another disparity was that, while women in our study had experienced more pain with CS [84], caregivers

thought women wanted CS in order to avoid pain [77]. Religious beliefs influenced some women's CS perceptions [89], which was expected as it plays an important role in the everyday lives of most Tanzanians [136]. In many low-income counties, women have a fatalistic approach that the power over events during birth lies within an external locus of control [68], and religion might act as a way to cope with stress, anxiety, and unpredicted events [92]. When religion and religious leaders became too influential, however, it was regarded as a problem by caregivers, because it challenged their position as decision-makers. Increased costs and loss of working capacity was put forward by many women as problems following CS [68, 69, 86, 167], but these seldom affected doctor's decisions. Likewise, caregivers often overlooked women's potential desire for more children. Many women in our study grieved that CS had put limitations on their future reproduction, and, according to the latest Demographic Health Survey, women in urban areas in Tanzania want, on average, four to five children [139]. Most importantly, as stated in FIGO's ethical framework [110], women and their partners should be able to decide for themselves how many children they wish to have, and their reproduction should not be limited by interventions performed on dubious indications.

It seemed, although women and caregivers in many ways had similar cultural backgrounds, low educational level fell outside the caregiver's personal experience and hindered their communication with women [92]. If caregivers fail to understand the values that underpin their patients' decisions and desires, they might make erroneous assumptions and take inappropriate actions [91]. Women and relatives who wish to avoid unwanted, costly, and, in their view, unnecessary procedures might avoid delivering at health care facilities [68, 69, 91]. This could, in the long-term perspective, inhibit women's access to adequate care and counteract the Safe Motherhood Initiative and fifth Millennium Development Goal. To optimise women's proper and timely access to care and compliance with treatment, caregivers need to take women's emotional and social well-being, as well as their beliefs and explanations of health and illness, into account when making decision [92].

Caregivers use defence mechanisms to withdraw from their responsibility of high CS rates

All caregivers emphasised external factors outside their control to explain the high CS rates. We know that the maternal age has increased during the past decade, which increases the risk of CS [74]. It is also true, as caregivers stated, that women with low educational level have higher risk of severe complications and arriving at hospital in a critical condition [168], which might leave no other option than to perform CS. MNH will also be inclined to have a high CS rate due to its status as a referral hospital. Yet, two-thirds

of the women who deliver at the hospital are self-referred, probably because healthy women sometimes bypass referring facilities [44]. The CS rate had also increased significantly after controlling for maternal age and referral status. The way in which our respondents withdrew from their responsibility of the hospital's high CS rate by pointing to external factors draws on theories about blame avoidance and defence strategies [114-116]. Also in other studies on maternal health in Tanzania, caregivers have been reported to emphasise external factors as reasons for substandard care [140] and to focus on changes in the community rather than at their health care facilities to reduce maternal mortality [169]. Caregivers in our studies stressed that maternal requests for CS among private patients was a major reason for the high CS rate, and some seemed to have adopted the 'too posh to push' rhetoric [77, 95]. Women's perspectives on CS, with fear of death, shock over the decision, and pain afterwards, contradicted that there would be a large maternal demand for CS. Caregivers' overestimation of maternal request might therefore be a way to withdraw from their own role in the hospital's high CS rate [77, 80, 83, 86]. The problem with medically unjustified CSs can never be successfully addressed unless caregivers acknowledge their own responsibility for high CS rates as well as their roles as decision-makers and medical experts.

Dysfunctional team-work leads to an overuse of CS

Failures in team-work and communication are among the top causes of adverse obstetric events [170] and, in our setting, dysfunctional team-work might also have contributed to an overuse of CS. There seemed to be competing roles between staff, and the team-spirit appeared to be stronger among midwives than between midwives and doctors, or between doctors. Senior doctors' provision of support to their junior colleagues during calls was insufficient, and in an audit study at MNH only 25% of CSs performed on public patients due to foetal distress were reviewed by a specialist (Andrew Mgaya, unpublished 2014). Because residents need to have an opportunity to discuss their decisions, especially during their first years, such inadequate support might lead to CSs being performed on doubtful indications.

Midwives are often put forward as advocators for normal delivery [27, 28, 105]. We found, however, that midwives were generally very positive towards CS, and residents sometimes felt pushed by the midwives to perform CSs. As reported in another study from Tanzania, where the medical doctor or assistant medical officer in charge was not involved in a third of the CS decisions [40], midwives sometimes bypassed the resident if he or she did not agree with their proposal of CS. Midwives and doctors might view risks with CS differently, as midwives more rarely see – and have to take responsibility for – late CS complications such as postoperative infections [105]. On the other hand, midwives will be held accountable for adverse events in

the labour room. It seemed as if midwives wanted to demonstrate their competence by emphasising that they had enough experience to know when a woman needed CS. In other developing countries, concerns have been raised that midwives might get marginalised when the economy grows rapidly and birth becomes medicalised [28]. Many midwives in our study expressed concern that their profession was not respected enough, and deprecated the traditional role of midwives being compliant, passive and subservient to doctors [92].

Residents seemed to be lonely and mistrusted by both seniors and midwives. Because midwives were generally older than residents, they naturally enjoyed the resident's respect [136], and residents were highly dependent on creating a smooth relationship with the midwives to function as doctors. Although formally responsible for CS decisions during calls, many residents witnessed that they sometimes performed CSs on doubtful indications to avoid friction with the midwives. Midwifery-led care has, in randomised controlled trials, been shown to have a number of preferable effects compared to obstetrician-led care [27, 28], and there is no doubt that midwives play an important role in the labour ward. At a tertiary institution with many patients with severe complications, however, functioning team-work between doctors and midwives is crucial. To avoid further friction between the two groups, which might impair the decision-making process and ultimately pose a patient safety concern, each player's autonomy and competence must be respected.

Transparency and fear leads to an overuse of CS

That fears of lawsuits and complaints can lead to medically unjustified CSs has been reported before [95, 99, 101, 116]. But we could also see that the regular meetings, audits, and statements to the management encouraged caregivers to perform CS. It seemed as if these methods of observing and evaluating the staff created such fear and anxiety that the outcome of these evaluations had become equally, or even more, important than the outcome of the patient. Fear of blame during audit sessions have been reported in other studies from Africa [169, 171, 172], and punishment for inappropriate work-related behaviour in the form of written and verbal warnings was fairly common in a survey at MNH [173]. In our study, caregivers had reconstructed their view of CS [126, 127]; CS had become a 'rescue', a safe procedure that would free them from blame from colleagues. This reconstruction facilitated an overuse of CS, and seemed to be widely accepted by both residents and specialists. Thus, transparency and auditing, which have previously been reported to alter caregivers' behaviour and induce other types of defensive practices [118, 120, 121, 128], might also lead to medically unjustified CSs.

What can be done?

From my observations of an unorganised emergency care, and the fact that several MNM events and deaths during CS were related to anaesthetic complications, there seems to be an urgent need to prioritise anaesthetic services. Concerns for poorly trained anaesthetic personnel and lack of senior anaesthetic supervision have been raised before as being among the major reasons for morbidities and deaths related to CS in low-resource settings [49, 174]. In a questionnaire covering a third of Uganda's anaesthesia providers, only 6% stated that their facilities could offer safe anaesthesia services for CS [48]. As stressed by Souza et al., severe obstetric complications do not only require utero-tonic drugs and magnesium sulphate, but also proper shock management, pre-delivery stabilisation, severe hypertension management, and airway protection [2]. Although many skilled birth assistants are unable to provide such measures [140] and severity of symptoms are often underestimated [2], the Tanzanian Global Health Initiative Strategy to improve maternal health states nothing about the need to improve anaesthetic services to avert maternal ill-health and death [137]. Introducing ranking scores based on the MNM criteria has been suggested as one way to help clinicians assess severity of symptoms and build a plan for treatment, referral, and consultation of anaesthetic staff [175].

Although experience of using non-medical doctors in Tanzania is generally good [176], our results of a high level of CS complications at peripheral hospitals are of concern. Policy-makers need to make sure that such staff are continually trained and supervised, in order to guarantee that task-shifting does not jeopardise the quality of care. Moreover, low work morale and a lack of a feeling of accountability among caregivers might affect their work performance, and have previously been related to low salaries, dissatisfaction with working conditions, and poor communication channels [173]. Such issues also need to be addressed by hospital managements.

The WHO states maternal death reviews to be one of the most important tools towards reducing maternal mortality [3]. Although such reviews are already in practice in Tanzania, the current audit system struggles with several challenges, such as insufficient coverage in the use of maternal death audits [137], fear of punishment and demotivation [140], and failure to explore challenges and solutions at facility level [169]. Auditing severe outcomes have been found to be successful in other low-resource settings [177] with up to 82% of recommendations being implemented [124]. To make audits and maternal death reviews work, enough resources need to be in place to induce change [124] and ideas need to be supported by the management [172]. The efficacy of audit is also highly dependent on the way in which feedback to the staff is provided [178]. Avoiding humiliation of staff during sessions was stated among the top suggestions to facilitate audit procedures in Burkina Faso [124]. Focus needs to be redirected from blaming

individual caregivers to illuminating structural problems. A recent randomised controlled trial from Senegal and Mali reported promising reduction in MMRs when maternal death audits were introduced coupled with supervision by trained external facilitators [179]. Other suggestions to improve quality of care are MNM reviews [18], which can limit the feeling of guilt and blame, or confidential enquiries, which take the quality assurance process ‘one level up’, that is, to politicians and health planners who have the power to allocate adequate resources [140].

The problem with an overuse of CSs in low-resource settings also needs to be addressed. In prior studies, audits and feedback have been reported to prevent medically unjustified CSs [156, 180], although results are conflicting [181]. Implementing the Robson classification can be another way to change practices [38, 156, 182], one of its advantages being that interventions can be targeted at and later evaluated in specific obstetric groups [1]. Having the specialist on call at the hospital instead of at home [102] as well as introducing a mandatory second-opinion for CS decisions [181] might improve the situation for the residents and prevent unnecessary operations. Likewise, group decisions among specialists, for example in cases on maternal request for CS or when indications are questionable, might make decisions more appropriate [104]. In a Canadian study, a ‘hard-stop’ approach towards elective CSs < 39 weeks of gestation was found to be more effective than a ‘soft-stop’ approach or ‘education-only’ approach [183], something that might be worth considering when planning interventions. Reinforcing the use of vacuum extraction is another commonly mentioned intervention to avoid unnecessary CSs, and might provide a faster, safer, and more cost effective alternative if used wisely [142, 184]. Social support to women during pregnancy and labour has also been reported to reduce antenatal hospitalisation as well as the use of caesarean delivery [11]. As demonstrated by our findings, however, any interventions to reduce CSs need to start by identifying the barriers to change in order to be effective [11, 180].

Methodological considerations

The major strength with this thesis is that it derived from a clear, clinical problem and that the triangulation of methods, including epidemiological, qualitative, and observational studies, made our results more comprehensive. For example, the improved perinatal outcomes and increased MMR is logical when knowing that women and caregivers have started to prioritise perinatal outcomes over potential maternal risks with CS, and that caregivers involved in events with stillbirths or ‘low-scores’ are subjected to blame and disciplinary measures. Because we understand the working situation at peripheral hospitals, how poorly the referral system functions, and how caregivers reason around letting women with previous scars try labour, we can interpret the unexpected finding that multipara with previous scars had better outcomes than multipara with previous vaginal deliveries.

Quantitative data collections

Most important strengths

The Robson classification is an objective tool for international comparisons of CS rates [1], and provided us with a useful overview from which to start. By applying the WHO MNM criteria, we could identify women with direct signs and symptoms of organ dysfunction, which more reliably reflects life-threatening conditions than using a diagnosis-based inclusion [14]. When assessing MNM events and deaths potentially associated with CS, we considered each one individually, taking any pre-existing conditions and indications of the operations into account. By doing so, we got an estimate of the intrinsic risk with CS and not only the case fatality rate. In our study of multipara with and without previous CSs, participants were comparable in terms of socio-demographic and clinical characteristics, which facilitated the comparison of the two groups.

Most important limitations

Using register data is always associated with risks of underreporting and errors. For example, Robson group 9 (transverse lie) presented large differences in the total number of deliveries between the years, indicating that this

type of presentation was occasionally underreported. Neither did group 9 have a 100% CS rate as it should [38]. The surprisingly high CS rate in Robson group 3 (multipara without previous CSs) could potentially have been explained by an underreporting of previous scars. In the data quality check, however, CS scar showed ‘substantial agreement’, indicating that it was a reliable variable. Groups 2 and 4, inductions and elective CSs, were very small in comparison with other studies [38, 44, 45]. Although this might be partly due to a local tradition to rarely perform induction and difficulties to plan for elective CSs, there seemed to be an underreporting of induction of labour in the MNH database, as reflected by the low Kappa coefficient in the data quality check.

Other problematic variables in the data quality check were marital status and private/public status. The relatively low Kappa coefficient and wide CIs in these variables are, however, largely an effect of the high prevalence of ‘married’ and ‘public’ women, which makes the statistical chance of agreement in such dichotomous variables very high, and consequently creates a low Kappa coefficient [185]. In ‘area of residence’, the poor agreement was most likely due to our different ways of categorising Dar es Salaam into urban, semi-urban, and rural areas, where the hospital staff’s data were most likely more accurate. However, our most important variables, such as mode of delivery and perinatal outcomes reflected as Apgar score at 1 and 5 minutes, presented ‘almost perfect agreement’.

Moreover, we had to redefine some variables and use proxies for some outcomes. For example, we used birth-weight instead of gestational age to classify women into the Robson groups. Although this redefinition makes our results less comparable with other Robson studies, it was preferable to using fundal height and last menstruation period as our main interest was time trends. The proportion of babies with low birth-weight in our dataset was also in accordance with the estimated prevalence of preterm birth in Sub-Saharan Africa [186]. The use of Apgar score < 7 at 5 minutes as a proxy for birth asphyxia has been questioned by the American Academy of Pediatrics [187], but, as it might predict neonatal survival [188], we chose to use it to estimate neonatal distress. Important to stress regarding Study I is also that we cannot determine whether the increased MMR was due to the CS rise or other factors, but only that the increase in these two outcomes coincided in terms of time.

In Study II, we could not apply all WHO MNM criteria due to limited resources at the two facilities, a problem encountered by other authors [157, 189-191], and might therefore have underestimated the occurrence of MNM, especially at TH. At the time we started the study, there were no publications that had applied the new criteria. When we now compare our results with others, we can see that they have made a different interpretation of the criterion ‘uncontrollable fits’, only including women with continuous seizures [2, 8, 191] while we included all with unconsciousness and generalised fits. This

difference has to be considered when comparing our estimated MNM ratio with other studies. Due to practical reasons we could not follow women after their discharge from hospital. Because some women may have died at home or at another institution within 42 days, we might have underestimated the number of maternal deaths and overestimated the MNM ratio. As autopsies were not performed, the underlying cause of death was based solely on information in the medical record, and must therefore be interpreted with caution. The panorama was, however, coherent with the panorama found in a recently published audit of maternal deaths at MNH in 2011 [161]. Moreover, determining whether CS complications were due to the operation per se was sometimes difficult, especially among complications that can also occur after vaginal delivery. Our grading system might, however, be further developed in future studies.

Our inability to detect an association between MNM and death and previous CS scar might be because there was no difference in risk between multipara with previous CSs and previous vaginal deliveries in this setting. However, given the small absolute numbers of women with MNM and death, the study size might also have been too small to detect such an association, as suggested by the wide CI [192]. Moreover, as mentioned in the discussion, there might have been a selection bias in Study IIb that can explain the absence of increased risk of MNM and death, as well as the lower risk of adverse perinatal outcomes among women with previous CSs. Because the university hospital is a tertiary institution, women with previous CSs might have constituted a ‘healthier’ group that were admitted only because of their scars. Women with previous vaginal deliveries, on the other hand, are typically regarded as a low-risk group and were probably more often admitted when they experienced complications. This makes our results less generalisable to other obstetric populations. Another limitation is that we did not know the number and indications of previous CSs, which would have provided valuable information.

Qualitative data collection

Most important strengths

By including both women and caregivers, we were able to capture their converging and diverging perspectives on CS. The qualitative design made it possible to explore how CS was viewed within women’s social context, and thereby captured how the wider community influenced birth preferences. Interviewing women in their homes, instead of at a health care facility, seemed to make them more comfortable and out-spoken. Caregivers were also surprisingly open, and vividly expressed their opinions about sensitive topics. In in-depth interviews, the first minutes are decisive, as the respond-

ents want to have a grasp of the interviewer before he or she talks freely [149]. Several of the respondents, both caregivers and women, recognised me from hanging around in the hospital, which might have facilitated the contact. I was also familiar with abbreviations and slang terms frequently used by caregivers, and did not need to interrupt the respondents for explanations. Because I had no particular loyalties or responsibilities at the department, my position as a foreigner seemed to enhance openness rather than acted as a barrier. Although I had problems to obtain rich data from the midwives, recruiting a midwife to the project and letting her interview the midwives instead, gave us a better understanding of the midwives' opinions and made it possible to triangulate responses from different categories of staff. Data could also be peer-checked for authenticity, as two research group members worked at the department. It is sometimes stated that FGDs should be comprised of participants who do not know each other. Working with pre-existing groups, however, enables the researcher to explore how people talk about a topic within the group that actually operate, and this has the advantage that participants can relate to each other's comments about incidents in their shared daily lives [150]. Consequently, this method allows for a deeper understanding of how ideas are formed and how decisions are made within that particular context.

Most important limitations

The use of an interpreter and translated transcripts can always introduce bias as meaning may get lost in translation [193]. In most of our interviews, however, the translator was a member of the research team, and analysis was performed through dialogue between the research group members. Although I eventually learned some Kiswahili and could understand most of what was going on, the language barrier did partly isolate me from fully capturing events in the hospitals, and precluded informal conversations with women that might have provided additional understanding and depth.

The fact that we interviewed women ourselves, being medical professionals, might have inhibited women to speak freely. Although women did express negative feelings about their operations and care encounters, we cannot rule out that using an external interviewer might have given other responses. A group of women who were not represented in the dataset were women who had undergone CSs but who had lost their babies delivered by CS. Including the voices of these women might have added additional information and more diversity. Important to stress is also that our study does not seek to conclude anything about birth preferences generally among Tanzanian women, but only to provide an understanding of the reasons behind their CS perceptions.

Arranging a FGD with specialists or a combined FGD with residents and midwives would probably have provided interesting data. We did, however,

experience practical difficulties in arranging the FGDs. Neither was data from FGDs as rich as those from individual interviews. In the FGD with midwives, participants were very well-tuned and the group dynamics suggested that there was a strong leader in the group, which might have inhibited other opinions. Residents were more prone to debate, but were stressed due to work and studying for their exams.

The generalisability of qualitative research findings is always under debate, as the results are defined by the specific context in which they occur [127]. We believe, however, that health care professionals working in both high- and low-resource settings might recognise many of the phenomena we describe, such as situations where maternal health is jeopardised on questionable indications, problems with team-work during night shifts, and defensive practice originating in a fear of blame from colleagues. We hope that our results might guide future inquiries, as well as stimulate discussions and reflection on the use and overuse of CS globally.

Conclusion

CS rates can never be judged in isolation from other epidemiological or contextual aspects. Neither is the question whether CS rates are too high or too low, but whether CSs are used adequately or not. Together with other research findings from the same and similar settings, our results present evidence that CS is being overused also in low-resource contexts. Overuse of CS is sometimes portrayed as a ‘luxury problem’, where almost infinite resources are used to promote a painless, safe, and ‘controlled’ birth. The medical literature is clear, however, that CS does not offer such a delivery. In this thesis, I argue that an overuse of CS in low-resource settings should be seen as a sign of substandard care. Because women cannot be guaranteed vaginal deliveries under safe circumstances, women without proper indications are sent for CS. While monitoring and supporting normal labour is time-consuming, demanding, and requires human resources and organisation, CS is a ‘quick fix’.

Despite improved surgical and anaesthetic procedures during recent years, and caregivers’ perceptions that CS is a safe operation, we have demonstrated that CS still entails high risks for women in low-resource settings. We have provided estimates, not only in relation to complications such as haemorrhage or thrombosis, but of risks defined as life-threatening conditions by using the MNM concept. We believe this approach to be useful to assess the severity of complications and that it might be applicable in future studies. We have reported improved perinatal outcomes during the same time period as the CS rates increased, and demonstrated that both women and caregivers justify maternal risks with CS by referring to a need to ‘secure’ the baby, even when indications for CS are dubious. We believe that private practice and dysfunctional team-work play a part in the overuse of CS, and that transparency and auditing have created a new performance orientation where staff prioritise to safeguard themselves over what is best for their clients. To conclude, I raise a concern that maternal health, interests, and voices are overlooked through the CS decision for the benefit of perinatal outcomes and caregivers’ liability, a shift in focus that can have serious consequences on women’s health in low-resource settings and violates FIGO’s ethical frameworks. Although universal access to CS is of utmost importance, preventing its overuse needs to be among the key actions in order to improve maternal health beyond 2015.

Clinical recommendations

Based on our research findings, my observations, and caregivers' suggestions, I here list a number of clinical recommendations to reduce severe maternal morbidity, strengthen women's birth preparedness and autonomy, and minimise medically unjustified CSs in the Dar es Salaam area and similar urban settings. Although there is an obvious need to strengthen the Tanzanian health care system, which requires additional funding, some of these suggestions can be implemented given the resources that are currently available. Some recommendations might also be suitable for future research projects. Few of these points are new, however, our results demonstrate that they need to be repeatedly highlighted.

At health care system level

- Human and material health care resources need to be more evenly distributed in order to meet the needs for comprehensive emergency obstetric care where the majority of women give birth. One of the key issues is to recruit more medical doctors to peripheral hospitals and avoid 'accumulation' of competence in one hospital. Peripheral hospitals need to have the same access as central hospitals to operating theatres, basic equipment, and emergency drugs in order to manage severe complications and perform necessary CSs.

At antenatal care level

- The quality of antenatal care services needs to be strengthened and should be able to detect complications such as pre-eclampsia. Women need to be better informed about danger signs, especially those related to hypertensive disorders, and urged to seek health care earlier. Promoting full coverage of antenatal care cannot be prioritised as long as quality of care is substandard.
- Women should be better informed about CS indications and complications during antenatal care visits in order to facilitate communication with caregivers during labour and enhance women's birth preparedness.

At hospital level

- Anaesthetic staff need qualified, continual training and supervision. Improving anaesthetic services needs to be among the top priorities to improve obstetric care in low-resource settings and needs to be incorporated as a natural part of assessing and managing emergency obstetric complications.
- Surveillance and management during labour needs to be closer and more active, with continual palpation of uterine contractions, repeated vaginal examinations, and wise use of Oxytocin, in order to prevent obstructed labour and uterine ruptures.
- Surveillance of foetal heart rate needs to be structured, continual, and documented in order to decrease perinatal mortality and birth asphyxia. Providing caregivers with basic Doppler machines might encourage and facilitate foetal heart rate auscultation.
- Postpartum monitoring needs to be closer, after CSs as well as after vaginal deliveries, in order earlier detect severe haemorrhage and trigger appropriate measures. To avoid severe complications and prevent hysterectomies, a larger variety of utero-tonic drugs needs to be available, and the use of uterine artery ligation and B-lynch suture should be encouraged.
- The main barriers to why surveillance and monitoring are substandard need to be identified and addressed. Although lack of staff might be a contributing factor, there seems to be a need for clearer leadership, better organisation of work, and a more genuine feeling of accountability among health care professionals.
- Auditing cases with iatrogenic complications, including severe CS complications, in a blame-free environment might identify risk situations and strengthen patient safety.
- The Robson classification should be prospectively implemented as a way to monitor and analyse CS rates, with continual, hospital-based feedback to the staff. When writing their operation report or documenting a vaginal delivery, doctors and midwives can note their patient's Robson group in the medical record and the information can later be used to present statistics.
- Standard operating procedures or checklists with locally accepted criteria for CS on 'foetal distress' and 'obstructed labour' might help and

guide caregivers in their decision-making and reduce the risk of blame in the case of adverse outcomes. Work towards such routines is already ongoing at MNH.

- The use and training on instrumental deliveries, such as vacuum extraction, should be increased and encouraged. A research project to identify the main barriers to why instrumental deliveries are underused might be of value.
- Incentives and policies related to private practice should be arranged so that CSs without proper indications are not promoted. Specialists with private practice located at the same hospital should come to a consensus on what indications CSs in private patients should be performed or not, for example regarding maternal request.
- The collaboration between labour wards and operating theatres needs to be optimised, in order to shorten time intervals between CS decisions and deliveries. Such shorter time interval would improve maternal and perinatal outcomes in emergency situations, and might encourage caregivers to try more instrument deliveries and allow more trial of vaginal delivery in women with previous CS scars.
- A blame-free environment during meetings, audit sessions, and between colleagues is crucial to improve practices and avoid an overuse of CS. Case presentations in meetings should include all staff involved in the case, and also midwives, so that all aspects of the event are highlighted. Actions and recommendations from audits need to be focused on systematic problems and blaming individuals should be avoided. Future studies might be useful to find ways in which to conduct audits and provide feedback that is as blame-free as possible.

At inter-individual level

- Women should be allowed to bring with them a family member or friend during labour, who can provide comfort and care and who can support their decisions.
- Women need to be better counselled on CS decisions, so that they fully understand the reasons for and long-term effects of their operations. In the case of an emergency situation, where such a consultation is difficult, women should be thoroughly counselled during the postpartum period or during the follow-up visit.

- Caregivers need to incorporate women's views of birth and any long-term effects CS might have, including socioeconomic consequences, when making decisions. Caregivers need to thoroughly penetrate the reasons for maternal demands for CS, in order to prevent misconceptions and unnecessary operations.
- Senior doctors need to better support junior doctors, in order to strengthen junior doctors' feeling of competence and improve their decision-making capacity. This could be done by introducing a mandatory second opinion for CS decisions or having stricter guidelines on when the residents should consult the specialists. To facilitate communication and cooperation, guidelines might need to state that the specialist should stay at the hospital during calls or that the time interval from phone contact to appearance at the hospital should be shorter than two hours.
- The team-work between residents and midwives needs to be as free as possible of conflicts and competition. An important step towards such a working environment is that each player's competence and autonomy is respected; that midwives feel that their experience and expertise is appreciated and that the responsibility that lies on junior doctors is recognised.

Summary in Swedish/Sammanfattning på svenska

Adekvat tillgång till kejsarsnitt är en förutsättning för att kunna garantera kvinnor och deras barn en säker förlossning. Under de senaste årtiondena har kejsarsnittsfrekvenserna ökat kraftigt över hela världen. Trots att de flesta låginkomstländer fortfarande har en utbredd underanvändning av kejsarsnitt, rapporteras det i allt högre grad om höga kejsarsnittsfrekvenser även i dessa länder. Det övergripande syftet med den här avhandlingen är att försöka förstå effekterna av och orsakerna till en ökning av kejsarsnittsfrekvensen i sådana lågresursmiljöer.

Studierna utfördes på ett universitetssjukhus i Dar es Salaam, Tanzania. I *Studie I* använde vi sjukhusets databas för att analysera tidstrender gällande kejsarsnittsfrekvenser samt utfall för kvinnor och nyfödda barn. Vi delade in alla kvinnor i tio grupper enligt den s.k. Robsonklassificeringen. Detta klassificeringssystem är baserat på huruvida kvinnan har haft tidigare förlossningar samt om dessa var vaginala eller kejsarsnitt; om kvinnan väntar ett eller flera foster; om fostret ligger i huvud-, säte- eller tvärläge; om förlossningen startar spontant eller sätts igång; samt vilken graviditetsvecka kvinnan befinner sig i. Vi fann en kraftig ökning av kejsarsnittsfrekvensen; från 19 % år 2000–2002 till 49 % år 2009–2011. Under samma tidsperiod hade det skett en statistiskt säkerställd ökning av mödradödligheten, men en förbättring i utfallen för nyfödda barn. Som en följd av denna förändring i obstetrisk praxis hade andelen kvinnor med ärr efter ett tidigare kejsarsnitt ökat kraftigt, men i övrigt var kejsarsnittsökningen påtagligt hög i typiska ”låg-riskgrupper”. Studiens resultat ledde till en hypotes att många kejsarsnitt utfördes på medicinskt tvivelaktiga grunder, samt väckte frågor om ökningen i mödradödlighet kunde bero på kejsarsnittskomplikationer.

I *Studie II* dokumenterade vi förekomsten och panoramat av livshotande tillstånd under graviditet och förlossning, s.k. ”near-miss”, samt mödradöd under 20 veckor 2012 på universitetssjukhuset och ett av regionssjukhusen i samma stad. ”Near-miss” är enligt Världshälsoorganisationen ”en kvinna som nästan dör men överlever en komplikation under graviditet, förlossning eller inom 42 dygn efter förlossning”. Vi granskade alla fall och analyserade huruvida dessa tillstånd var relaterade till kejsarsnittskomplikationer eller ej. Totalt registrerade vi 467 fall av ”near-miss” (36 per 1000 levande födda barn) och 77 mödradödsfall (587 per 100 000 levande födda). Trots att

de flesta fallen var orsakade av kända vanligt förekommande komplikationer såsom havandeskapsförgiftning och blödningar efter förlossning, var en stor andel av de livshotande tillstånden (7,9 %) och mödradödsfallen (13 %) direkt orsakade av kejsarsnittskomplikationer. Vi räknade ut risken per 1000 operationer att drabbas av livshotande tillstånd eller mödradöd p.g.a. en kejsarsnittskomplikation, och fann att den risken var tre gånger så hög på regionssjukhuset jämfört med universitetssjukhuset. Många av fallen var relaterade till komplikationer i samband med ryggbedövning och svåra infektioner i ärrer. Vi tolkade våra fynd som ett bevis för de stora risker det innebära att genomgå kejsarsnitt i lågresursmiljöer, f.f.a. på mindre sjukhus, och att det finns ett behov att stärka omhändertagandet främst vad gäller narkos-och intensivvård.

I Studie II gjorde vi också en delanalys där vi försökte ta reda på om kvinnor med ärr efter tidigare kejsarsnitt hade högre risk för att drabbas av "near-miss", mödradöd eller dåligt utfall för det nyfödda barnet i sin nästa graviditet jämfört med kvinnor med tidigare vaginala förlossningar. Vi fann inget sådant samband, men såg att kvinnor med tidigare kejsarsnitt hade bättre utfall för det nyfödda barnet. Dessa fynd strider mot tidigare publicerade studier, men vi tror att de beror på att kvinnor med ärr efter tidigare kejsarsnitt får en bättre vård jämfört med kvinnor med tidigare vaginala förlossningar i just den här kontexten. Bl.a. blir de uppmanade att söka vård i ett tidigare skede, de blir i högre grad remitterade till sjukhus med bättre resurser, de blir snabbare omhändertagna på sjukhuset och får snabbare komma till operationsavdelningen när kejsarsnitt behövs.

Studie III och Studie IV var kvalitativa studier där vi ville förstå kvinnors och vårdgivares uppfattningar och attityder till kejsarsnitt samt hur vårdgivare förklarade den höga kejsarsnittsfrekvensen på sjukhuset. Vi intervjuade och arrangerade fokusgrupper med 13 kvinnor som nyligen genomgått kejsarsnitt, 18 läkare och 14 barnmorskor. Både kvinnor och vårdgivare föredrog vaginal förlossning, men läkare och barnmorskor var generellt mer positiva till kejsarsnitt än de nyförlösta kvinnorna. Trots att alla kvinnor hade varit rädda för att dö under operationen, och att de flesta vårdgivare ansåg att kejsarsnitt var förenat med en ökad sannolikhet för svåra komplikationer för mamman jämfört med normal förlossning, var båda parter redo att ta sådana risker för att "säkra" ett bra utfall för det nyfödda barnet. Kvinnors bekymmer att kejsarsnittet hade lett till ökade kostnader och utgjorde en belastning för familjens ekonomi, hade lett till arbetsförmåga veckorna efter operationen, samt begränsade antalet barn de kunde skaffa i framtiden togs sällan med i beräkningen av vårdgivare när de fattade kejsarsnittbeslut.

Både läkare och barnmorskor förklarade den höga kejsarsnittsfrekvensen genom att åberopa externa faktorer som de inte råde över, t.ex. att globaliseringen lett till övervikt och "västerländska" sjukdomar, att de remitterande sjukhusen var dåligt utrustade och därför oförmögna att ta hand om sina egna kejsarsnitt, att kvinnor kom sent till sjukhuset p.g.a. sin låga utbild-

ningsnivå samt att kvinnor själva önskade kejsarsnitt. Det framkom också att läkare under specialistutbildning, som bar det yttersta ansvaret för kejsarsnittsbeslut under jourtid, hade dålig uppbackning av sina överordnade samt att konflikter mellan de yngre läkarna och barnmorskorna ibland resulterade i onödiga kejsarsnitt. Både läkare och barnmorskor uttryckte starkt obehag och rädsla för att bli skuldbelagda av kollegor och sjukhusledning för händelser med dåligt utfall, och sa att detta ledde till att de ibland valde att göra kejsarsnitt trots att det inte fanns någon medicinsk anledning.

Sammanfattningsvis visar våra resultat att det finns en överanvändning av kejsarsnitt även i låginkomstländer. Avhandlingen belyser att kejsarsnitt i lågresursmiljöer fortfarande, trots förbättrade kirurgiska metoder under de senaste åren, är förenade med höga risker för kvinnan. I den här avhandlingen lyfts en farhåga att kvinnors hälsa, intressen och röster nedprioriteras genom kejsarsnittsbeslutet till fördel för det nyfödda barnets utfall och vårdgivarnas ansvarsfrihet. Avhandlingen visar att överanvändning av kejsarsnitt i lågresursmiljöer inte ska ses som ett ”lyxproblem”, utan som ett uttryck för en undermålig vård där kvinnor inte kan garanteras en säker vaginal förlossning. Att förebygga en överanvändning av kejsarsnitt bör inkorporeras i de nya mål och riktlinjer som nu formuleras för tiden efter 2015, då Förenta Nationernas millenniemål för global hälsa går ut. Den här avhandlingen presenterar en rad kliniska rekommendationer för att förbättra vårdkvaliteten och förebygga medicinskt tvivelaktiga kejsarsnitt.

Summary in Kiswahili/Muhtasari kwa Kiswahili

Upatikanaji wa huduma ya uzazi kwa njia ya upasuaji ni jambo la muhimu lakuzingatia ili kuhakikisha matokeo mazuri ya uzazi kwa mama na watoto. Katika miongo ya karibuni hizi, kiwango cha uzazi kwa njia ya upasuaji kimeongezeka kwa kasi duniani kote. Pamoja na kuwa sehemu kubwa ya nchi zenye kipato cha chini bado zinakabiliana na mahitaji yasiyofikiwa ya huduma ya uzazi kwa njia ya upasuaji, kuna ongezeko la taarifa kutoka nchi hizo zinazoonyesha matumizi ya uzazi kwa njia ya upasuaji yaliyozidi kiwango. Kwa ujumla, madhumini ya andiko hili ni kuelewa madhara na sababu zinazochangia ongezeko la uzazi kwa njia ya upasuaji katika sehemu zenye uhaba wa rasilimali.

Andiko hili ni la tafiti zilizofanyika katika hospital ya Chuo Kikuu kilichopo Dar es Salaam, Tanzania. Katika utafiti wa kwanza (I), taarifa za uzazi zilizopo kwenye kumbukumbu za hospital zilitumika katika kuchambua mwenendo wa viwango vya uzazi kwa njia ya upasuaji pamoja na matokeo yake kwa mama na watoto. Wakina mama waligawanywa katika makundi kumi, kulingana na mchanganuo uitwao, “*Robson classification*”. Utaratibu wa mchanganuo huo unazinagatia yafuatayo: Kama mama alishajifungua siku za nyuma kwa njia ya kawaida na upasuaji, kama mtoto umetanguliza makalio au kichwa, kama amekaa mshazari, kama uchungu ulianza wenyewe au ulianzishwa na yuko wiki ya ngapi ya ujauzito. Matokeo ya utafiti yameonyesha ongezeko kubwa la kiwango cha uzazi kwa njia ya upasuaji kutoka 19% kwa mwaka 2000 mpaka 49% kwa mwaka 2011. Katika muda huo huo, kulikuwa na ongezeko la vifo vya kinamama lakini matokeo ya watoto wachanga yaliridhisha. Ongezeko la uzazi kwa upasuaji ya upasuaji lilionekana zaidi miongoni mwa kundi la wajawazito wenye vidokezo hatarishirishi hafifu. Pia tuliona ongezeko kubwa la akina mama ambao walishaanza kwa njia ya upasuaji. Matokeo haya yanadhihirisha kwamba kiwango kikubwa cha upasuaji kilifanyika kwa kutumia vigezo vilivyona mashaka, na kuibua maswali, kama ongezeko la vifo vya kinama havisabashwi na matatizo katika upasuaji.

Katika utafiti wa pili (II), tulidhihirisha matukio na hali zinazohatarisha maisha kipindi cha ujauzito na wakati wa kujifungua, yaaitwayo matukio ya “*near miss*”, pamoja na vifo vya akima mama. Tulikusanya taarifa kwa wiki 20 katika hospitali ya Chuo Kikuu na moja ya hospital za mkoa, zote zikiwa

katika jiji moja na kuchambua akina mama 467 waliyopata matatizo ya uzazi na kupunea chupu chupu kufa yaani “near miss events” (matokea 36 kwa uzazi wa watoto hai 1000) na vifo vya akina mama 77 (vifo 587 kwa uzazi wa watoto hai 100,000). Akina mama wenye matokeo mabaya ya uzazi walikuwa na matatizo yanayojulikana mfano hali ya awali kabla ya kifafa cha mimba yaani “*pre eclampsia*” na kutoka damu ukeni baada ya kujifungua. Tuligundua kuwa asilimia kubwa ya matatizo ya hali hatarishi kwa maisha (7.9%) and vifo vya kinmama (13%) vilichangiwa moja kwa moja na matatizo yahusianayo na uzazi wa upasuaji. Tulikokotoa pia hatari ya kupata matatizo haya kwa upasuaji kwa wagonjwa 1,000 na kuona kuwa hatari hii ni mara tatu zaidi katika hospital ya mkoa kuliko hospitali ya chuo kikuu. Matukio mengi yalihusiana na matatizo katika nusu kaputi (dawa ya ganzi), maambukizi makali ya vidudu katika kovu. Matokeo haya yalionyesha hatari zinazoambatana na upasuaji katika sehemu zenye rasilimali duni hasa katika hospitali ndogo , na kwamba kuna umuhimu wa kuboresha huduma katika maeneo haya na hasa huduma za dawa na nusu kaputi.

Pia tulifanya mchanganuo mdogo katika utafiti wa pili (II) ambapo tulipima kama mama akiwa na kovu la upasuaji katika mimba iliyotangulia ana ongezeko la matukio ya kupunea chupu chupu kufa “*near miss*”, kifo na matokeo mabaya kwa mtoto mchanga kuliko mama aliyejifungua kawaida uzazi uliyopita. Hatukuweza kuona uwiano wowote, ingawa tuligundua kuwa akinamama wenye kovu la upasuaji katika uzazi uliyotangulia wanamotokeo mazuri zaidi ya mtoto. Matokeo haya yanapingana na tafiti zilizopita, lakini ingewezekana kuelezea matokeo haya kwa ukweli kwamba akinamama wajawazito wenye kovu la awali hupewa kipau mbele kwenye ngazi kadhaa; hupewa misisitizo wa kuwahi hospital mapema endapo watahisi uchungu; mara kwa mara wajawazito hawa wanapata rufaa kwenda katika hospitali zenye uahueni wa rasilimali., wanachunguzwa mapema katika vituo vya huduma za afya na pia wanapewa kipao mbele kwenye foleni za kusubiri kufanyiwa upasuaji.

Utafiti wa tatu (III) na wanne (IV) ulikuwa uchunguzi wa ubora “*qualitative studies*” ambapo tulitaka kuelewa zaidi hisia na ufahamu wa akina mama na watoa huduma, mtazamo na maoni ya watoa huduma kuhusu uzazi kwa njia ya upasuaji na maelezo ya kiwango kikubwa cha uzazi kwa njia ya upasuaji hospitalini kwao. Tulifanya mahojiano na majadiliano katika vikundi kwa kuhusisha akina mama 13, madaktari 18 , na wauguzi wakunga 14. Wote akinamama na wauguzi wakunga walipendelea uzazi kwa njia ya kawaida, lakini kwa ujumla, madaktari na wauguzi wakunga walikubalina na uzazi kwa nia ya upasuaji zaidi kuliko akina mama. Pamoja na kuwa wakimama wote walikuwa na hofu ya kupoteza maisha yao wakati wa upasuaji, na kwamba watoa huduma walifahamu kuwa uzazi kwa njia ya upasuaji ni hatari zaidi kwa mama kuliko uzazi kwa njia ya kawaida, makudi yote mawili yalikuwa tayari kukubali uhatarishi kwa ajili ya kupata mtoto mwenye afya. Wasiwasi wa akina mama kuhusu gharama za uzazi kwa njia

ya upasuaji , kushindwa kurudi kazini mapema baada ya upasuaji , kudorore-shwa kiuchumi, na kupangiwa kiwango cha idadi ya watoto, hayakupewa uzito na watoa huduma waliokuwa wakitoa uamuzi wa kutumia njia ya upasuaji.

Madaktari na wauguzi wakunga walielezea ongezeko la kiasi cha upasuaji kuwa ni sababu zilizo nje ya uwezo wao; utandawazi umeleta matatizo ya fetma “obesity” na magonjwa ya nchi za magharibu, hospitali zinazotoa rufaa kwa kutokuwa na vifaa vya kutosha and kutoweza kufanya upasuaji wakutosha kutimiza mahitaji, akina mama kuchelewa kufika hospotali kuto-kana na kutokuwa na elimu ya kutosha, na kuomba kuzaa kwa upasuaji. Pia ilidhihirika kuwa madaktari wa ngazi ya chini, ambao pia wamekuwa na jukumu lakufanya upasuaji wakiwa zamu, hawapati usimamizi wa kutosha kutoka kwa madaktari wa ngazi za juu yao na pia migogoro kati ya madaktari wa ngazi ya juu na wauguzi wakunga imechangia katika uzazi wa upasuaji usiyokuwa na sababu. Wote, madakari na wauguzi wakunga walionyesha kuogopa lawama kutoka kwa wenzao au uongozi wa hospital, kama wakihusika na matukio mabaya ya uzazi, na walisema kuwa mara nyingine hali hii inawafanya waamue uzazi kwa njia ya upasiaji bila sababu za msingi za kitaalamu.

Kwa kumalizia, hili andiko linaonyesha wasiwasi kuwa maslahi ya kina mama kiafya na sauti zao zinadidimizwa katika maamuzi ya uzazi kwa njia ya upasuaji kwa kigezo cha kulinda matokeo ya afya ya mtoto na dhima za watoa huduma. Hili andiko limepambanua kwamba kukidhiri kwa ongezeko la uzazi kwa njia ya upasuyaji kusionekane kama “tatizo anasa” bali kama dalili za huduma ya kiwango cha chini ambayo pia haimsaidii mama mzazi kumhakikisha uzazi salama. Usambazaji wa rasilmali usiyolingana hapa Dar es Salaam unachangia matumizi ya uzazi kwa njia ya upasuaji ya ziada na pungufu katika maeneo tofauti, hali ambayo inaweza kuongezeka miaka ijayo. Kuepuka ongezeko la uzazi kwa njia ya upasuaji kunapaswa kuwa tendo kuu la kuboresha afya ya mama baada ya 2015, pale ambapo malengo ya milinia yatakapopitwa na wakati. Andiko hili linaleta mapendekezo ya kitaalamu kadhaa ya kuinua kiwango cha huduma na kuepuka uzazi kwa njia ya kwa upasuaji usiyo kuwa na sababu za kitaalamu.

Summary in English

Adequate access to caesarean section (CS) is a prerequisite in order to guarantee a safe birth for women and their children. During recent decades, however, CS rates have increased rapidly worldwide. Despite that most low-income countries still struggle with an unmet need for CS, there are an increasing number of reports from low- and middle-income countries indicating high CS rates also in such contexts. The overall aim with this thesis was to explore the effects of and reasons for rising CS rates in low-resource settings.

The studies were performed at a university hospital in Dar es Salaam, Tanzania. In *Study I*, we used the hospital's obstetric database to analyse time trends of CS rates as well as outcomes for women and newborns. We divided all women into ten groups according to the 'Robson classification'. This classification system is based on whether women have given birth before and whether that was a vaginal delivery or a CS; if the foetus is positioned in a cephalic, breech, or transverse lie; if labour starts spontaneously or is induced; and the gestational week of the pregnancy. We found a sharp increase in the CS rate from 19% in 2000–2002 to 49% in 2009–2011. During the same time period, there was a statistically significant increase in the maternal mortality ratio but improvements in the outcomes for newborns. We also found that the proportion of women with a scar after previous CS increased substantially. Because the CS rise was particularly high among 'low-risk' groups, our results led to a hypothesis that many CSs were performed on medically doubtful indications. The results also raised questions if the increase in maternal mortality was due to CS complications.

In *Study II*, we documented the occurrence and panorama of maternal life-threatening conditions during pregnancy and childbirth, so-called maternal 'near-miss', and maternal deaths. A maternal near-miss is, according to the World Health Organization, 'a woman who almost dies but survives during pregnancy, childbirth, or within 42 days after termination of pregnancy'. We collected data during 20 weeks in 2012 at the university hospital and one of the regional hospitals in the same city, and analysed all cases to determine if they were caused by CS complications. In total, we registered 467 cases of near-miss events (36 per 1,000 live births) and 77 maternal deaths (587 per 100,000 live births). The majority of cases were caused by commonly known complications such as hypertensive disorders and postpartum haemorrhage, but we found that a large proportion of the life-threatening conditions (7.9%)

and maternal deaths (13%) were directly related to CS complications. We calculated the risk to suffer from such a complication per 1,000 operations and found this risk to be three times higher at the regional hospital than at the university hospital. Many of the events were related to complications due to spinal anaesthesia and severe infections in the scar. We interpreted our findings as evidence for the high risks associated with CSs in low-resource settings, especially at smaller hospitals, and that there is a need to improve the quality of care, especially the anaesthetic services.

In Study II, we also performed a sub-analysis where we sought to determine if women with scars after previous CSs had a higher risk of 'near-miss', death, or poor outcomes for the newborn than women with previous vaginal deliveries. We could not find such an association, but found that women with previous CSs had better outcomes for their newborns. These findings contradict previous literature from other contexts, but might be explained by the fact that women with previous CSs are prioritised on a number of levels in the health care system in this context; they are encouraged to come to the hospital early when labour starts, they are more often referred to hospitals with better resources, they are more promptly assessed at the health care facilities, and are prioritised in the operation queue.

Studies III and IV were qualitative studies where we wanted to understand women's and caregivers' attitudes and perceptions of CS and how caregivers explained their hospital's high CS rate. We interviewed and performed focus group discussions with 13 women who recently had undergone CSs, 18 doctors, and 14 midwives. Both women and caregivers preferred vaginal delivery, but doctors as well as midwives were generally more positive towards CS than were women. Despite the fact that all women had been afraid of dying during the operation, and that caregivers perceived CS as being more dangerous to women than vaginal delivery, both groups were ready to take such risks in order to 'secure' a healthy baby. Women's concerns that the operation would lead to increased costs, inability to resume their work and chores, put strains on the family economy, and limit the number of children they could have, were seldom taken into account by caregivers when making decisions.

Both doctors and midwives explained the high CS rates by referring to external factors outside their control; globalisation had led to more obesity and 'western' diseases, the referring hospitals were underequipped and unable to take care of their own CSs, women came late to hospital due to their low educational level, and some women requested CS. We found that junior doctors, who were formally responsible for CS decisions during calls, had inadequate support from their seniors and that conflicts between junior doctors and midwives sometimes resulted in unnecessary CSs. Both doctors and midwives expressed anxiety and fear of being blamed by their colleagues or the hospital management during meetings and audit sessions if they were

involved in events with poor outcomes, and stated that this sometimes made them perform CSs without genuine medical reasons.

To conclude, our results demonstrate that an overuse of CS also exists in hospitals in low-income countries. This thesis highlights that CS is, despite improved surgical procedures during recent years, still associated with high risks for the mother. In this thesis, I raise a concern that women's health, interests, and voices are down-graded through the CS decision for the benefit of newborn outcomes and caregivers' liability. An overuse of CS in low-resource settings should not be seen as a 'luxury problem', but as a sign of substandard care in which women cannot be guaranteed safe vaginal deliveries. Preventing an overuse of CS should be among the key actions to improve maternal health beyond 2015, when the United Nation's Millennium Development Goals expires. This thesis presents a number of clinical recommendations to improve quality of care and prevent medically unjustified CSs.

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Appendix

Table 7. *Criteria used for inclusion of MNM events, including definitions, interpretations, and applicability at the two settings.*

Criteria	Definition according to WHO [14]	Applicable at MNH	Applicable at TH
Clinical			
Acute cyanosis	Blue or purple colouration of the skin or mucous membranes due to low oxygen saturation ^a	Yes	Yes
Gasping	Terminal respiratory pattern, the breath is convulsively and audibly caught.	Yes	Yes
Severe bradypnea	Respiratory rate < 6	Yes	Yes
Severe tachynea	Respiratory rate > 40	Yes	Yes
Shock	Persistent systolic blood pressure ≤ 80 mmHg or a persistent systolic blood pressure ≤ 90 mmHg with a pulse rate ≥ 120	Yes	Yes
Oliguria	Urinary output < 30 ml/hour for 4 hours or < 400 ml/24 hours non-responsive to fluids or diuretics	Yes	Yes
Failure to form clots	Bedside clotting test ^b or absence of clotting from the IV site after 7 minutes	Yes	Yes ^c
Prolonged unconsciousness	Complete or near-complete lack of responsiveness to external stimuli for ≥ 12 hours	Yes	Yes
Cardiac arrest	Sudden absence of pulse and loss of consciousness	Yes	Yes
Stroke	Neurological deficit of cerebrovascular cause persisting ≥ 24 hours	Yes	Yes
Uncontrollable fits	Refractory, persistent convulsions ^d or status epilepticus	Yes	Yes

Total paralysis	Complete or partial paralysis of both sides of the body	Yes	Yes
Jaundice in the presence of pre-eclampsia	Presence of hypertension (blood pressure > 140/90) associated with proteinuria (> 1 + dipstick in ≥ 2 samples) and jaundice	Yes	Yes
Laboratory-based			
Severe hypoxemia	Oxygen saturation < 90% for ≥ 60 minutes	Yes	No
	OR PaO ₂ /FiO ₂ < 200 mmHg	No	No
Acute severe azotemia	Creatinine > 300 mmol/l or > 3,5 mg/dl	Yes	No
Severe acute hyperbilirubinemia	Bilirubin > 100 μ mol/l or > 6.0 mg/dl.	Yes	No
Severe acidosis	pH < 7.1	No	No
Severe hypoperfusion	Lactate > 5 mmol/l or > 45 mg/dl	No	No
Severe acute thrombocytopenia	<50 000 platelets/ml	Yes	No
Metabolic coma	Loss of consciousness and glucose + ketoacids in urine	Yes	No
Management-based			
Use of continuous vasoactive drugs	Uninterrupted infusion of dopamine, epinephrine, or norepinephrine.	Yes	No
Hysterectomy	Surgical removal of the uterus due to infection or haemorrhage	Yes	Yes
Massive blood transfusion	Transfusion of ≥ 5 units of blood ^e	Yes	Yes ^f
Intubation and ventilation not related to anaesthesia		Yes	Yes

Dialysis for acute renal failure		No ^g	No ^g
Cardiopulmonary resuscitation	Emergency procedures including chest compressions and lung ventilation.	Yes	Yes

^a As defined by the authors.

^b The bedside clotting test: (1) Take 2 ml of venous blood into a small, dry clean glass-tube; (2) Hold the tube in your closed fist to keep it warm; (3) After 4 minutes, tip the tube slowly to see if a clot is forming. Then tip it again until the blood clots and tube can be turned upside down; (4) Failure for a clot to form after 7 minutes or a soft clot that breaks down suggests coagulopathy.

^c Could have been applicable given the resources, but was not regularly practiced.

^d No further explanation provided in the guidelines. Was interpreted as loss of consciousness and repeated fits.

^e Including all types of blood products.

^f Blood for transfusion was available but never in these quantities.

^g Not available at the two hospitals at the time of the study, but was available at private hospitals in Dar es Salaam.

Table 8. *Interview guide and examples of questions posed to women*

Topic: Experiences of delivery

Can you please start by telling me about your past deliveries?

Probes: Circumstances? Reactions? Experiences of time afterwards?

Topic: Community perceptions of CS

What do you family members and friends say when you talk with them about your operation?

Probes: Husband? Friends? Relatives? Advises on mode of delivery?

Topic: Opinions of CS as mode of delivery

From your experience, what do you think about CS as mode of delivery?

Probes: Preferred mode of delivery? Advice to sister or friend?

Topic: Future fertility plans

How do you think regarding future pregnancies?

Probes: Future deliveries? Family size?

Table 9. *Interview guide and examples of questions posed to caregivers*

Topic: Experience of CS

Can you please start by telling me about the last CS that you did/were involved in?

Probes: Circumstances? Woman's reactions to the decision? Woman's understanding of the indications? Interaction with other staff? Experiences in general? Private vs. public patients?

Topic: Opinions of CS as mode of delivery

What do you think about CS as mode of delivery in general?

Probes: Risks? Traditions of birth? Advice to family members?

Topic: Future fertility plans

As you know, many women want to have several children. How do you reason around that when you make decisions?

Probes: Affect decision? Depends on woman or her characteristics?

Topic: Rationales for the CS rate

As you know, the CS rate at MNH is currently around 50%. What are your thoughts around that?

Probes: Reasons? Problem? Ways to reduce?

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