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Quality of maternal healthcare

*Exploring severe maternal outcomes and
the influence of delays and decision-making
on caesarean sections in a low-resource setting*

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Abstract

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Somaliland has one of the highest maternal mortality rates worldwide, yet there is limited evidence for severe maternal outcomes and challenges with the provision and utilisation of emergency obstetric care (EmOC). This thesis studied quality of maternal healthcare by exploring severe maternal outcomes and the influences of delays and decision-making on caesarean sections in Somaliland.

In Paper I, incidences of severe maternal outcomes and unmet need for emergency obstetric care interventions were investigated at the national hospital using a cross sectional study. The maternal mortality ratio was 462 per 100,000 live births and the maternal near miss ratio 56.5 per 1000 live births, according to sub-Saharan Africa criteria. Most laparotomies (60%) were performed after more than 3 hours. Medical complications (63%) had the highest mortality index.

In Paper II, an explorative qualitative study using focus group discussions was conducted with healthcare providers. A collective decision-making process at the family rather than individual level by the woman; poverty and lack of awareness; and healthcare system factors such as miscommunication, infrastructure and inadequate collaboration were experienced as factors contributing to delays with the utilisation of EmOC.

In Paper III, a cohort study examined whether there was an association between delayed caesarean section (CS) and adverse maternal and newborn outcomes and the type of barrier leading to delayed CS. A delay in CS of more than 3 hours was associated with higher odds of severe maternal outcomes (aOR 1.58, 95% CI [1.13–2.21]). Moreover, family decision-making for consent was the most important barrier leading to delays of more than 3 hours (48%).

In Paper IV, a mixed methods study was conducted to investigate barriers to and facilitators of timely family consent for CS. Women with hypertensive disorders (aOR 8.491, 95% [1.076–66.991]) and obstetric hemorrhage (aOR 3.209, 95% CI [1.159–8.887]) were likely to have late family consent for CS. Poor communication and understanding, differences in understanding between family members on the need for CS and absence of the person giving consent were barriers to timely family consent for CS to be performed. Husband's autonomous decision-making for CS, adequate disclosure of all relevant information about CS and previous CS aided timely family consent for CS performance.

There is need to improve the overall quality of maternal healthcare to reduce severe maternal outcomes. A proactive-orientated model is suggested with strategies targeting the community and healthcare system including training of healthcare providers on intracultural communication competence, obtaining consent and using associated protocols and guidelines, interprofessional collaboration and the use of alternative birth methods other than CS. Antenatal care should be used to prepare families for potential obstetric emergencies and obtain written informed consent. Moreover, women should be allowed to give consent in maternal health emergencies.

Keywords: Somaliland, maternal mortality, delayed caesarean section, maternal near miss, severe maternal outcomes, emergency obstetric care, low resource setting

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To my family, Carol, Freya and Jorell

List of Papers

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

- I. Egal JA, Kiruja J, Litorp H, Osman F, Erlandsson K, Klingberg-Allvin M. Incidence and causes of severe maternal outcomes in Somaliland using the sub-Saharan Africa maternal near-miss criteria: A prospective cross-sectional study in a national referral hospital. *International Journal of Gynaecology & Obstetrics*. 2022 Dec;159(3):856-864. doi: 10.1002/ijgo.14236.
- II. Kiruja J, Essén B, Erlandsson K, Klingberg-Allvin M, Osman F. Healthcare providers' experiences of comprehensive emergency obstetric care in Somaliland: An explorative study with focus on cesarean deliveries. *Sexual and Reproductive Healthcare*. 2022 Dec;34:100768. doi: 10.1016/j.srhc.2022.100768.
- III. Kiruja J, Osman F, Egal JA, Klingberg-Allvin M, Litorp H. Association between delayed cesarean section and severe maternal and adverse newborn outcomes in the Somaliland context: a cohort study in a national referral hospital. *Global Health Action*. 2023 May; 16 (1). doi: 10.1080/16549716.2023.2207862.
- IV. Kiruja J, Osman F, Litorp H, Egal JA, Essa A, Klingberg-Allvin M. Barriers to and facilitators of timely family consent in Caesarean sections: experiences, perspectives and associated factors—a mixed-methods study in Somaliland. Manuscript.

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Abbreviations

ANC:	Antenatal care
BEmOC:	Basic emergency obstetric care
CEmOC:	Comprehensive emergency obstetric care
CS:	Caesarean section
EmOC:	Emergency obstetric care
HCPs:	Healthcare providers
MCH:	Maternal health and child health centres
MM:	Maternal mortality
MNM:	Maternal near miss
SDG:	Sustainable development goals
SMO:	Severe maternal outcome
SSA:	Sub-Saharan Africa
UHC:	Universal health coverage
WHO:	World health Organization

Glossary and definitions of variables

Acute cyanosis is defined as blue or purple colouration of the skin or mucous membranes because of low oxygen saturation.

Eclampsia is defined as a diastolic BP ≥ 90 mmHg or proteinuria +3 and convulsion or coma.

Failure to form clots is defined as the absence of clotting from the IV site after 7–10 min.

Gasping refers to a terminal respiratory pattern whereby the breath is convulsively and audibly caught.

Loss of consciousness lasting >12 h is an alteration of mental state that involves complete or near-complete lack of responsiveness to external stimuli. It is defined as <10 on the Glasgow Coma Scale (moderate or severe coma).

Maternal death is the death of a woman during pregnancy, birth or within 6 weeks after birth from any pregnancy-related cause or care provided but not due to accidental or incidental related causes.

Maternal healthcare is defined as the care provided to women during the antenatal and intrapartum periods and within 6 weeks from the end of pregnancy. This entails services such as emergency obstetric care.

Maternal mortality ratio is defined as the total number of women who have died in every 100,000 live births.

Maternal near-miss ratio means the number of women who nearly died but survived a complication during pregnancy, birth or 6 weeks after birth per 1000 live births.

Maternal near-miss is a woman who nearly dies after developing a severe maternal complication during pregnancy, birth or within 6 weeks after the end of pregnancy but survives.

Mortality index means the number of maternal mortalities divided by the total number of severe maternal outcomes.

Oliguria is defined as a urinary output <30 ml/h for 4 h or <400 ml/24 h

Pre-eclampsia is defined as the presence of hypertension associated with proteinuria.

Pulmonary oedema is defined as accumulation of fluids in the air spaces and parenchyma of the lungs.

Sepsis or severe systemic infection is defined as a clinical sign of infection and three of the following: temp >38 °C or <36 °C, respiration rate >20/min, pulse rate >90/min, WBC >12,000

Severe abortion complications refers to a septic incomplete abortion or complicated gestational trophoblastic disease with anaemia.

Severe maternal outcome ratio refers to the number of women with life-threatening conditions per 1000 live births.

Severe maternal outcome is a life-threatening condition (i.e. organ dysfunction), including all maternal deaths and maternal near-miss cases identified by clinical, laboratory or management marker.

Shock is defined as persistent severe hypotension, defined as a systolic BP <90 mmHg for ≥60 min with a pulse rate of at least 120 despite aggressive fluid replacement (>2 L)

Stillbirth is defined as a newborn with no signs of life at or after 28 weeks' gestation.

Stroke is a neurological deficit of cerebrovascular cause that persists beyond 24 h or is interrupted by death within 24 h.

Uncontrolled fits/total paralysis is refractory, persistent convulsions or status epilepticus.

Uterine rupture is defined as the complete rupture of the uterus during labour and/or confirmed later by laparotomy.

Preface

This thesis represents the culmination of my academic journey, encompassing a unique blend of practical experience in healthcare and a profound commitment to improving maternal health outcomes. Throughout my career as a perioperative care educator, epidemiologist and population health professional, I have been driven by a passion for addressing the quality of healthcare, focusing specifically on maternal health.

The motivation for this research emerged from a deeply personal encounter that profoundly impacted me. I vividly recall a critical incident during a caesarean section where I witnessed first-hand the life-threatening complications faced by a woman during childbirth. The experience left an indelible mark on my professional journey, fuelling my determination to delve into the field of maternal health and contribute to preventing such near misses.

Within these pages, I embark on an empirical exploration of the multifaceted dimensions of maternal health. Employing rigorous research methodologies such as cross-sectional studies, cohort and qualitative study designs, I endeavour to shed light on the factors that influence maternal outcomes. By investigating the intersection of emergency obstetric care, patients' and healthcare providers' experiences and the use of evidence-based interventions, I intend to contribute to the growing body of knowledge aimed at understanding the determinants of severe maternal outcomes.

Importantly, this research takes place in a low-resource setting, where maternal mortality rates are still alarmingly high. Conducting research in such settings is of the utmost importance, as it enables us to gain a deeper understanding of the unique challenges faced by healthcare systems with limited resources and infrastructure. By shedding light on the factors contributing to severe maternal outcomes in these contexts, we can inform targeted interventions and policies that are contextually appropriate and resource sensitive.

Beyond knowledge production, this thesis recognises the importance of knowledge transfer and application. It is my aspiration to disseminate these findings among a diverse array of stakeholders, including healthcare professionals, educators, policymakers and communities in low-resource settings. By fostering collaboration and engagement, we can collectively strive to transform research into tangible improvements in maternal health services, even in challenging circumstances.

Finally, I dedicate this thesis to the resilient women, families and communities who entrust their well-being to the healthcare system, particularly in low-resource settings. It is my sincere hope that the knowledge generated by this research contributes to the advancement of maternal healthcare, fostering safer, equitable and compassionate care for all, regardless of the constraints faced by the healthcare systems they rely upon.

Jonah Kiruja
July 2023
Hargeisa

Introduction

Over the years, there have been significant efforts made to improve maternal survival by reducing severe maternal outcomes during pregnancy and birth and within 42 days after birth. However, developing countries continue to have unacceptably high maternal mortality rates, and most maternal deaths are often preventable[1]. In 2020, the global maternal mortality rate was 152 per 100,000 live births, and more than 70% of maternal deaths occurred in Africa[2-4]. Moreover, in a study conducted to determine the applicability of the World Health Organization (WHO) maternal near miss (MNM) tool in sub-Saharan Africa, the findings showed the MNM ratio to be from 24.2 per 1000 live births with a range of 4 in a study conducted in South Africa to 198 in a study conducted in Nigeria[5].

Severe maternal outcomes are defined as a combination of MNM and maternal mortality[6]. An MNM is defined as a woman surviving after developing a severe maternal complication during pregnancy or birth or within 42 days after birth and nearly dying[6]. To overcome the challenge of drawing conclusions from the assessment of maternal deaths, which has become rare, the MNM concept was developed. This is because women who have had an MNM share similar characteristics with maternal deaths and can provide valuable information on the barriers that were surmounted by their MNM to prevent the progression of MNM to maternal deaths[7]. Severe maternal outcomes result mainly from obstetric haemorrhage, hypertensive disorders and sepsis[8].

Challenges contributing to the slow progress in the reduction of severe maternal outcomes have been attributed to pre-hospital and hospital barriers affecting the utilisation and provision of emergency obstetric care (EmOC)[9, 10]. In recent years, the concept of MNM has been used to identify and enable understanding of the suboptimal factors contributing to preventable MNM and maternal mortality (MM). A multi-country study showed that scaling up EmOC did not necessarily imply a significant reduction in MM[11]. Moreover, variations in frequency, contributing factors and underlying causes of severe maternal outcomes have been observed across countries and regions, for instance in Bolivia, Tanzania, Iran, Rwanda and Ethiopia[12-18]. Therefore, specific research is required to identify and understand the main drivers for adverse maternal health outcomes, particularly in contexts with high maternal morbidity and mortality. Such studies have the potential to

inform obstetric care interventions specific to each setting and can facilitate quality-of-care improvements. Moreover, improvements in antenatal and obstetric care may in turn have a positive impact on reducing adverse maternal and new-born outcomes. The focus of this thesis is to identify and explore the determinants of severe maternal outcomes, including the identification of barriers that affect the utilisation of emergency obstetric care, with a focus on caesarean section (CS) in Somaliland. Despite the few studies already conducted in Somaliland[19, 20], the main drivers for severe maternal outcomes are still unclear.

Background

Sexual and reproductive health

Sexual and reproductive healthcare entails the methods and techniques that contribute to reproductive health and well-being by preventing and solving reproductive health problems. The major components of sexual and reproductive health include maternal and new-born health; family planning; the prevention of unsafe abortions; the management of reproductive tract infections, sexually transmitted infections and HIV/AIDS; and the promotion of sexual health[21, 22]. Reproductive healthcare components are integrated within the primary healthcare system to ensure increased access and utilisation of these services[23].

Although gains have been made in improving access to and the utilisation of sexual and reproductive healthcare, many women still have limited access to the components of reproductive healthcare[24], such as maternal and new-born health, and they have limited capacity to make their own decisions about their own health[25]. The International Conference on Population and Development in Cairo in 1994 led to the adoption of policies that recognised access to sexual and reproductive healthcare as a basic human right[26]. Reproductive rights refers to the ‘recognition of the basic rights of all couples and individuals to decide freely and responsibly the number, spacing and timing of their children and to have the information and means to do so, and the right to attain the highest standard of sexual and reproductive health’[27]. Of key relevance to reproductive rights are the right to autonomy and to privacy in decision-making about reproductive health as well as the right to informed consent in relation to receiving reproductive healthcare.

As a component of reproductive health, maternal health refers to healthy women during pregnancy, childbirth and the postpartum period. Antenatal care (ANC), intrapartum care and postnatal care are interventions that are often offered under maternal healthcare services[28]. There has been much global attention on maternal health because most women in their reproductive years die as a result of a cause linked to pregnancy. To reduce the incidence of maternal morbidity and mortality, is often recommended to implement both quality improvement programmes for healthcare facilities and community interventions. This means that both the supply side and the demand side, including awareness of maternal health services, should be increased to improve maternal health[29].

Sustainable Development Goals

In 2015, the Sustainable Development Goals (SDGs) were initiated following the conclusion of the Millennium Development Goals. The SDGs were developed through a consultative process among countries and endorsed by 193 United Nations member states and international organisations[30]. The overall purpose of the SDGs is to provide targets for the well-being of women, children, families, communities and nations worldwide. SDG 3 aims to ensure healthy lives and promote well-being for all by reducing mortality and achieving universal health coverage (UHC). Relevant to this thesis is a new initiative of the SDG, Target 3.1, which aims to reduce the global MM ratio from 216 per 100,000 live births in 2015 to 70 per 100,000 live births by 2030[31, 32]. Once this target is achieved, it is projected that approximately 1.6 million mothers will be saved[33]. In 2020, the global MM ration was 223 per 100,000 live births, indicating a failure to achieve the desired reduction[4].

However, to achieve these targets, countries must be committed and should use evidence-based interventions to improve the quality of maternal healthcare. Moreover, there is need to address the underlying social, political and economic determinants of maternal health[34] in each country to achieve the ambitious target of reducing the global MMR. According to Boldosser-Boesch et al.[31], there is need for every country to reduce its national MMR by two-thirds from the baseline MMR of 2015. Their study emphasised the importance of every country setting national targets and not just relying on the global targets alone.

Universal health coverage

In most low-resource countries, financial resources are extremely limited. Moreover, there is maldistribution of resources within regions with disparities between urban and rural areas[35]. In the 2001 Abuja Declaration, member countries of the African Union agreed to allocate 15% of their national budgets to health programmes[36]. Many African countries have limited finances allocated to health, and families continue to carry the burden of health through out-of-pocket expenditure[37]. To address this problem, UHC was initiated[38]. UHC means that all people should be able to obtain the health services they need. These services should be of good quality, and people should not suffer financial hardship when paying for them[38].

UHC thus aims not only to ensure the increased utilisation of healthcare services but also to protect individuals from the extreme poverty that can result from high health expenditure. UHC is included in the third SDG as a strategic goal to ensure that all individuals have access to promotive, preventive, curative and rehabilitative health services without financial limitations. However, to date, only African three countries have been able to achieve this

goal, namely Rwanda, Botswana and Zambia[39]. Many countries struggle to achieve UHC due to inadequate national financial resources to invest in health services. The relevance of UHC in maternal healthcare is that poverty, poor health insurance coverage and living in rural areas far from healthcare facilities are considered the key determinants for the low utilisation of maternal healthcare in sub-Saharan Africa (SSA)[40]. In this regard, UHC lowers the financial and geographical barriers by ensuring access to health services for women during pregnancy, birth and the postpartum period[40]. When countries prioritise and develop plans to achieve UHC, they must consider the burden of disease in their country, the capacity of their health institutions and the levels of income of their communities[38].

Quality of maternal healthcare

The concept of quality of healthcare dates back to 1966, when Avedis Donabedian devised a new description of the concept of quality of care[41]. His definition of quality of healthcare was ‘that kind of care which is expected to maximize an inclusive of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts’. In the 1980s, he developed the Donabedian quality triad, a framework on how to understand and evaluate the quality of healthcare[41]. The three components of this triad are structure, process and outcome[42]. Structure refers the health system, including its hospital infrastructure, health workers, medicines, supplies and equipment. The process dimension includes the competencies of healthcare providers through the provision of health services in an effective, timely and evidence-based manner. As per the triad, the endpoint is measuring the outcomes; its outcome component includes the measurement of mortality, infection rates, medical complications and the recovery of patients[41].

Over the years, gaps have been identified in the use of the Donabedian quality triad, in that the model fails to consider important aspects of quality, such as patient-centred care, the use of the latest information for informing care and looking at healthcare as a system to continuously redesign[43]. Informed by the Donabedian quality triad, the new WHO framework for quality in maternal and neonatal care[44] expands on it within the context of maternal and neonatal healthcare. The framework contains eight domains within the healthcare system that not only focus on the provision of care at healthcare facilities but also the role of service users and their experiences with utilising healthcare services (Figure 1). In this regard, the framework can be used to provide different perspectives on the dimension of quality of care from the angle of women utilising healthcare services, of healthcare providers and of health managers. The WHO places emphasis on six areas that are vital for improving the quality of maternal healthcare, namely standards of care,

clinical guidelines, effective interventions, measures of quality of care, research and capacity-building[44].

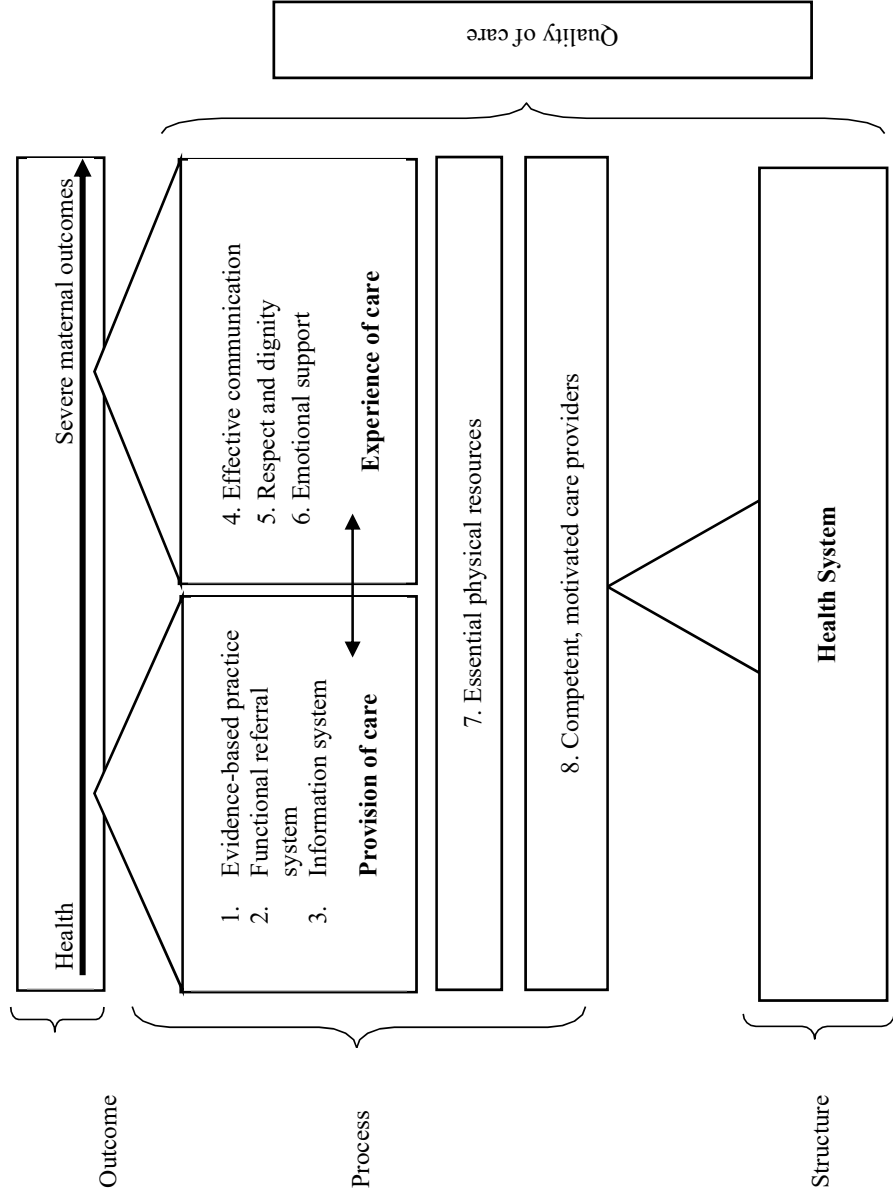


Figure 1. The WHO framework for quality of maternal healthcare[44]

Audits have also been used to examine and provide understanding on poor knowledge and skills and the inadequacy of supplies, medicine and equipment as well as other resources in the context of maternal healthcare[9]. An audit is a systematic process of reviewing the appropriateness of current care, analysing it by looking into the strengths and weaknesses, implementing evidence-based interventions and reassessing the care being provided for further actions. MM audits have been used in both low- and high-income settings with the aim of improving the quality of care[45]. The Robson classification system has been recommended as a method to audit CS at the healthcare facility level to aid in prioritising resources for specified groups with the greatest need[46]. However, several studies have highlighted challenges with using the audit framework to improve quality of care, such as lack of commitment by leadership to implement shortfalls identified with quality of care, blaming culture and lack of adequate skills for conducting audits[47-49].

Effective interventions in maternal healthcare

Antenatal care

The WHO recommends that in low-resource settings, women in pregnancy should attend four or more ANC visits[50]. As such, the focused ANC approach requires the first two ANC visits to take place within the first two trimesters and the last two during the final trimester[50]. ANC focuses on identifying complications and providing tetanus toxoid injections, iron and folic acid supplementation and education for women regarding nutrition, healthy lifestyle and birth preparedness. Although studies have identified the benefits of ANC use, including a reduction in severe maternal outcomes and neonatal mortality, many women do not attend ANC visits in low-income countries[51, 52]. The pooled prevalence of optimal ANC visits was found to be 55.66% in low-income countries with high maternal mortality, which was identified as relatively low[53].

Studies have found that many women in low-income countries do not utilise ANC services and have a low opinion about ANC because they view pregnancy as a normal physiological process and do not see it as a threat to their well-being[54, 55]. Although ANC is provided free, women view the cost of transport to the health facility or paying for additional medicines as a burden to their already limited personal financial resources[54]. Moreover, many women do not consider ANC to be beneficial. These negative perceptions of ANC are further worsened by poor interpersonal and communication skills of healthcare providers and disrespectful care[56].

Skilled birth attendance and postnatal care

The rationale behind there being an emphasis on skilled attendance during birth and the provision of postnatal care is that most of the severe maternal outcomes take place during labour, birth and the first 24 hours after delivery[57]. Life-threatening conditions can develop very quickly, even in pregnancies that have been normal and without risk factors, and in some cases, it is difficult to predict when complications will occur[58]. Moreover, most of the leading causes of severe maternal outcomes, such as hypertensive disorders, obstetric haemorrhage, sepsis, obstructed labour/prolonged labour and unsafe abortion, can be prevented through the provision of essential life-saving interventions[8, 59]. Skilled birth attendance thus emphasises women giving birth in an enabling environment with the required infrastructure, medicines, supplies and equipment; trained healthcare professionals; and effective systems of referral[60].

According to the WHO[61], approximately 15% of pregnant women develop potentially life-threatening complications. In this regard, these women require skilled care, and some may require major maternal healthcare interventions, such as CS, to survive[61]. Unfortunately, in many low-income countries, women seek to utilise the services of traditional birth attendants, who are unskilled and not equipped to manage maternal complications. Globally, approximately 25% of deliveries take place outside healthcare facilities. In some low-resource countries, more than 50% of deliveries occur outside the healthcare system[62]. In many cases, early postnatal care is associated with delivery at a healthcare facility[63], although women who have previously delivered outside healthcare facilities are often encouraged to visit such locations. Early postnatal care provides the opportunity to detect danger signs and avert most postnatal-related maternal deaths[64].

Caesarean section

The United Nations Children's Emergency Fund and United Nations Fund for Population Activities introduced EmOC as an essential intervention that can significantly save the lives of mothers and foetuses[59]. Since then, EmOC services have been rolled out and scaled up, particularly in low-income settings with high maternal mortality. EmOC services are classified as basic or comprehensive. Basic EmOC (BEmOC) includes the use of parenteral antibiotics, anticonvulsants and uterotonics; the removal of retained products of conception; assisted vaginal delivery; and manual removal of the placenta. Comprehensive EmOC (CEmOC) includes the BEmOC services and adds blood transfusion, surgical capacity for procedures such as CS; and laparotomy for ectopic pregnancy[59]. Previous studies of Somali immigrants in high-income settings have explored encounters between healthcare

providers[65-68], women and family members during the provision of obstetric care and shown that sociocultural factors can have an influence on the uptake of EmOC, including CS[19, 20].

CS is an essential component of CEmOC that is used as a life-saving intervention. Emergency CS is conducted to deliver foetuses that have attained viable gestational age. CS delivery is performed through an abdominal and uterine incision in situations whereby spontaneous vaginal delivery is not likely to provide good outcomes or would lead to risks to the mother, the foetus or both[69]. It is performed via general, epidural or spinal anaesthesia. The indications include foetal distress, umbilical cord prolapse, placenta abruptio or previa with bleeding, dystocia and malpresentation[70].

As has been shown in previous studies, it is challenging to ascertain the optimal CS rate for a given population[71]. This is because it is difficult to establish the true medical need at the population level. Optimal CS is the level of births expressed as the percentage delivered via CS that results in the best possible maternal and new-born outcomes. A prevalence ranging from 5% to 20% of CS for a given population is considered to be the optimal CS rate[71]. Lower CS rates are indicative of inadequate access to CS, a life-saving procedure[72]. On the other hand, higher CS rates are indicative of overuse of CS without medical reasons. At both extremes of high and low rates of CS is the risk for adverse consequences leading to high maternal and new-born morbidity and mortality[71]. Previous multi-country studies of 32 low- and middle-income countries and 26 countries in SSA and southern Asia[73, 74] showed that the low-resource countries had lower CS rates, with disparities between and within the countries, due to differences in the availability of healthcare resources, access to emergency obstetric care and obstetric care practices. A study conducted among WHO member states showed that national CS rates of 19% were associated with a reduction in maternal and neonatal mortality rates[75]. The study found that the previously recommended 10%–15% CS rates were too low.

Delayed caesarean section and severe maternal and new-born outcomes

Timeliness is among the key quality of care domains that should be considered to reduce delays in the provision and utilisation of CS[76]. Although CS is an essential intervention, its performance without consideration of time can contribute to adverse maternal and new-born outcomes[76]. According to the American College of Obstetricians and Gynecologists Committee on Professional Standards and the National Institute of Clinical Excellence guidelines in 1989, it was recommended that emergency CS should be performed within 30 minutes from the time the decision for CS is made to the

delivery of the new-born[77, 78]. This is to prevent adverse maternal and new-born outcomes. However, this 30-minute standard has been subject to a debate on whether it is evidence based and if it is achievable[79, 80]. In 2011, the NICE guidelines recommended that when there is immediate threat to the life of the woman or foetus, the decision-to-delivery interval should be 30 minutes[78], whereas if maternal and foetal compromise is not life threatening, CS should be conducted within 30–75 minutes.

Different studies have shown variations in terms of the association between delayed CS and severe maternal and new-born outcomes[79, 81, 82]. Some studies have shown no association, whereas others have shown an association. A study conducted in Ethiopia showed there to be no association between the decision-to-delivery interval and maternal and foetal outcomes[83]. This finding was in line with previous studies conducted in Singapore, Thailand and Uganda[79, 81, 82]. Moreover, the performance of CS in less than 30 minutes from CS decision to delivery did not affect neonatal outcomes[84]. A study conducted in England showed that a CS decision-to-delivery interval longer than 75 minutes was associated with adverse maternal and foetal outcomes[85]. Moreover, another study also showed an association between delayed CS decision and adverse maternal and foetal outcomes at longer than 2 hours[86].

Several factors can contribute to a delayed decision for CS delivery. Poor hospital organisational structure, inadequate staff, inadequate knowledge and skills of obstetric care staff, lack of adequate equipment and supplies for CS, prolonged patient preparation processes, transfer from ward to operating theatre, inadequate operating rooms and delays in the preparation of the operating room can contribute to the delayed performance of CS[87, 88]. Moreover, delays in getting consent from the family can also lead to delayed CS performance[19].

Medical ethics clash with family's decision for and acceptance of caesarean section

Patient-centred care is also a key dimension of quality of care[76]. Patient-centred care means that the healthcare provider does not just aim to prevent severe maternal and new-born outcomes but also should value the needs, sociocultural norms and experiences of the patient[76]. In patient-centred care, healthcare providers must respect the preferences of the patient; inform, communicate and educate the patient about the need for the intervention; and involve the patient's family in decision-making for the care to be provided[76]. However, studies have shown that despite healthcare providers giving an indication for CS, women delay or refuse the performance of CS[89].

In most SSA countries, vaginal delivery is considered the preferred mode of delivery by women and family members. A study conducted in Nigeria showed that due to sociocultural norms[89], women refused CS due to fear that it would limit their reproductive ability to have more children and concern over poor outcomes, such as they might die. Moreover, evidence has shown that women and family members refuse CS due to the previous bad experiences of other women who died when they underwent CS[90]. Other factors, such as being distant from healthcare facilities and low income and education, contribute to CS refusal. Moreover, past positive experiences of vaginal delivery influence women against accepting CS[91]. In some African settings, husbands take the role of decision-makers in the home setting and decide how the family will access and receive healthcare services[19]. This is contrary to the case in developed settings, where individuals have their own right to seek healthcare services and provide consent on their own[92, 93].

The principles of autonomy, beneficence and non-maleficence are foundational tenets of medical ethics that guide healthcare providers in their decision-making processes[94] and care delivery[95]. When faced with a woman or her family's refusal of CS, healthcare providers encounter a complex ethical landscape where these principles often come into conflict[96]. Striking a balance between these ethical considerations while respecting a woman's right to make decisions about her childbirth requires careful navigation and thoughtful ethical deliberation[94].

Autonomy, as a principle, upholds an individual's right to make informed decisions about their healthcare, including the mode of delivery during childbirth[97]. Respect for a woman's autonomy necessitates providing comprehensive and unbiased information about the risks and benefits of both CS and vaginal birth. Open and effective communication is crucial in ensuring that the woman understands her options, allowing her to make an informed and autonomous choice[96]. However, challenges arise when healthcare providers perceive that there would be potential harm to the woman or the unborn child if CS were not performed, leading to tension between respecting autonomy and safeguarding the best interests of both parties[95].

Beneficence, on the other hand, requires healthcare providers to act in the best interests of their patients, aiming to maximise their well-being and health outcomes[94]. In the context of childbirth, beneficence encourages healthcare providers to prioritise the safety and health of both the mother and the baby. When confronted with a woman's refusal of CS, healthcare providers may feel compelled to advocate for the procedure based on their assessment of the potential risks of vaginal birth, especially in cases of medical indications whereby CS may be medically indicated for the well-being of the mother or the baby[96].

Non-maleficence emphasises the principle of 'do no harm'. Healthcare providers have a duty to avoid causing harm to their patients and to minimise the potential risks associated with medical interventions[94]. In cases of CS

refusal, healthcare providers may be concerned about the potential harm to the woman or the unborn child if complications arise during vaginal birth. This ethical consideration further complicates the decision-making process, as providers must carefully weigh the risks of CS against those of vaginal birth to ensure the least harm to both parties[96].

Balancing these ethical considerations requires healthcare providers to engage in ethical deliberation and shared decision-making with the woman and her family. Collaborative discussions allow healthcare providers to explore the woman's values, beliefs and preferences while also addressing her concerns over CS or vaginal birth. A patient-centred approach that respects a woman's autonomy while considering beneficence and non-maleficence can help in reaching a decision that aligns with the woman's preferences and ensures the best possible health outcomes[76, 95].

Furthermore, healthcare providers must also be aware of the cultural and social factors that may influence a woman's decision regarding CS[95]. Respect for cultural beliefs and values is vital in promoting patient-centred care and maintaining a woman's autonomy in decision-making. When healthcare providers encounter a woman or her family's refusal of caesarean section, navigating the principles of autonomy, beneficence and non-maleficence can present complex ethical challenges. Effective communication, shared decision-making and a patient-centred approach are essential for ensuring that healthcare providers balance these ethical considerations while respecting a woman's right to make informed choices about her childbirth[76].

The Somaliland context

Somaliland Protectorate was formed in 1887 following treaties signed by Britain with Djibouti to the west, Ethiopia to the south and Somalia to the east. Following a long struggle, Somaliland gained its independence on 26 June 1960. After five days of independence, Somaliland united with Somalia on 1 July 1960 to form Greater Somalia. Following the collapse of the central government of Somalia in 1991, Somaliland re-declared its sovereignty and became the Republic of Somaliland. However, since Somaliland's self-declaration of independence, the country has not yet been internationally recognised[98].

The governance system consists of three arms, namely the executive, a bicameral legislature and the judiciary. The bicameral legislature consists of an upper house, which is led by traditional Somali elders responsible for peace and internal conflict resolution, and a lower house consisting of elected members of parliament who lead the parliament by representing the electorate, making laws and providing government oversight[98]. Although the major source of economic growth in Somaliland is through the export of livestock,

the government has limited access to trade and foreign investment. The gross domestic product (GDP) of Somaliland is estimated at USD 2.5 billion, and its GDP per capita was USD 566 in 2018. The lack of international recognition is a major factor limiting Somaliland's ability to have bilateral agreements with international partners on direct investment and aid[98, 99].

The healthcare system in Somaliland

Despite its limited resources, Somaliland's national healthcare system is functioning and provides primary-, secondary- and tertiary-level health services. Both the private and public sector are involved in the delivery of healthcare services (Table 1)[98, 99]. However, Somaliland falls among the countries with the lowest ratings for well-being. This is due to challenges with the access to and coverage of healthcare services, human resources for health and the quality of service delivery. In its strategic plan of 2017–2021, the Ministry of Health identified nine priorities[98], namely (1) increasing essential and basic health and nutrition services, (2) addressing the quality and quantity of human resources for health, (3) improving the leadership and governance of the healthcare system, (4) increasing access to essential medicines and technologies, (5) strengthening the health information system, (6) improving the physical infrastructure of the health sector, (7) improving health emergency preparedness and response(8) promoting action on the social determinants of health and health in all policies and (9) increasing health financing. Less than 1% of the population have health insurance that can cover costs for healthcare services. Although healthcare services are provided free in public health facilities, households spend on average less than USD 50 to cover the costs of healthcare services[98].

Quality of maternal healthcare in Somaliland

Emergency obstetric care services are provided within the component of reproductive health services. Maternal and child health centres are the facilities closest to the community, where antenatal care, intrapartum care, postnatal care and family planning services are offered. BEmOC services are also provided at this level of the healthcare system. However, ANC coverage (at least four visits) is low, at 47%, and births attended by skilled birth attendants are at 40%. Although the current MMR has declined remarkably, from 732 per 100,000 live births reported in 2015[99] to 396 per 100,000 live birth in 2020, the rate is still considered among the worst globally. This rate is also far from the target set in the SDGs for reducing MMR to at least 70 per 100,000 live births[31]. The demographic and reproductive health indicators are shown in Table 1[98].

Healthcare providers at Somaliland healthcare facilities are often trained to offer BEmONC and CEmONC services. However, for EmOC to be effective,

there is evidence to recommend that other pre-hospital barriers are addressed. EmOC services should be provided with the consideration and implementation of interventions that will address sociocultural aspects such as level of education and perceived need for care, which are factors that influence decision-making in seeking EmOC[21, 44]. Moreover, it is vital to consider healthcare system barriers, such as quality of care, to increase the uptake of EmOC[21, 44].

A previous study in Somaliland led to the hypothesis that barriers such as delay in performing CS can contribute to adverse maternal and birth outcomes[19]. This is in line with studies conducted in high-income countries exploring healthcare providers' dilemma with the provision of CS among women and family members refusing the procedure due to fear[66, 67]. This is contrary to healthcare providers' principles and experience and conflicts with their personal values and training in CS as a lifesaving intervention for the pregnant woman, foetus or both. There is evidence reiterating the importance of understanding the experiences and perspectives of healthcare providers regarding EmOC to broaden understanding of the specific barriers in each setting. There is evidence reiterating the importance of understanding the experiences and perspectives of healthcare providers regarding EmOC to broaden understanding of the specific barriers in each setting[6].

In Somaliland, the national CS rate is estimated to be 4%[98], indicating the possible inadequate use of CS. Although healthcare providers are required to assess patients and make decisions on the need for medical interventions, in the Somaliland context, it is not the woman who gives consent for medical procedures; rather, the family makes the final decision as to whether such an intervention will be provided to a woman. Based on a literature review[19, 20], there is limited empirical information available that examines the link between the family's role of giving consent for EmOC, CS delay and its contribution to MNM and adverse birth outcomes in Somaliland. According to our previous study, the MNM ratio at the national referral hospital in Somaliland was 88.6 per 1000 per 1000 live births, while the MNM mortality ratio of 6.7:1 was low, indicating the need to improve the quality of healthcare services provided to women during pregnancy, birth and 42 days after birth[20]. The study also established that there were more MNMs and deaths at arrival than there were within the healthcare facility.

Table 1. Basic demographic and reproductive health indicators for Somaliland[98, 99]

General demographic and socioeconomic indicators	
Total population	4.2 million
Percentage of population in an urban setting	53%
Population density	22 persons per/km ²
Education	41% adult literacy for women of reproductive age
Health service indicators	
Public hospitals	21 (2019)
Private hospitals	21 (2020)
Maternal and child health centres	122 (2019)
Health posts	173 (2019)
Reproductive health indicators	
Total fertility rate	5.7
General fertility rate	172 births per 1000 women of reproductive age
Crude birth rate	37 births per 1000 population
Antenatal care coverage (at least four visits, %)	47%
Births attended by skilled attendants	40%
Teenage pregnancies (15–19 years)	7.4%
Contraceptive prevalence rate	7%
Maternal mortality ratio	396 per 100,000 live births
Infant mortality rate	73 per 1000 live births

Conceptual framework

The findings derived from facility-based studies are conceptualised and discussed using the original Thaddeus and Maine three delays model(Figure 2)[100]. The framework has been used in low-income settings to conceptualise the suboptimal factors contributing to adverse obstetric outcomes in the community to a facility-based care context, and it is used to explain delays in seeking, reaching and receiving obstetric care.

Studies have criticised the original three delays model[101, 102], which emphasises that delays happen in a systematic, sequential manner and is based on the premise that delays only occur when women develop complications[103]. The model is judged to be too simplistic, and its approach is retrospective in identifying barriers, rather than proactive in identifying interventions to prevent the three delays[101, 103]. Moreover, the model fails to capture the role of sociocultural barriers in influencing the uptake of maternal healthcare at the healthcare facility level[103]. According to the original three delays model, sociocultural factors mainly contribute to the first delay of seeking care; the second delay is due to factors such as physical access to the hospital, travel time to the hospital and the availability and cost of transport; while the third delay is due to healthcare facility–related barriers, such as shortages of staff, equipment and drugs; clinical mismanagement; and administrative delays.

We use the framework to generate new knowledge about the circumstances related to and factors contributing to severe maternal outcomes in Somaliland. Further, we use the framework to inform a proactive-orientated model to improve the quality of maternal healthcare and, in effect, prevent the three delays from contributing to severe maternal outcomes.

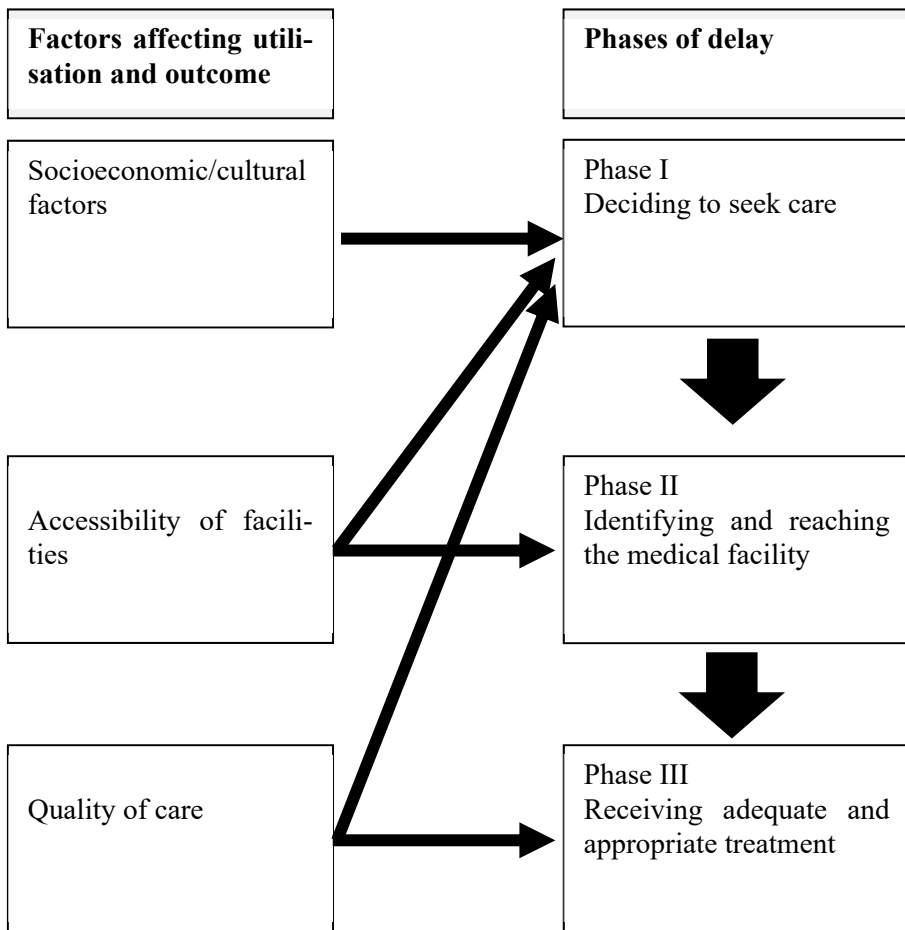


Figure 2. The three-delays model[100]

Rationale for the thesis

Although quality of care is a critical component of achieving the sustainable development goal for maternal care, especially during pregnancy and birth, it is yet to be achieved[104]. Low-income countries and vulnerable populations suffer the most from poor quality of care. More attention has been channelled into increasing the quantity of health facilities and coverage, yet half of maternal deaths can be prevented through high quality of care from existing healthcare systems[105]. Therefore, measures should be taken to address the problem of severe maternal outcomes by also focusing on quality-of-care aspects in the context of maternal healthcare.

Encouraging progress has been made to improve maternal health in Somaliland through EmOC programmes. However, progress has been slow, with the MM ratio remaining high, at an estimated 396 maternal deaths per 100,000 live births[98]. The use of obstetric care services is still low, with one or more ANC visits at 47% and skilled births at 40%[98], implying that there are potential barriers to the use and provision of EmOC. Our previous studies[19, 20], which described MNM and mortality and hypothesised possible challenges encountered by healthcare providers involved in EmOC, established the need to explore further and find out the factors contributing to suboptimal care and MNM events. Several studies[106, 107] have recommended the need to use more inclusive criteria (SSA MNM approach) to investigate MNM, but this approach has not been applied in Somaliland.

Additionally, limited studies have been conducted in Somaliland through the lens of maternal healthcare provision and healthcare providers to understand the determinants of severe maternal outcomes. This thesis includes four studies, each constituting research questions that will potentially inform future interventions that will contribute to improved maternal healthcare quality and reduced severe maternal outcomes in Somaliland. This thesis will broaden knowledge of how the three delays of seeking, reaching and receiving care contribute to the suboptimal quality of maternal healthcare in a low-resource setting in Somaliland. Derived from a review of the literature[19, 20, 98], the specific research questions are shown in Figure 3.

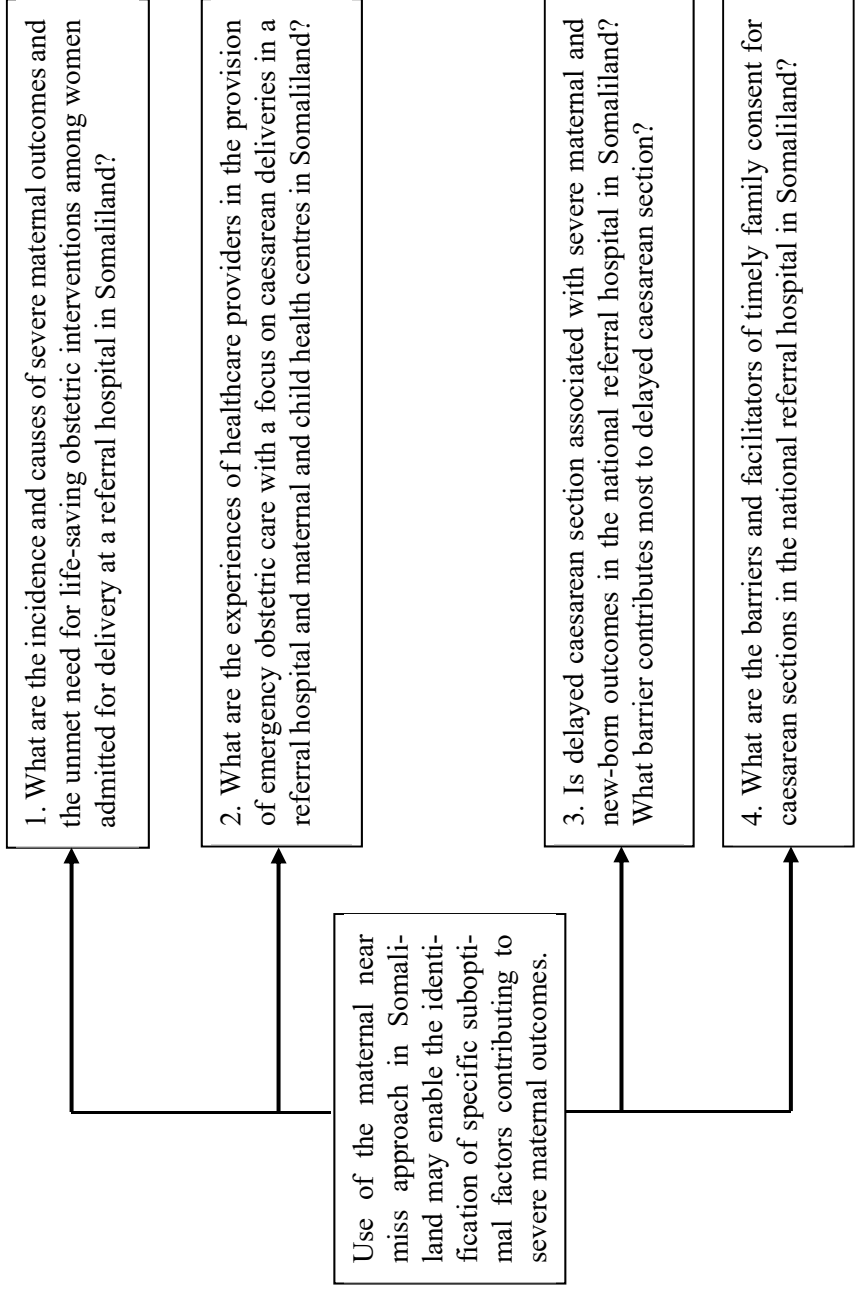


Figure 3. Research questions derived from the literature review.

Aims

The overall aim of this research is to investigate the quality of maternal healthcare by exploring severe maternal outcomes, delays and decision-making for caesarean sections in public health facilities in Somaliland. The specific aims of the studies are:

1. To describe the incidence and causes of severe maternal outcomes and measure the unmet need for life-saving obstetric interventions among women admitted for delivery at a referral hospital in Somaliland (Paper I).
2. To explore the experiences of healthcare providers regarding the provision of emergency obstetric care with a focus on caesarean deliveries at a referral hospital and maternal and child health centres in Somaliland (Paper II).
3. To determine the association between delayed caesarean sections and severe maternal and adverse new-born outcomes at the national referral hospital in Somaliland (Paper III).
4. To investigate the barriers to and facilitators of timely family consent for caesarean sections at the national referral hospital in Somaliland (Paper IV).

Methods

This thesis is based on qualitative, quantitative and mixed methods methodologies. Table 2 provides a summary of the study designs, data collection methods, study participants and methods of analysis.

Table 2. Overview of methods used in this thesis

Paper	Design	Participants	Data collection	Analysis
I	Cross-sectional study	Maternal near misses, maternal deaths and non-maternal near misses (n = 6658)	Hospital records using a data abstraction form	Descriptive statistics
II	Explorative, qualitative	Four focus group discussions with 6–8 healthcare providers (doctors, nurses and midwives) (n = 28)	Focus group discussions	Thematic analysis
III	Cohort study	Women with and without caesarean section delay and adverse maternal and new-born outcomes (n = 1255)	Hospital records using a data abstraction form	Descriptive statistics, bivariate and multivariate logistic regression
IV	Convergent mixed methods	Quantitative: women with timely and late family consent in caesarean sections (n = 516) Qualitative: women who have undergone caesarean section (n = 16)	Hospital records using data abstraction and individual semi structured interviews	Descriptive statistics, bivariate and multivariate logistic regression, thematic analysis

Study setting

The studies for Papers I, III and IV were performed at the national referral hospital (Hargeisa Group Hospital; HGH), and that of Paper II was performed at the national referral hospital and four maternal and child health centres in Hargeisa, Somaliland. Somaliland is a post-conflict, low-income country located in the horn of Africa with an approximate population of 4.2 million. The setting faces healthcare and economic challenges[98]. The country's public and private sectors are involved in the delivery of BeMoC and CeMOC services. The public healthcare system is organised into four levels: the primary health unit; maternal and child health centres (MCHs), regional health centres and referral district hospitals; and regional referral hospitals[108].

HGH is the national and main referral hospital serving not only Maroodi Jeex region but also all the other five regions of Somaliland (Sanaag, Sool, Sahil, Awdal and Togdheer)[108]. Private healthcare facilities also offer maternal healthcare services. There are approximately 5500 deliveries annually at the main referral hospital [109] and 3120 annual deliveries at the four MCHs. Comprehensive emergency obstetric care is provided at the main referral hospital by approximately 40 staff, consisting of senior and junior consultant obstetricians, residents, junior doctors, nurses and midwives. More than two thirds of women with severe maternal complications who visit the hospital are self-referred (67%), while about a fifth are referred by healthcare providers. Nurses and midwives are responsible for normal deliveries, but a partograph is not adequately used to monitor the progress of labour. The hospital has anaesthetists, a blood transfusion centre, a clinical laboratory and an intensive care unit. Due to the inadequate availability of blood, family members are often requested to donate blood. The operating theatre for EmOC interventions such as CS is located outside the maternity wards, where decisions for CS are made. In the four MCHs, approximately 60 nurses and midwives are responsible for the provision of basic emergency obstetric care. Nationally, ANC utilisation in this setting is low, estimated at 47%, only 39.6% of deliveries are attended by skilled health personnel and 33% of deliveries occur at healthcare facilities [98].

Moreover, most deliveries (48%) are conducted at home, assisted by traditional birth attendants. Based on a population survey, the CS delivery rate in the country is low, estimated at 4%[98]. Patients have to pay for the cost of supplies, medication and services, although these prices are government subsidised. Non-governmental organisations also aid in stocking the facilities with parenteral drugs, such as uterotonics, anticonvulsants and antibiotics.

Study design and participants

Paper I

This cross-sectional study was conducted at the national referral hospital, HGH, between 15 April 2019 and 31 March 2020. All women admitted during the study period who were pregnant and those up to six weeks after delivery were included in the study and followed until discharge (n=6657). Women were screened to identify if they met the SSA MNM criteria, as described by Tura et al.[107].

Paper II

An exploratory qualitative study was conducted at the national referral hospital and four maternal health centres in Somaliland. Focus group discussions were conducted with a heterogeneous sample of healthcare providers (HCP) (four focus group discussions) consisting of doctors, nurses and midwives (28 HCPs in groups of six to eight). The HCPs recruited had experience of providing care to women with severe maternal complications and were selected purposively. They were recruited after access had been granted by their healthcare facilities' administrators.

Paper III

A cohort study design nested in the larger MNM prospective study was conducted at the national referral hospital between 15 April 2019 and 31 March 2020. All women who had undergone CS and had a singleton pregnancy were included in the study (n=1255). Women who had not undergone CS despite a decision for CS being made or who had died before a CS could be performed were excluded from the study.

Paper IV

This study applied a convergent mixed method design[110] with parallel sampling. This design involved combining a quantitative facility-based survey with an exploratory qualitative study. The quantitative study aimed to identify factors associated with timely family consent for CS, whereas the qualitative study explored barriers to and facilitators of timely family consent for CS at the national referral hospital in Somaliland. The convergent mixed methods design involved the collection of different but complementary data on the same topic. Figure 4 shows the inclusion of study participants in the study.

In the quantitative part of paper IV, a hospital-based cross-sectional study design was employed from the study sample in Paper I. The study population included all women who had undergone CS at the national referral hospital between 15 April 2019 to 30 March 2020 and whose CS decision had mainly been influenced by the family decision-making process (n=516). The family decision-making process was defined according to Paper II as a 'collective decision-making process in which several decision-makers in the extended family structure (father/mother, father/mother-in-law and husband of the woman giving birth) are involved with deliberations on need for CS before the male family member provides formal consent for CS to be performed'. Women were divided into two groups for comparison, namely women with timely family consent (≤ 3 hours) and women with late family consent (> 3 hours delay) between a healthcare professional's decision for CS to the birth of the neonate (Figure 4). We used a cut off of > 3 hours based on findings from Paper III, which identified that CS performed more than 3 hours after the HCP's decision for CS to be performed was associated with severe maternal outcomes, whereas CS performed at less than 3 hours was not associated with severe maternal outcomes.

In the qualitative part of Paper IV, an exploratory qualitative study design[111] using individual semi structured interviews was applied to explore the experiences and perspectives of women who had undergone CS following timely or late family consent. Women who had experienced an MNM and underwent CS at the national referral hospital between the 15 April 2019 and 30 March 2020, during the data collection for the quantitative part of the study, were eligible for inclusion. During the data collection of the quantitative part of this study, the study participants were purposively sampled for interviews when they were stable and about to be discharged from the hospital. The purposive sampling method was chosen to recruit study participants who would provide rich information regarding the aim of the study[112, 113]. Prior to data collection, the women were provided with details about the purpose of the study and all relevant information pertaining it.

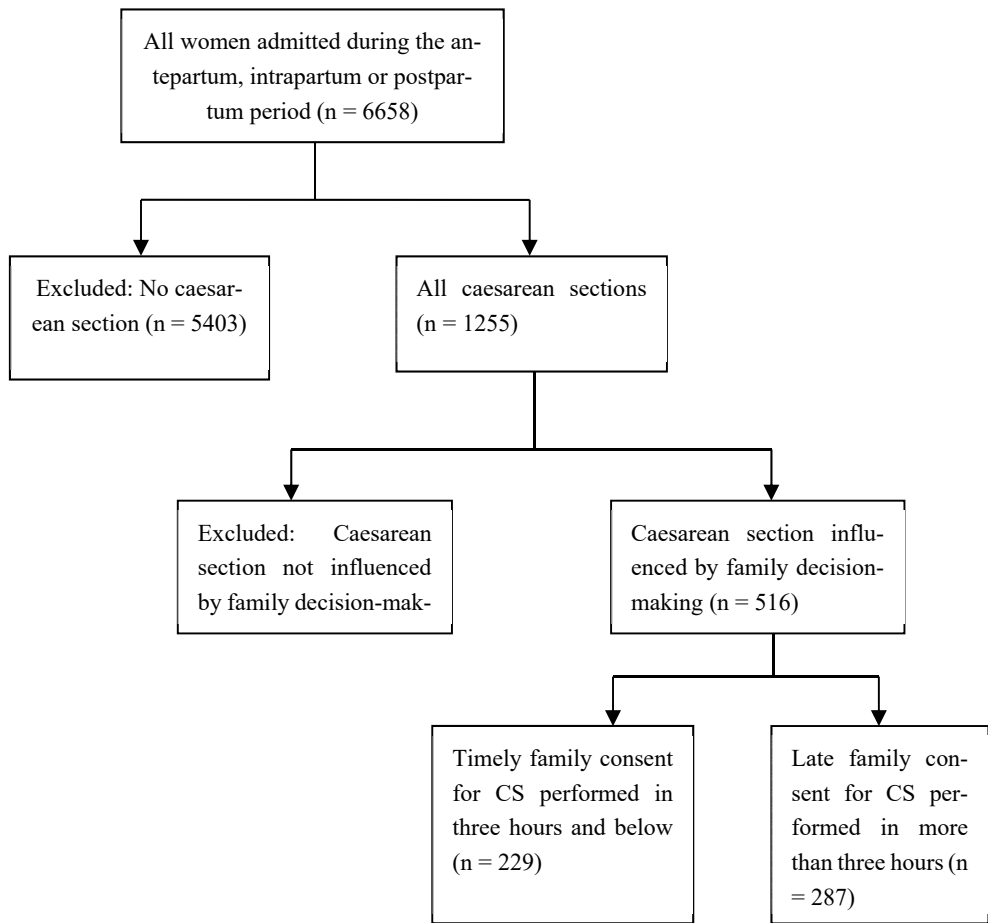


Figure 4. Flow-chart of the participants included in this study from the original maternal near-miss study.

The number of study participants in Paper I, III and IV are illustrated in Figure 5.

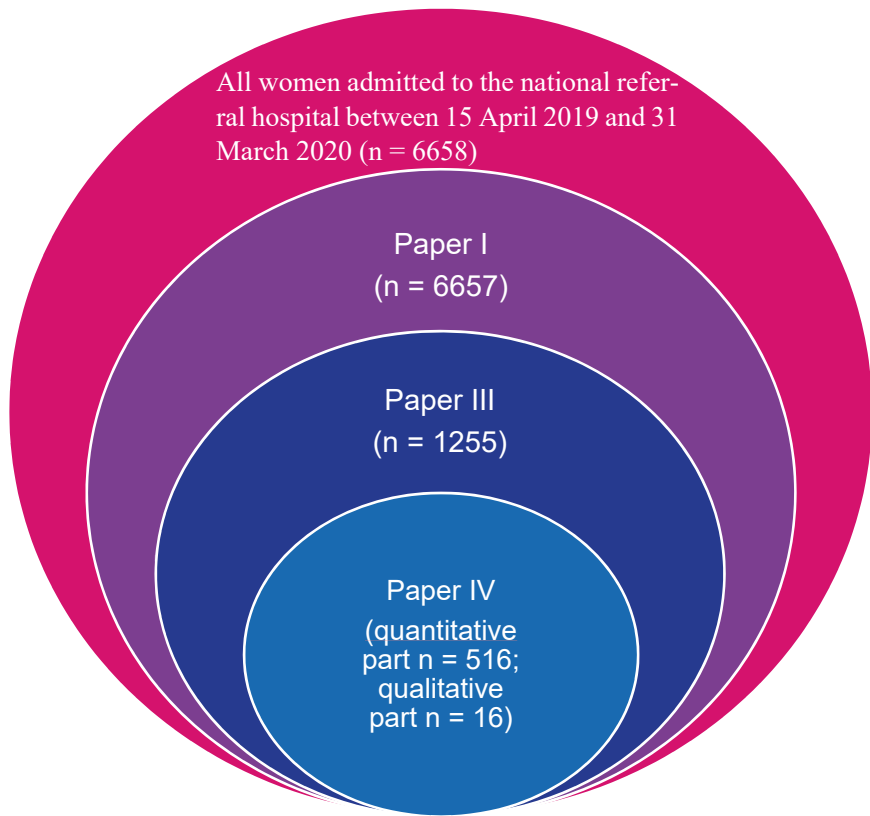


Figure 5. The number of study participants in Paper I, III and IV from the larger MNM study

Data Collection

Papers I, III and IV

Prior to data collection, a data collection group consisting of doctors, nurses and midwives working in the obstetrics and gynaecology department was constituted. In December 2018 to March 2019, preparatory meetings and training sessions were conducted with the research members on the SSA and WHO MNM approach, and there were discussions on how to abstract accurate and valid data. When we previously conducted a pilot MNM study at the same health facility, the data collectors had faced challenges with collecting data[20]. For example, patients were discharged with medical records containing empty sections on history and physical examination, and some files lacked laboratory forms. We therefore predicted that we might face similar challenges.

In the first three months from December 2018 to March 2019, we aimed to improve the quality of the medical records. We explained the aim and purpose of the study. We also trained data collectors on how to conduct checks on the medical records to ensure all data were available prior to patient discharge, in line with the variables in our data abstraction form. If data were missing, the data collectors would approach the HCPs responsible for the patient to acquire the missing data and ensure the completeness of the medical records.

The data collectors included all cases from during pregnancy to six weeks after birth and identified MNM cases during the day hospital shift. Data were continuously collected and entered into the medical records from the point of a woman's admission to the hospital through to the labour ward, ICU, operating theatre or gynaecology wards until her discharge from the hospital. To minimise information errors, with the assistance of members of our research group, we periodically validated the data against the original records and held meetings with data collectors to discuss ways to improve data collection.

In Paper I, we collected sociodemographic data, including age, education and residence. In terms of obstetric factors, data on gestational age, parity, female genital cutting, mode of referral, previous caesarean section and mode of delivery were included. Data on live births; MNMs, according to SSA and WHO MNM, based on clinical, laboratory and management criteria (Table 3); maternal deaths; underlying causes of severe maternal outcomes; and variables on the use of evidence-based interventions to manage severe maternal complications were collected. We did not include $\text{PaO}_2/\text{FiO}_2 < 200$ mmHg, lactate > 5 mEq/ml, $\text{pH} < 7.1$ and intubation and ventilation ≥ 60 min not related to anaesthesia criteria due to limitations in resources and the frequency of use in the study setting.

In Paper III, data collectors in the operating theatre calculated CS time intervals by computing the times when decisions were made for CS in the obstetrics ward and when babies were delivered via CS in the operating room. The data collected included background factors, namely age, education, residence, parity, referral status and previous CS.

The exposure variable was CS delay, which was defined as the time interval from a decision being made by the medical doctor to perform Cs to the delivery of the baby. The CS delay variable was collected in categories of less than 15 minutes, 15 to 59 minutes, 1 hour to 2 hours 59 minutes and 3 hours and above. In this study, we used the following categories of delays: (1) no CS delay, defined as CS being performed less than one hour after a decision being made (2) a CS delay of between 1 and 3 hours and (3) a CS delay of more than 3 hours. These cut-offs for CS delays are in line with the recommended ranges in the literature on CS (i.e. that it should be performed within 30 minutes to 3 hours, depending on the indication of the

operation[114]) and were also agreed upon at a project meeting that included nurses, midwives and doctors at the study site, based on their expert opinions and experiences and in consideration of the local context. In terms of outcome variables, we explored CS delay in relation to maternal and new-born health. Severe maternal outcomes (SMO) were defined as maternal death according to the adapted SSA MNM criteria (Table 2)[107]. Regarding the reasons for delayed CS, we explored the roles of family decision-making, financial resources and HCPs as barriers contributing to delayed CS.

In the quantitative part of Paper IV, the independent variables were sociodemographic factors (age, education, residence area) obstetric factors (parity, previous history of caesarean section, underlying causes of hypertensive disorders, obstetric haemorrhage and contributory/associated factors such as anaemia, obstructed labour/prolonged labour) and questions on whether there had been a delay in the performance of CS and the reason for the delayed performance of CS, such as family decision-making. The dependent variable was *timely family consent for CS to be performed*, defined as CS performed less than 3 hours following consent provided by the family, whereas *late family consent for CS to be performed* was defined as CS performed more than 3 hours following delayed consent from family members. In the qualitative part of the study, a total of 16 individual semi structured interviews were conducted among women who had undergone CS during the period of the quantitative part of this study. Semi structured interviews were chosen as the data-gathering technique because they enable the researcher to delve deeper into the details of the phenomenon being studied. A semi-structured interview guide was developed with open-ended questions regarding the performance of CS and family decision-making, including what possibly led to near-miss events. The individual semi structured interviews were conducted in a quiet private room at the national referral hospital in Somaliland.

Table 3. SSA and WHO maternal near miss inclusion criteria, adapted from Tura et al.[107]

Category	WHO MNM criteria	SSA MNM criteria
Clinical criteria	Acute cyanosis ^a	Acute cyanosis ^a
	Gaspings ^a	Gaspings ^a
	Respiratory rate > 40 or < 6/min ^a	Respiratory rate > 40 or < 6/min ^a
	Shock ^b	Shock ^b
	Cardiac arrest ^b	Cardiac arrest ^b
	Oliguria non-responsive to fluids or diuretics ^c	Oliguria non-responsive to fluids or diuretics ^c
	Loss of consciousness lasting more than 12 h ^d	Loss of consciousness lasting more than 12 h ^d
	Stroke ^d	Stroke ^d
	Uncontrollable fit/total paralysis ^d	Uncontrollable fit/total paralysis ^d
	Jaundice in the presence of pre-eclampsia ^e	Jaundice in the presence of pre-eclampsia ^e
	Failure to form clots ^f	Failure to form clots ^f
		Eclampsia
		Uterine rupture
	Sepsis or severe systemic infection	
	Pulmonary oedema	
	Severe abortion complications	
	Severe pre-eclampsia with ICU admission	
Laboratory criteria	Oxygen saturation < 90% for >60 min ^a	Oxygen saturation < 90% for >60 min ^a
	Creatinine $\geq 300 \mu\text{mol/l}$ or $\geq 3.5 \text{ mg/dL}$ ^c	Creatinine $\geq 300 \mu\text{mol/l}$ or $\geq 3.5 \text{ mg/dL}$ ^c
	Acute thrombocytopenia (<50,000 platelets/ml) ^f	Acute thrombocytopenia (<50,000 platelets/ml) ^f
	Bilirubin > 100 $\mu\text{mol/l}$ or > 6.0 mg/dl ^e	
	Loss of consciousness and ketoacids in urine ^d	Loss of consciousness ^d and ketoacids in urine ^d
Management criteria	Use of continuous vasoactive drugs ^b	
	Transfusion of ≥ 5 units of blood ^b	Transfusion of ≥ 2 units of blood ^b
	Cardio-pulmonary resuscitation ^b	Cardio-pulmonary resuscitation ^b
	Dialysis for acute renal failure ^c	
	Hysterectomy following infection or haemorrhage ^g	Hysterectomy following infection or haemorrhage ^g
	Laparotomy other than caesarean section	Laparotomy other than caesarean section

^a Respiratory dysfunction, ^b Cardiovascular dysfunction, ^c Renal dysfunction, ^d neurological dysfunction, ^e Hepatic dysfunction, ^f Coagulation dysfunction, ^g Uterine dysfunction

Paper II

Focus group discussions (FGDs) were conducted face to face with HCPs at the healthcare facility. The FGDs started with a description of the purpose and aims of the study, and consent was sought to take part in the study. Afterwards, open-ended questions were asked about the HCPs' experiences of providing care to women with severe maternal complications and about barriers to seeking, accessing and receiving timely emergency obstetric care. I conducted the FGDs, which were observed by other members of our research group. The HCPs were encouraged to debate and discuss their experiences and differences in perspectives relating to the provision of emergency obstetric care, in particular CS. The FGDs lasted 60–90 minutes, were conducted in English and recorded and transcribed. They continued until no new information was discerned.

Data Analysis

Paper I

Analysis was conducted on three groups, namely a group with MNM, another with maternal deaths and one without MNM or death. Statistical Package for the Social Sciences (SPSS) version 22 was used. The sociodemographic and obstetric characteristics of MNM, maternal deaths and no MNM or death were described using frequencies and percentages. Severe maternal outcome indicators were calculated using frequencies and ratios[6]. The SSA/WHO inclusion criteria and causes of MNM, mortality indexes as per the causes of MNM and MD (number of maternal deaths divided by the number of women with severe maternal outcome expressed as a percentage) and use of evidence-based interventions to evaluate quality of care were also described using frequencies and percentages.

Paper III

Using SPSS, we calculated descriptive statistics to present the sociodemographic and obstetric characteristics of the study participants. Chi-square tests at a statistical significance set at $p \leq 0.05$ were used to analyse the barriers to CS consent and underlying reasons for CS among women with and without one-hour and three-hour delay of CS. Bivariate and multivariate analyses was conducted to assess whether a delay in CS increased the odds of maternal outcomes (severe maternal outcomes vs no severe maternal outcome) and new-born outcomes (stillborn or alive). In the multivariate analysis, we adjusted for maternal age, education and parity.

Paper IV

The quantitative data analysis entailed the use of SPSS to perform chi-square tests to compare the differences between the group with timely family decision-making and the group with late family decision-making for CS. To find out the variables significantly associated with timely or late family decision-making for CS, binary logistic regression was performed. The variables that had a p value of ≤ 0.2 were entered into the multivariate analysis. Variables in the multivariate analysis with a p value of ≤ 0.05 were considered significant and associated with timely or late family decision-making for CS to be performed.

The qualitative data analysis began following the transcription of the interviews from Somali to English. The transcripts were read multiple times while considering the aims of the study. The multiple readings enabled me to become well acquainted with the content of the interviews. Thematic analysis using a deductive approach was used. The deductive approach involved coding the data according to the barriers to and facilitators of timely family decision-making for CS to be performed. The transcripts were coded manually and sub-themes were generated by checking for repeated patterns, differences and similarities. The authors engaged in discussions regarding the analytical process for coding and developing sub-themes until agreement was reached on the sub-themes identified under the theme of barriers to timely family decision-making and the sub-themes generated under the theme of facilitators of timely family decision-making.

Paper II

Analysis of the FGDs began after the first FGD using the thematic approach described by Braun and Clarke[113, 115]. This method entails a process of identification, analysis and reporting of repeated patterns, differences and similarities. The transcripts were read multiple times and codes were generated using the inductive approach. The codes were discussed in the research group and organised into themes. The process of reaching consensus with the final themes entailed the themes to be mapped back to the transcripts to ensure they reflected the original meaning of the HCPs. Further definition and refinement of the themes was conducted following multiple discussions on data interpretation. A workshop was held in which member checking was done. The HCPs reviewed the themes, provided recommendations for separating the themes that overlapped and finally confirmed that the themes reflected their experiences of the provision of EmOC.

Ethical considerations

The ethical principles of Helsinki Declaration were applied throughout the implementation of the studies[116]. Clearances to conduct the studies were obtained from the University of Hargeisa Ethical Clearance Board (Dr: CS/41/05/18) and approvals were provided by the Somaliland Ministry of Health Development (MOHD/DG: 2/165/2018). These ethical principles include the following:

Respect for autonomy

Information about the study was openly provided and approved by the local healthcare facility authorities. All participants were given verbal information about the study and told that they could withdraw from participation at any time without consequences. Detailed explanations regarding the aim and purpose of the FGDs and interviews were given to HCPs and subjects. In this way, the study participants were free from influence or coercion and their dignity and rights were respected and protected. After gaining all the information about the studies, the FGD and the interviews, the participants provided verbal consent to be included in the studies.

Beneficence

The studies in this thesis aim to provide novel knowledge that will identify gaps in the quality of maternal healthcare and recommend ways to address suboptimal care. Severe maternal outcomes have not only social, economic and psychological effects on immediate families and the community but also negative effects on a country's development agenda. The potential benefit of this thesis is that the findings and recommendations will inform future interventions that will be implemented to reduce the incidence of severe maternal outcomes.

Non-maleficence

The studies conducted in this thesis were observational and not experimental. From a risk–benefit point of view, the studies posed no potential risk of harm. Our search was for knowledge, and we safeguarded the interests of the study participants. We explained to the HCPs and women in the qualitative part of the studies that if the discussions or interviews led to upsetting experiences, there was a plan in place to manage the distress through counselling, if requested. The methodological procedures for our studies were evidence driven, based on the WHO MNM approach[6].

Confidentiality

All the data collected from this research were kept confidential and only used for the purpose of this thesis. No names of the women or HCPs were used when writing the research reports. All the women and HCPs were assigned a code for identification during the review of documents and data analysis. The data were kept in a secure location and handled according to good practices for research and the national laws and guidelines.

Justice

All study participants who were eligible to participate according to the predefined inclusion criteria of the studies were asked to participate without bias or discrimination.

Results

This thesis was conducted based on the research questions and hypothesis in a setting with high maternal mortality and morbidity. The results in Paper I raised research questions that were explored in Paper II. The second study generated findings that established the need to explore one hypothesis and research question, which were tested in Paper III. Our findings were further pursued in a mixed-methods study that provided a broader understanding of Papers II and III. A summary of the findings of this thesis is presented in Figure 6 and Table 4.

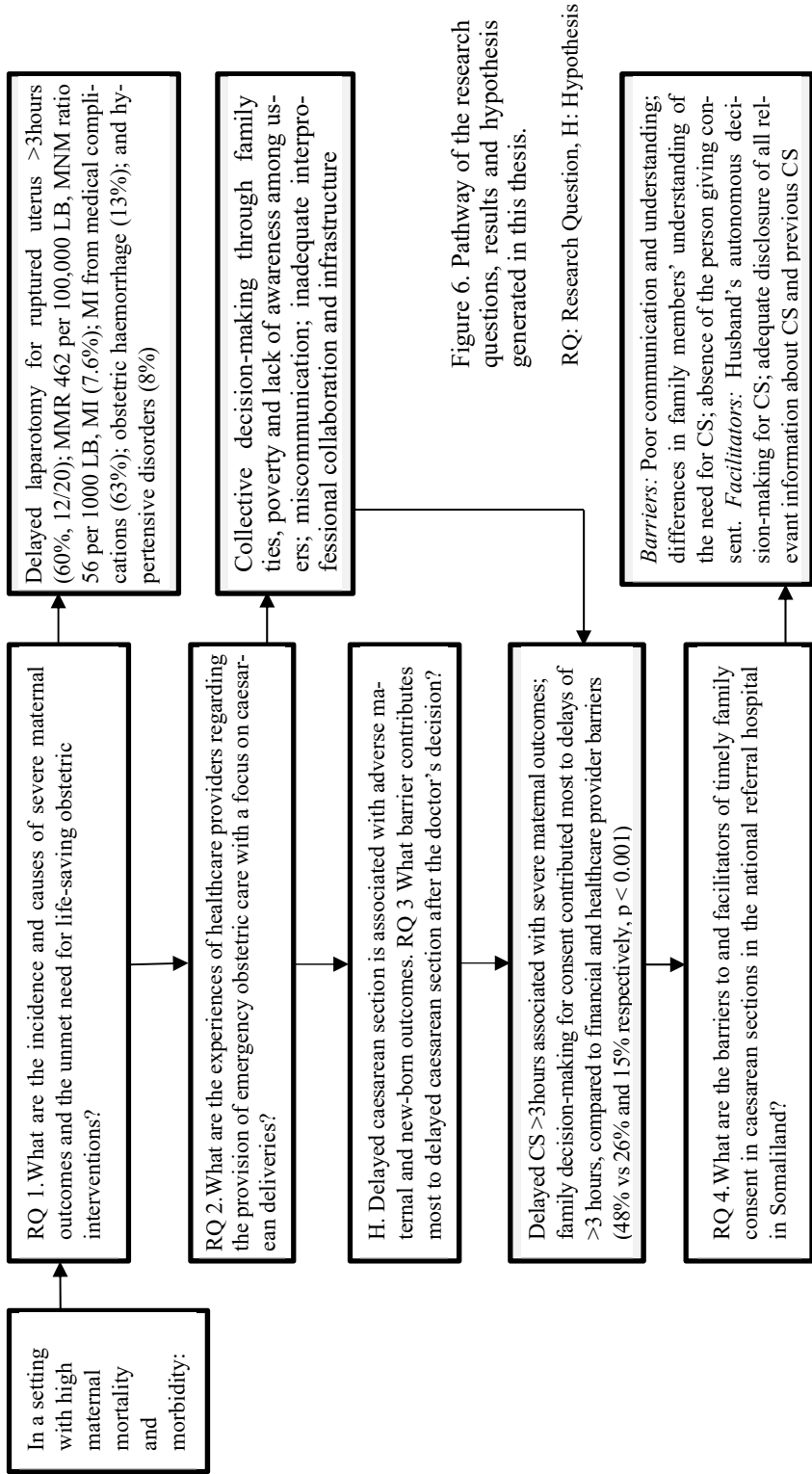


Figure 6. Pathway of the research questions, results and hypothesis generated in this thesis.

RQ: Research Question, H: Hypothesis

Table 4. Characteristics of Study Participants from the Quantitative Parts of the Papers

Characteristics	Paper I		Paper III			Paper IV			
	Total cohort n = 6657	No delay n = 429	CS delay 1-3 hours n = 232	CS delay >3 hours n = 594	Total CS n = 1255	Timely family consent for CS n = 229	Late family consent for CS n = 287	Total CS influenced by family decision-making n = 516	
Age	<20 yrs	1222 (18.4%)	41 (17.7%)	105 (17.7%)	201 (16.0%)	40 (17.5%)	47 (16.4%)	87 (16.9%)	
	20-34 yrs	4201 (63.1%)	297 (69.2%)	163 (70.3%)	378 (63.6%)	838 (66.8%)	154 (67.2%)	335 (64.9%)	
	≥35 yrs	1234 (18.5%)	77 (18.0%)	28 (12.0%)	111 (18.7%)	216 (17.2%)	35 (15.3%)	59 (18.2%)	
Education	n = 6657	n = 429	n = 232	n = 594	n = 1255	n = 229	n = 287	n = 516	
	No formal education	4083 (61.3%)	238 (55.5%)	123 (53.0%)	384 (64.6%)	745 (59.4%)	188 (82.1%)	420 (81.4%)	
Formal education	2574 (38.7%)	191 (44.5%)	109 (47.0%)	210 (35.4%)	510 (40.6%)	41 (17.9%)	55 (18.6%)	96 (18.6%)	
Residence	n = 6657	n = 429	n = 232	n = 594	n = 1255	n = 229	n = 287	n = 516	
	Urban	6165 (92.6%)	394 (91.8%)	216 (93.1%)	529 (89.1%)	1139 (90.8%)	212 (92.6%)	245 (85.4%)	457 (88.6%)
Rural	492 (7.4%)	35 (8.2%)	16 (6.9%)	65 (10.9%)	116 (9.2%)	17 (7.4%)	42 (14.6%)	59 (11.4%)	
Parity	n = 6657	n = 429	n = 232	n = 594	n = 1255	n = 229	n = 287	n = 516	
	0 (nulliparous)	1095 (16.4%)	43 (10.0%)	49 (21.1%)	124 (20.9%)	216 (17.2%)	41 (17.9%)	55 (19.2%)	96 (18.6%)
	1-4 (multiparous)	3946 (59.3%)	292 (68.1%)	162 (69.8%)	384 (64.6%)	838 (66.8%)	188 (82.1%)	420 (81.4%)	
>4 (multiparous)	1616 (24.3%)	94 (21.9%)	21 (9.1%)	86 (14.5%)	201 (16.0%)				
Pregnancy outcome	n = 6657	n = 429	n = 232	n = 594	n = 1255	n = 229	n = 287	n = 516	
	Vaginal delivery	5048 (75.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	Caesarean section	1255 (18.9%)	429 (100.0%)	232 (100.0%)	594 (100.0%)	1255 (100.0%)	229 (100.0%)	287 (100.0%)	516 (100.0%)
Abortion	292 (4.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	Laparotomy for ectopic pregnancy	7 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Previous CS (multipara)	n = 5562	n = 386	n = 183	n = 470	n = 1039	n = 188	n = 232	n = 470	
	Yes	745 (13.4%)	232 (60.1%)	149 (81.4%)	296 (63.0%)	677 (65.2%)	135 (71.8%)	138 (59.5%)	273 (65.0%)
No	4817 (86.6%)	154 (39.9%)	34 (18.6%)	174 (37.0%)	362 (34.8%)	53 (29.2%)	94 (40.5%)	147 (35.0%)	
Mode of Referral	n = 6657	n = 429	n = 232	n = 594	n = 1255	n = 229	n = 287	n = 516	
	Self-referred	6486 (97.5%)	359 (83.7%)	226 (97.4%)	560 (94.2%)	1145 (91.2%)	223 (97.4%)	267 (93.0)	490 (95.0%)
Healthcare provider at maternal and child health centre	149 (2.2%)	66 (15.4%)	5 (2.2%)	24 (4.0%)	95 (7.6%)	5 (2.2%)	14 (4.9%)	19 (3.7%)	

Traditional birth attendant	22 (0.3%)	4 (0.9%)	1 (0.4%)	10 (1.7)	15 (1.2%)	1 (0.4%)	6 (2.1%)	7 (1.3%)
Underlying causes of severe maternal outcomes	<i>n</i> = 370	<i>n</i> = 40	<i>n</i> = 30	<i>n</i> = 97	<i>n</i> = 167	<i>n</i> = 28	<i>n</i> = 68	<i>n</i> = 96
Direct obstetric causes								
Obstetric haemorrhage	104 (28.1%)	6 (15%)	2 (6.7%)	42 (43.3%)	50 (29.9%)	5 (17.9%)	29 (42.7%)	34 (35.4%)
Hypertensive disorders	89 (24.1%)	12 (30)	3 (10%)	27 (27.8%)	42 (25.2%)	3 (10.7%)	27 (39.7%)	30 (31.3%)
Pregnancy-related infection	29 (7.8%)	1 (2.5%)	0 (0%)	7 (7.2%)	8 (4.8%)	0 (0%)	0 (0%)	0 (0.0%)
Pregnancy with abortive outcome	32 (8.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0
Indirect obstetric causes								
Severe anaemia	108 (29.2%)	21 (52.5%)	25 (83.3%)	19 (19.6%)	65 (38.9%)	20 (71.4)	12 (17.6%)	32 (33.3%)
Medical complications	8 (2.2%)	0 (0%)	0 (0%)	2 (2.1%)	2 (1.2%)	0 (0%)	0 (0%)	0 (0%)
Barriers to consent	<i>n</i> = 1255	<i>n</i> = 429	<i>n</i> = 232	<i>n</i> = 594	<i>n</i> = 1255	<i>n</i> = 229	<i>n</i> = 287	<i>n</i> = 516
Family decision-making barriers	516 (41.1%)	152 (35.4%)	77 (33.2%)	287 (48.3%)	516 (41.1%)	229 (100.0%)	287 (100.0%)	516 (100.0%)
Financial barriers	377 (30.0%)	68 (15.9%)	93 (40.1%)	216 (36.4%)	377 (30.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Healthcare provider barriers	228 (18.2%)	75 (17.5%)	62 (26.7%)	91 (15.3%)	228 (18.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
No barriers	134 (10.7%)	134 (31.2%)	0 (0%)	0 (0%)	134 (10.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Caesarean section delays	<i>n</i> = 1255	<i>n</i> = 429	<i>n</i> = 232	<i>n</i> = 594	<i>n</i> = 1255	<i>n</i> = 229	<i>n</i> = 287	<i>n</i> = 516
No delay	429 (34.2%)	429 (100.0%)	0 (0%)	0 (0%)	429 (34.2%)	229 (0.0%)	0 (0.0%)	229 (44.4%)
Shorter delay (1-3 hours)	232 (18.5%)	0 (0%)	232 (100.0%)	0 (0%)	232 (18.5%)			
Longer delay (>3 hours)	594 (47.3%)	0 (0%)	0 (0%)	594 (100.0%)	594 (47.3%)	0 (0.0%)	287 (0.0%)	287 (55.6%)
Severe maternal outcomes	<i>n</i> = 6657	<i>n</i> = 429	<i>n</i> = 232	<i>n</i> = 594	<i>n</i> = 1255	<i>n</i> = 229	<i>n</i> = 287	<i>n</i> = 516
Women without complications	4795 (72.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0.0%)	0 (0.0%)
Women with complications	940 (14.1%)	209 (48.7%)	90 (38.8%)	120 (20.2)	418 (33.3%)	140 (61.1%)	126 (43.9%)	266 (51.6%)
Women with potentially life-threatening condition	552 (8.3%)	180 (42.0)	112 (48.3%)	377 (63.5%)	670 (53.4%)	47 (20.5%)	105 (36.6%)	152 (29.5%)
Severe maternal outcomes	370 (5.6%)	40 (9.3%)	30 (12.9%)	97 (16.3%)	167 (13.3%)	42 (18.4%)	56 (19.5%)	98 (19%)
New-born outcomes	<i>n</i> = 6303	<i>n</i> = 429	<i>n</i> = 232	<i>n</i> = 594	<i>n</i> = 1255	<i>n</i> = 229	<i>n</i> = 287	<i>n</i> = 516
Alive	6055 (96.1%)	377 (87.9%)	203 (87.5%)	555 (93.4%)	1135 (91.4%)	215 (93.9%)	257 (89.5%)	472 (91.5%)
New-born died at birth	248 (3.9%)	52 (12.1%)	29 (12.5%)	39 (6.6%)	120 (9.6%)	14 (6.1%)	30 (10.5%)	44 (8.5%)

Paper I

What are the incidence and causes of severe maternal outcomes and unmet need for life-saving obstetric interventions among women admitted for delivery at a referral hospital in Somaliland?

Between 15 April 2019 and 31 March 2020, a total of 6658 women were admitted to the obstetrics unit. Of these, 342 were MNM and 28 maternal deaths. The incidence of severe maternal outcomes was 5.6%. According to SSA MNM criteria, the MNM ratio was 56.5 per 1000 live births (95% CI 50.8–62.8) and the mortality index was 7.6%. The MMR was 462 per 100,000 live births (95% CI 310–670). No formal education was more common among women in the MNM and maternal deaths groups (72% and 75%, respectively) than in the non-MNM group (61%). Most of the women living in rural areas were in the MNM (21%) and maternal deaths groups (17%), compared to the non-MNM group (9%). Although the majority of women in the MNM, maternal deaths and non-MNM groups self-referred themselves (86%, 89% and 98%, respectively), more MNM (11%) and maternal deaths (18%) than non-MNMs (2%) were referred by HCPs from maternal and child health centres.

According to the SSA criteria, the most common criteria fulfilled by women were blood transfusion with ≥ 2 units (221 women), eclampsia (54), cardiovascular dysfunction (44) and sepsis or severe systemic infection (31). The main direct obstetric causes of severe maternal outcomes were obstetric haemorrhage (28.1%), hypertensive disorders (24.1%), pregnancy with abortive outcome (8.6%) and pregnancy-related infection (7.6%), while severe anaemia (29.2%) was the most common indirect obstetric cause (Table 4).

Medical complications had the highest mortality index (63%), followed by obstetric haemorrhage (13%) and pregnancy-related infection (10%). The mortality index among women with MNM due to hypertensive disorders was 8%. Most of the women (97%) giving birth received prophylactic oxytocin to prevent postpartum haemorrhage, and all eclamptic women received magnesium sulphate (100%). However, although all women who underwent CS received prophylactic antibiotics, 50% did so late after CS. Moreover, 60% of laparotomies were conducted after 3 hours of hospital stay.

Paper II

What are the experiences of healthcare providers regarding the provision of emergency obstetric care with a focus on caesarean deliveries in a referral hospital and maternal and child health centres in Somaliland?

All the HCPs shared their frustration at not being able to provide emergency obstetric care on time, especially in cases of CS. We identified

three themes that reflected the experiences of the HCPs with the provision of emergency obstetric care, namely collective decision-making through family ties; poverty and lack of awareness among users; and miscommunication, inadequate interprofessional collaboration and infrastructure.

Collective decision-making through family ties

The HCPs stated that decision-making for emergency obstetric care occurred at the group level among the family rather than at the individual level by the woman. Their encounters with the family decision-making practice were described as a time-consuming process, as they had to wait for the husband, father to the near miss or male family member to provide consent. This delay resulted in severe maternal outcomes. One HCP said:

The woman had placenta previa and urgently needed blood transfusion. I informed the managers about the case, but because no man was present to give consent, nothing could be done. The woman was brought late at night by other female relatives. Unfortunately, the mother did not survive because we did not get consent on time. (FGD 4, Senior nurse/midwife 6)

In addition, the HCPs felt helpless that they could not provide timely emergency care, despite having the competence to perform CS. One doctor stated: ‘I remember that case because it was disastrous. We did not operate because we didn’t have someone to sign the consent.’ (FGD 2, junior doctor 3)

Poverty and lack of awareness among users

The HCPs perceived that families from disadvantaged socioeconomic backgrounds delayed seeking, accessing and receiving care due to a lack of financial means to utilise the existing emergency obstetric care services. They also stated that most of the women who presented for care in a critical condition lacked knowledge about the danger signs in pregnancy; hence, they did not perceive the severity of the illnesses to be managed at the healthcare facility and stayed at home and delayed.

Mostly, mothers deliver at home with the help of traditional birth attendants because it’s cheap with no transportation costs, and that’s why they prefer it. However, when a complication becomes severe, they come to the hospital, albeit late. (FGD 4, Senior nurse/midwife 5)

Relatives do not always have any information or knowledge about the risks and complications of pregnancy for the patient. We often meet patients with scars who have delayed at home so they can have a normal delivery. Then they come to hospital very late, and still want to deliver normally. (FGD 3, Junior nurse/midwife 3)

Miscommunication, inadequate interprofessional collaboration and infrastructure

The HCPs described that in some situations, staff failed to adequately explain to the woman and the family members the need for EmOC. Poor understanding of EmOC among the women and family members led them to decide to wait and delay making the decision for EmOC.

Sometimes, the staff do not explain everything to the relatives and the patient. Due to poor communication, the patient and family members don't understand the importance of emergency obstetric care as a solution. The healthcare providers tell the patient and relatives: 'we will do a caesarean section; will you sign or not?'. (FGD 3, Junior nurse-midwife 5)

All the HCPs stated that different healthcare cadres with the responsibility for providing emergency obstetrics did not work together as a team and that care could be better coordinated. Moreover, the HCPs expressed the need for responsive systems that would bridge the gap between the family and themselves and have consent and care provided on time.

We are not working together. Some healthcare providers don't monitor the vital signs of the patient, while others do not effectively use the partograph. I remember one mother who stayed for many hours without monitoring; she was just in bed. (FGD 4, Senior midwife 2)

Paper III

Is delayed caesarean section associated with severe maternal and new-born outcomes in the national referral hospital in Somaliland? What barriers contributes the most to delayed caesarean section?

A total of 1255 women who had undergone CS were included in this study, out of a larger cohort of 6658 women in Study I. Our analysis showed nulliparous women and those with no formal education to be more common among the groups with >3 hours CS delay than for those in the groups with 1–3 hours delay and no delay (21.1% and 20.9% vs 10.0%, respectively, $p < 0.001$; 64.6% vs 53.0% and 55.5%, respectively, $p = 0.007$). Regarding the association between delayed CS and types of barrier that cause the delayed decision to perform CS (Table 5), financial barriers were more common than family decision-making and barriers related to HCPs in CS delays of 1–3 hours. However, the incidence of family decision-making as a barrier to delayed CS was higher in the >3hours CS delay group than were health provider and financial barriers.

Table 5. Association between delayed CS and type of barrier to delayed CS^a

	CS delay 1–3 hours, n = 232 (%)	CS delay >3 hours, n = 594 (%)	p-value
Barriers to consent^b			
Healthcare provider barriers	62 (26.7%)	91 (15.3%)	<0.001
No healthcare provider barriers	170 (73.3%)	503 (84.7%)	
Total	232 (100.0%)	594 (100.0%)	
Financial barriers	93 (40.1%)	216 (36.4%)	<0.001
No financial barriers	139 (59.9%)	378 (63.6%)	
Total	232 (100.0%)	594 (100.0%)	
Family decision-making barriers	77 (33.2%)	287 (48.3%)	<0.001
No family decision-making barriers	155 (66.8%)	307 (51.7%)	
Total	232 (100.0%)	594 (100.0%)	

^a CS = caesarean section. ^b There were 1255 caesarean section cases; however, 429 such cases were excluded, since there was no CS delay (< 1 hour).

The odds of severe maternal outcomes (aOR 1.58, 95% CI 1.13–2.21) were significantly higher among women with a CS delay of >3 hours than women without CS delay. However, the odds of stillbirth (aOR 0.48, 95% CI 0.32–0.71) were significantly lower among women with a CS delay of >3 hours than among women without CS delay (Table 6).

Table 6 Bivariate and multivariate logistic regression analyses with crude and adjusted odds ratios of severe maternal outcome or stillbirth with CS^a delays of 1–3 hours and >3 hours

Outcome	Crude OR (95% CI)			Adjusted OR ^b (95% CI)		
	No CS ^a delay	CS delay of 1–3 hours	CS delay >3 hours	No CS delay	CS delay of 1–3 hours	CS delay >3 hours
Severe maternal outcome	1.0	1.04 (0.64–1.68)	1.65 (1.19–2.30)	1.0	1.50 (0.89–2.50)	1.58 (1.13–2.21)
Still birth	1.0	1.44 (0.87–2.39)	0.50 (0.34–0.75)	1.0	1.00 (0.61–1.64)	0.48 (0.32–0.71)

^a Caesarean section. ^b Adjusted for maternal age, maternal education and parity

Paper IV

What are the barriers and facilitators of timely family consent in caesarean sections in the national referral hospital in Somaliland?

We integrated the qualitative and quantitative findings, as shown in Table 7. Below, we describe the barriers to and facilitators of timely family consent for CS.

Barriers to timely family consent for CS to be performed

The women stated that *poor communication* and *women's poor understanding of having informed choice for CS* were barriers to timely family consent. They pointed out that HCPs' inadequate explanations regarding the need for CS deterred family members from accepting CS. Consequently, it was a time-consuming process for the family to provide consent. They acted when they realised that the woman was in a critical state. Moreover, lack of formal education among women was associated with 1.67 times higher odds of late family consent (COR 1.67; 95% CI 1.17–2.39), compared to having formal education. However, the adjusted odds ratio was not significant. This finding indicates the complex situation of family decision-making and that other factors may cause delay because the provision of consent is in the hands of the family. One woman said:

The doctors did not talk to me in a respectful way, and when I repeated questions or when the family members wanted to make sure the intervention was necessary, the doctors did not answer the questions or re-explain the difficult things they were talking about. ... My family refused CS, so it took more than three hours, and lastly, they accepted when they realised that I had a very serious situation. (Interview 12, woman with a ruptured uterus)

Despite the women having severe maternal complications, *differing understanding among family members on the need for CS* due to family disagreements and arguments about CS prolonged the time taken for consent to be provided. Obstetric haemorrhage (aOR 3.209; 95% CI .159–8.887) and hypertensive disorders (aOR 8.491; 95% CI 1.076–66.991) were associated with higher odds of late family consent than women without obstetric haemorrhage and hypertensive disorders, respectively. The qualitative findings give a deeper understanding of the quantitative findings on delayed family consent despite the woman having severe maternal complications.

My husband was ready to provide the signature, although we were shocked about this. However, my family refused to let my husband sign because my family was not confident about the caesarean section, and it caused me to wait an additional 2 hours. After more consultation, my family agreed to it, and finally, my husband signed. (Interview 9, woman with severe antepartum haemorrhage and postpartum sepsis)

Moreover, the women pointed out that although they were in need of CS at the healthcare facility, they had to wait for the family member with authority due to *absence of the person giving consent*.

Two days later, I agreed, but my husband still could not be found, and my brother-in-law was brought to the hospital in the hope that he would take responsibility and sign on his brother's behalf. He refused to sign the consent, as he was worried his brother would get angry with him. (Interview 10, woman with eclampsia)

Facilitators of timely family consent for CS to be performed

Husband's autonomous decision-making for CS was a facilitator of timely family consent for CS. The women described that when the husband had limited involvement with other family members in the CS decision-making process, when indicated, the husband gave consent without delay. The presence of the husband alone or fewer family members at the healthcare facility when consent was requested led to timely family consent for CS. One woman said, 'I lived in Daami Village, ... and it took me around one hour to travel to the hospital. My husband and my friends stayed with me, so as soon as the doctor decided on an operation, he signed, and there was no delay' (Interview 6, eclampsia). The quantitative results showed that women from rural areas had 0.47 lower odds of late family consent for CS (cOR 0.47; 95% CI 0.26–0.85), compared to women from urban areas. The qualitative finding on the husband alone or fewer family members from rural areas during decision-making for CS provides a deeper understanding of the quantitative results on rural residence as a facilitator of timely family consent.

Family members provided timely consent for CS when HCPs gave *adequate disclosure of all relevant information* regarding the possible risks and adverse outcomes of not giving consent on time. Women who survived severe complications and gave birth to healthy babies emphasised the importance of adequately explaining the complications that the woman had.

Although I and my baby survived the problem, when women experience difficulties, they may suffer many times because their relatives do not know what happened or the complications that arose, so it is better to tell the families what is the cause of the complications. (Interview 14, woman with severe postpartum haemorrhage)

Women who had *previous CS* had lower odds of late family consent compared to those without a history of previous CS (cOR 0.59; 95% CI 0.38–0.87), although the adjusted odds ratio showed no statistical significance.

Table 7. Integration of quantitative and qualitative findings on barriers to and facilitators of timely family decision-making for CS to be performed

Variable/issue studied	Quantitative finding	Qualitative finding	Converges, adds, explains
Barriers to timely family consent for CS to be performed	No formal education (cOR 1.67; 95% CI 1.17–2.39) (aOR 1.146; 95% CI 0.759–1.729)	Poor communication and understanding delays informed the choice for CS	Explains
	Hypertensive disorders (cOR 7.82; 95%CI 2.34–26.13) (aOR 8.49; 95% CI 1.076–66.991)	Differing understandings among families on indications for CS	Explains
	Obstetric haemorrhage (cOR 5.04; 95% CI 1.92–13.22) (aOR 3.209; 95% CI 1.159–8.887)		
		Absence of the person giving consent	Adds
Facilitators of timely family consent for CS to be performed	Previous CS (cOR 0.59; 95% CI 0.38–0.87) (aOR 0.727; 95%CI 0.472–1.12)		Adds
	Rural residence (cOR 0.47; 95% CI 0.26–0.85) (aOR 0.536; 95% CI 0.271–1.060)	Husband's autonomous decision-making for CS	Explains
		Adequate disclosure of all relevant information about CS	Adds

Discussion

High quality of care is a vital component of the right to maternal health and of the path to ensuring the preservation of dignity to women and their families. The studies in this thesis explored the reasons for suboptimal EmOC and found the quality of maternal care in this context was suboptimal, in particular for CS. We were able to gain an understanding from different perspectives about the circumstances related to severe maternal outcomes.

The results highlight the complexity in the provision and utilisation of CS when the decision for consent is in the hands of the family. This complexity necessitates a proactive approach to the three phases of delay in the provision and utilisation of EmOC. In effect, it improves maternal health outcomes and gives women, families and HCPs positive experiences and outcomes.

In this section, I discuss how delays in the provision of CS impact quality of care and contribute to severe maternal outcomes. In Figure 7, I contextualise our main interpretation of the research findings in relation to the original three delays model. I conclude the section by showing, in Figure 6, a proactive-orientated model to improve the quality of maternal healthcare and prevent the three delays from contributing to severe maternal outcomes.

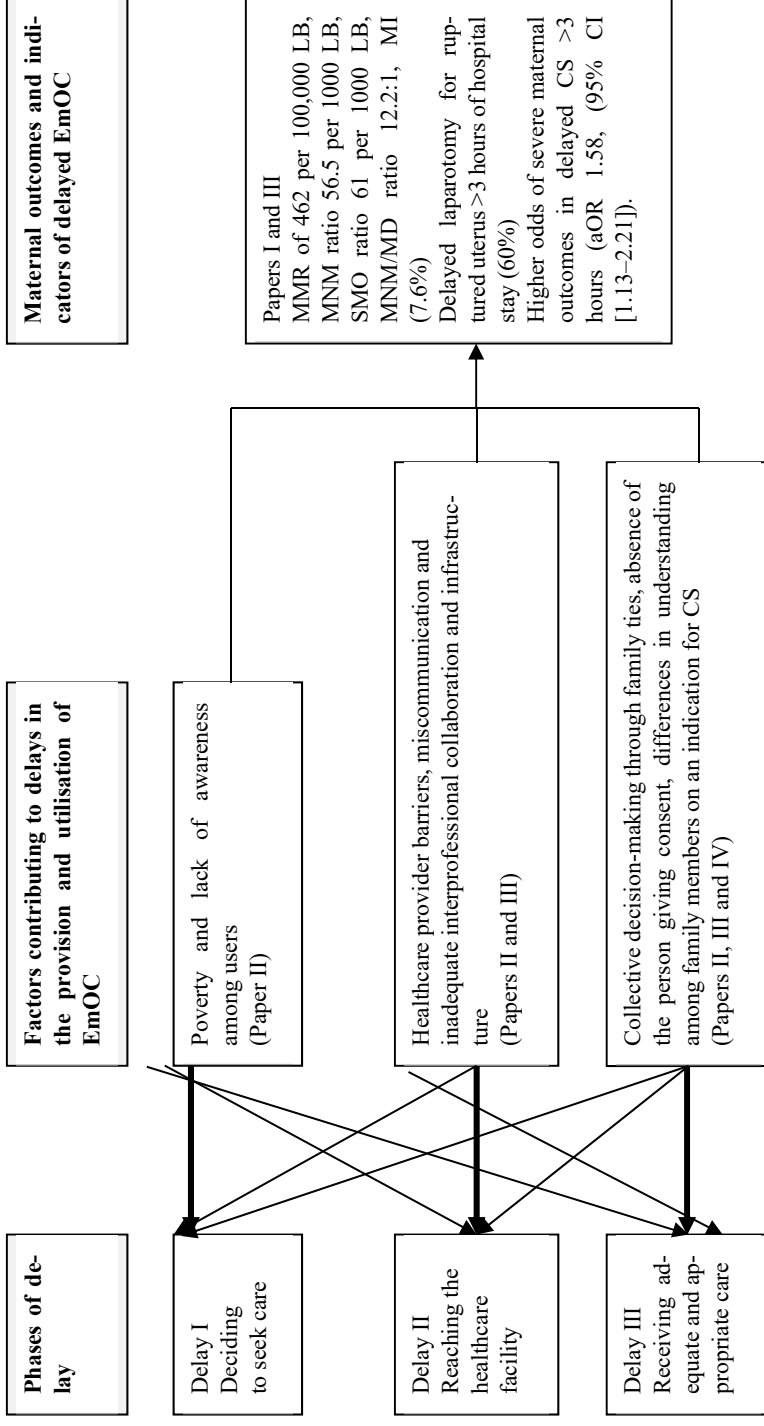


Figure 7. Factors influencing the utilisation and provision of emergency obstetric care and maternal outcomes and indicators illustrated using the original three-delays model. The thicker the arrow, the greater the influence of factors on delays in a specific phase.

Deciding to seek care

We found that financial barriers among the users contributed to the first delay in seeking care. In Paper II, the HCPs reported that the inability of family members to afford EmOC was a major barrier that discouraged women and family members from seeking care. In the Somaliland setting, although public sector maternal healthcare services are offered for free[117], our findings showed that women were required to pay out of pocket for medications and supplies. This is not an isolated problem for Somaliland, and the barrier has been described in other low-resource settings[118-120], despite the policy of maternal health services being free. In Somaliland, there appears to be a possible reason why women are required to pay some fees out of pocket for EmOC, which is that in such a low-resource setting, it is likely that maternal and healthcare facilities have limited funding from the government budget, and so, to prevent potential stock-outs[121] for medications and supplies, the health facilities must charge users for drugs and medical supplies.

Women and their family members had limited knowledge of the danger signs in pregnancy and how to address maternal complications. This lack of awareness among users about when to utilise emergency obstetric care services, despite them having severe maternal complications, led to delays in the decision to seek EmOC (Paper II). It is conceivable that the women and their family members perceived the risk of dying, ending up with a foetal death or developing other severe consequences to be low. Despite severe complications, they stayed at home and failed to seek early care at EmOC health facilities. Similar to our findings[122], there may be several reasons that influenced the women's perceived susceptibility and severity when seeking care. Study I showed that most of the women with severe maternal outcomes had no formal education and were multipara and self-referrals. These factors have been identified in other studies as contributing factors for delaying access to EmOC[20, 123, 124].

It was found that suboptimal care at EmOC health facilities was caused by inadequate interprofessional collaboration between HCPs, a lack of adequate infrastructure and communication and the time-consuming process of obtaining consent for CS to be performed. The effect of this suboptimal care possibly led to a lack of trust and loss of confidence[125, 126] in EmOC services and made the women and their families decide not to seek care at the healthcare facilities.

Reaching healthcare

Healthcare system barriers (Paper III), such as miscommunication and inadequate interprofessional collaboration between HCPs and infrastructure (Paper II), were considered important causes of delay in reaching care. In

Paper IV, the women were frustrated by the lack of adequate explanation about the need for CS, and there was poor communication among HCPs, the woman in need of CS and family members. In this regard, we found that the HCPs did not have adequate competence in communicating and interacting with the women and their family members (Papers II and IV). According to previous studies[100, 127, 128], the second delay is caused by transport or the time taken to reach care due to the poor physical accessibility of the roads, the distance to healthcare facilities and the lack of finances to cater for transport costs. However, according to Binder et al.[126], HCP barriers such as miscommunication between HCPs and patients can also contribute to the second delay.

In this case, reaching healthcare was interpreted as a woman's inability to be transferred to the appropriate unit within a hospital or to another hospital due to healthcare system barriers[103]. Although the operating theatre may be reachable in terms of distance when the woman and her family members are in the EmOC healthcare facility, a lack of clear communication between the HCPs and the woman and her family can lead to delays in the initiation of a transfer to the operating theatre for CS. Moreover, based on our observations, in the study setting, the operating theatre for procedures such as CS was located outside the maternity wards, impeding the timely transfer for care. It is recommended that operating theatres should be close to labour and delivery rooms[129].

Our study showed that there was inadequate collaboration among HCPs concerning the provision of EmOC. Delays in EmOC provision occurred when HCPs failed to work collaboratively and coordinate effectively. This was exacerbated by the unavailability of some HCPs at the facility, resulting in women not being taken promptly to the operating theatre for a CS. We found that the HCP barrier not only led to the second delay but also the third delay of receiving care. According to Knight et al.[130], delays in the mobilisation of operation theatre staff, a lack of essential drugs, inadequate blood for transfusion and a lack of space in the theatre are factors that contribute to suboptimal care as the third delay of receiving care. However, our findings highlight the interconnection between HCP and facility barriers with not only the second and third delay but also the first delay, as explained earlier.

Receiving care

Our study showed that the collective family decision-making process, the absence of the person supposed to provide consent and differences in understanding among family members on an indication for CS (Papers II and IV) contribute to the third delay in receiving care. We found that these factors were rooted in sociocultural beliefs and practices. Although in many settings,

it is the patient who provides consent for the provision of healthcare, in Somaliland, it is the family members who do so for CS. In addition, it was found to be time consuming for the family to provide consent, since in some cases, the person with the responsibility to provide consent was not present at the healthcare facility when consent was needed. Some family members had different opinions on the mode of birth. They preferred a natural birth rather than CS and delayed the process of providing consent in the hope that the woman would give birth naturally. These sociocultural factors, which are considered to be major predictors of the first delay of seeking care[100], were identified in our study as major contributors to the third delay of receiving care.

Our findings showed that despite the women arriving at the EmOC facility, the Somali tradition of decision-making at the group level took precedence over the woman's autonomy to make the decision for CS. In many settings, such as in the USA, Malawi and India[131-133], it is the woman with the indication for CS who provides consent for CS to be performed. It is conceivable that the HCPs aimed to uphold the principles of beneficence and non-maleficence by doing what was best and avoiding harm. However, although it is the fundamental right of a pregnant woman to give or decline medical procedures[96], in our setting, the decision to provide consent and responsibility to do so was in the hands of the family.

In the context of the family and woman's refusal of CS, reproductive health rights become particularly significant. These rights encompass a range of fundamental human rights that enable individuals, including women, to make autonomous decisions about their reproductive health and well-being[27]. Autonomy is a cornerstone of reproductive health rights, emphasising an individual's right to make informed choices about their own body and healthcare[95]. In the case of CS refusal, it is essential to recognise and respect a woman's autonomy to make decisions about her childbirth. This includes providing comprehensive and unbiased information about the risks and benefits of CS and vaginal birth as well as supporting the woman's decision-making process. However, challenges may arise when HCPs perceive potential risks to the woman or her unborn child with vaginal birth, leading to tensions between respecting the woman's autonomy and safeguarding the well-being of all parties involved.

Nonetheless, the principle of autonomy should be balanced with considerations of beneficence and non-maleficence[95]. HCPs have a duty to act in the best interests of their patients and avoid causing harm. When faced with CS refusal, HCPs must carefully evaluate the potential risks and benefits of both CS and vaginal birth to ensure the well-being and safety of both the woman and the unborn child. This delicate balancing act requires collaborative discussions and shared decision-making among the woman, her family and HCPs while also acknowledging the woman's right to make autonomous choices.

Upholding reproductive health rights requires comprehensive and patient-centred care that acknowledges the complexity of ethical considerations and legal frameworks[76]. By fostering open communication and shared decision-making and providing women with access to quality healthcare, HCPs can navigate the ethical complexities and uphold the reproductive health rights of women in the context of CS refusal. Healthcare system barriers such as miscommunication and inadequate collaboration (the second delay) and financial barriers and lack of awareness among users (the third delay) were also important factors that contributed to the third delay of receiving care[100, 130].

While acknowledging the cultural significance of family-orientated decision-making, the proposition of a consent process centred on individual preferences raises the fundamental consideration of its feasibility and implications within the familial context of Somaliland. The practice of family engagement in Somaliland extends beyond the realm of childbirth to encompass various surgical scenarios, even those involving male patients, thereby highlighting the intricate interplay between cultural norms and healthcare decision-making. Despite a proposition to permit women's consent in obstetric emergencies being introduced for parliamentary deliberation in Somaliland, it has failed to gain approval. It is imperative to engage multiple stakeholders, including women, men, religious leaders, traditional authorities and policymakers, in the formulation of a policy enabling women to autonomously provide consent during obstetric emergencies.

Indicators of severe maternal outcomes

We identified a possible relationship between the factors contributing to delays in the provision of EmOC and the maternal outcomes (Figure 4). According to Paper I, the MM ratio was high, at 462 per 100,000 live births, with a MNM ratio of 56.5 per 1000 live births and a mortality index of 7.6%. Moreover, there was a positive association with higher odds for severe maternal outcomes in delays longer than 3 hours for CS (Paper III). A higher MNM mortality ratio in comparison to a lower mortality index indicates to some degree that better care was provided in the case of MNMs. Furthermore, there was high compliance with guidelines but still a high disease and mortality burden. The high MM ratio indicates the need to continuously improve the quality of maternal healthcare.

Our interpretation of the relationship between delays in the provision of EmOC and poor maternal outcomes is consistent with Sign et al. [134], who found any kind of delay (i.e. first, second or third delay) during pregnancy to be associated with higher odds for poor maternal outcomes. Another study conducted in Ethiopia showed women with at least one of the three delays in receiving EmOC to be associated with three times higher odds for developing

severe maternal outcomes[135]. The first (i.e. decision to seek care) and second delays (receiving adequate and appropriate care) were found to be the most important factors contributing to maternal deaths in the study by Tesfaye et al.[136]. Our findings show that delays at the three levels are interconnected and can interact with each other and lead to severe maternal outcomes. It is important for the healthcare system to develop mechanisms to address delays in the provision of EmOC to reduce high rates of severe maternal outcomes.

A proactive-orientated model to improve the quality of maternal healthcare

To prevent the occurrence of delays and improve the quality of maternal healthcare, a proactive approach is proposed that focuses on prevention (Figure 8). The model has been developed cognisant of insights from previous literature[103, 137-139] and the need to recognise the three types of delay in a cyclical manner, rather than one that is sequential. The model recognises that the phases of delay influence each other in a complex manner and considers the importance of using ANC as a means to prevent potential sociocultural-related delays at the hospital level. The components of the interventions are presented and discussed below.

The problem with the first delay (i.e. deciding to seek care) can be addressed by ensuring that EmOC services are provided at no cost. The government can take the lead in ensuring that maternal health services, even at the tertiary level of care, are available free of charge. Awareness-raising programmes on the danger signs in pregnancy and when and how to utilise EmOC can be implemented at the community level. A community intervention using community health workers can be implemented to reach more people, including women in their households[140, 141]. This model can be used as an opportunity to reach more women, considering that the Somali setting has low utilisation of ANC. Moreover, considering that most women lack formal education, it is important to design communication messages[142] that can be easily understood by women and their family members.

Regarding the second delay (i.e. healthcare system barriers such as miscommunication, inadequate collaboration and infrastructure), there is need to build the competencies of HCPs and further equip healthcare facilities with adequate equipment and supplies. HCPs can also be trained to suggest alternative methods of birth as options for delivery in addition to CS, depending on the indication[143]. An interprofessional teamwork approach is suggested in this context[144]. There is a need for HCPs to train in sharing common goals, to have clear job descriptions, to engage in periodic competency training and to be trained in how to communicate with women and their family members when seeking consent. According to the FIGO

ethical committee, it is the responsibility of HCPs to provide information to mothers on risks and management alternatives and allow them to ask questions before making a decision about care[145]. On the part of communication training, HCPs can have a standard tool to follow when seeking informed consent for CS to ensure that they have given adequate disclosure of all the relevant information related to benefits and risks of CS.

The factors contributing to the third delay (i.e. receiving appropriate care) can initially be addressed by carrying out extensive dialogues with different key stakeholders[146], such as religious leaders, traditional leaders and policymakers, on the problem of collective decision-making at the family level in maternal emergencies. Such dialogues can lead to consensus on the importance of transferring the responsibility of consent from family members to women themselves. A policy can then be co-created that would enable women to have autonomous responsibility and provide consent for EmOC, including CS. ANC can be used as an opportunity to prepare women and families for birth by educating women on timely decision-making and providing formal consent for EmOC. More importantly, to reduce the high ratio of severe maternal outcomes, there is need to continuously improve the quality of care through the provision of evidence-based obstetric interventions[147]. Medical complications had the highest mortality index, indicating the need to engage multidisciplinary teams with other specialities besides obstetrics in providing essential obstetric care interventions. This approach will address the high mortality index from indirect obstetric causes of maternal mortality. Moreover, since obstetric haemorrhage, hypertensive disorders and sepsis were the leading direct obstetric causes of severe maternal outcomes, there is need to allocate resources at the healthcare facility level to implement evidence-based obstetric interventions. The standard operating procedures should be updated, and HCPs should undergo in-service training[148].

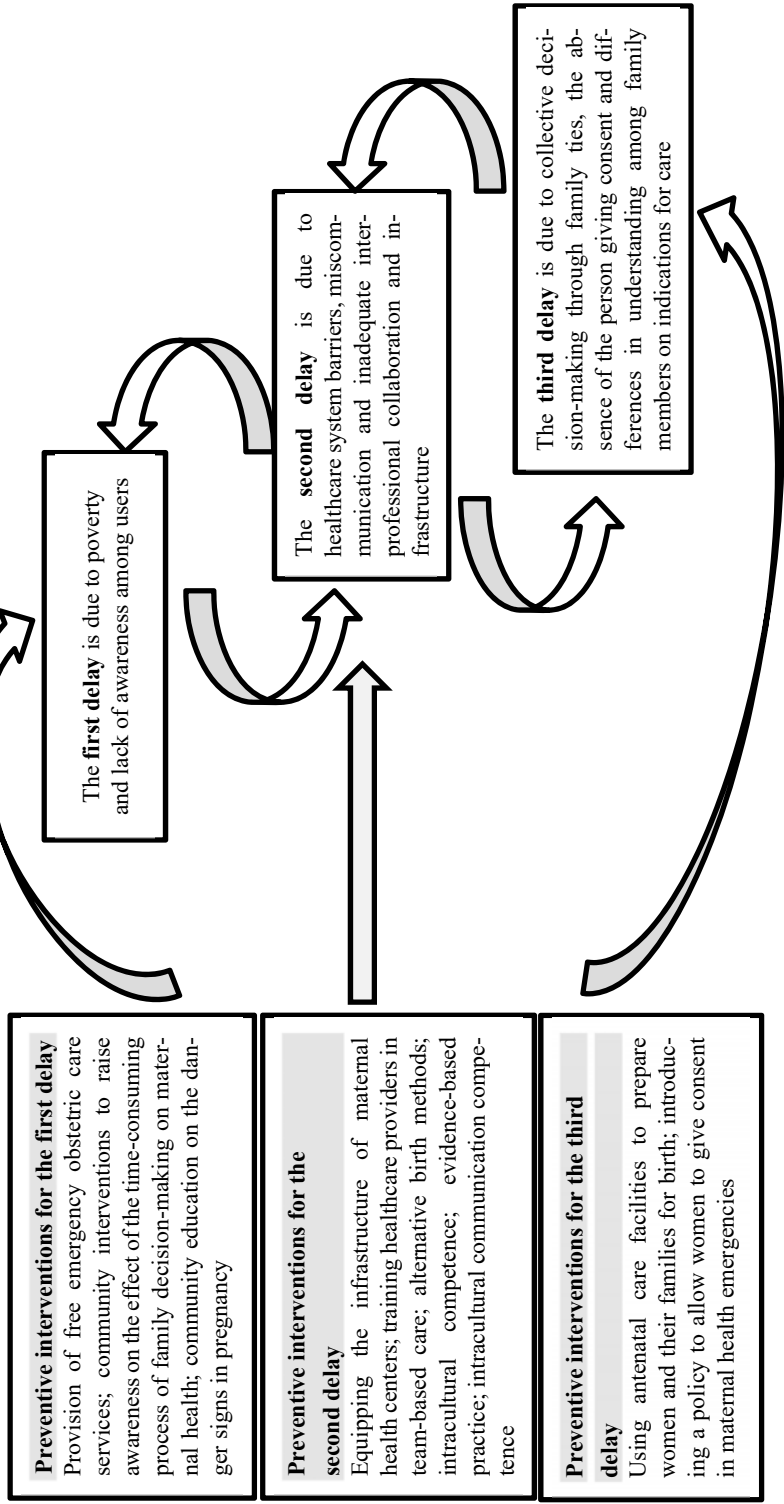


Figure 8 A proactive-oriented model to improve the quality of maternal healthcare and prevent the three delays contributing to severe maternal outcomes. Arrows show the complexity of delays, how they influence each other and the preventive interventions that can address the delays

Methodological considerations

This thesis has the advantage of using the standard MNM approach[6, 107] to investigate the quality of maternal healthcare in Somaliland. The combination of qualitative, quantitative and mixed scientific methods has been vital and useful for gaining a better understanding of the challenges in the provision of EmOC. The results from each scientific approach complemented the others. The methodological strengths and limitations are considered below.

Internal Validity

Internal validity pertains to the degree to which conclusions can be confidently drawn about whether the independent variables have truly influenced the outcome, independent of any systematic errors that may have influenced the estimated effects[149]. It serves as a fundamental prerequisite for external validity, ensuring the generalisability of the research findings beyond the immediate study context. The threats to internal validity can generally be categorised into three main groups, namely selection bias, information bias and confounding factors[149]. These factors need to be carefully addressed and controlled in any research design to ensure the reliability and accuracy of the study's conclusions.

Selection bias

Selection bias can arise due to the methods employed in choosing individuals for a study and the factors influencing their decision to participate[149]. Biased results occur when there are systematic differences between participants and non-participants, leading to distinct associations between exposure and outcome for the two groups.

A strength of this thesis is that in Papers I and III, where the variable of severe maternal outcomes was measured, a validated tool for SSA was used. This was to ensure that all participants had been screened using the standard criterion of MNM by Tura et al.[107]. Moreover, the definition of maternal deaths was consistent according to the WHO[150]. To prevent the risk of selection bias, the study included all women admitted at the referral hospital during pregnancy, birth or the postpartum period from 15 April 2019 to 31 March 2020, which provided a large sample covering almost one year's study population at the national referral hospital.

The limitation of Paper III is that we did not follow up on neonates after birth to find out if they had later died or developed severe morbidity. This possibly led to a smaller sample size of the group with adverse new-born outcomes and the possibly of the odd finding of reduced risk of stillbirth after a CS delay of longer than 3 hours. Moreover, we did not include women who were indicated for CS but did not undergo the procedure. The inclusion of this

group of women could have added valuable information on the effects of delay on maternal and perinatal outcomes. This possible bias should be considered when interpreting the findings of Paper III.

Information bias

Information bias may arise due to various factors, such as measurement bias, misclassification of outcomes and inaccurate data[149]. A strength of Papers I, III and IV (quantitative data) is that we applied rigorous quality control measures during data collection and ensured from the time of the patients' admission to the ward to the time they were discharged, vital data were captured. Back and forth, we checked the data collected to ensure none were missing. When we found missing data in the data abstraction forms, we went back to the medical records and filled in the missing data.

However, in Paper III, there was a measurement bias limitation in that we did not collect data on low APGAR scores, mask ventilation and/or new-born resuscitation and transfer to the new-born intensive care unit, which are criteria for adverse new-born outcomes. Moreover, we did not collect information on the indications for CS. This information could have added valuable information to the study. In this regard, this bias should be considered when interpreting findings of Paper III.

Confounding

Confounding refers to the influence of external factors that may distort the estimation of the effect of independent variables on the outcome measure, leading to under- or overestimation[149]. While it is a challenge to completely eliminate confounding in observational studies, it can be mitigated through the use of adjusted models that help to control for the potential impact of confounding variables and enhance the validity of the study's results. In Papers III and IV, after considering the variables to include in the multivariate analysis, an adjusted odds ratio was used. Previous studies and potential confounders provided the motivation for the inclusion of variables in the model.

External validity (generalisability)

External validity refers to the degree to which the study findings can be implied to a broader population or other target populations[149]. External validity can be influenced by several factors, including the representativeness of the study sample, the characteristics of the population under study, the settings in which the research is conducted, the social cultural context and the healthcare systems in place. These elements play a crucial role in determining

the extent to which the research findings can be generalised to broader populations.

In Paper I, a large sample size enabled a closer representation of the actual current situation in relation to the incidence and causes of severe maternal outcomes from a hospital-based study. However, although we were able to estimate the MMR, this value might not be representative or generalised to the population of Somaliland, as this study was only conducted in the national referral hospital. Moreover, it was conducted at a facility that receives most mothers with severe maternal complications. As such, the findings may be relevant for referral hospitals, rather than for the primary healthcare facilities at the lower level of the healthcare delivery system. However, our results can be generalised to contexts with similar sociocultural and demographic characteristics.

Trustworthiness

Trustworthiness refers to the degree of confidence with the data and interpretation, including the methods used to ensure the quality of a study [151, 152]. Paper II was a qualitative study based on FGDs. To the best of our knowledge, it is the first to provide rich insights into the barriers to EmOC utilisation in Somaliland. HCPs' accounts uncovered factors that contributed to the three delays, namely deciding to seek care, reaching the healthcare facility and receiving care. We ensured that *credibility* and *confirmability* were increased by conducting a member checking session with the study participants. They reviewed the findings of the study, including the interpretations, and confirmed that the themes reflected their encounters and the situation of EmOC provision in Somaliland.

The researchers involved in the studies in this thesis engaged in regular meetings and dialogue during the data collection and analysis. This prevented the author of this thesis from expressing personal pre-understandings of the findings. The *dependability* of the study was maintained by ensuring that the data analysis was conducted in a consistent manner through observations and by taking notes and discussing the data with the research team, and the research procedures were documented to leave an audit trail. To ensure *transferability*, there were rich descriptions of the study context and the participants' characteristics, and rigorous research methods were used. The FGDs for the different HCPs cadres were conducted separately. The doctors, nurses and midwives were not mixed, ensuring that the study participants were free and felt comfortable to share information related to their experiences in providing EmOC with other cadres of healthcare workers.

In this study, we missed the voices of women and the community, which could have added valuable insights shared by HCPs about EmOC. Holding FGDs at the hospital might have affected the results by introducing

information bias due to HCPs feeling uncomfortable about talking freely due to fear of being judged by their colleagues.

A major strength in the use of a mixed-methods study design in Paper IV is that it enables quantitative and qualitative findings to be compared and contrasted. In this study, credibility was increased with use of two strategies. First, data were analysed by a team of researchers with different disciplinary backgrounds, and second, the findings of the study were presented and discussed through peer debriefing with other colleagues. Another strength was that conducting interviews in the Somali native language enabled more natural and nuanced communication. This led to rich and detailed responses, as the study participants were likely to express their thoughts and experiences more accurately and comprehensively in their native tongue. Nevertheless, a potential limitation is that the translation of Somali interviews into English may to some extent have lost the original meanings of the narratives from the women; however, a strength of this study is that the interviews were cross checked by co-authors fluent in English and Somali. This ensured the preservation of the original meaning of the qualitative data. We missed the voices of husbands and other male family members, which may have added further depth to the whole concept.

Reflexivity

Reflexivity is a vital part of quantitative and qualitative research whereby researchers encounter the challenge of personal bias and perception. Reflexivity means that the researcher is self-aware of personal assumptions and has a social background and values throughout the research process to enhance the trustworthiness of the research[153]. All through the studies, I was conscious of my position as an outsider. However, I also consider myself to be an ‘insider’, to some degree. As a Kenyan citizen, albeit one who has lived and worked in Hargeisa, Somaliland, for over 10 years and has a basic understanding of the Somali language, I have an insider perspective and first-hand experience of the challenges the healthcare system faces. This has enabled me to have a better understanding of the challenges faced by the HCPs when they shared their experiences of providing emergency obstetric care. Moreover, from my insider position, it was possible to gain acceptance, trust and cooperation from HCPs and individuals involved in our research throughout the stages of the research process.

Moreover, as a non-Somaliland citizen, being an outsider made the HCPs feel comfortable in talking to me and believe that what they shared in the interviews would not get back to the hospital administration, which might cause them to be reprimanded or viewed negatively later on. Having a multidisciplinary research team with diverse and varied experiences and expertise played a role in eliminating bias that could have affected the studies. The discussions we held during the conceptualisation of the studies, data

collection, data analysis and interpretation enabled me to gain insights into how the Somaliland context has influenced my personality and made me a better researcher.

Conclusion

This thesis aimed to study the quality of maternal healthcare by exploring severe maternal outcomes and the influences of delays and decision-making on CS. The findings represent a clear need to improve the quality of maternal healthcare through a multisectoral approach focusing on the community and healthcare system interventions as conceptualised in a proactive approach to preventing delays in seeking, reaching and receiving care. The SSA MNM approach applied in this thesis enabled us to identify areas of quality of care that require improvement. We found that delays in the provision of CS contributed to severe maternal outcomes. The HCPs' accounts of their encounters and experiences with the provision of EmOC enabled us to identify healthcare system barriers, financial barriers and family decision-making barriers as important factors contributing to delaying the provision of EmOC.

Our findings also showed the need to give women the right to provide consent for themselves in cases of maternal health emergencies. This can be achieved by initiating discussions and dialogues among religious leaders, traditional leaders, HCPs and policymakers. A policy focusing on EmOC can then be co-created with these stakeholders to transfer the responsibility of providing CS consent to women themselves. To improve the quality of EmOC, it is critical that HCPs undergo continuous training on how to communicate with women and their family members when seeking consent for CS and how to collaborate with other HCPs involved in the provision of EmOC. Community interventions can provide an opportunity to increase awareness of the importance of EmOC to prevent delays in the access and utilisation of EmOC.

Recommendations

Based on our research findings, single interventions cannot resolve the problems we identified. Instead, there is need for a multisectoral approach. I list below our recommendations to decrease severe maternal outcomes and reduce delays in the provision of EmOC. These recommendations consider the context of a low resource setting with limited financial means.

The HCP level

- Caregivers should clearly communicate with women and their family members by providing adequate information about the recommended EmOC.
- Doctors, midwives and other healthcare professionals involved in the provision of EmOC should work as a team towards the same goal of providing quality maternal healthcare.
- Caregivers should inform women and family members during the ANC period about the possibilities of CS as a mode of birth and to be prepared to give consent on time if it is needed.

The hospital level

- The hospital should provide training to HCPs on alternative methods of birth, such as vacuum extraction, and encourage them to use these, depending with the indication of the woman.
- A standard counselling checklist could help by guiding HCPs on how to seek CS consent from women and their family members. This will ensure that they provide adequate information about the need for CS.
- The implementation of a continuous MNM surveillance system at the hospital is suggested to monitor SMOs and gaps with evidence-based practice.
- Staff involved in the provision of EmOC should be trained on interprofessional teamwork and how to work together as a team to achieve a reduction in SMOs.

The healthcare system level

- The healthcare system should remove out-of-pocket expenses for EmOC and ensure hospitals provide free maternal health services at no cost at all.
- The Ministry of Health should take the lead in co-creating a policy that will allow women to give consent for CS.
- The healthcare system, in collaboration with other key stakeholders, should raise awareness in the community about the availability of EmOC and when to seek these services.
- The healthcare system should provide adequate infrastructure in healthcare facilities to ensure HCPs have adequate tools necessary to provide EmOC.
- The healthcare system should pay more attention to socioeconomically disadvantaged women, especially in the community, and maternal and child health services.
- The healthcare system should scale up and utilise community health workers in raising awareness about EmOC and danger signs in pregnancy.
- Further studies are needed to test the effect of the proposed proactive model to improve the quality of maternal healthcare. Moreover, studies should be conducted to explore and determine whether women themselves want to be given the responsibility of providing consent themselves in maternal health emergencies.

Summary of the findings

The maternal healthcare situation in Somaliland presents significant challenges, with one of the highest MM rates globally and limited evidence on severe maternal outcomes and emergency obstetric care provision and utilisation. This thesis aimed to assess the quality of maternal healthcare by studying severe maternal outcomes and the impact of delays and decision-making on CS procedures in a low-resource setting.

It was found that the MMR was alarmingly high, with 462 deaths per 100,000 live births, and the ratio for MNM cases was 56.5 per 1000 live births. Medical complications had the highest mortality index, followed by obstetric haemorrhage, pregnancy-related infections and hypertensive disorders. The decision-making process being at the family level, rather than individualised; poverty; and lack of awareness as well as healthcare system factors such as miscommunication and inadequate collaboration were identified as significant contributors to these delays.

The findings indicated that a delay of more than three hours in performing a CS is linked to higher odds of severe maternal outcomes. Family decision-making for consent emerged as the most critical barrier leading to delays in this procedure.

Women with hypertensive disorders and obstetric haemorrhage were more likely to experience late family CS consent. Communication issues, differences in understanding among family members about the need for a CS and absence of the person giving consent were identified as barriers to timely decision-making. Conversely, the husband's autonomous decision-making, adequate disclosure of information about the procedure and previous CS supported timely family decision-making.

Overall, this thesis emphasises the urgent need to improve the quality of maternal healthcare to reduce severe maternal outcomes. It suggests a proactive model that focuses on strategies targeting both the community and the healthcare system. These strategies include training HCPs in intracultural communication competence, obtaining consent using proper protocols and guidelines, promoting interprofessional collaboration and exploring alternative birth methods. Allowing women to give consent in maternal health emergencies, using ANC to prepare families for potential obstetric emergencies and obtaining written informed consent are also highlighted as important measures to enhance maternal healthcare outcomes in Somaliland.

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