



# **Delivery Care at Mangochi District Hospital, Malawi**

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**Thesis for the Degree of Bachelor of Science**

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**Introduction:** Maternal mortality is a significant disease burden in many countries. Despite global progress, it is unevenly spread with sub-Saharan Africa particularly lagging behind. The Sustainable Development Goal 3.1 aims for maternal mortality ratio (MMR) reduction to less than 70 maternal deaths per 100,000 live births, and all deliveries to be assisted by skilled birth attendants (SBA). The aim of this study was to identify key challenges in labour and delivery care in a low-income sub-Saharan setting.

**Methods:** The study was conducted in Mangochi District, Malawi. It included participant observation to better understand the setting of delivery care in the district, in particular at the new maternity wing at the Mangochi District Hospital (MDH) which was inaugurated in January 2019. The Health Management Information System (HMIS) in Malawi provided district level maternity care data for the years 2015-2019. Two additional datasets were created based on registration books in the labour ward and its surgical theatre at MDH. These include all delivery services at MDH from 19 February to 17 March 2020. Interviews were conducted with eight staff members at the maternity wing. The data were analysed in RStudio and the Mangochi Health Research Committee granted the study a permission.

**Results:** From 2015 to 2019, on average about two out of three deliveries in Mangochi District took place in health facilities; the Caesarean-section (C-section) rate was 4%. A quarter of the district's institutional deliveries and nearly two thirds of the district's C-sections took place at MDH. Institutional MMR in the district decreased from 162 to 64 per 100,000 live births in the period. MDH registers annually on average 34 maternal deaths. During the data collection period in 2020, 797 women received delivery care at MDH; 27 of the women had delivered before admission out of whom just less than one third delivered by SBA. All women who delivered at MDH were assisted during the delivery with SBA. Out of all admissions, 18% had obstetric complications and 6% received emergency obstetric care; about one in five of deliveries at MDH were C-sections. Nine out of 10 operations at the maternity wing were C-sections and 97% of the operations were emergencies. Overall, the staff were happy with the new facility, staffing had improved, and patients were better accommodated. However, having only one surgical theatre caused delays for C-sections. Further, lack of equipment was reported as well as deficient maintenance, especially for anaesthesia. Supply of drugs and single use items was also often reported as insufficient and unaccountable. Although teamwork was good and staffing had improved, there was still shortage of anaesthetists, Clinical Officers, and nurses.

**Conclusion:** To decrease maternal mortality rate still further in Mangochi District, SBA needs to be improved with better and timely access to C-sections. While the new maternity wing at MDH was a quality improvement in delivery services, the option for a second theatre should be considered, coupled with improved maintenance, better staffing and stable supply of equipment and drugs to further decrease maternal mortality ratio in Mangochi District. These results may have implications for other similar settings.

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**Inngangur:** Mæðradauði er enn algengur víða um heim. Þrátt fyrir framfarir á heimsvísu er árangrinum misdreift og Afríka sunnan Sahara hefur sérstaklega orðið á eftir. Heimsmarkmið 3.1 stefnir á lækkun mæðradauða undir 70 andlát á hverjar 100.000 lifandi fæðingar og að allar fæðingar séu í umsjá menntaðs heilbrigðisstarfsfólks. Markmið þessarar rannsóknar var að bera kennsl á áskoranir í fæðingarþjónustu í lágtekju aðstæðum sunnan Sahara.

**Efni og aðferðir:** Mangochi hérað, Malaví var heimsótt til að auka skilning á fæðingarþjónustu á vettvangi og sérstaklega á nýrri kvennadeild við héraðssjúkrahúsið, Mangochi District Hospital (MDH). Hún var opnuð í janúar 2019. Sjúkrasskrá Malaví veitti aðgang að skráningum yfir fæðingarþjónustu héraðsins fyrir árin 2015-2019. Í vettvangsferðinni voru tvö gagnasett til viðbótar gerð. Þau voru byggð á skráningarbókum á MDH, ein frá fæðingardeildinni og önnur frá skurðstofu kvennadeildarinnar. Skráning þeirra náði yfir alla skráða einstaklinga milli 19. febrúar og 17. mars 2020. Einnig voru tekin viðtöl við 8 starfsmenn á kvennadeildinni. Gögnin voru greind í Rstudio. Heilbrigðisvísindanefnd Mangochi veitti leyfi fyrir framkvæmd rannsóknarinnar.

**Niðurstöður:** Á tímabilinu 2015-2019 fóru um tvær af hverjum þrem fæðingum í Mangochi héraði fram á heilbrigðisstofnunum og tíðni keisaraskurða var 4%. Fjórðungur fæðinga innan heilbrigðisstofnanna, og nær tveir þriðju allra keisaraskurða héraðsins fóru fram á MDH. Yfir tímabilið virðist tíðni mæðradauða lækka innan heilbrigðisstofnanna frá 162 til 64 á hverjar 100.000 fæðingar. Á MDH eru að meðaltali 34 tilfelli mæðradauða árlega. Yfir skráningartímabilið 2020 fengu 797 konur fæðingarþjónustu á MDH; 27 þeirra höfðu fætt fyrir komu og af þeim hafði tæplega þriðjungur fætt í umsjá menntaðs heilbrigðisstarfsfólks. 761 kona sem fæddu á MDH voru í umsjá menntaðs heilbrigðisstarfsfólks. Um ein af hverjum 5 fæðingum á MDH voru keisaraskurðir. Af öllum konum sem leituðu á deildinni voru greindust 18% með fylgikvilla og 6% fengu neyðarmeðferðir. Níu af hverjum 10 aðgerðum á kvennadeildinni voru keisaraskurðir og 97% aðgerðanna voru bráðaaðgerðir. Í heildina var starfsfólk ánægt með nýju kvennadeildina, mönnun varð betri og pláss fyrir sjúklinga jókst. Hinsvegar er einungis ein skurðstofa á kvennadeildinni og það veldur seinkun á bráðum keisaraskurðum. Einnig var greint frá vöntun á áhaldasettum fyrir keisaraskurði og skorti á viðhaldi lækningatækja, sérstaklega svæfingarbúnaði. Margir nefndu að auki óáreiðanlega birgðastöðu lyfja og hjúkrunarvara s.s. þvagleggja og saumum.

**Ályktun:** Til að lækka tíðni mæðradauða en frekar í Mangochi héraði þarf að auka umsjá menntaðs starfsfólks yfir fæðingum og bæta aðgengi kvenna að keisaraskurðum. Nýja kvennadeildin var til mikilla bóta fyrir fæðingarþjónustu spítalans. Þó þyrfti að íhuga möguleika á að byggja auka skurðstofu ásamt því að bæta viðhald, útrýma manneklu, og tryggja stöðugar birgðir hjúkrunarvara og lyfja til að lækka tíðni mæðradauða í Mangochi héraði.

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## Abbreviations

CHAM	Christian Health Association of Malawi
CO	Clinical Officer
C-section	Caesarean section
CPD	Cephalo-Pelvic Disproportion
DALY	Disability-Adjusted Life Years
DHIS	District Health Information System
DHMT	District Health Management Team
DHO	District Health Officer
DMO	District Medical Officer
DNO	District Nurse Officer
EMOC	Emergency Obstetric Care
FVBAC	Failed Vaginal Births After C-section
HMIS	Health Management Information System
HAS	Health Surveillance Assistants
ICEIDA	Icelandic International Development Agency
MA	Medical Assistant
MBSP	Mangochi Basic Services Program
MBSPII	Mangochi Basic Services Program II
MDH	Mangochi District Hospital
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio
NMT	Nurse-Midwife Technician
PHC	Primary Health Care
RNM	Registered Nurse-Midwife
RPOC	Retained Products of Conception
SBA	Skilled Birth Attendant
SDG	Sustainable Development Goal
SMI	Safe Motherhood Initiative
TA	Traditional Authority
TBA	Traditional Birth Attendant
WHO	World Health Organization

# 1 Introduction

## 1.1 Global initiatives for mothers

### 1.1.1 Primary Health Care

Maternal mortality has been a concern since the first ideas of primary health care (PHC) gained ground. The 1978 World Health Assembly declaration of Alma-Ata<sup>1</sup> prioritized that health required mental, physical and social wellbeing and was an integral part of socially and economically productive life. It stated that health should be achieved for all people before the year 2000 and for which and PHC was the key driver. PHC ought to address the health problems in each community and include at least awareness on prevailing health problems, proper nutrition, safe drinking water and sanitation, health of women and children, preventative measures for infectious diseases, and appropriate treatment and drug availability. This involved community health system strengthening rather than disease specific-approach.<sup>1</sup>

However, once implemented, funding prioritized mostly on two incentives, child health and family planning through a selective PHC.<sup>2</sup> Following criticism<sup>3</sup> on the neglect of maternal health, the World Health Organization (WHO) began monitoring and publishing maternal mortality trends. The first global estimates were announced in 1985, with 500,000 maternal deaths annually worldwide.<sup>2</sup> This was the basis for the Safe Motherhood Initiative (SMI) in 1987. The SMI emphasized a three-tier system in the spirit of Alma-Ata, that is community-level maternal PHC, referral facilities, and an alarm and transport system.<sup>4</sup> The initiative, as well as several other campaigns and conferences held in the 1990s, set a goal of halving Maternal Mortality Ratio (MMR), that is maternal deaths per 100,000 live births, from the year 1990 by the year 2000.<sup>2</sup>

Only 11% global reduction in MMR was achieved from 385 in 1990 to 341 in 2000.<sup>5</sup> At the end of the century, the disparity in maternal health in different regions was evident. In the year of 2000, MMR in developed regions was 23 compared with 377 in developing regions but the highest ratio was in sub-Saharan Africa (770) followed by southern Asia (377).<sup>5</sup>

### 1.1.2 The Millennium Development Goals

As a result of the Millennium Declaration in the year 2000, the United Nations' Millennium Developmental Goals (MDGs) were established.<sup>6</sup> The MDGs consisted of eight ambitious goals with 21 targets to accomplish globally before 2015.<sup>6</sup> Three of the MDGs, goals number 4,5, and 6, addressed health directly by aiming to decrease child mortality, promote maternal health, and combat infectious diseases namely HIV and malaria.<sup>6</sup> Two additional MDGs addressed health indirectly, goals number 1 and 7, by aiming for reduced hunger prevalence and increased access to safe drinking-water.<sup>6</sup> The MDG's strengths lied in their conciseness, measurability and time limitation. They also left a legacy within national monitoring system in developing countries where the capacity improved during the MDG era.<sup>6</sup>

Overall, the MDGs were successful in improving and saving lives with significant progress towards most of its' targets.<sup>7</sup> However, many targets were not met globally.<sup>7</sup> Goal 4 targets were not achieved despite millions of children's lives being saved.<sup>7</sup> Goal 5 failed to reduce global MMR by three-quarters as the decrease stood at 44% in 2015.<sup>7</sup> Globally the MMR fell from 385 in 1990 to 216 in 2015.<sup>5</sup> Another maternal health indicator; Skilled Birth Attendant (SBA) coverage during deliveries of 90% was not met either but stood at 71% in 2015. <sup>7</sup> Goal 6, to combat HIV/AIDS, malaria and other diseases, was however achieved with reduced disease incidence.<sup>7</sup>

Some regions met, or came close to meeting, the MDGs' targets while others were lagging far behind.<sup>6</sup> In terms of MMR, developed and developing countries reduced their MMR by 48% and 44% respectively. <sup>5</sup> However, MMR in developed countries was only 12 per 100,000 live births compared with 239 in developing regions.<sup>5</sup> Further, MMR reduction in eastern Asia was 72% while in western Asia reduced by only 43%.<sup>5</sup> The two regions with the highest MMR at the baseline in 1990 were sub-Saharan Africa and southern Asia. Although these still held the highest MMR in 2015, the percentage reduction achieved was considerably different. MMR reduction in sub-Saharan Africa was 45% while the reduction in southern Asia was 67% and a MMR of 546 and 176, respectively.<sup>5</sup>

The health MDGs were criticized for their narrow spectrum, outcome-based approach as it comes at the expense of sustainable strengthening of health systems.<sup>8</sup> It has also been noted that the MDG targets are not helpful for national agenda planning. They are global goals and were lacking a country specific recommendation<sup>7</sup> where each nation's or region's baseline is fully considered.<sup>9</sup>

### **1.1.3 The Sustainable Development Goals**

"Transforming our world: 2030 Agenda for Sustainable Development", or Agenda 2030, was approved by the United Nations in 2015.<sup>10</sup> According to the agenda it is a global action strategy that contains 17 Sustainable Development Goals (SDG's), with 169 affiliated targets, to achieve by the year 2030. The SDG's are built on the MDGs and aim to continue the progress and address what was left unachieved.<sup>10</sup>

Learning from the MDGs, only SDG goal number 3 specifically addresses health. It is broadly phrased as: „*Ensure healthy lives and promote well-being for all at all ages*“. The health goal includes 13 diverse global targets. Like all the SDGs' targets, they are ambitious and require national governments to set local targets considering domestic circumstances. One target is for universal health coverage, under which all other health targets can be addressed resulting in a less vertical approach. From the remaining SDG health targets, four aim to complete and expand the MDG health goals, four are new targets on health threats and four are implemental targets to facilitate the achievement of other targets.<sup>6</sup> Target 3.1 sets out to „reduce the global maternal mortality ratio to less than 70 maternal deaths per 100.000 live births“<sup>10</sup>. Two indicators are used to monitor its progress.<sup>11</sup>

First, the SDG indicator 3.1.1 addresses MMR, that is the number of female deaths associated with pregnancy per 100,000 live births in a given time period.<sup>12</sup> In the United Nations Statistics Division

metadata repository, maternal deaths are defined as “*female deaths from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy*”.<sup>12</sup> About a third of all countries have reliable data on maternal deaths, other countries require the use of adjusted country-reported estimates or the use of predicted figures derived from statistical models in cases where no maternal mortality data is registered.<sup>12</sup> MMR point estimates are reported with uncertainty interval (UI) as predicted or adjusted values might not capture accurate MMR.<sup>12</sup> In 2015, global MMR was 219 but since then it has reduced to 211 in 2017.<sup>13</sup> (SDG data)

Second, the SDG indicator 3.1.2 addresses skilled birth attendance, that is childbirths assisted by skilled birth attendant (SBA) as a percentage of total live births, during a given time period. These are typically deliveries assisted by doctors, nurses or midwives.<sup>14</sup> In some countries health providers not considered skilled need to be excluded before national data is accepted. Where SBA is not registered, percentage of births in health centres are used instead.<sup>14</sup> Before the SDG era (years 2006-2013), global SBA coverage was 69% but it has increased to 81% since then (years 2013-2018).<sup>15</sup> Although these are promising figures, less than 60% of deliveries are assisted by SBA in sub-Saharan Africa where two out of every three maternal deaths occur.<sup>15</sup>

## **1.2 Maternal deaths**

Identifying the causes for maternal deaths is one cornerstone of decreasing the risk of childbirth in developing nations. Clinical causes for maternal deaths are either direct or indirect. Worldwide, indirect causes account for 27.5% of maternal deaths but over two thirds are by pre-existing diseases. HIV is one of them and alone it causes 5.5% of maternal deaths.<sup>16</sup> Direct causes account for nearly 73% for maternal death.<sup>16</sup> The leading causes are haemorrhages, hypertension, infections, and abortions.<sup>16</sup>

### **1.2.1 Haemorrhage**

Maternal haemorrhages account for 27.1% of maternal deaths worldwide.<sup>16</sup> They are classified by their timing relative to childbirth; antepartum (6.5% of maternal deaths worldwide), intrapartum (0.9%) or postpartum (19.7%).<sup>16</sup> WHO defines postpartum haemorrhages as bleeding within 24 hours of delivery exceeding 500 ml and it is considered severe if blood loss exceeds 1000 mL.<sup>17</sup> Although some organizations use higher threshold,<sup>18</sup> clinical relevance is low until 1000 ml blood loss.<sup>19</sup> The most common cause for postpartum haemorrhage is atony of the uterus but other frequent causes include retained placenta or blood clots, obstetric trauma and coagulopathy.<sup>20</sup> Antepartum haemorrhage and intrapartum haemorrhage occur after 22 weeks of pregnancy or in labour.<sup>17</sup> Underlying causes are abruption of placenta and placenta previa although cause is frequently unknown.<sup>21</sup> Amongst many risk factors significantly associated with severe postpartum haemorrhage is anaemia. Prevalence of anaemia in pregnant women is notably higher in developed regions (Europe: 25.1%) compared to developing regions (Africa: 57.1%).<sup>22</sup>

### **1.2.2 Hypertensive disorders**

Hypertensive disorders account for 14.0% of maternal deaths worldwide but with a notably high portion of maternal deaths in south America (22.1%).<sup>16</sup> Hypertensive disorders in pregnancy have been classified as chronic hypertension, gestational hypertension, preeclampsia, and preeclampsia with underlying chronic hypertension.<sup>23</sup> Chronic hypertension is diagnosed before pregnancy whereas the onset of gestational hypertension is after 20 gestational weeks. Preeclampsia is now defined as hypertension with some symptom of end-organ failure such as thrombocytopenia, impaired liver function, pulmonary oedema, cerebral disturbance, or the development of renal insufficiency.<sup>23</sup> Eclampsia is diagnosed if women with hypertensive disorder of pregnancy has tonic-clonic seizures.<sup>24</sup> Eclampsia causes most maternal deaths associated with hypertensive disorder in pregnancy.<sup>16, 25</sup>

### **1.2.3 Maternal sepsis**

Sepsis accounts for 10.7% of maternal deaths worldwide.<sup>16</sup> Maternal sepsis is defined as infection accompanied with an organ dysfunction during pregnancy, after abortion, during childbirth or postpartum period.<sup>26</sup> Maternal infections occur most frequently in the post-partum period (43.8%) and during pregnancy but before labour (33.9%).<sup>27</sup> About half of infection-related severe maternal outcomes occur during post-partum period.<sup>27</sup> Infections with severe outcomes are most commonly result from endometritis, skin or soft tissue infections , urinary tract infections, chorioamnionitis, and abortion related infections.<sup>27</sup>

### **1.2.4 Abortions**

Abortions, miscarriages and ectopic pregnancies accounts for 7.9% of maternal deaths.<sup>16</sup> An unsafe abortion is performed by a unskilled provider in an unsanitary environment, using dangerous techniques.<sup>28</sup> Nearly half of all abortions are considered unsafe and 97% of them occur in developing countries.<sup>29</sup> In 1990-2008, the number of unsafe abortions decreased in all regions except Africa which also faced the highest number of abortions related maternal deaths, nearly twice the number of other regions.<sup>30</sup> Serious complications associated with unsafe abortions include haemorrhages, sepsis, and trauma to genitalia, reproductive, or abdominal organs.<sup>31</sup>

## **1.3 Losing mothers in sub-Saharan Africa**

Sub-Saharan Africa alone accounted for two-thirds of global maternal deaths with an overwhelming 196,000 lives lost associated with childbearing in 2017.<sup>32</sup> That year, 19 countries had over 500 maternal deaths per 100,000 live births, and 18 of them were in sub-Saharan Africa.<sup>32</sup>

### **1.3.1 Maternal health**

HIV is one of many infectious diseases with an uneven load put on sub-Saharan Africa. It is estimated to cause 5.5% of maternal deaths worldwide<sup>16</sup> but in sub-Saharan Africa specifically, about a quarter of

maternal deaths are associated with HIV.<sup>33</sup> Pregnant women with HIV are estimated to have eight times higher mortality compared to other pregnant women in the region.<sup>33</sup>

Additionally, sub-Saharan Africa has the world's highest adolescent's fertility rate, with over 100 births per 1000 adolescent women aged 15-19 years old.<sup>34</sup> The birth rate among 12-15 years old girls is also high in all sub-Saharan countries.<sup>35</sup> Adolescent maternal deaths are more frequently caused by hypertensive disorders and abortions compared to maternal deaths of older women.<sup>36</sup> Girls giving birth while under 14 years of age are at an increased risk for obstetric fistula formation<sup>37</sup>, an abnormal communication between the reproductive tract and the urinary tract or the gastrointestinal tract.<sup>38</sup>

### 1.3.2 Health systems

Receiving adequate health care is further complicated by the availability of health workers and the quality of care they can provide. In 2006, an estimated threshold of 2.28 health workers per 1000 population was deemed necessary for achieving SBA of 80%.<sup>39</sup> Africa was proportionally lacking the most health workers; needing a 140% increase.<sup>39</sup> One solution applied in many sub-Saharan countries is shifting the tasks of some health worker professions onto mid-Level Health Workers. Those are certified health providers that do the tasks of globally established professions such as doctors, nurses, midwives, and biomedical scientists. However, their educational background is often shorter and their field of work more confined.<sup>40, 41</sup>

In 2016, nearly 1 million deaths in sub-Saharan Africa were caused by poor quality care.<sup>42</sup> Similarly, just over 1 million deaths are attributed to the underutilization of health services.<sup>42</sup> The access to, use of and quality of Emergency Obstetric Care (EMOC) can be monitored using EMOC handbook by WHO.<sup>43</sup> Training on the use of these guidelines has proven to improve the competence of obstetric health workers in sub-Saharan Africa.<sup>44</sup> However, a Nigerian study on EMOC services suggested that WHO guidelines are not readily available in health facilities and rarely used by health workers.<sup>45</sup> Based on a study including five sub-Saharan countries, the quality in delivery services in the region is poor although it is worse in primary health centres compared to secondary facilities. Poor quality is also associated with facilities with few deliveries (<500 each year).<sup>46</sup>

The function of health services depends also on the access of women in need. Africa has by far the lowest Caesarean section (C-section) rate compared with other regions.<sup>47</sup> Other than not exceeding a rate of 10-15% there is no recommended range for C-section rates. Instead, all women in need for that lifesaving intervention should receive it.<sup>48</sup> C-sections are not distributed evenly, the wealthier population in developing countries has increased rates.<sup>49</sup> A study from Uganda found that C-section rates were lower among women delivering in rural health facilities, furthest from an EMOC facility providing C-sections. This suggests that rural and poorer women are not receiving necessary interventions during delivery.<sup>50</sup>

Facing understaffing, inadequate quality and poor access to health care coupled with a high burden of diseases, sub-Saharan African health systems are fragile. New diseases can be a significant threat



to weak health systems like as is already feared about the ongoing COVID-19 pandemic.<sup>51</sup> Additional maternal deaths due to health system disruption associated with the pandemic are estimated to range from 12,200 to 56,700 over six months, depending on how well EMOC is maintained despite the pandemic.<sup>51</sup>

## **2 Aim of this study**

The overall aim of the study was to outline key challenges of delivery services in a low-income setting in sub-Saharan Africa. More specifically in Mangochi District Hospital (MDH), Malawi, the aims of the study were to

- Outline and describe maternity care and access to C-sections for delivering women;
- Review and analyse flow of patients before and after inauguration of new maternity wing and surgical theatre with focus on C-sections;
- State and discuss the main problems for maternity care and delivery of C-section; and
- Appraise quality of maternity care and C-section services and how they can be improved.

### 3 Materials and methods

The research included a field visit, data analysis, and thesis writing. The field visit took place in Mangochi District, Malawi, from 23 February to 18 March 2020, with particular attention given to Mangochi District Hospital for observation and data collection. The data used for the study is both quantitative and qualitative. The quantitative data includes a dataset retrieved from the Health Management Information System (HMIS) in Mangochi and two datasets retrieved by the author (EDÓ) from the hospital's labour ward. The qualitative data consisted of staff interviews conducted by the author. The field visit allowed for a deeper understanding of the context of maternity services in Mangochi and independent data collection.

#### 3.1 Getting to know the setting

##### 3.1.1 Malawi

Malawi is a landlocked country in sub-Saharan Africa. Its total area is 118,484 km<sup>2</sup> out of which 24,208 km<sup>2</sup> are Lake Malawi.<sup>52</sup> The population was over 17.5 million in the most recent census<sup>53</sup> in 2018 with 2.9% yearly population growth. Although still high, the fertility rate has been declining steadily<sup>54</sup>, in 2008 the fertility rate (children per woman) was 5.2<sup>54</sup> but 4.2 in 2018<sup>53</sup>. Consequently, Malawi has a young population, with a median age of 18.1 years. In comparison, Iceland's median age is 37.5.<sup>55</sup> The population has different ethnic backgrounds. The most populous is Chewa (34%), Lomwe (13%), and Yao (10%).<sup>53</sup> Most live in rural areas (84%)<sup>53</sup> and work in agriculture, 59% of the women and 44% of the men.<sup>56</sup> Nearly 70% of the nation is living under the income poverty line of 1.9 USD a day.<sup>57</sup>

Life expectancy at birth in Malawi is 63 years for both genders combined.<sup>57</sup> The five leading causes of Disability-Adjusted Life Years (DALY's) in Malawi are HIV/AIDS (34.9%), lower respiratory tract infections (9.1%), malaria (7.7%), diarrhoeal diseases (6.4%) and conditions during perinatal period (3.3%).<sup>52</sup> Malawi met some important MDG targets, including for infant mortality rate, under-five mortality rate, and death rates associated with tuberculosis.<sup>52</sup> However, many targets were not achieved and are now included in the SDG agenda. Those include targets on combating malaria, HIV and improving maternal health.<sup>52</sup>

In 2015, an estimated 4,200 maternal deaths occurred in Malawi, ending the MDG era with a MMR of 634 (UI 422-1080). This accounts to 1 in 29 risk that a 15 years old woman will eventually die a maternal death.<sup>5</sup> In 2016, 89.9% of births in Malawi were assisted by SBA<sup>57</sup> and in the five years prior, 6.1% of births were through a C-sections.<sup>56</sup>

##### 3.1.2 The health system

Health expenditure on in Malawi was 9.83% of the GDP in 2016.<sup>57</sup> International collaborators contribute 61.6% of the health expenditure, government 25.5%, and private institutions or households

12.9%.<sup>52</sup> With this high dependency on donor funding, the health system is unstable and financially unsustainable.<sup>52</sup>

As is conveyed in Malawi's Services Provision Assessment 2013-14, health facilities are either governmental facilities without user charges or private facilities that apply user fees. Private facilities are further divided into non-profit and for-profit.<sup>58</sup> The Christian Health Association of Malawi (CHAM) is an important non-profit health provider throughout the country with emphasis on rural areas. For-profit private facilities include various clinics, pharmacies, and traditional healers. About half of health facilities in the country are governmental, 15% are operated by CHAM and the rest are other private facilities.<sup>58</sup> The Ministry of Health has, through district health offices, made service level agreements with 103 CHAM health facilities in the country.<sup>59</sup> The agreements ensure free maternal and newborn care in CHAM facilities.<sup>59</sup> This increases equity in health service access and brings free health care closer to vulnerable population in rural areas.<sup>52</sup> This has proved to increase antenatal care visits and deliveries in CHAM facilities with.<sup>60</sup>

Malawi's four levels referral system is described in the Health Sector Strategic Plan II.<sup>52</sup> Community services in villages or mobile clinics focus on promotive and preventative health care. These are operated by Health Surveillance Assistants (HSA), each is responsible for an area with 1,000 people. Primary services in health centres and community hospitals offer outpatient, inpatient, and maternity services for an area with 10,000 people. Secondary services are provided in district hospitals. Those offer referral services to primary and secondary health facilities in the district. Tertiary services offer specialist care in central hospitals and provide referral service to district hospitals.<sup>52</sup>

In Malawi there are 0.016 medical doctors per 1,000 population. This is equivalent to 280 medical doctors for the whole country of 17.5 million inhabitants.<sup>57</sup> A median of one doctor is employed at each hospital but none at smaller health facilities.<sup>58</sup> Consequently, the core of Malawi's health workforce are mid-level health workers. Namely Clinical Officers (CO), Registered Nurse-Midwives (RNMs) and Nurse-Midwife technicians (NMTs) but also laboratory technicians, enrolled midwives, midwife technicians, Medical Assistants (MAs), and other auxiliary health workers.<sup>52</sup> Additionally, Health surveillance Assistants (HSAs) are community health workers whose role is to provide village or outreach preventative and promotive healthcare<sup>52</sup>. In Malawi, COs are non-doctors that functionally provide the care physicians do internationally, including surgeries. Their post-secondary education is three years of training and a one-year internship.<sup>40</sup> RNMs and NMTs are the main nursing cadre in Malawi. RNMs undergo four to five years of training but NMTs three years.<sup>61</sup> In hospitals, RNMs often take positions with more responsibility or management but NMTs direct patient care. In primary health centres a NMT is often the only nurse.<sup>62</sup> HSAs on the other hand, undertake a 12-week course on primary health service.<sup>59</sup>

Malawi's Ministry of Health has established the HMIS for registering and monitoring health service delivery in the country. The District Health Information System (DHIS) is the software used for data registration. Functionally, each health facility provides data on paper format which is then collected by the health districts and registered into the DHIS centrally.<sup>63</sup> Registration of health indicators faces some

challenges in Malawi. Data is not collected or submitted in a timely manner from many facilities resulting in inaccurate data with limited use.<sup>52</sup> The collection and report of data is also dependent on adequate number of staff, a current limiting factor in the HMIS.<sup>52</sup>

### **3.1.3 Mangochi District**

Mangochi district is home to nearly 1.1 million Malawians. It lies against the south-eastern side of Lake Malawi, four hours' drive from Malawi's capital, Lilongwe, and 2.5 hours from Blantyre, another major city. The district is divided into nine Traditional Authorities (TAs) ruled by chiefs.<sup>59</sup> Each TA consists of many villages.<sup>52</sup> About three out of four inhabitants belong to the Yao ethnic group.<sup>64</sup> Unlike in the rest of the country, Islam is the most populous religion in Mangochi followed by 70.3% of the residents but Christianity by 28.7%.<sup>64</sup> Life expectancy in the district for both sexes combined is 58 years<sup>65</sup>, five years lower than the overall life expectancy in Malawi.<sup>57, 65</sup>

Malawi and Iceland have been engaging in development collaboration since 1989.<sup>66</sup> At first, the Icelandic Development Agency (ICEIDA) participated in the cooperation on behalf of the Icelandic Government.<sup>65</sup> However, since 2015 the Embassy of Iceland in Lilongwe has managed the collaboration on behalf of Iceland's Ministry of Foreign Affairs and International Cooperation.<sup>65</sup> Initially, Malawi's fishery sector was the focus but the collaboration expanded to other sectors in 2000.<sup>66</sup> ICEIDA's fishery collaboration had established connection to Monkey Bay area in Mangochi district, where health indicators had been lagging behind other parts of Malawi.<sup>66</sup> In the period 2000-2011, ICEIDA concentrated its activities within Nankumba TA in the Monkey Bay area. It included water and sanitation projects, adult literacy campaign, construction and support to primary schools and strengthening primary healthcare services.<sup>67</sup> Particularly, the health care development included the construction of Monkey Bay Community Hospital, strengthening telecommunications and logistics, renovating two primary health centres in the area, training health care providers, building staff houses, and adding a maternity wing to Community Hospital.<sup>68</sup> Further, Icelandic health workforce provided technical assistance on behalf of ICEIDA until 2008.<sup>68</sup>

Since 2012, Iceland has become one of the main funders for social infrastructure in water and sanitation, education, and public health, reaching all of Mangochi District.<sup>67</sup> The Mangochi Basic Services Programme 2012-2016 (MBSP) was developed in a partnership between 1) Mangochi District Council, 2) Ministry of Local Government and Rural Development and 3) the Government of Iceland. The ongoing second phase of MBSP (MBSP II) covers the years 2017-2021. It prioritises public health, basic education, water and sanitation, youth and women economic empowerment, and increasing the district's council capacity to implement its development plans.<sup>65</sup> The construction of a new maternity wing at MDH was a part of this program.<sup>65</sup> The support also involves providing funds and logistical assistance.<sup>67</sup> Through the Embassy of Iceland in Lilongwe, the Government of Iceland is responsible for funding and monitoring the implementation of MBSP II.<sup>65</sup>

A District Health Management Team (DHMT) includes a District Health Officer (DHO), District Nurse Officer (DNO) and District Medical Officer (DMO), and other key leaders in health care management. A district health office manages Mangochi's health care and public health facilities.<sup>52</sup> The district consists

of five health zones, that is Chilipa, Boma, Makanjira, Monkey Bay, and Namwera. There is a total of 43 health facilities, including 25 public and 15 operated by CHAM.<sup>64</sup> Yet, 27% of Mangochi residents live further than 8 km from a health facility.<sup>52</sup> To address this problem, there are 109 village clinics operated in the district for health service delivery in the hardest to reach areas.<sup>64</sup> Four of the 45 health facilities are hospitals.<sup>59</sup> Mangochi District Hospital (MDH), the district's secondary referral facility, is in Boma zone. Table 1 outlines the distance from health facilities in every health zone to MDH. Other hospitals are Monkey Bay Community Hospital in Monkey Bay zone, Saint Martin's CHAM Hospital in Makanjira zone, and Mulibwanji CHAM Hospital in Namwera zone.<sup>59, 64</sup>

The Mangochi Socio-Economic profile 2017-2022 outlines the health workforce in the district.<sup>64</sup> Per population ratio of doctors was 1:92,461 (recommended is 1:50,000), and nurses was 1:4,520 (recommended 1:5,000). This includes doctors and nurses in other positions than direct patient care. At the time of the profile publication, HSAs were 1:2,038 (recommended 1:1,000). There is also a lack of statistical clerks that should ideally be employed in each health facility. Instead, other workers have been trained to document and report data.<sup>64</sup>

**Table 1. Mangochi District health zones**

Health zone	Population (2019)	Health facilities n	Health facility distance from MDH (km)
<b>Boma</b>	322,812	9	5 - 59
<b>Chilipa</b>	152,041	5	26 - 85
<b>Makanjira</b>	209,825	7	19 - 132
<b>Monkey Bay</b>	172,898	6	35 - 89
<b>Namwera</b>	315,200	17	47 - 108

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Source: HMIS Mangochi District Hospital

### 3.2 Data collection

The first quantitative dataset used for this research derives from the HMIS registration system. It consists of cumulative numbers for delivery care from all health facilities in Mangochi District for the years 2015-2019. Within each health centre, a birth attendant registers basic information for each delivering women into a standardized delivery registration book (sample page can be found in Annex). From this book, the number of mothers for each variable is tallied and compiled by HMIS in Mangochi. This numerical data was retrieved from the HMIS for this study, grouped by health centre and year. The numbers include all women delivering at health centres within Mangochi Districts in the period. This registration includes tallied numbers by health facility on HIV testing, -status and - treatment, obstetric complications, obstetric care, delivery place, delivery mode, referrals, birth attendance, newborn

complications and their survival and treatment, multiple births, breastfeeding, and maternal deaths. This data was compiled and stored in the HMIS but originates in registration books from each health facility.

The second quantitative dataset was collected during the field visit in MDH. This data covers the four-week period from 19 February to 17 March 2020, during which the field visit took place. Data was retrieved by the author (EDÓ) from the delivery registration books (sample page can be found in Annex) at the hospital's labour ward. Within the ward, birth attendants registered information about each mother into the registration book. This registration was usually completed by the respective birth attendant shortly after delivery. The registration book is the same as used in HMIS records. For this study, variables for each patient were individually collected from the book on to an Excel datasheet. Treatment information per patient is currently unavailable in the HMIS collection of datasets despite using the same data source as this study. Variables collected included age, gravity, parity, gestational age, HIV-testing, -status, -exposure and -treatment, obstetric complications, obstetric care, delivery place, delivery mode, referrals, date and time of delivery and discharge, birth attendance, and ward of discharge. The dataset included all women receiving care at the labour ward in MDH according to the registration book in the study period.

The third and last quantitative dataset was collected during the field visit at MDH and covers the four-week period from 19 February to 17 March 2020. It was collected from a standardized operational theatre registration book (sample page can be found in Annex). Variables for each patient were registered by the CO immediately after every surgical operation at the hospital's maternity wing. From the book, variables for each patient were individually collected by the author (EDÓ) for the research on to an Excel datasheet. Variables collected from the book were: date of operation, age, diagnosis, surgery type, anaesthesia type, emergency or elective surgery, outcome, and maternal status. The dataset included all women undergoing surgical operations at the maternity wing in MDH according to the operational theatre registration book.

Data collection from the registration books was chosen based on their accessibility and their high coverage. The books are available in the labour ward and its surgical premises. These books are designed to be filled out using checkmark boxes to minimize handwriting making information retrieval accessible and reliable. All delivering mothers should be registered in the respective book by the responsible birth attendant. Other forms of treatment registration proved difficult to access or unreliable for use in the research. No computerized data was available apart from tallied numerical data compiled by HMIS.

The fourth dataset is qualitative, based on interviews (interview sheet can be found in Annex) with maternity care providers that were conducted by the author (EDÓ). Three COs, two midwife technicians, one NMT, and two anaesthetists were interviewed. Staff was invited to take part in the interview part of the research during their work hours. Participants were recruited based on availability. It depended on their ability to leave duties for the 15-20 minutes required for the interview. Interviews were open-ended and semi-structured, allowing participants to express their experience and opinions on their work and

the facilities, its advantages and challenges. Answers were written down by the interviewer during the interview.

### **3.3 Data treatment**

In HMIS data from Mangochi District's health facilities, tallied numbers for multiple variables were available. Yet the total number of registered deliveries in these facilities was however not available. To estimate the total number of deliveries in the district's health facilities, a sum of different registered variables could be used. The variables had to rule out multiple counts of each woman yet add up to as close as possible to the true number of women delivering at the health facilities. HIV status of the women was used for this purpose: 1) The indicator had the highest number of women, minimizing the potential loss of women with missing values for the variable; 2) Low chances of multiple counts as women are unlikely to be registered as both HIV-positive, HIV-negative, and with unknown status; and 3) HIV status had the least missing values in data collection during the field visit. In this research, number of deliveries at health facilities in Mangochi districts are the sum of women delivering in health facilities who were HIV-negative, HIV-positive or with an unknown HIV status. It includes both women tested during antenatal visits and tested at the labour wards.

Quantitative datasets were analysed and prepared using RStudio. Interview data was analysed based on Glaser's and Strauss's grounded theory<sup>69</sup> using Microsoft Word.

### **3.4 Ethical permission**

The Committee on Research of Medical students at the University of Iceland approved the study during its preparation. A field visit for observation and data collection was proposed to the Mangochi's DHO. The collaboration was positively perceived; hence the research's' plan was further developed. At the beginning of the field visit, the study plan was presented to the Mangochi Health Research Committee. The committee permitted the conduction of the study and provided a valuable recommendation for the research execution, in addition to assigning a national supervisor during the field work.



## 4 Results

### 4.1 Deliveries in Mangochi District

The estimated total number of deliveries in Mangochi District by health zone is calculated based on expected population number. Within each zone, the number of pregnancies and deliveries are estimated to be 5% of the expected population each year. During the five-year study period from 2015-2019, the number of estimated yearly deliveries in the district rose by 15% (Table 2). On average nearly 150 deliveries were estimated to occur in the district each day. Health facility coverage, compared to the estimated number of total deliveries in the district, was on average 67% (median 66, SE 2) during the study period. Throughout these five years, the highest average coverage of health facility deliveries was 82% in Boma health zone (median 78, SE 3) and 66% in Monkey Bay health zone (median 65, SE 2). The lowest registration average coverage was of 55% in Makanjira zone (median 60, SE 4). The coverage of health facility deliveries compared to the estimated number of total district deliveries was highest in 2018. That year nearly three-quarters of district deliveries were conducted and registered in health facilities (Table 2).

Three of the district's health facilities have surgical theatres and can operate C-sections. In the period 2015-2019, the number of C-sections increased by more than two thirds (Table 2) and were on average 5-6 each day. Between 2015 and 2019, on average more than two out of every three C-sections (median 74%, SE 3) in the district's C-sections were done in MDH in Boma. On average 14% of the district's C-sections were done in Monkey Bay Community Hospital in Monkey Bay (median, 12%, SE 2) and 11% in Namwera (12% median, SE 1) (Table 2). C-section rate as a proportion of the expected number of deliveries in Mangochi District was on average 4% in the period (range 2.7-4.4).

MMR in the district's health facilities was 162 in the year 2015 and 74 in 2019, calculated as maternal deaths per 100,000 live births in health centres. The highest MMR was in Boma zone, on average 295 (median 304, SE 35) in the period 2015-2019 (Table 2).

During the study period, almost all deliveries or 97% in the district's health facilities were assisted by SBA (MO, CO, MA, nurse, or midwife) (Table 2). Health facility deliveries in Mangochi without SBA were either assisted by staff such as patient attendants, ward attendants, and health surveillance assistants (mean 1%) or others, including a few with no assistant (mean 2%).

**Table 2. Delivery care in Mangochi District by health zones, 2015-2019.**  
Source: HMIS.

	2015	2016	2017	2018	2019
<b>Total expected deliveries, n</b>					
Boma	13,998	14,500	15,024	15,571	16,141
Chilipa	6,593	6,829	7,076	7,334	7,602
Makanjira	9,098	9,425	9,766	10,121	10,491
Monkey Bay	7,497	7,766	8,047	8,340	8,645
Namwera	13,668	14,158	14,670	15,204	15,760
<i>Mangochi District, total</i>	<b>50,854</b>	<b>52,679</b>	<b>54,583</b>	<b>56,569</b>	<b>58,639</b>
<b>Deliveries in health facilities, n (%)<sup>1</sup></b>					
Boma	11,162 (80)	11,301 (78)	12,546 (84)	14,227 (91)	12,504 (78)
Chilipa	3,948 (60)	4,247(62)	4,475 (63)	4,791 (65)	4,161 (55)
Makanjira	5,590 (61)	3,992 (42)	5,001 (51)	6,265 (61)	6,297 (60)
Monkey Bay	4,864(65)	4,941 (64)	5,394 (67)	6,008 (72)	5,476 (63)
Namwera	8,214(60)	7,719 (55)	9,241 (63)	10,044 (66)	10,176 (65)
<i>Mangochi District, total</i>	<b>33,778 (66)</b>	<b>32,200 (61)</b>	<b>36,734 (67)</b>	<b>41,335 (73)</b>	<b>38,641 (66)</b>
<b>C-sections, n (%)<sup>2</sup></b>					
Boma	1,144 (74)	1,101 (77)	1,439 (65)	1,911 (74)	1,626 (63)
Chilipa	15 (1)	0 (0)	119 (5)	0 (0)	63 (2)
Makanjira	27 (2)	5 (0)	72 (3)	64 (2)	53 (2)
Monkey Bay	190 (12)	233 (16)	275 (12)	289 (11)	511 (20)
Namwera	160 (10)	85 (6)	314 (14)	317 (12)	337 (13)
<i>Mangochi District, total</i>	<b>1,536 (100)</b>	<b>1,424 (100)</b>	<b>2,219 (100)</b>	<b>2,581 (100)</b>	<b>2,590 (100)</b>
<b>Maternal deaths, n (MMR)<sup>3</sup></b>					
Boma	41 (382)	36 (329)	35 (287)	42 (304)	21 (172)
Chilipa	1 (27)	2 (53)	4 (93)	6 (138)	1 (24)
Makanjira	2 (50)	4 (105)	0 (0)	1 (17)	0 (0)
Monkey Bay	1 (21)	1 (21)	4 (79)	4 (67)	2 (37)
Namwera	5 (65)	5 (69)	3 (35)	5 (53)	3 (34)
<i>Mangochi District, total</i>	<b>50 (162)</b>	<b>48 (157)</b>	<b>46 (133)</b>	<b>58 (148)</b>	<b>27 (74)</b>
<b>Skilled Birth Attendance, n (%)<sup>4</sup></b>					
Boma	10,716 (98)	10,790 (98)	12,292 (98)	13,901 (98)	12,096 (97)
Chilipa	3,535 (93)	3,624 (94)	4,099 (96)	4,403 (93)	3,781 (94)
Makanjira	3,813 (97)	3,708 (95)	4,469 (97)	5,695 (97)	5,900 (97)
Monkey Bay	4,584 (97)	4,619 (96)	5,007 (95)	5,760 (97)	5,389 (97)
Namwera	7,483 (96)	6,973 (95)	8,481 (97)	9,030 (95)	8,980 (97)
<i>Mangochi District, total</i>	<b>30,131 (97)</b>	<b>29,714 (96)</b>	<b>34,471 (97)</b>	<b>38,789 (96)</b>	<b>36,186 (97)</b>

<sup>1</sup> Health facility coverage as a percentage of total expected deliveries.

<sup>2</sup> Percentage of all district C-sections

<sup>3</sup> Number of maternal deaths at health facilities per 100,000 live births at health facilities

<sup>4</sup> Percentage of registered birth attendance in the respective area

## **4.2 Mangochi District Hospital**

### **4.2.1 Participant observations on delivery care**

MDH is a referral hospital for the whole Mangochi District. It services a wide range of medical issues including maternal, surgical, pediatric, and infectious diseases. Until 2019, all wards were located on the hospital's main premises. A maternity wing was inaugurated on the 31<sup>st</sup> of January 2019. The building was financed through the collaboration between ICEIDA and Mangochi district. This new facility houses antenatal care, labour and delivery ward, operational theatre for C-sections, postnatal ward, and a nursery. On the premises is also an under-five (U5) clinic, family planning clinic, and a maternity waiting home.

The maternity waiting home provides a shelter for women living far away from health facilities to wait for their labour close to good quality care. This encourages women to deliver with SBA in a health facility rather than at home or with a traditional birth attendant. It also prevents delay in admission to the labour ward as women do not need to walk or bike from their homes to the hospital once they start laboring. The expecting women tend to stay at the waiting home for the last month or weeks of pregnancy. A guardian, usually older female relative, often accompanies them during the waiting period. The facility includes a house with open spaces for the women to sleep in but no beds, a toilet facility, and a cooking facility. There is high demand for using the waiting facility. Tents have been added to accommodate more women and their guardians. During daytime, every shadow in the maternity wings outdoor area is occupied by pregnant women and guardians. At nights, women and guardians sleep on the concrete floor of the waiting home, the tent and the hospitals' corridors.

The labour and delivery services consist of an admission desk, labour ward, and surgical facility. Each of these has a distinct area and a distinct staff apart from labour ward CO who take part in the management of women in all three service levels. Nurses admit the women to the maternity wing, perform an initial examination on the women in labour and register their arrival. For admission and registration, a big desk is used. For examination, an area is sectioned off by curtains to ensure privacy. The labour ward staff consists of COs, nurses (RMNs or NMTs), midwives (midwife technicians or enrolled midwives), NMT students, and ward attendants (clean ward and equipment).

The labour ward has four delivery rooms and three beds in each room. The staff prefers the use of two rooms out of the four as they are better equipped for newborn care. Women are sometimes moved from other rooms to deliver in these preferred rooms. When few women are in labour, the four rooms available are not used to give women increased privacy but they are often placed all in three adjacent beds in one room. Each room also has two basins, a cabinet with equipment, a newborn resuscitation station, and disposal bins. Both basins in the one of the preferred delivery rooms were out of order during the study period. A restroom with a shower is accessible from each of the delivery room although seldomly used by the women. One of the delivery rooms is for emergency cases. It is equipped with emergency trays for common complications. Throughout the study period many listed items were missing from the trays and some trays were empty. The last time these trays had been updated was a month before the start of this study. The labour ward is also equipped with some essential instruments.

These include a vacuum extraction kit, two Doppler fetal monitors, and Pinard stethoscopes. Deliveries are not performed at the hospital using obstetric forceps.

The nurses and students assign women in labour a bed at the ward. Vaginal examination is conducted every two hours after admission. Nurses and students monitor the women from a workstation separated from the delivery room by a glass window. Before each delivery, a pre-prepared delivery is brought to the delivery bed. The set includes a sterilized kidney dish, two forceps, and scissors as well as a cord clamp and gauzes. After preparation these sets are stored in cupboards in the delivery room, wrapped in a sterilized cotton cloth to remain somewhat free from environment contamination. Oxytocin is not picked until after the second stage of labour. A nurse attending to each woman monitors her, assist during the delivery of the baby and placenta, wraps the baby in a cloth, administers oxytocin, and sutures most perineal tears. The nurses also call a CO to assess women in case of complications such as obstructed labour, seizures or serious perineal tears

Women delivering at the facility ought to bring some necessities with them. That includes a plastic basket with a lid for dirty laundry, a plastic sheet to cover the delivery bed, six cloths (two for wrapping the infant, one to lie on during delivery, one to clean the infant immediately after birth, one for the mother to wear after the delivery and one spare cloth) a razorblade to cut the umbilical cord and lastly a waistband and towels for postpartum lochia. The baskets are also used by the women to urinate and defecate during their time in the labour ward despite the available restrooms.

The surgical facility in the maternity wing consists of one operational theatre, sterilization room, storage room, anaesthesia room, scrubbing area and staff changing facility. The theatre itself is equipped with a surgical bed, medicine and equipment cabinet, work trays, anaesthetic machine, and a newborn care table. A CO on labour ward duty performs the surgery along with a surgical nurse. Anaesthetist manages the anaesthesia and a surgical ward attendant is present to prepare equipment and clean the facility. Along with this team is a nurse or midwife technician from the labour ward to care for the newborn after the delivery. During the field visit, the surgical theatre's air conditioners were out of order, causing the theatre to reach an estimated temperature of 35 C° with extremely humid air. The anaesthetic ventilator pump was also out of order during the field visit.

Other wards in the maternity wing care for the mother and newborn before or after delivery. The antenatal ward holds antenatal visits and provides inpatient ward for pregnant women with complications. The ward also monitors the women in the waiting home. Postnatal ward cares for women in the first 48 hours after delivery however, demand for beds is high so women are typically discharged 24 hours after delivery. There are beds for 18 women, split into rooms by mode of delivery and time from delivery. Due to limited space, postpartum mothers in less risk after spontaneous vaginal deliveries are assigned beds by the nursery ward or the antenatal ward. A high dependency unit admits mothers at high risk after delivery and a nursery admits neonates at high risk. All these wards are staffed with primarily nurses, COs, and ward attendants.

Treatment registration is completed by the nurses, midwife technicians or students. The format of registration can be divided into three types. First are personally kept booklets. These include pamphlets

on family planning, antenatal care or under-5 (U5) monitoring. A patient brings the booklet when seeking health care and the services provided are registered in by the provider. This is the only registration format kept in between each health facility visit and can be used to determine the patient's treatment upon their next visit. The second format is paper forms. These include an admission form, partogram, and treatment sheets. During admission in the maternity wing, these papers are kept stapled together with the woman's antenatal booklet. It is then kept at the patients' bedside or in a staff work area. After discharge, the booklet is returned to the woman, but the forms are kept at the hospital. Initially, they are stored at the postnatal ward then later picked up by a clerk. During the field visit, these papers proved to be hard to utilize. For recently discharged individuals, the papers were not filed, not organized, and many were missing. The third format is hospital registration books. Staff fills in standard information for each patient. The registration is either handwritten or filled onto checkboxes. In the labour ward, such registration books used are for admissions, delivery registration, surgical operations, and for breathing help for newborns. These books are used to tally the numbers of patients for different variables. The tallied data is compiled and kept by the HMIS in Mangochi District.

#### 4.2.2 Deliveries in the period 2015-2019

A quarter of institution deliveries (Table 3) and one sixth of all deliveries in Mangochi District were registered to have been at MDH in the period from 2015 to 2019. On average, 7,557 deliveries were registered in MDH yearly (median 9,532, SE 424) or about 25 deliveries daily. MDH, as the main referral hospital, operates nearly two-thirds of all C-sections in the district; on average, 1,297 C-sections were conducted in MDH each year during the study period or 3-4 each day (Table 3).

The coverage of SBA in MDH is high, yet 1-2% of deliveries were not assisted by SBA. Those might be women registered at MDH who gave birth without SBA before admission but received care at MDH after delivery. Annual MMR for the hospital decreased by about 37% during the study period, from 428 out of 100,000 live births in 2015 down to 270 in 2019. This decline was not gradual as the MMR spiked up to 427 in 2018. On average, annually there were 34 registered maternal deaths in MDH or nearly three every month (Table 3).

**Table 3. Delivery care in Mangochi District Hospital, 2015-2019. Source: HMIS.**

	2015	2016	2017	2018	2019
Deliveries n (%) <sup>1</sup>	8,353 (25)	9,532 (30)	9,719 (30)	10,183 (25)	7,960 (21)
C-sections n (%) <sup>2</sup>	1,144 (75)	1,101 (77)	1,307 (59)	1,639 (64)	1,295 (50)
Deliveries with SBA n (%) <sup>3</sup>	8,277 (99)	9,205 (98)	9,602 (99)	10,092 (99)	7,829 (98)
Maternal deaths n (MMR) <sup>4</sup>	35 (428)	36 (388)	35 (369)	42 (427)	21 (270)

<sup>1</sup> Percentage of all district deliveries

<sup>2</sup> Percentage of all district C-sections

<sup>3</sup> Percentage of MDH deliveries with registered attendance

<sup>4</sup> Maternal deaths at MDH per 100,000 live births at MDH

### 4.2.3 Maternal characteristics

Data collected in the period from 19 February to 17 March 2020 highlights some background characteristics of the women delivering at MDH (Table 4). In total 797 women were admitted for delivery services. On average, they were aged 23.7 years. The youngest mother was 13 years old and the oldest 46 years. 179 (22%) of the women were under 18 years old. Their number of pregnancies varied greatly, from the first to the 11<sup>th</sup>, and on average they delivered just less than 37 weeks of gestation (Table 4). Out of 766 women with registered HIV status, almost one in 10 were HIV-positive and most were on antiretroviral treatment (ART). In total, 14 (2%) of the women admitted to MDH in the period, were not on ART (Table 4).

**Table 4. Characteristic of women presenting at the MDH labour ward from 19 February to 17 March 2020. Source: Patient registration book.**

<b>Variables:</b>	<b>N=797</b>	<b>Births at MDH (n=761)</b>	<b>Births before arrival (n=27)</b>
<b>Age (years)</b>			
Mean	23.7	23.7	23.7
Median [Min, Max]	22.0 [13.0, 46.0]	22.0 [13.0, 46.0]	21.0 [16.0, 42.0]
<b>Gravidity</b>			
Mean	2.60	2.58	2.65
Median [Min, Max]	2.00 [1.00, 11.0]	2.00 [1.00, 11.0]	2.00 [1.00, 10.0]
<b>Gestational age (weeks)</b>			
Mean	36.9	36.9	36.5
Median [Min, Max]	37.0 [24.0, 43.0]	37.0 [24.0, 43.0]	37.0 [30.0, 42.0]
<b>HIV status/treatment, n (%)<sup>1</sup></b>			
HIV negative	710 (91)	679 (91)	23 (92)
HIV positive on ART	52 (7)	51 (7)	1 (4)
HIV positive not on ART	14 (2)	13 (2)	1 (4)
<i>Missing values n</i>	21	18	2

<sup>1</sup> Of available data

### 4.2.4 Labour services

Out of the 797 women who presented at the facility in the period from 19 February to 17 March 2020, 761 women (97%) delivered at MDH (Table 5). Those who did not deliver at MDH delivered at home or with a Traditional Birth Attendant (TBA) (8), during transit (15), or were referred from other facilities (4). Almost all the deliveries at MDH during the study period were attended by SBA. About three out of 10 women delivering before arrival were assisted by SBA. Lowest SBA coverage was among those women who delivered at home/with TBA and those who delivered in transit (25% and 20%, respectively) (Table 5).

Out of the 761 deliveries at MDH, 579 (78%) were spontaneous vaginal deliveries and 145 (20%) were C-sections (Table 5). The daily mean number of deliveries at MDH was about 27 (median 28, range 18-37). On average, there were 5.2 C-sections done every day (median 4.5, range 0-15).

During the study period, the time of birth was not registered for about a quarter of the deliveries at MDH (Table 5). For those with delivery time reported, most (39%) delivered during daytime.

**Table 5. Flow at MDH labour ward from 19 February to 17 March 2020.**  
Source: Patient registration book

Variables:	N	(%) <sup>1</sup>	Variables:	N	(%) <sup>1</sup>
<b>Admissions</b>			<b>Coverage of SBA</b>		
Births at MDH	761	97	Births at MDH	759	100
Births before admission	27	3	Births before admission	8	30
At home/TBA	8	1	At home/TBA	2	25
During transit	15	2	During transit	3	20
Other facilities	4	<1	Other facilities	3	75
<i>Missing values n</i>	9		<i>Missing values n</i>	2	
<b>Deliveries modes at MDH</b>			<b>Delivery times at MDH</b>		
Spontaneous vaginal	579	78	Night (00:00-07:59)	186	33
C-sections	145	20	Day (08:00-16:59)	221	39
Breech	12	2	Evening (17:00-23:59)	163	29
Vacuum Extraction	6	<1	<i>Missing values n</i>	191	
<i>Missing values n</i>	19				
<b>Delivery of emergency care<sup>2</sup></b>	46	6	<b>Diagnoses of complications</b>	145	18
<i>Missing values n</i>	10		<i>Missing values n</i>	3	

<sup>1</sup> Of available data

<sup>2</sup> Excluding oxytocin administration

In total, 46 (6%) out of 797 women admitted to the labour ward at MDH received emergency obstetric care with 49 individual reports on the emergency treatment given (Table 5). Most reports were of antibiotic treatment (44) but others were of anticonvulsant medications (4) or blood transfusion (1). No reports were of antenatal corticosteroids, manual removal of placenta, evacuation of retained products, or non-pneumatic anti-shock garment. Oxytocin was administered to 784 (98%) of the women after delivery. Although registered with emergency treatments, oxytocin was not included in total emergency treatments given as it is a part of standard treatment. Seven women were not administered oxytocin, four of whom had C-sections.

In the four-week study period, obstetric complications were reported for 145 women (18%) in the study period (Table 5) or on average five delivering women with complications each day. With some women diagnosed with multiple complications, a total of 804 complications were registered, including

reports of “none” complication. The single most common complication reported was prolonged/obstructed labour followed by preeclampsia/eclampsia and postpartum haemorrhage. In total, 71 delivering women had unspecified complications (Table 6). Although the majority did not have comments on the type of complication, a few had handwritten notes indicating that they were either failed vaginal births after C-section (FVBAC) or previous C-section scar.

**Table 7. Obstetric complications at MDH from 19 February to 17 March 2020.**  
Source: Patient registration book

	N= 804	(%) <sup>1</sup>
None	651	82
Obstructed labour	39	5
(Pre-)Eclampsia	10	1
Postpartum haemorrhage	9	1
Antepartum haemorrhage	6	<1
Fetal distress	6	<1
Premature labour	4	<1
Ruptured uterus	4	<1
Retained placenta	1	<1
Sepsis	0	0
Other complications	71	9
<i>Missing values</i>	3	

<sup>1</sup> Percentage of available values

**Table 6. Obstetric surgeries at MDH from 19 February to 17 March 2020.**  
Source: Theatre registration book.

	N = 185	(%) <sup>1</sup>
<b>Operations</b>		
C-section	165	90
Evacuation	12	7
Laparotomy	4	2
Repair	2	1
<i>Missing values</i>	2	
<b>Type of operation</b>		
Emergency	177	97
Elective	6	3
<i>Missing values</i>	2	
<b>Anaesthesia</b>		
General	17	9
Spinal	163	90
Local	1	1
<i>Missing values</i>	4	

<sup>1</sup> Percentage of available values

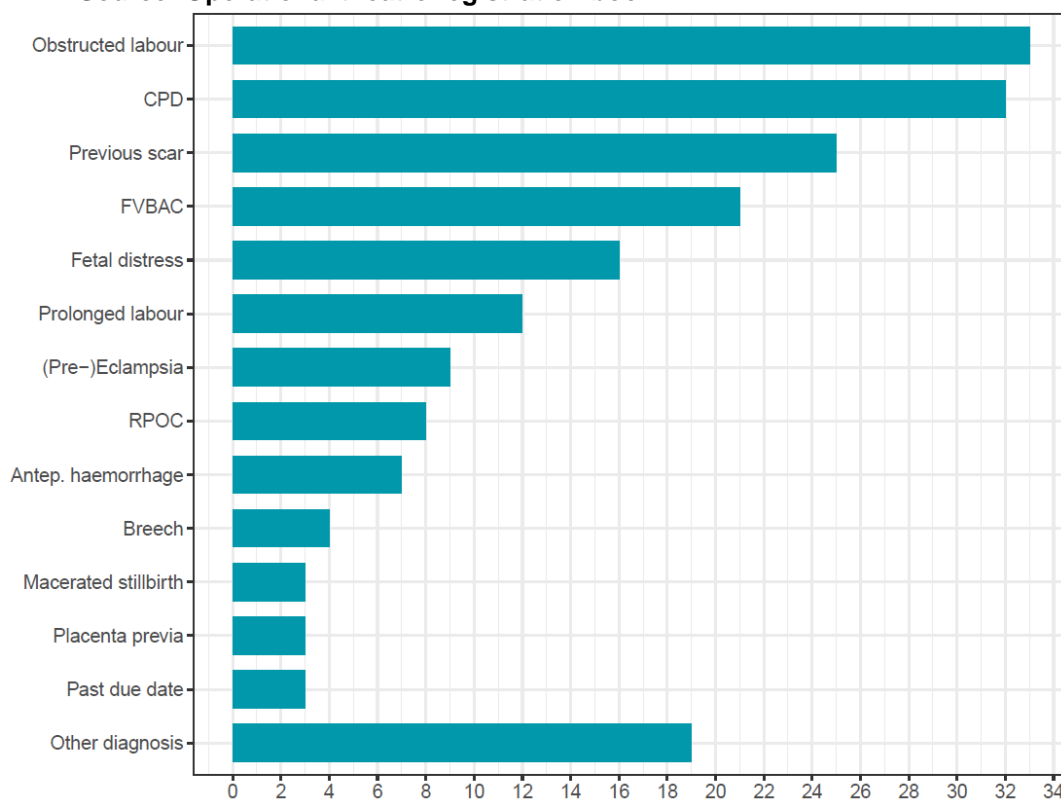
#### 4.2.5 Obstetrical operations

In total, 145 C-sections were reported in the labour ward’s registration book in the study period (Table 5), somewhat less than the 165 C-sections that were reported in the operational theatre’s registration book (Table 7). Nine out of 10 surgical procedures at the MDH’s maternity wing were C-sections. On average, the daily number of C-sections was nearly 6 (median 6.5, range 1-10). Other operations were evacuations of retained products (after macerated stillbirths, retained products of conception or postpartum haemorrhages), laparotomies (after uterine ruptures or perforations), and perineal repairs. Out of 185 surgical operations, 177 (97%) were emergency operations and six (3%) were elective. Four elective operations were C-sections and two were evacuations. For anaesthesia, spinals were used in nine out of 10 operations (Table 7). Apart from one missing value, all operations had a registered outcome as “Successful” and status of women after the operation registered as “Alive”.



The most common diagnosis (three or more) leading to operations at MDH are displayed in Figure 1. Those less frequent were combined under “Other diagnosis”. The most frequent diagnosis was obstructed labour and cephalo-pelvic disproportions (CPD) with 33 and 32 occurrences respectively. “Other diagnoses” included compound presentations, perineal tears, twins, and ruptured uteri, each with two reported cases. One case each was reported on cervical dystocia, cord presentation, face presentation, failed vaginal birth after C-section, hand prolapse, pelvic abscess, postpartum hemorrhage, retained placenta, retained twin, severe oligohydramnios and uterine perforation. Diagnoses were missing for 14 operations. For 24 operations, more than one diagnosis was reported.

**Figure 1 Diagnoses leading to obstetric surgeries at MDH from 19 February to 17 March 2020.**  
**Source: Operational theatre registration book.**



*Abbreviations: RPOC= Retained Products of Conception,  
 FVBAC= Failed Vaginal Birth after C-section  
 CPD = Cephalo-pelvic Disproportion,*

### 4.3 Interviews

Interviewees were asked about the facility at the new maternity wing. An important quality improvement of the facility that the interview participants greatly appreciated, was having an obstetrics-only theatre. At the old facility, two theatres were shared between the obstetric department and other surgical wards. The participants also frequently highlighted improved staffing. They agreed that nurses

are also more specialized now. The new maternity wing houses multiple wards allowing each nurse to stay within one field of maternity care. Before they struggled to care for many patients with different needs. The wards are more spacious in the maternity wing compared to the old hospital. That allowed more delivery beds in the labour ward and more space for equipment. At the old facility, some women would have to deliver on the floor but now they all get a bed.

This newly acquired space at the maternity wing is already proving to be too small. Some reported that the delivery beds are already too few. To improve the privacy of delivering women, participants mentioned the need for separation screens and to fix the currently broken doors into the delivery rooms. One expressed a need for private rooms for each woman in labour. Since the opening of the new maternity wing, the limitations of the new laboratories have become more evident for some interviewees. It is not equipped for some essential tests such as to determine blood status, electrolytes and liver functions. Therefore, many samples still need to be sent to the main hospital for these tests, causing delays and inefficiency. When asked about the waiting home for pregnant women, some mentioned its importance to their clients. Others were concerned with the lack of attendance to the waiting women. They said the women should be examined weekly or even daily but understaffing limited how many and how frequently women could be examined during their waiting time. Most study participants felt that the waiting facility is already too small.

Many of the interviewees expressed some issues with the theatre at the new maternity wing. What stood out is having only one surgical theatre for all obstetric operations. According to most of the participants, this is a common cause for delays in referring women to C-section when another operation is already taking place. In some cases, women had to be sent to the old hospital for an emergency operation. They also frequently reported a lack of maintenance or replacement of theatre equipment. Poorly functioning equipment mentioned included the surgical bed, air conditioners, autoclave, and anaesthetic machine, some of which were outdated at the facility's inauguration. For example, the anaesthetic ventilator pump has been broken for a long time requiring the anaesthetist to manually ventilate the patient with an Ambu bag or administer anaesthetics with minimal respiratory impact, usually ketamine.

Surgical equipment packs for C-sections were mentioned by most study participants. The C-section packs were reported to run out at times, the facility is equipped with too few packs to be sterilized before they are needed again. Some interviewees expected that 15-20 packs were available at the time of the study. One participant estimated that 15 more C-section packs would be needed to prevent them from running out while in sterilization. The shortage of packs was frequently mentioned to cause delay in emergency C-sections. Other reported causes for C-section delay was associated with staffing. If busy with other duties, nurses might not be able to review women to refer to a clinician in due time. A few participants expressed concern that CO's were contacted too late for assessing women with complications or that they were unable to assess women while they were operating another one.

Many study participants expressed a positive experience of the staff teamwork. They felt that team members could seek advice, rely on each other, and work in good coordination. Most Interviewees

reported improved staffing compared to before the new maternity wing opened. Despite that, some understaffing is evident to the participants. Anaesthetists are severely understaffed with only three individuals currently covering all duties at both the main hospital and the maternity wing. The number of anaesthetists should ideally be doubled according to one interviewee. CO's and nurses or midwives are not as understaffed although the participants also reported some shortage. Each day, the labour ward should have one CO and one intern CO on duty. During the study period, no intern was working at the maternity wing. Therefore, only one CO is responsible for both operations like C-sections and labour ward consultations. This resulted in delayed assessment on delivering women with potential complications. The same was reported on nurse/midwife staffing. They were better staffed than before but there are times where the lack of SBA might be an issue. When asked about birth attendance at the labour ward, all participants stated that SBA took care of all deliveries. When asked about the role of students, interviewees mentioned that understaffing and overworked nurses might however in some cases require students to attend deliveries with minimal supervision. In very rare cases, women might deliver without direct attendance if nurses were busy caring for other women.

A frequent issue that the participants mentioned was the supply of single-use equipment and drugs. Items like gauzes, cord clamps, catheters, some sutures, iodine, and alcohol have run out in the hospital's stocks. There were reports of catheters being out for four months and cord clamps that were frequently out of stock, forcing them to use cotton threads. The supply of drugs is also irregular, highlighted by most of the staff members. The drugs mentioned were dexamethasone, adrenalin, diazepam, and IV metronidazole. Some of these were not available due to long-term nationwide shortages but others were sent from other hospitals that might take a few days. One participant also reported there was limited drug selection available for treatment and anaesthesia. Other equipment in maternal care was mentioned as lacking. There was only one ultrasound machine shared for both the labour ward and the antenatal ward. Although the labour ward was equipped with two fetal heart rate monitors, they were not functional due to missing pieces. Some labour ward staff members reported a lack of oxygen concentrators and resuscitators. There should be one in each of the delivery rooms but at the time of study, they were only functioning in one room.

## 5 Discussions

### 5.1 Main results

Using MDH in Mangochi District in Malawi as an example, this study aimed to identify key challenges of delivery services in a low-income, sub-Saharan setting and identify how they might be improved. The main challenges facing the delivery services are low coverage of health facility deliveries resulting in low SBA coverage, delay in obstetric care, limited access to timely C-sections, shortage of essential health providers, weak supply chain and lack of maintenance. To further reduce maternal mortality, SBA coverage should reach all women, deliveries should be conducted with timely access to essential obstetric care including C-sections, and health facilities should have adequate staff and a secure supply chain.

Since 2015, two-thirds of deliveries in Mangochi District took place in health facilities. The C-section rate in the district was on average only 4% but nearly two-thirds of the districts' C-sections are done at MDH, the remainder is done in Monkey Bay Community Hospital and Namwera (Table 2). SBAs attend over 96% of deliveries in the district's health facilities (Table 2). MMR in the district decreased from 162 to 74 maternal deaths per 100,000 live births in the period from 2015 to 2019 with the biggest difference being between 2018 and 2019 (Table 2). MMR was highest in MDH where it was MMR is 428 per 100,000 live births in 2015 and the 270 in 2019 (Table 3).

MDH plays a key role as a referral hospital for Mangochi District. During the period 2015-2019, one of every four institutional deliveries and one of every six overall deliveries took place in MDH. During the research period from 19 February to 17 March 2020, on average about 27 women delivered daily at the facility and about 20% of them delivered through a C-section (Table 5). About six C-sections were done at MDH each day. About one in five (18%) of the women who delivered at MDH had complications but 6% received emergency obstetric care (Table 5). Women who delivered before their admission to MDH were less likely to deliver with SBA compared to those who delivered at MDH or other health facilities (Table 5). Nine out of 10 operations at MDH were C-sections but only 3% of operations were elective (Table 7).

The new maternity wing at MDH, inaugurated in January 2019, improved the facility and its services. Staffing improved and the labour and delivery ward could now provide more women with beds during their delivery. Having an obstetrics-only surgical theatre decreased delay in emergency operations but having only one theatre was still commonly considered a cause for delay. Lack of maintenance and inadequate supplies of drugs and commodities were also a concern for many of the staff. Despite improvements, staffing was still evident according to the interviewees.

### 5.2 SBA coverage

Between 2015-2019, almost all health facility deliveries were assisted by SBA (Table 2). Yet, a third of the estimated total deliveries did not take place in facilities. Instead these women delivered at home or

with a TBA and were never admitted and registered at a health facility. Choice of delivery location is significantly associated with urban residence, woman's literacy, higher income-level, higher age, number of ANC visits, ANC by a skilled provider.<sup>70, 71</sup> Among the mothers who delivered at home or with a TBA but were later admitted to MDH, only 25% were assisted during the delivery by SBA. Most women who delivered before admission to MDH had however delivered during transit (Table 5). Most women who did not deliver in health facilities in Malawi had intended to deliver at a health facility with SBA.<sup>72</sup> According to interviews with these women, labouring at night and not having men available to escort them safely to a health facility or difficult transport during the rainy season caused some women to deliver at home. When the walk to a TBA was shorter than the walk to a health facility, women would rather seek their help. The women interviewed who delivered during transport said that progression of labour or physically not being able to continue the walk caused them to deliver before reaching the health facilities.<sup>72</sup> In another study, Ethiopian women interviewed and who chose to deliver at home expressed the opinion that it wasn't needed to go to a health facility for delivery.<sup>73</sup> For others, it was not a part of their culture, too costly, or impossible due to lack of transport.<sup>73</sup>

### **5.3 Access to C-sections**

The C-section rate in Mangochi District was on average 4% of all deliveries, slightly less compared to the national rate in Malawi and neighbouring Tanzania and Zimbabwe.<sup>74</sup> Specific and predetermined C-section rates are no longer strived towards for MMR reduction.<sup>48</sup> Instead, C-section access should be ensured for all labouring woman who needs it.<sup>48</sup> This study revealed that in Mangochi District, one-third of deliveries in 2015-2019 took place outside of health facilities and never came close to a surgical theatre. Further, workers at MDH expressed concern for the delay in operations for multiple reasons. This indicates that many women in Mangochi do not have timely access to C-section when in need. To provide necessary surgical interventions to obstetric complications, access needs to be improved and delay decreased.

Thaddeus's and Main's<sup>75</sup> three-delay model is commonly used when assessing causes for poor maternal outcomes. The three delays are in deciding to seek health care, reaching health care facility, and receiving treatment from a health care provider.<sup>75</sup> Another study<sup>76</sup> conducted in Mangochi District assessed the delays experienced among women with maternal death outcome. It found that 39.4% of institutional maternal deaths had faced the first delay, commonly due to lack of awareness about obstetric complication, avoiding costs, or poor perceived quality of care and negative experience at health centres. Out of maternal deaths, 59.6% had experienced the second delay while trying to reach health care, often associated with long travel time, high transport costs, and bad road conditions. That study also found that 96.8% of institutional maternal deaths had faced the third delay, commonly linked to long waiting time, shortage of supplies or drugs, and wrong assessment of risk.<sup>76</sup> Although all three types of obstetric health care delays in Mangochi District are evident, the third delay was involved in nearly all institutional maternal deaths.<sup>76</sup> Improved quality of care at health facilities is necessary for minimizing the risk of maternal deaths. In MDH, rapid referral to C-sections can still be improved to provide quality care with minimal third delay.

## **5.4 Quality care**

Staff was asked about causes for C-section delay. The most frequently mentioned cause was having only one theatre. With six C-sections operated daily, two or more women will inevitably need C-sections simultaneously some days. Understaffing was also said to increase the delay in assessment and operation when COs were busy in surgery or anaesthetists are taking their breaks. Shortage of C-section packs due to sterilization delay was also a cause for delay in operations. Almost all (97%) operations at MDH are classified as emergencies. First and second delays were likely to further increase the urgency of rapid surgical intervention. The staff was very much aware of this delay in intervention at MDH. They were motivated to reduce it, but involvement of the management was requested. Ensuring an adequate number of C-section packs and considering means to sterilize them on a more regular basis were identified as a relatively inexpensive way to prevent delay due to their sterilization. However, a construction of a new theatre and improving staffing are long term commitments that need thorough planning and secure funding. Further, a second theatre will not reduce delays if COs and anaesthetists are not available to perform surgeries in both theatres at the same time. Additionally, if maintenance of equipment is not ensured, none of the theatres can provide quality care. Sterilization autoclave frequently broke down and the anaesthetic machine never functioned to the fullest. Equipment availability and function has been reported to limit the use of a second theatre on Malawi and its neighbouring nations.<sup>77</sup>

## **5.5 MDH staffing**

Interviewees shared the opinion that an important improvement of the new maternity wing was the better staffing that followed. Many also identified good teamwork to be a quality improvement they appreciated about their work and the services provided. The field visit showed, not only how motivated these health providers were, but also how problem-solving their approach on care was despite facing shortage of some key service providers.

The most prominent understaffing was amongst anaesthetists. This crucial and specialized cadre had just three workers during the study period, covering both operations in the main hospital and the maternity wing. Lack of anaesthetist was recently reported from 33% of district hospitals in Malawi.<sup>77</sup>

Although all deliveries are said to be attended by SBA, students were not always supervised when they managed deliveries. This was evident during the field visit and, when asked about student's supervision, interviewees admitted that if nurses and midwives were too busy, students sometimes must deliver without direct supervision. Additionally, late response of overworked COs was a reoccurring cause of delayed patient assessment and referral for C-sections. While the labour ward CO was operating no one could assess labouring women or perform interventions such as vacuum extractions. This was especially true at the time of the study as no intern was employed at the facility. Evidence from Malawi shows that high workload amongst health care providers negatively affected their performance<sup>78</sup>

and makes them consider leaving the health sector<sup>79</sup>. Further, a study from Namibia revealed that health care providers were more likely to be disrespectful when overworked.<sup>80</sup> It is therefore very important for delivery services to maintain moderate workload to provide quality care.

## **5.6 Strengths and limitations of the study**

The strengths of this study rest on its multifaceted approach. The role of MDH as a referral hospital in a low-income, sub-Saharan setting was described based on various data. It included on a five-year, district-level data as well managing to describe the services in more detail during four weeks from 19 February to 17 March 2020. The four-week data included, not only registered treatment information from the hospital's labour ward but also all surgical registration to emphasize the hospitals important role in surgical obstetric services. The status of services and facilities at MDH and the effect of the new maternity wing were further examined through interviews with various health care providers at the hospital. The interviews give this study better means to understand challenges and needed improvements.

Despite its considerable strengths, there are some limitations. Compiled data registration at this level is relatively recent in Malawian health service and poor data quality inevitable affected the study results. For instance, C-section registration within MDH; 145 C-sections were registered in the labour ward registration book (Table 5) but 165 were registered at the surgical theatre registration book (Table 7) in the same period. This indicates that compiled HMIS statistics, which originates in the labour ward registration book, is missing a considerable number of C-sections which are not registered there. Infrastructure and workforce still need to be strengthened while actions to improve data quality is already well underway.<sup>63</sup>

A language barrier between the author (EDÓ) and MDH staff and clients was also limiting factor. Some interviewees, although happy to share their points of view, found it challenging in English. For the participant observation of the study, it was limiting not to fully understand client-staff interaction for better understanding of the services provided.

This study uses MDH to examine challenges in delivery care in a low-income setting. Despite its important role in the districts' delivery services, to fully examine challenges facing delivery care in the area, other delivery settings would need to be taken into consideration.

## **5.7 Conclusions**

Despite ongoing improvements, MMR is still high in Mangochi district, Malawi. To decrease it further it is necessary to improve the coverage of SBAs, timely access to C-sections, and address challenges in care at the district's health facilities. The new maternity wing at MDH significantly improved the quality of care while still confronting several issues that need attention. Currently, the main challenges in delivery services at MDH are delay in surgical care, inadequate maintenance, weak supply chain and understaffing. Sustainable improvements of services at MDH are essential as the facility plays a key role in the district's delivery services. Improving maintenance of equipment, ensuring enough C-section

packs, and strengthening the supply chain should first be considered to properly utilize the new maternity wing in keeping women safe. The construction of a fully functional second surgical theatre coupled with improved staffing, could then further minimize intervention delay to life-threatening complications.

In low-income settings, such as Mangochi District, improved delivery care can further reduce MMR. Increasing SBA coverage and access to timely interventions including C-sections are ongoing challenges. Referral health facilities are cornerstones in delivery care, and strengthening such facilities needs to be considered essential when investing in improved quality of delivery care.



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Baby		Delivery Details				Newborn care Circle all that apply or none if there is no complication																
Birth date and time	Twins	Sex	Birth Weight	APGAR (1 min & 5 min)	Place				Mode				Complication									
					This facility	In Transit (BBA)	Other facility	Home/TBA	SVD	VE	BR	CS	Caesar. Section	None	Weight less 2500g	Prematurity	Asphyxia	Sepsis	Other	KMC	Res	EB
__/__/__	S	M		__/10	Here	TR	OthF	Hom	SVD	VE	BR	CS	Non	Non	Pre	Asph	Sep	Ot	KMC	Res	EB	Ot
__/__/__	S	M		__/10	Here	TR	OthF	Hom	SVD	VE	BR	CS	Non	Non	Pre	Asph	Sep	Ot	KMC	Res	EB	Ot
__/__/__	S	M		__/10	Here	TR	OthF	Hom	SVD	VE	BR	CS	Non	Non	Pre	Asph	Sep	Ot	KMC	Res	EB	Ot
__/__/__	S	M		__/10	Here	TR	OthF	Hom	SVD	VE	BR	CS	Non	Non	Pre	Asph	Sep	Ot	KMC	Res	EB	Ot

Baby										Newborn survival and PMTCT Management Circle only one of the 7 options below									
Discharged Alive	Mother HIV Neg.	Mother HIV Pos	NVP Syrup	None	Started	Still births		Breast-feeding initiated within 60 mins		Routine care			Provider name		Date and Time of transfer or discharge	Comment			
						Fsb	MSb	N	Y	TEO	Chlorohexidine	Vitamin K	ITN	Yes			No		
Alive Not exp	Alive Exp No NVP	Alive Exp NVP	None	None	None	Fsb	MSb	N	Y	N	Y	N	Y	N	Y	__/__/__			
Alive Not exp	Alive Exp No NVP	Alive Exp NVP	None	None	None	Fsb	MSb	N	Y	N	Y	N	Y	N	Y	__/__/__			
Alive Not exp	Alive Exp No NVP	Alive Exp NVP	None	None	None	Fsb	MSb	N	Y	N	Y	N	Y	N	Y	__/__/__			
Alive Not exp	Alive Exp No NVP	Alive Exp NVP	None	None	None	Fsb	MSb	N	Y	N	Y	N	Y	N	Y	__/__/__			



# Operational theatre book

Name of Patient	Address/ TA/ Village	Age Yrs/Months	Sex	Date of Admission	Diagnosis/ Condition	ASA score before surgery	Condition before Surgery
						Score 1 to 5	If ASA = 2 or more

Type of surgical procedure	Elective or emergency	Type of Anaesthesia	Surgical Team (Initials)				Outcome of Surgery	Status on transfer to ward
	Elect / Emrg	1. Local 2. Regional 3. Spinal/Epidural 4. General	Principal Surgeon	Assistant Surgeon	Anaesthetist	Scrub Nurse	Successful / Complication (specify) / Comorbidity (specify) / Unsuccessful	Alive or Dead

## Interview sheet

Date:..... Year of graduation:..... Profession:.....

Age:..... Year starting at MDH:.....

1. Describe and explain you work schedule:

.....  
.....  
.....

2. How many are working with you each day?

Does staffing affect the delivery services?

.....  
.....  
.....

3. Are all deliveries assisted by skilled birth attendants?

Who else could be assisting in deliveries?

Please explain in what situation

.....  
.....  
.....

4. Overall, what do you like about the facility and services in the labor ward or surgical theater?

Has it improved, gotten worse or stayed the same?

.....  
.....  
.....

5. Overall, what do you dislike about the labor ward/surgical theater?

.....  
.....  
.....

6. What is your opinion on necessary delivery/surgical/anesthetic equipment? Do they work? Is something lacking?

.....  
.....  
.....

**7. Does access to electricity/water/drugs/supplies effect the services?**

.....  
.....  
.....

**8. Do you encounter any problems when referring a delivering woman for C-sections?  
What problems?**

.....  
.....  
.....

**9. If you have been working at MDH since before the new maternity Wing was built,  
what is different now?**

.....  
.....  
.....

**10. What protocols do you use while at work?  
How did you learn/hear about them?  
Do you have the necessary training/tools/time to follow the protocols?**

.....  
.....  
.....

**11. What is your opinion on the waiting facility for pregnant mothers?**

.....  
.....  
.....