Identifying the national network of health facilities providing Emergency Obstetric and Newborn Care (EmONC) in the Republic of Sudan

– TECHNICAL REPORT –

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In collaboration with:

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Acronyms

APH	Antepartum haemorrhage
AMDD	Averting Maternal Death and Disability
AVD	Assisted Vaginal Delivery
ARV	Antiretroviral
BEmONC	Basic Emergency Obstetric and Newborn Care
CEmONC	Comprehensive Emergency Obstetric and Newborn Care
CS	Caesarean Section
CSPro	Census and Survey Processing software
DOCFR	Direct Obstetric Case Fatality Rate
EmONC	Emergency Obstetric and Newborn Care
EPMM	Ending Preventable Maternal Mortality
FANC	Focussed Antenatal Care
FMoH	Federal Ministry of Health
FP	Family Planning
GIS	Geographic Information System
GP	General Practitioner
GPS	Geographic Positioning System
HMIS	Health Management Information System
IM	Intramuscular
IRB	Internal Review Board
IV	Intravenous
MD	Medical Doctor
MHDU	Medical High Dependency Unit
MICS	Multiple Indicator Cluster Survey
MMR	Maternal Mortality Ratio
MNH	Maternal and Newborn Health

MVA	Manual Vacuum Aspiration
NA	Need Assessment
NGO	Non-Governmental Organization
NICU	Newborn Intensive Care Unit
NMSF	National Medical Supplies Fund
Ob/Gyn	Obstetrician/Gynaecologist
PHC	Primary Health Care
PMTCT	Prevention of Mother to Child Transmission (of HIV)
PPH	Postpartum Haemorrhage
PROM	Preterm Rupture of Membranes
RMNCAH	Reproductive, Maternal, Newborn, Child and Adolescent Health
SAM	Severe Acute Malnutrition
SDG	Sustainable Development Goals
SMoH	State Ministry of Health
SPSS	Statistical Packages for Social Sciences
STI	Sexually Transmitted Infections
TWG	Technical Working Group
UN	United Nations
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Executive Summary

Despite progress over the last decades, the maternal and neonatal health situation in Sudan is still a major issue, with a maternal mortality ratio (MMR) estimated at 295 [uncertainty interval 80%: 207; 408] per 100.000 live births. The MMR is stagnant since 2010 and every year, an estimated 3.900 women die from preventable causes related to pregnancy and childbirth. The institutional delivery rate in health facilities is very low (27.7 percent) and the first national EmONC assessent conducted in 2018 showed that only 32 percent (127 health facilities) of the 396 EmONC facilities recommended by the international standards were providing EmONC services. In order to accelerate the reduction of maternal mortality and reach the SDG 3.1 target for Sudan of an MMR of 117 maternal deaths per 100,000 live births, it is critical to ensure that all pregnant women can access quality obstetric care 24h/7d.

In order to improve access to quality EmONC, the FMoH decided to define a national network of EmONC health facilities accessible by most of the population within 2h travel time. Using objective criteria related to the health facilities and referral linkages, the AccessMod software developed by WHO and the University of Geneva, and GIS mapping, the FMoH and State level stakeholders identified through a bottom-up process a national network of referral health facilities composed of 167 EmONC health facilities (including 89 CEmONC and 78 BEmONC health facilities) covering 91% of the population within 2 hours of travel time.

This innovative methodological approach allows measuring the coverage of the population able to access the closest health facility among the 631 health facilities performing routine deliveries. An estimated 96% of the population have access to these health facilities within 2h travel time. Through a participative process and using objective criteria on population geographic access and characteristics of each health facility, stakeholders at the State level have identified among these 631 health facilities, a national network of 167 health facilities that should provide EmONC services 24h/7d (in addition of comprehensive reproductive, maternal, and newborn healthcare). An estimated 91% of the population have access to these designated EmONC health facilities within 2h travel time. Based on the same analysis criteria, the FMoH, UNFPA and the University of Geneva have analyzed the national network of EmONC health facilities proposed by the State stakeholders and suggest a national EmONC network composed of 158 EmONC health facilities covering 90% of the population within 2h travel time. Among the 158 EmONC health facilities, 139 are common with the network proposed by the State stakeholders (meaning 83% of their 167 designated EmONC health facilities). In addition, the follow-up analysis 'reclassified' 21 health facilities as designated CEmONC instead of designated BEmONC health facilities.

The formal identification of a national network of EmONC health facilities in Sudan and the reduced national EmONC network proposed by the follow-up analysis provides the opportunity to focus scarced resources (including midwives) in a targeted number of health facilities in order to make them functioning 24h/7d with quality of care. Based on the 2018 EmONC Assessment date, there were 63 functioning EmONC health facilities in Sudan covering an estimated 75% of the population within 2h trave time. For the FMOH and its partners, the objective of the current and next programmatic cycle (2022-2025) is therefore to increase the number of functioning EmONC health facilities from 63 to 158 in order to increase the coverage of the population by functioning EmONC health facilities from 75% to 90%. A major challenge is also to increase the quality of the care provided in the functioning EmONC health facilities.

The estimated population covered by the national EmONC network could further improve with a better road network as well as the availability of affordable transportation, including for referral between health facilities, and improved security. In some States, these challenges are important and could be partly and temporarely addressed with the set-up of maternity waiting homes and other context specific outreach startegies linked with the national EmONC network.

The approach proposed by UNFPA and implemented in Sudan also provides a concrete operationalization of the notion of network of care at national scale, which is essential for ensuring the management of obstetric and neonatal complications. The organization of good and affordable referral linkages between the basic and the comprehensive EmONC health facilities is essential for the functioning of the network. The State level working groups have analyzed the referral linkages between each designated BEmONC and its referral CEmONC health facility(ies). This analysis shows that that more than half of the referral linkages in the designated EmONC network are good ('green'), 47% have issues that should be solved by the health sector ('orange'), and 4% have major issues that should also be solved by other sectors (eg. infrastructure). All regions have highlighted financial barriers for the referrals, with average referral costs between 1000 and 5000 SDG in Blue Nile and South Darfur States. These costs cannot be afforded by the majority of the population and solidarity mechanisms should be set-up and imporved at national and State levels to address these financial barriers. Transportation means are missing in several States, including ambulances. Moreover, when ambulances are available, they can be in poor state. Finally, some areas face insecurity, which can affect referrals.

Finally, the approach led to the development of national standards on the mission and roles of basic and comprehensive EmONC health facilities and their infrastructure and resource requirements, including in tems of the number of midwives that should staff such facilities. The capacity of EmONC health fcailities to manage obstetric and neonatal complicatiosn with quality care depends on the availability and capacities of midwives and OBGYNs. In order to assess the gap in midwives in the designated EmONC health facilities in Sudan, only the graduate nurse midwives/'sister' midwives (3 years nursing diploma + 1 year midwifery) and the nurse midwives (nursing certificate + 1 year midwifery) were considered as these cadres are the ones which are the closest to the ICM/WHO standards of midwives. Bachelor midwives (4 years midwifery Bachelor of Science) were also included but there are very few graduates to date. According to the national standard of midwives in EmONC health facilities defined by the FMoH during the inception national workshop on the identification of the EmONC network, an EmONC health facility should have a minimum of midwives (educated to international standards) as part of the shifts to ensure availability of services 24h/7d: minimum 4 midwives for a CEmONC health facility in urban area and minimum 3 midwives in a CEmONC health facility in a rural area and in a BEmONC health facility (in an urban or rural area). In addition, each midwife should do a minimum of 30 deliveries per month in order to be able to manage the major obstetric and neonatal complications. Based on these parameters, an estimated 367 midwives are missing in the short and medium term in the 167 EmONC health facilities designated by the State working groups. This estimation corresponds to the difference between the number of midwives needed in each designated EmONC health facility (to ensure care 24h/7d, adjusted based on the total number of deliveries per month) and the number of midwives who are part of the shifts (including both graduate nurse midwives and nurse midwives). In the long term, an estimated 536 midwives are missing in the 167 designated EmONC health facilities (by not including anymore the nurse midwives in the calculation and by taking the assumption that the 367 missing midwives in the short and medium term are deployed). There is also a critical need to strenghten the capcities of midwives, with a strenghtened in-service education aligned with ICM-WHO standards and in-service training and mentorship.

This report aims to inform the validation by the FMoH of the national network of EmONC health facilities in Sudan and to inform operational strategies and plans at national and State levels to improve the access to functional EmONC health facilities providing high quality care. Once the national EmONC network validated an immdeiate next step for the FMoH and State level authorities will be to disseminate this network to national and sub-national stakeholders, health facility staff and communities and to monitor key RMNH indicators (cf. Annex 3) in these health facilities to inform quality of care improvement.

I. Context

The Republic of Sudan is the third largest country in Africa with an estimated population of 40.2 million and is composed of 18 States (cf. Figure 1), from which five are in a humanitarian/fragile context. Sudan is located in Northeast Africa. It is bordered by Egypt to the north, the Red Sea to the northeast, Eritrea and Ethiopia to the east, South Sudan to the south, the Central African Republic to the southwest, Chad to the west and Libya to the northwest. It has an annual population growth rate of 2.5 percent, total fertility rate of 5.2 children per woman (5.6 rural, 4.4 urban), and 62 percent of the population below 25 years of age. About 21.2 percent of young women age 15-19 years are married.[1]

Sudan has experienced continuous population movement reflected in rural-urban migration, internal displacement of 2.23 million people, and an influx of 1 million refugees.

Over a quarter (27.7 percent) of births in Sudan are delivered in a health facility; of which 26.1 percent occur in public sector facilities while only 1.6 percent of the deliveries occur in private sector facilities. The MICS results also indicate that 71.3 percent of the deliveries take place at home. Women in urban areas (45.2 percent) are more than twice as likely to deliver in a health facility as their rural counterparts (21.5 percent).[1]

Current use of contraception in Sudan is reported as 12.2 percent of women currently married. The most popular method is the pill, which is used by about one in ten married women in Sudan (9.0 percent). Almost 87.8 percent of the married women reported that they are not using any form of contraception. About 27 percent of women 15-49 years reported for unmet need in the Sudan.[1]

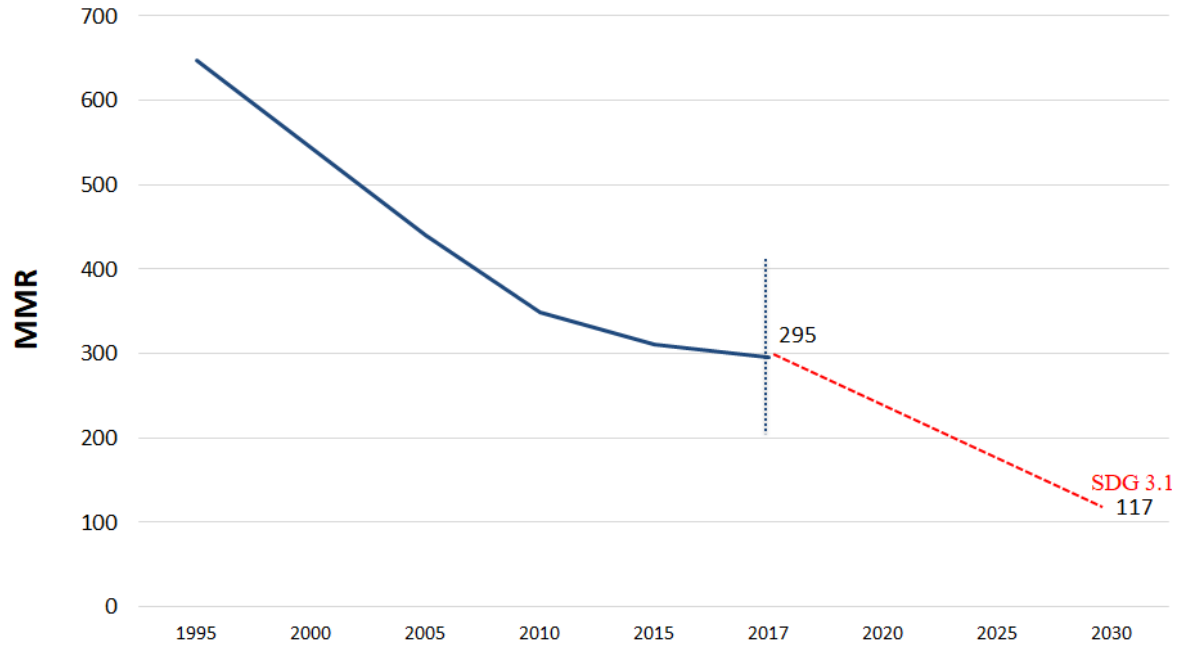
Six out of ten (59.8 percent) young women in Sudan are literate and that literacy status varies greatly by area (79.8 percent in urban areas and 50 percent in rural areas).[1]

Figure 1: Map of the 18 administrative States of Sudan

1.1 Maternal Health in Sudan

Despite progress over the last decades, the maternal and neonatal health situation in Sudan is still a major issue. In 2017, the maternal mortality ratio (MMR) was still high, estimated at 295 [uncertainty interval 80%: 207; 408] per 100.000 live births.[2] Sudan also has high child and neonatal mortality rates, respectively 68 and 33 per 1,000 live births[1]. As shown on Figure 2, by 2030, Sudan should reach an MMR target of 117 maternal deaths per 100,000 live births in order to reach the SDG3.1 target ("For countries with MMR less than 420 in 2010, to reduce the MMR by at least two thirds from the 2010 baseline by 2030"[3]).

Figure 2: Trends of the Maternal Mortality Ratio in Sudan



Most maternal deaths are due to direct obstetric complications, with the leading causes being postpartum haemorrhage, severe (pre) eclampsia, and postpartum sepsis (source: EmONC Assessment report 2018).

The institutional delivery rate in health facilities is very low (27.7 percent)[1]. This low proportion of institutional deliveries must alert on the challenges, including financial and gender based, faced by women to deliver in health facilities in the country. In addition, Sudan does not have a recognised status for the profession of midwives and the midwifery pre-service education is not yet aligned with international standards (from ICM/WHO), except the existing Bachelor programme of midwives which was launched in 2012 and is implemented in one school run by the National Academy of Health Sciences (the first students graduated in 2011). A recent gap analysis of midwifery in Sudan was conducted by ICM concluded that "the Sudanese definition of a midwife is different from that of the ICM and how the midwife is defined impacts on the education programme through which the midwife should be educated"[4]. The country has seven different cadres of "so named" midwives:

The list below shows the cadres and their period of training.
1. Midwife: 4 years midwifery Bachelor of Science (BSC) - very few graduates to date
2. Graduate Nurse Midwife: 3 years nursing diploma + 1-year midwifery
3. Nurse midwife: nursing certificate (not graduate) + one-year midwifery
4. Health Visitor: nursing certificate + 1 year midwifery + 2-years health visitor training.
5. Technical Midwife: 2-years basic training on nursing and midwifery.
6. AHS (Assistant Health Visitor) community midwife certificate + 9 months assistant health visitor training
7. Community midwife

The lack of a strong midwifery workforce, recognized and trained to international standards to manage BEmONC is one of the challenges leading to a low availability and quality of EmONC services. Based on the EmONC Needs Assessment of 2018, only 32 percent (127 health facilities - including 112

Comprehensive EmONC facilities) of the 396 EmONC facilities recommended by the international standards (5 EmONC per 500,000 population) are functioning.[5]

However, the improvement of maternal and newborn health is a priority for the Government of Sudan and the country decided to adopt a midwifery reform strategy in order to avail that enough number of professional midwives meet the WHO required competencies and to revise its EmONC strategy by adopting an approach for the development of a national network of EmONC health facilities. UNFPA is supporting these two major interventions under the leadership of the FMoH of Sudan.

1.2. Decision to develop a national EmONC network in Sudan

After persistent advocacy by both UNFPA and FMoH, the process started in 2017 when the government of Sudan through the Federal Ministry of Health (FMoH) conducted the first-ever EmONC Needs Assessment of the country. The country had no formal national network of EmONC health facilities defined and a total of 631 health facilities (17 Referral/specialized hospitals, 58 State/general hospitals, 365 Locality/rural hospitals, 53 private or NGO maternity/general clinics and 138 public or NGO/private health centres) that provided delivery services at the time of the assessment were included in the survey.

Following the dissemination of the EmONC NA in 2018, in order to increase the availability and quality of EmONC in Sudan, the FMoH decided to define a national network of EmONC health facilities by focusing available resources on a limited number of health facilities while ensuring access by the population within 2 hours of travel time. Based on the data from the assessment, the FMoH, with the technical support of UNFPA, decided that the first national network of EmONC health facilities should not exceed 198 health facilities (half of the 396 EmONC facilities recommended by the international standards of 5 EmONC per 500,000 population[6]). Stakeholders from the national and State levels identified, during four workshops organized between November 2018 and February 2019, 167 EmONC health facilities (including 89 CEmONC and 78 BEmONC health facilities) covering 91% of the population within 2 hours of travel time. Due to the changing context in the country, the results from these consultations were analyzed in 2020 by a team composed of the FMoH and UNFPA, which recommended 158 designated EmONC health facilities (including 114 designated CEmONC and 44 designated BEmONC health facilities) covering 90% of the country population within 2 hours of travel time.

This report presents the results of this analysis, which will be used by the FMoH to define the official national network of EmONC health facilities in Sudan.

II. Objectives of the EmONC prioritization

The main objective of the EmoNC prioritization is to define a national network of EmONC health facilities in the 18 States of Sudan. This prioritization used objective criteria described below and innovative tools (AccessMod - https://www.accessmod.org and GIS) to estimate the population covered by EmONC health facilities within 2 hours of travel time and to map the national network of EmoNC health facilities. The specific objectives are:

- Propose an objective and effective distribution of EmONC health facilities in the health system of Sudan
- Support a better planning and deployment of resources (eg. human resources, equipment etc) in the EmONC health facilities of the national network
- Identify the required number of midwives needed in EmONC health facilities to ensure the provision of services 24h/7d (and adapted to the obstetric activity)
- Define and analyze the referral linkages between BEmONC and CEmONC health facilities

- Set-up a network of referral health facilities that can serve as platforms for the provision of integrated reproductive, maternal and newborn health services
- Facilitate the communication and coordination of stakeholders involved in maternal health (FMoH, financial and technical partners, NGOs, civil society, professional associations, sub-national and health facility stakeholders) to better plan and implement quality improvement efforts in EmONC at State and national levels.

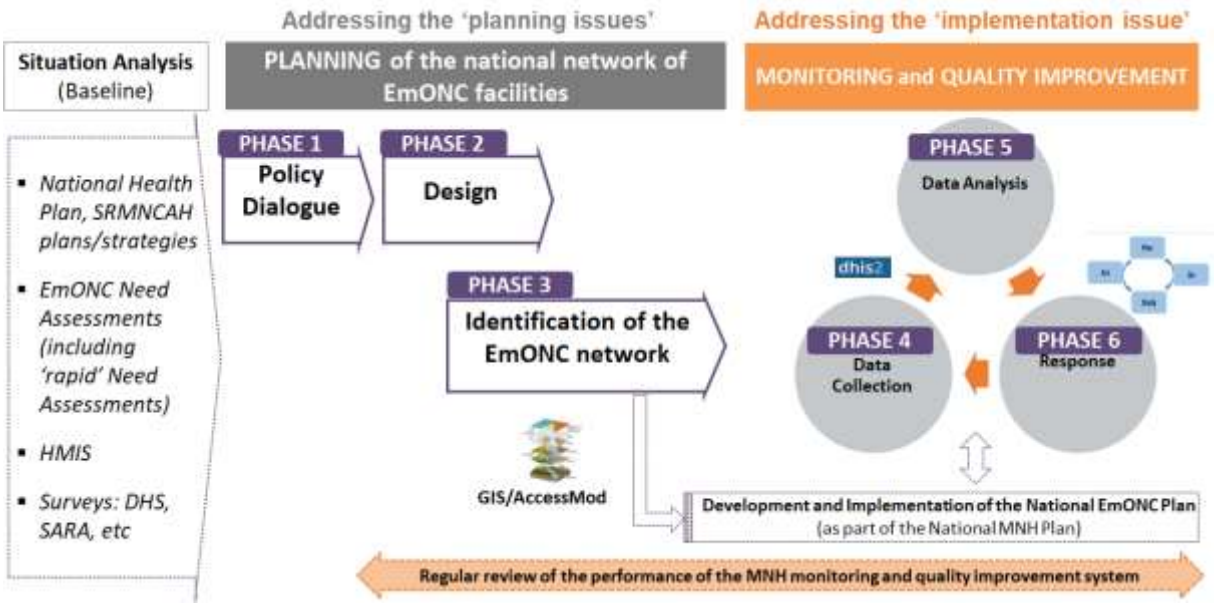
III. Methodology

3.1. Description of the development of a national EmONC network

The FMoH of Sudan adopted the approach developed by UNFPA for setting-up a national network of EmONC health facilities[7]. This approach is detailed in an operational manual available on UNFPA's website (https://www.unfpa.org/fr/node/25244) and summarized in Figure 3 below. It includes six steps to define the national EmONC network and to set-up quality improvement cycles in the designated EmONC health facilities:

- Phase 1: advocate for the approach of developing a national network of referral maternity facilities to ensure that the main political stakeholders and decision makers in MNH are involved and are committed to the proposed principles and processes;
- Phase 2: design the processes and the necessary tools for developing and monitoring the national network of referral maternity facilities;
- Phase 3: identify the national network of referral maternity facilities and include it in the national MNH plan;
- Phase 4: collect data;
- Phase 5: analyse data;
- Phase 6: use these data to address gaps in availability and quality of care of identified health facilities, while also directly informing the health system on how effectively the maternal health programme is managed;
- Phase 7: monitor the implementation of the process.

Figure 3: Process for setting-up a national network of EmONC health facilities and a monitoring and quality improvement cycles[7]



This report describes the phase 3 related to the identification of the national EmONC network in Sudan which was done through 4 State level workshops. During these workshops, the State level stakeholders identified for each State the most efficient EmONC network, meaning ensuring the best balance between feasibility of making the designated health facilities functioning 24h7d with quality of care in the coming 3-4 years while covering the majority of the population within 2 hours of travel time.

3.2. Workshops for the development of the national EmONC network

3.2.1. National workshop for the presentation of the EmONC development approach and monitoring (14-16 August 2018)

Following the dissemination of EmONC NA results, Maternal and Child Health Directorate at FMoH and UNFPA co-chaired a workshop on EmONC development approach. 60 participants took part to this workshop, including representatives from the FMoH and from the 18 States (Director Generals of the State Ministry of Health, Reproductive Health coordinators, Child Health coordinators), representatives of professional associations, and technical and financing partners (UNFPA, UNICEF, Italian Cooperation, Sudanese-American Medical Association). The objectives of the workshop were: (1) To present/familiarize the participants with the approach for the development of the national network of EmONC facilities in Sudan, (2) To analyze the results of the EmONC NA and make preliminary recommendations to address gaps in human resources, availability of essential medicines, infrastructure, and referrals.

3.2.2. National technical workshop on the development and monitoring of the national network of EmONC facilities (06-08 November 2018)

This workshop aimed at (1) orienting stakeholders and partners at national and sub-national levels on the concept of EmONC facilities network; (2) getting a common understanding of the health management information system in Sudan (HMIS/DHIS2) and the monitoring processes of health facilities already in place;and (3) defining the approach for monitoring the national network of EmONC facilities (from data collection to analysis and response) including key MNH/RH indicators

as suggested in the national 'monitoring sheet. This workshop was co-lead by the FMoH and UNFPA and was attended by MNH Technical staff from the FMoH (including from HMIS); two participants from each State, including the Directors of RH; UNFPA, WHO, UNICEF, NGOs; private sectors focal persons involved in the health services planning; representatives of professional associations (OBGYN, midwifery).

3.2.3. Workshop on GIS and AccessMod (06-08 November 2018)

The goal of this technical workshop was two-fold: (1) to build capacity of a technical team from FMoH, UNFPA and technical partners in order to facilitate the appropriation of GIS modelling methodologies to support the implementation and monitoring of the EmONC network, and (2) to enable a small GIS team in Sudan to follow up the GIS and mapping work during the follow-up regional workshops.

A national team (FMoH, UNFPA and technical partners) of 15 participants were taught how to use QGIS and AccessMod, and was able to use that tool to model physical accessibility to health services, and to get and use useful statistics on population coverage. During the workshop, advocacy of the importance of integration of accessibility indicators was also carried out, together with the initial mapping and coverage of the EmONC network in the first set of five states in Sudan. Finally, the spatial database of geospatial data sets to use for the accessibility modelling in Sudan was discussed and agreed with the participants.

3.2.4. State level workshops for the identification of the EmONC network

a) Organization of the State level prioritization workshops:
   - 11-13 November 2018 (Khartoum): 5 States (Blue Nile, Gazeera, North Darfur, North Kordofan, and White Nile),
   - 20-27 January 2019 (Khartoum): 8 States (Sinnar; Gedarif; Kassala; Red Sea; River Nile; Northern State; Khartoum; South Kordofan) and
   - 18 -21 February 2019 (Khartoum): 5 States (South, West, East and Central Darfur and West Kordofan).

Each of these workshops has used a predefined Excel template for the State level participants to:

- Define the maximum number of EmONC health facilities to be designated for each State based on the population;
- Identify the means of transport usually used by the population and their speed on different roads;
- Propose an initial list of designated EmONC health facilities for each State based on objective selection criteria includes obstetric activity, catchment area, gaps in signal functions, skilled birth attendants, the capacity to refer to another health facility (the link between BEmONC and CEmONC facilities) within a reasonable travel time (eg. within 2 hours), the level of infrastructure and available skilled attendants;
- Review this initial list of designated EmONC health facilities using the analysis if the catchment areas within 2h, 3h, and 4h travel time and based on the strengths and weaknesses of the identified health facilities, including the management capacity of the HF team;
- Analyze the quality of referral linkages between BEmONC and CEmONC health facilities; and
- Define the needs of each designated EmONC health facility in terms of skilled birth attendants (particularly midwives) to ensure the availability of services 24h7d.

b) Profile of the participants

About 50 persons have participated in each State level prioritization workshop. Participants at the State level usually included: Director General of SMoH, Director of Curative Medicine, Director of Strategic Planning, Director of PHC/MCH, Reproductive Health Coordinator, Child Health Coordinator.

The workshops were co-facilitated by the FMoH, UNFPA, and international consultants (from the University of Geneva).

c) Methodology

The data on the obstetric activity, the functionality of the EmONC health facilities and the number of skilled birth attendants in each health facility were retrieved from the national EmONC Assessment in 2018. The data of each health facility surveyed was consolidated for each State in an excel file and shared with the State level participants during the workshops. Missing data were completed during the workshops by calling the health facilities. The minimum number of deliveries defined by the FMoH for an EmONC health facility is 30 deliveries per month. Participants were therefore asked to select the designated EmONC health facilities within the list of health facilities doing at least 30 deliveries per month.

Population data used for each State is the one used in the EmONC Assessment, from the Central Bureau of Statistics Census 2008, projection made up to 2018. In 2018, the estimated total population in Sudan was 39,598,700.

The estimated[2] gaps in skilled birth attendants is based on the midwifery national norms defined by the FMoH during the national EmONC workshop of November 2018. The FMoH has defined the following national norms:

- Urban Areas: At least 4 midwives in a designated CEmONC health facility located in an urban area and at least 3 midwives in a designated BEmONC health facility located in an urban area.
- Rural Areas: 3 midwives in a designated CEmONC or a BEmONC health facility located in a rural area.
- A midwife working in an EmONC health facility should perform at least 30 deliveries per month

The estimation of the gaps in midwives in each EmONC health facility is based on the number of midwives working in the health facility (part of the shifts).

The gaps in EmONC signal functions were analyzed based on the information provided by the EmONC Assessment of 2018. However, the 2018 assessment highlighted that health facility records were often not complete in the health facilities surveyed and that the number of direct obstetric complications were often missing. The functionality of EmONC health facilities was therefore mostly based on the interview of health providers and on the availability of essential medicine and equipment and it was not cross-checked with the number of obstetric complications and the availability of care 24h7d. Therefore, in the EmONC Assessment and in this report, the functionality of the EmONC health facilities reflects more the readiness of the EmONC health facility to perform the EmONC signal functions. The first national monitoring of the designated network of EmONC health facilities will provide the EmONC availability in Sudan.

The analysis of the referral linkages between the BEmONC and the CEmONc health facilities was done by the State level participants based on their knowledge. They estimated:

- The duration of the referral between the call for an ambulance or other transportation mean and the arrival of the patient in the CEmONC health facility
- The quality of the referral linkage between the BEmONC and the CEmONC health facility
- The estimation of the financial cost for the referral (out of pocket cost for the patient).

This analysis is detailed in the excel file of each State and is summarized using the following color code:

- Green: referrals are generally unproblematic and done in less than 2 hours;
- Orange: difficulties with referral link related to problems that can be easily solved, generally by the health sector itself, and/or a reference between 2 and 4 hours
- Red: major problems with referral links generally related to the state of travel routes or with river crossings, which are difficult to resolve in the medium term and which often involve other sectors than the health sector, and/or a reference above 4 hours.

The State level prioritization workshops included presentations from the FMoH and UNFPA on the concepts of network of EmONC health facilities, on the prioritization criteria and on the EmONC monitoring and quality improvement. The University of Geneva also presented the concepts of Geographic Information System (GIS) and the use of maps to visualize the population covered by the network of EmONC health facilities within 2h of travel time. Following the presentations, the participants worked in small groups to identify the EmONC facility network for each State, using maps and statistics of the population covered by the EmONC network within 2h travel time that were developed in real time by the GIS experts and the University of Geneva. The CEmONC health facilities and the functioning EmONC health facilities (according to the 2018 EmONC assessment) were selected in the first list proposed by each State level team.

d) Geographic Information System (GIS) mapping

In order to be able to perform the AccessMod analysis and produce the maps and statistics for this report, a number of geographic layers are required. Some of these layers come directly from the country while others come from international sources. Among these, that concerning the distribution of the population plays a key role. We used the unconstrained Worldpop population data set (https://www.worldpop.org/project/categories?id=3), as there was no other high-resolution data set (e.g. the one from CIESIN / FACEBOOK) for Sudan available at the time of the in-country workshops. AccessMod has been used for all accessibility analysis analysis to produce three types of maps for each region:

- Map 1: Population density map on which is overlaid all the maternities, roads and barriers to movement (rivers, lakes);
- Map 2: Geographic accessibility map (travel time to the nearest maternity) calculated with the maternities that must constitute the selected EmONC network;
- Map 3: Map of the catchment areas at 120 minutes maximum travel time to each of the selected EmONC maternity.

The GIS team also used the "Zonal statistics" tool in AccessMod, applied on the accessibility map, to calculate the percentage of the population that is within 2 hours of access to each of the maternities considered (physical access), without taking into account State administrative limits. A first scenario of the travel speeds of pregnant women was discussed and proposed by the participants in the capacity building workshop on AccessMod. This scenario was then discussed and modified by the State experts of the regional workshops. The goal of these travel scenarios is to establish the means and travel speeds of pregnant women who must join an EmONC quickly, taking into account the geographical

realities and the constraints for travel, by assigning average travel speeds on the different road types and off-road. These scenarios were State-specific according to the State travel specificities, and are presented in Annex 1.

The working hypothesis for the transport model of most States was that the target population (the women having to reach an EmONC facility as quickly as possible) walk (or is transported at low speed) to the nearest road, then continue the road trip with a motor vehicle that is immediately available. Somes States such as the one in the Darfur region adopted a model by which only transport by vehicles occurs and anywhere on or off roads.

e) Limitations

On data:

- The population distribution data from WorldPop tends to smooth out population in areas where there is no population. This could lead to a small under-estimation of accessibility. However, because the population in Sudan is found mainly along the Nile river and in cities, this effect should not be too pronounced.
- Data on the road network are based on OSM (open street map) data and national roads based on maps from the Ministry of Transport and Roads. Maps not available or updated for primary and secondary roads.This can lead to an under-estimation of the physical accessibility in some regions.
- EmONC and MNH data are from the EmONC assessment conducted in 2018 and some data were not available in the registers of the health facilities, for example the number of direct obstetric complications. As mentioned above, this is a limitation for the analysis of the functionality of the EmONC health facilities.

On geographic accessibility analysis:

- The geographic accessibility is based on the underlying assumption that women will always go to the closest EmONC health facility (from their home) in terms of travel time. This may not reflect the reality as women may bypass the closest EmONC facility to go to another EmONC health facility for reasons such as better quality of care, economic constraints (for example if the closest EmONC health facility is a private institution). The geographic accessibility to EmONC that is modeled using the approach implemented in Sudan (and in other countries using the same approach) may therefore be overestimated.
- The travel scenarios (means of transport and average related speed associated with each type of roads and land cover type outside the roads) has been discussed and informed by national road experts and by the State level participants in the prioritization workshops. While a specific travel scenario has been defined for each State, the proposed scenario is still an average for the State and some local specificities may not have been captured. For urban areas, the travel scenarios did not take into account the traffic jams. Moreover, travel scenarios are based on the situation during the dry season. Additional barriers (e.g. waddies) and slower travel speeds may be encountered in some States during the wet season, which would lower accessibility to some EmONC facilities.
- The duration of referrals between BEmONC and CEmONC health facilities have been informed by the State level experts. There may be some differences between these empiric travel times and the ones estimated by the model with AccessMod (displayed on the physical accessibility maps). For example, the modeled travel time for a reference can be more important than the empiric travel time. This can be due to various factors, such as the means of transport used (ex. Ambulance for reference between BEmONC and CEmONC vs other means of transportation), a high travel speed for references, missing information on part of the road network (eg. missing road, different

quality of the roads influencing the travel speed) or on obstacles (eg. river) or on frequent traffic jams.
- When a road is crossing a river, we assume that there is a functioning bridge, except if we received other information from the State stakeholders or the GIS experts
- Some areas of the country are facing high insecurity which strongly limits the movement of population. In this case, the roads of these regions were considered as closed or for walking only (eg. in Blue Nile State).

On the results of the prioritization workshops

- The State level workshops for the identification of the EmONC network were organized from November 2018 to February 2019. The analysis of the proposed EmONC health facilities by the FMoH and UNFPA was delayed to the end of 2019 and in 2020 due to the political transition in Sudan and the COVID19 pandemic. The results of this analysis is presented in the second part of this technical report and will serve as the basis for the validation by each State and by the FMoH of the network of EmONC health facilities. This validation will take place in 2021 and some data (such as the number of deliveries) may be updated for informing it.

3.2.5. Analysis of the results from the State level workshops for the identification of the EmONC network

All the maps, the list of designated EmONC health facilities and related information produced by the State working groups have been analyzed in 2019 and 2020 by a team of experts composed of the FMoH, UNFPA (including an international consultant), the University of Geneva and a national GIS expert. The results of this analysis are presented below. The suggestions and the comments from the experts on the EmONC health facilities proposed by the State Stakeholders are clearly highlighted under the section "Analysis by the expert team". These suggestions will be discussed in 2021 with the State stakeholders and the FMoH during the validation of the EMONC network.

IV National Analysis and Results

4.1. Overview of the designated EmONC network in the 18 States (as proposed by the State stakeholders)

Under the leadership of the Maternal and Child Health Department of the FMoH, the 18 State Directors for MNH and their teams have identified 167 designated EmONC health facilities (based on the approach described above) - about 40% of the maximum number of 396 designated EmONC health facilities based on the norm of 5 EmONC health facilities for 500,000 population. By taking into account the possibility for the catchment of an EmONC health facility to expand beyond the administrative border of the State, an estimated 92% of the population in Sudan is located within 2 hours of travel time from the closest designated EmONC health facility. As described above, the team of experts composed of the FMoH and UNFPA analyzed each of the proposed designated EmONC health facilities as well as the other health facility with routine deliveries (more than 30 deliveries per month) that were not selected by the State teams. Based on its analysis, the team of experts designated 158 EmONC health facilities also covering 92% of the population in Sudan within 2 hours of travel time. With less designated EmONC health facilities, the coverage of the population by the EmONC network proposed by the expert team is similar to the one proposed by the State level teams. Chapter V provides the details of the proposed changes. By reducing the number of designated EmONC health facilities well below the norm of 5 EmONC per 500,000 population while keeping a good coverage of the population within 2h of travel time, Sudan will have the opportunity to focus its resources on fewer EmONC health facilities in order to make them functioning 24h/7d with quality of care by the end of the current programmatic cycle (eg. coming 3-4 years).

The map below shows the CEmONC and BEmONC health facilities designated by the State's working group and how they were selected in areas with high population density. In Sudan, the population is highly concentrated around the two Nile rivers and in the States of Khartoum, El Gazira, and in the Darfur States on the West side of the country. It is important to keep in mind that in addition of the designated EmONC health facilities, normal deliveries will still be managed in lower level health facilities (non EmONC health facilities) and it is important to strengthen the quality of care provided in these health facilities and to link them with the EmONC network for referral in the case of a complication. The map also shows the road network in Sudan. The Northern part of the country has few roads but it is mostly a desertic region where the population can drive off road during most of the year. It is less the case in the Southern part of the country where some regions are isolated due to the poor road network or due to the poor conditions of roads during the rainy season. This impacts the coverage of the population by the network of EmONC health facilities.

Figure 4: Map of the population density and the national EmONC network (proposed by the State stakeholders) in Sudan

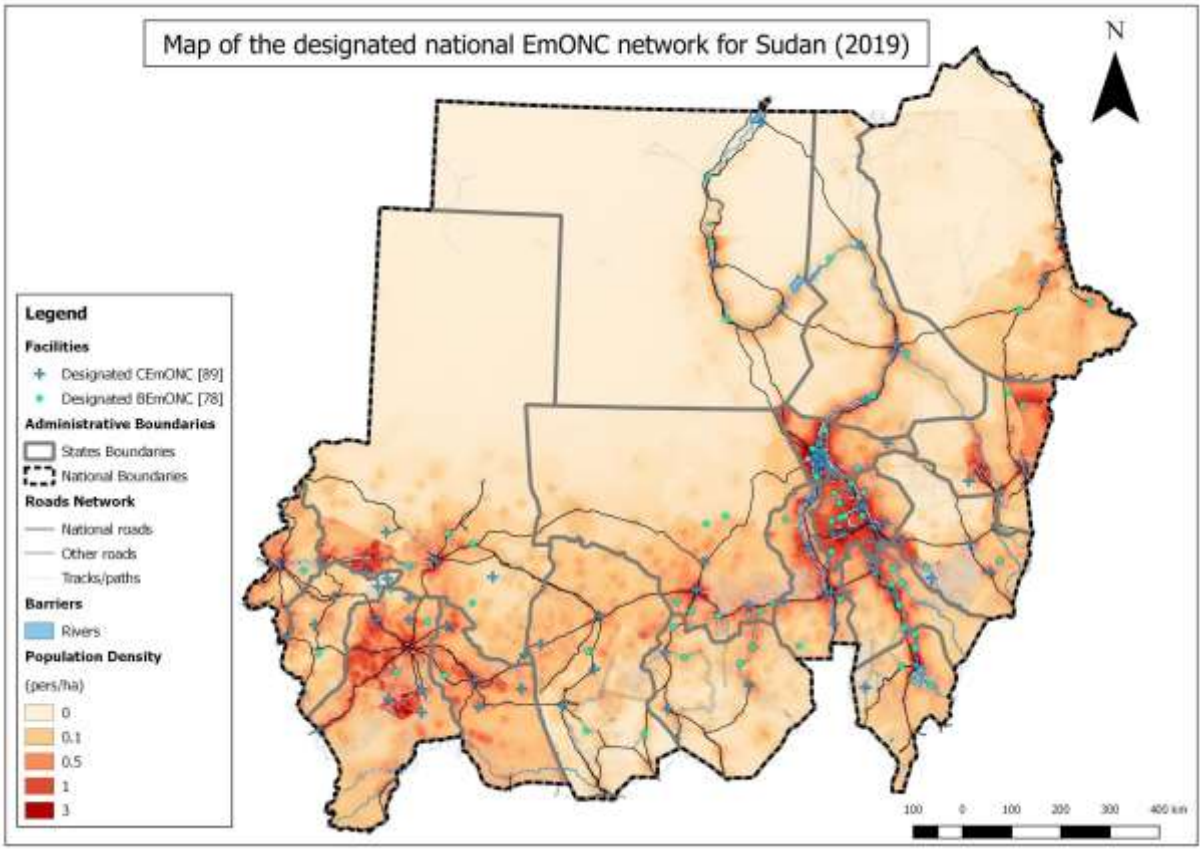


Table 1 below summarizes the identification of the national EmONC network by the State working groups. In order to ensure a good balance between the selection of a limited number of EmONC health facilities in order to make them functioning 24h7d and a good coverage of the population within 2 hours of travel time, the FMoH asked the State stakeholders to designate a number of EmONc health facilities below or equal to half the norm of 5 EmONC per 500,000 population. Eleven State teams have reached this objective: 8 teams have designated a number of EmONC health facilities below the recommendation of the FMoH (half the norm) and 3 teams have designated a number of EmONC health facilities equal to half of the norm of 5 EmONC per 500,000 population. Khartoum has strategically selected 25 EmONC health facilities, well below the 36 EmONC health facilities corresponding to half of the norm. However, 7 States (highlighted in red in the table below) have designated a number of EmONC health facilities slightly above the recommendation. For 4 of these States (Blue Nile, Northern, Central Darfur, and West Darfur), the expert support team also designated a number slightly higher than the recommendations due to the specific local context of these States.

Table 1: Number of designated and functioning EmONC health facilities in each State (by the State working group and by the experts support team – detailed list of health facilities available in appendix)

States	Number of CEmONC		Number of BEmONC		Total number of designated EmONC by the State teams	MAX number of recommended EmONC by the FMoH (half the norm of 5 per 500,000 pop.)	Total number of designated EmONC by the expert support team (# of facilities in common with the State group)
	Designated	Functioning	Designated	Functioning			
North Kordofan	3	2	7	0	10	12	10 (6)
Blue Nile	2	1	5	0	7	5	6 (6)
Sinnar	3	2	7	3*	10	8	9 (9)
Gedarif	5	2	3	0	8	10	7 (7)
Kassala	3	3	3	0	6	11	5 (5)
Red Sea	3	2	3	0	6	7	5 (5)
River Nile	4	2	4	0	8	7	10 (7)
Khartoum	15	7	10	2*	25	36	25 (20)
El Gazira	9	6	11	6*	20	23	19 (19)
White Nile	6	2	3	1	9	11	9 (8)
South Kordofan	3	1	4	1*+1	7	7	7 (7)
West Kordofan	3	3	4	0	7	5	6 (6)
Northern	3	1	3	0	6	4	6 (6)
North Darfur	5	2	6	1	11	11	7 (7)
East Darfur	4	0	1	0	5	5	5 (5)
South Darfur	8	2	3	0	11	19	12 (7)
Central Darfur	5	0	1	0	6	4	5 (5)
West Darfur	4	1	1	1	5	4	5 (4)
TOTAL	**88**	**39**	**79**	**16**	**167**	**189**	**158 (139)**

*These health facilities were designated as BEmONC health facilities by the working group but are functioning CEmONC health facilities (based on the EmONC NA) and are suggested as designated CEmONC health facilities by the support team

The State teams have designated 88 CEmONC and 79 BEmONC health facilities, for a total of 167 EmONC health facilities (below the 189 health facilities corresponding to half of the norm of 5 EmONC per 500,000 population). Among these health facilities, there are only 55 EmONC health facilities providing the EmONC signal functions - based on the EmONC Assessment of 2018 and further analysis by the State working groups. The States of Khartoum and El Gazira have the highest number of functioning health facilities. The EmONC availability for the national EmONC network designated by the State Working Group is 33% (55/167). In addition, none of the States have all the designated EmONC health facilities functioning. The first EmONC monitoring that is planned in 2021 will update the functionality of the designated EmONC health facilities.

The low EmONC availability in Sudan highlights the importance of limiting the spread of scarce resources (including human resources such as midwives) to make these designated EmONC health facilities functioning 24h7d with quality of care. While the State teams have made an important prioritization effort, the support team suggests to slightly reducing the national designated EmONC network in Sudan from 167 designated EmONC health facilities to 158 EmONC health facilities (with 114 designated CEmONC health facilities and 44 designated BEmONC health facilities). Among the 158 EmONC health facilities proposed by the support team, 139 were proposed by the State working group and among these, 21 health facilities are proposed by the support team as designated CEmONC instead of designated BEmONC health facilities (cf. table 2). The EmONC availability for the national designated EmONC network proposed by the Support Team is 40% (63/158). All the changes suggested by the expert support team are explained in the Chapter V (State Analysis). If the proposed national EmONC network of 158 designated EmONC health facilities is agreed by the FMoH and the States, one of the objectives of the national maternal and newborn health plan for the next one or two programmatic cycles should be to make them all functioning 24h7d.

Table 2: Overview of the designated EmONC health facilities in each State (by the State working group and by the experts support team – detailed list of health facilities available in appendix)

States	Number of CEmONC - State working Group		Number of BEmONC - State working Group		Number of CEmONC - Support team		Number of BEmONC - Support team	
	Designated	**Functioning**	**Designated**	**Functioning**	**Designated** (# of facilities in common with the State group)	**Functioning** (# of facilities in common with the State group)	**Designated** (# of facilities in common with the State group)	**Functioning** (# of facilities in common with the State group)
North Kordofan	3	2	7*	0	4 (4)	2 (2)	6 (2)	0
Blue Nile	2	1	5	0	2 (2)	1 (1)	4 (4)	0
Sinnar	3	2	7*	3**	7 (7)	5 (5)	2 (2)	0
Gedarif	5	2	3	0	5 (5)	2 (2)	2 (2)	0
Kassala	3	3	3	0	3 (3)	3 (3)	2 (2)	0
Red Sea	3	2	3	0	2 (2)	2 (2)	3 (3)	0
River Nile	4	2	4*	0	9 (6)	5 (2)	1 (1)	0
Khartoum	15	7	10*	2**	20 (16)	13 (9)	5 (4)	0
El Gazira	9	6	11*	6**	18 (18)	12 (12)	1 (1)	0
White Nile	6	2	3	1	6 (6)	3 (2)	2 (1)	1 (1)
South Kordofan	3	1	4*	1**+1	4 (4)	2 (2)	3 (3)	1 (1)
West Kordofan	4	3	3	0	4 (4)	3 (3)	3 (3)	0
Northern	3	1	3*	0	5 (5)	1 (1)	1 (1)	0
North Darfur	5	2	6	1	4 (4)	2 (2)	3 (3)	1 (1)
East Darfur	4	0	1	0	4 (4)	0	1 (1)	0
South Darfur	8	2	3	0	9 (5)	2 (2)	3 (2)	0
Central Darfur	5	0	1	0	5 (5)	0	0	0
West Darfur	4	1	1	1	3 (3)	1 (1)	2 (1)	1(1)
TOTAL	**88**	**39**	**79***	**16**	**114 (103)**	**59 (51)**	**44 (36)**	**4 (4)**

*Some health facilities designated as BEmONC by the State working groups are proposed as designated CEmONC by the support team (details are provided in table 6 below)
** Health facilities designated as BEmONC by the State working groups while they are functioning CEmONC

4.2. Population covered by the designated EmONC network in the 18 States (as proposed by the State stakeholders)

Table 3 below provides the estimation of the population living within 2h of travel time from the closest designated EmONC health facility. Such estimation is a critical innovation included in the UNFPA's approach to the EmONC network and allows to balance the selection of a limited number of EmONC health facilities while ensuring a good coverage of the population.

In Sudan, all the 690 maternities cover 96% of the population within 2h travel time. The 167 EmONC health facilities designated by the State working group cover 92% of the population. Among these designated health facilities, the 55 functioning EmONC health facilities selected for the EmONC network by the State working group cover 74% of the population. These results confirm the importance of focusing the scarce resources available on this limited number of EmONC health facilities to make them functioning as it is possible to cover with 167 EmONC health facilities a similar proportion of the population than with all the maternities of the country.

Table 3: Estimation of the proportion of the population (in %) living within 2 hours travel time from (1) the closest maternity, (2) the closest designated EmONC health facility, (3) the closest EmONC health facility 'ready' to perform the EmONC signal functions

States	All maternities (taking into account bordering States)	State Working Group propositions				Support team propositions			
		Population coverage of the designated EmONC health facilities within 2h travel time		Population coverage of the functioning EmONC health facilities within 2h travel time		Population coverage of the designated EmONC health facilities within 2h travel time		Population coverage of the functioning EmONC health facilities within 2h travel time	
		Coverage for the State	Coverage taking into account bordering States	Coverage for the State	Coverage taking into account bordering States	Coverage for the State	Coverage taking into account bordering States	Coverage for the State	Coverage taking into account bordering States
North Kordofan	96%	77%	83%	67%	72%	84%	90%	67%	72%
Blue Nile	53%	49%	49%	38%	38%	48%	49%	38%	38%
Sinnar	100%	91%	100%	84%	89%	91%	96%	84%	91%
Gedarif	100%	95%	99%	49%	61%	93%	96%	49%	61%
Kassala	99%	96%	97%	70%	71%	95%	96%	70%	71%
Red Sea	92%	79%	85%	61%	62%	79%	85%	61%	62%
River Nile	94%	84%	89%	79%	81%	84%	88%	79%	82%
Khartoum	100%	100%	100%	99%	99%	100%	100%	99%	99%
El Gazira	100%	100%	100%	100%	100%	100%	100%	100%	100%
White Nile	100%	100%	100%	76%	90%	100%	100%	84%	94%
South Kordofan	97%	88%	89%	80%	81%	88%	89%	80%	81%
West Kordofan	98	82%	90%	70%	77%	76%	88%	69%	77%
Northern	87%	83%	84%	33%	34%	83%	84%	33%	34%
North Darfur	95%	88%	89%	60%	75%	80%	83%	60%	75%
East Darfur	90%	81%	82%	0%	29%	81%	82%	0%	29%
South	96%	95%	96%	43%	43%	95%	96%	43%	43%

Darfur									
Central Darfur	100%	99%	99%	0%	20%	99%	99%	0%	20%
West Darfur	100%	100%	100%	90%	90%	100%	100%	90%	90%
TOTAL	**96%**	**91%**	**93%**	**69%**	**74%**	**90%**	**93%**	**70%**	**75%**

Based on the States selection, seven States (Sinnar, Gedarif, Khartoum, Al Gazira, White Nile, Central and West Darfur) have a network of designated EmONC health facilities covering their respective entire population within 2h travel time. Three other States (Kassala, West Kordofan, and South darfur) have a coverage above 90% and all the other States have a coverage between 80% and 90%, except Blue Nile State with the lowest coverage of 49%. This low coverage is similar for all the maternities of the Blue Nile State and can be explained by a poor road network across the State and insecurity in the Southern part of the State where no EmONC health facilities could be designated due to access issues.

The table shows that it is possible to cover a similar proportion of the population within 2h travel time with 158 designated EmONC health facilities than with 167 designated EmONC health facilities and the difference in coverage is small with the 690 maternities of the country. This result further support the importance of focusing scarce resources on a lower number of designated EmONC health facilities in order to make them functioning 24h/7d with quality of care. The objective for the country is to increase the proportion of the population covered by functioning EmONC health facilities within 2h of travel time from 74% to 92% in the next programmatic cycle (2022-2025). The analysis at State level described below highlights disparities between States in terms of the coverage of the population to functioning EmONC health facilities.

Three States, Khartoum, El Gazira, and West Darfur have at least 90% of the population within 2h travel time from the closest functioning EmONC health facility.

Figures 5a and 5b show the physical accessibility to the national EmONC network in Sudan designated by the States working groups and to the functioning EmONc health facilities. The green areas (accessibility to the closest designated EmONC health facility from home within 2 hours) follows the road network and the rivers, especially the two Niles where there is a high population density. The yellow and orange areas (access between 3-4h travel time) are broad in the Northern part of the country (composed of desert) where it is relatively easy for the population to circulate with motorized vehicles off roads. The red areas (access in more than 4h travel time) are mostly located in the Northern-West and Northern-East parts of the country, which have a low population density. The map also reflects well the physical accessibility challenges of the Blue Nile State with most of the State being in red, including areas with high population density.

Figure 5a: Map of the physical accessibility to the closest designated EmONC health facility (proposed by the State stakeholders) in Sudan

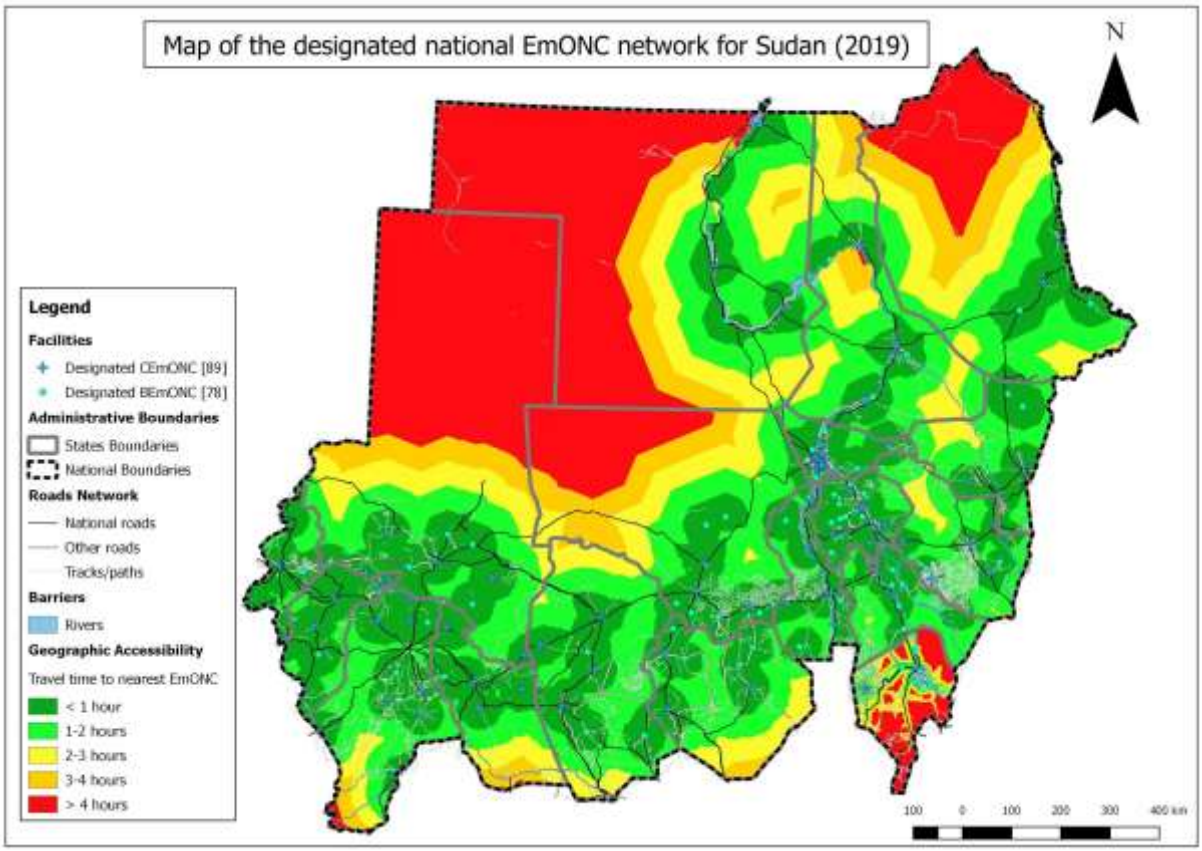
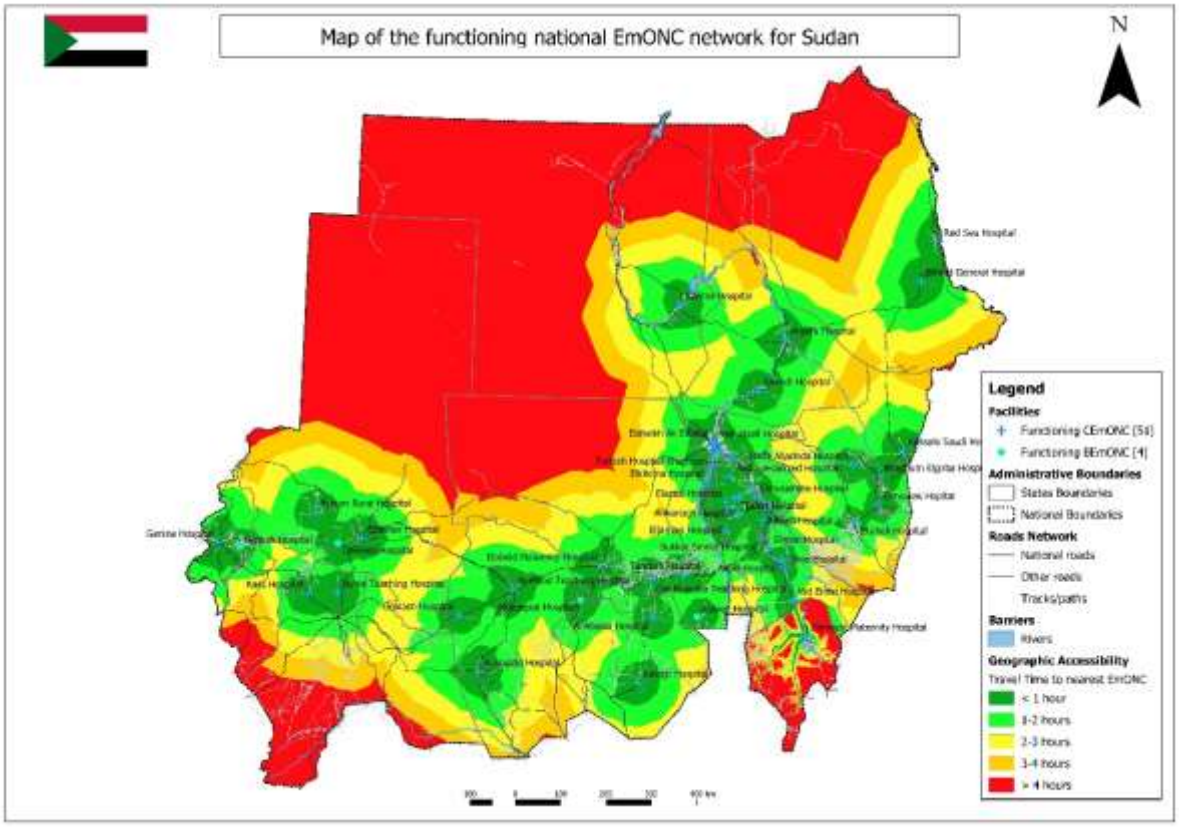


Figure 5b: Map of the physical accessibility to the closest functioning EmONC health facility in Sudan (based on the 55 functioning EmONc health facilities included in the EmONC network designated by State Working Groups)



4.3. Referral linkages between designated BEmONC and CEmONC health facilities in the 18 States (as proposed by the State stakeholders)

In order to organize the EmONC health facilities in a network and ensure that each BEmONC health facility can refer to a CEmONC health facility for obstetric and neonatal complications that cannot be managed in a BEmONC health facility, it is important to closely monitor the quality of each referral linkage and address potential financial and other barriers. In the context of reference of an emergency, it is critical to assess the quality of the referral link using travel time. For the referral linkages to be functioning and effective, the staff of a BEmONC health facility need to know, collaborate and communicate with the staff of the closest CEmONC health facility.

Table 4 provides an overview of the quality of the 93 referral linkages identified by the State teams between the designated BEmONC and CEmONC health facilities (a BEmONC health facility could refer to more than one CEmONC health facility). These linkages are described in Chapter V.

Overall, the State teams consider that more than half of the referral linkages in the designated EmONC network are good ('green'), 47% have issues that should be solved by the health sector ('orange'), and 4% have major issues that should also be solved by other sectors (eg. infrastructure). These proportions are important to monitor and to improve as they show that many BEmONC health facilities still have issues to refer their patients to the closest CEmONC health facility (ies). A referral linkage above 4 hours cannot be accepted between a BEmONC and a CEmONC health facility and if it cannot be improved, other advanced strategies should be considered and are described in Chapter V.

All regions have also highlighted financial barriers for the referrals, with average referral costs between 20 and 100 USD in Blue Nile and South Darfur States. These costs cannot be afforded by the majority of the population. Transportation means are missing in several States, including ambulances. And when ambulances are available, they can be in poor state. Finally, some areas face insecurity which can affect referrals.

Table 4: Referral linkages between designated BEmONC and CEmONC health facilities (by the State Working Group) in Sudan

States	Number of 'green' links	Number of 'orange' links	Number of 'red' links	Major obstacles identified (for the 'orange' links - can be addressed by the FMoH)
North Kordofan	4	3	0	financial barriers (no details provided by the State working group)
Blue Nile	0	4	0	financial barriers (50 USD), poor road network
Sinnar	0	7	0	financial barriers (10 to 20 USD), fuel shortage, poor road network
Gedarif	0	4	0	financial barriers, poor road network especially in rainy season, lack of ambulances
Kassala	1	3	0	financial barriers (10 USD)
Red Sea	3	1	0	financial barriers (10 USD), socio-cultural habits
River Nile	0	4	0	financial barriers (10 to 15 USD), poor road conditions in rainy season
Khartoum	18	0	0	
El Gazira	11	0	0	
White Nile	1	1	2	financial barriers (20-25 USD), poor road conditions especially in rainy season, public transport not available
South Kordofan	2	3	0	financial barriers (10 to 20 USD), insecurity
West Kordofan	0	4	0	financial barriers, road in poor conditions
Northern	0	5	0	financial barriers (30 USD)
North	4	2	0	financial barriers

Darfur				
East Darfur	0	1	0	financial barriers (50 USD for ambulance, 100 USD by taxi)
South Darfur	1	1	1	financial barriers (50 USD), poor road conditions
Central Darfur	0	0	1	financial barriers, very poor road conditions
West Darfur	0	1	0	financial barriers (50 Fuel USD + 10 USD for staff)
TOTAL	**45**	**44**	**4**	

4.4. Human resources for health in designated BEmONC and CEmONC health facilities in the 18 States (as proposed by the State stakeholders)

The EmONC health facilities should provide quality maternal and newborn healthcare and serve as a platform for the integration of reproductive health services. In order for these facilities to provide quality care 24h7d, they need to be staffed by skilled health personnel, particularly obstetricians/gynecologists, anesthetists, and midwives (educated to international standards WHO/ICM). These essential health cadres should be supported by cleaners and security agents. All should be educated and trained to the needed standards, deployed in sufficient numbers, supported in their career. This report will focus on the deployment of the midwives who are the main health workforce needed to make the designated EmONC health facilities functioning 24h and 7d with quality of care and accelerate the reduction of maternal mortality in Sudan. In order to assess the gap in midwives in Sudan, only the graduate nurse midwives/'sister' midwives (3 years nursing diploma + 1 year midwifery) and the nurse midwives (nursing certificate + 1 year midwifery) will be considered in our analysis as these cadres are the ones which are the closest to the ICM/WHO standards of midwives. Bachelor midwives were also included but there are very few graduates to date.

4.1. Number of midwives and obstetricians in the 18 States designated EmONC health facilities

During the national EmONC workshop in November 2018, the FMoH and the States representatives defined two parameters related to midwives in EmONC health facilities. The first parameter is that each EmONC health facility should have a minimum of midwives (educated to international standards) as part of the shifts to ensure availability of services 24h/7d: minimum 4 midwives for a CEmONC health facility in urban area and minimum 3 midwives in a CEmONC health facility in a rural area and in a BEmONC health facility (in an urban or rural area). The second parameter relates to the capacity of midwives to manage deliveries and the quality of the care provided by considering that each midwife should do a minimum of 30 deliveries per month in order to be able to manage the major obstetric and neonatal complications.

These parameters allow analysis of the gaps in midwives in each designated EmONC health facility. Overall, based on these parameters, an estimated 367 midwives are missing in the short and medium term in the 167 EmONC health facilities designated by the State working groups. This estimation corresponds to the difference between the number of midwives needed in each designated EmONC

health facility (to ensure care 24h/7d, adjusted based on the total number of deliveries per month) and the number of midwives who are part of the shifts (including both graduate nurse midwives and nurse midwives). In the long term, an estimated 536 midwives are missing in the 167 designated EmONC health facilities (by not including anymore the nurse midwives in the calculation and by taking the assumption that the 367 missing midwives in the short and medium term are deployed).

In light of their important obstetric activity, there is an urgent need of 219 additional midwives in the CEmONC health facilities. The need in the BEmONC health facilities is also important with 148 additional midwives needed. Only two States have 70% or more of their designated EmONC health facilities that have no gaps in midwives in the short and medium term (Sinnar State with 70% and White Nile with 78%). Height States have only between 25% and 55% of their designated EmONC health facilities that have nos gaps in midwives (North Kordofan with 30%, Gedarif with 25%, Red Sea with 33%, River Nile with 38%, Khartoum with 44%, El Gazira with 55%, South Kordofan with 43%, West Kordofan with 29%). Six States have all their designated EmONC health facilities with gaps in midwives (Kassala, Northern, East Darfur, South Darfur, Central Darfur, and West Darfur).

In the national EmONC network, there are only 59 designated EmONC health facilities (35% out of the 167 designated EmONC health facilities) that have no gaps in midwives. Facing such important gaps in competent midwives, the FMoH should give high priority to midwifery training to be in line with international standards. Such intervention will be essential for ensuring the functionality of the designated EmONC network in Sudan.

Table 5: Immediate needs of midwives in the designated EmONC health facilities (by the State working groups) in the 18 States

States	Number of missing midwives (short/medium term)			Proportion of designated EmONC health facilities without gaps in midwives (short/medium term)	Number of missing midwives (long term)		
	In designated CEmONC health facilities	In designated BEmONC health facilities	Total		In designated CEmONC health facilities	In designated BEmONC health facilities	Total
North Kordofan	15	16	31	2/10	17	5	22
Blue Nile	3	16	19	1/7	0	0	0
Sinnar	11	13	24	2/10	18	10	28
Gedarif	9	7	16	2/8	30	2	32
Kassala	7	8	15	0/6	36	1	37
Red Sea	12	2	14	2/6	16	7	23
River Nile	5	7	12	3/8	27	6	33
Khartoum	48	10	58	11/25	109	27	136
El Gazira	20	10	30	11/20	73	29	102

White Nile	0	6	6	7/9	3	0	3
South Kordofan	2	7	9	3/7	15	6	21
West Kordofan	7	9	16	2/7	11	0	11
Northern	21	9	30	0/6	7	6	13
North Darfur	8	15	23	2/11	22	3	25
East Darfur	19	3	22	0/5	2	0	2
South Darfur	13	3	16	8/11	29	6	35
Central Darfur	9	4	13	2/6	6	0	6
West Darfur	10	3	13	1/5	7	0	7
TOTAL	**219**	**148**	**367**	**59/167**	**428**	**108**	**536**

The short and medium term gap of midwives in the EmONC network advised by the support team is 332 and the long-term gap in midwives is 591.

Table 6 below provides the distribution of obstetricians in the national EmONC network designated by the State teams. Data are from the EmONC Assessment of 2018. There are 446 obstetricians deployed in the national EmONC network designated by the State teams. In addition, there is a high disparity of the distribution of obstetricians in the CEmONC health facilities across States. As expected, Khartoum has a high number of obstetricians with 35% of the 385 deployed in CEmONC health facilities. But the majority of the obstetricians (about 70%) are deployed in four States (Khartoum, El Gazira, West Kordofan, and White Nile). Consequently, 6 States have 5 or less obstetricians deployed in their designated CEmONC health facilities (Blue Nile, River Nile, South Kordofan, East Darfur, Central Darfur, and West Darfur).

A majority (385 meaning 86%) of obstetricians are deployed in a CEmONC health facility but the remaining 61 are unexpectedly deployed in 33 designated BEmONC health facilities (in 9 of the 18 States). Some of these BEmONC health facilities have good obstetric activity. As obstetricians should only be deployed in CEmONC health facilities, it would be important for the FMoH to confirm the number of obstetricians in each of these designated BEmONC health facilities and based on the number of deliveries per month, their catchment areas, their infrastructure, and their link with the closest CEmONC health facility to either reassign the obstetricians in designated CEmONC health facilities or to change the designation of the BEmONC health facility to CEmONC. In its recommendation of 158 designated EmONC health facilities, the support team does not recommend to include the following 2 designated BEmONC health facilities with an OBGYN in the EmONC

network due to their very low obstetric activity: Wad Aljabal Hospital and Elkhojabal Center (Khartoum). In addition, the support teams suggested to designate as CEmONC health facilities the following 21 health facilities with at least an obstetrician that were designated as BEmONC by the State working group (as some of these health facilities have a high obstetric activity and C-sections): Arahad Hospital (North Kordofan); Dinder Hospital, Assoki Hospital, Wd Elniel Hospital, Sukkar Sinnar Hospital (Sinnar); Elnorab Hospital, Wd Hamid (River Nile); Jebel Awlia Hospital, Haf Alsafi Hospital (Khartoum); Elhuda Hospital, Eljamosi Hospital, Elazazi Hospital, Tabat Hospital, Abogotta, Elmusalmea Hospital, Almehariba Hospital, Alrebie Hospital, and Wd Elhadad (El Gazira); Al-Abasia Hospital (South Kordofan); and Elburgeg Hospital and Eldaba Hospital (Northern).

Table 6: Distribution of obstetricians/gynecologists in the designated EmONC health facilities facilities (by the State working groups) in the 18 States of Sudan

States	**Number of obstetricians/gynecologists (including registrars) in the designated EmONC network**		
	In designated CEmONC health facilities	**In designated BEmONC health facilities**	**Total**
North Kordofan	18	1 (Arahad Hospital for 68 deliveries per month, including 19 C-sections per month)*	19
Blue Nile	3	0	3
Sinnar	12	2 (Dinder Hospital for 103 deliveries per month, including 62 C-sections per month)* 2 (Assoki Hospital for 52 deliveries per month, including 18 C-sections per month)* 1 (Wd Elniel Hospital for 60 deliveries per month, including 31 C-sections per month)* 1 (Doba Hospital for 38 deliveries per month, including 7 C-sections per month) 1 (Sukkar Sinnar Hospital for 80 deliveries per month, including 18 C-sections per month)* 1 (Karkoj Hospital for 33 deliveries per month)	20
Gedarif	16	1 (Almafaza hospital for 33 deliveries per month, including 2 C-sections per month)	17
Kassala	16	0	16
Red Sea	10	1 (Tukar rural Hospital for 27 deliveries per month including 5 C-sections per month) 1 (Swaken Hospital for 81 deliveries per month, including 3 C-sections per month) 1 (Hya General Hospital for 17 deliveries per month, including 2 C-sections per month)	13
River Nile	5	6 (Elnorab Hospital for 99 deliveries per month, including 22 C-sections per month)* 1 (Wd Hamid for 45 deliveries per month, including 13 C-sections per month)* 1 (Sidoon Hospital for 31 deliveries per month)	13

Khartoum	136	3 (Eljazeera Slang Slanj Island for 48 deliveries per month, including 1 C-section per month) 5 (Jebel Awlia Hospital for 175 deliveries per month, including 64 C-sections per month)* 10 (Haf Alsafi Hospital for 252 deliveries per month, including 53 C-sections per month)* 2 (Wad Aljabal Hospital for 21 deliveries per month, including 5 C-sections per month) 4 (Elfateh Hospital for 91 deliveries per month, including 2 C-sections per month) 2 (ElKhojalab Center for 22 deliveries per month)	162
El Gazira	49	1 (Elhuda Hospital for 50 deliveries per month, including 32 C-sections per month)* 1 (Eljamosi Hospital for 33 deliveries per month, including 12 C-sections per month)* 1 (Elazazi Hospital for 69 deliveries per month, including 24 C-sections per month)* 1 (Tabat Hospital for 95 deliveries per month, including 43 C-sections per month)* 1 (Abogotta for 107 deliveries per month, including 69 C-sections per month)* 1 (Elmusalmea Hospital for 32 deliveries per month, including 11 C-sections per month)* 1 (Almehariba Hospital for 31 deliveries per month, including 12 C-sections per month)* 1 (Alrebie Hospital for 64 deliveries per month, including 40 C-sections per month)* 1 (Wd Rawa Hospital for 43 deliveries per month, including 4 C-sections per month) 1 (Wd Elhadad for 42 deliveries per month, including 30 C-sections per month)*	59
White Nile	21	0	21
South Kordofan	4	1 (Al-Abasia Hospital for 47 deliveries per month, including 8 C-sections per month)*	5
West Kordofan	58	0	58
Northern	9	1 (Elburgeg Hospital for 179 deliveries per month, including 54 C-sections per month)* 2 (Eldaba Hospital for 153 deliveries per month, including 46 C-sections per month)*	12
North Darfur	9	0	9
East Darfur	2	0	2
South Darfur	8	0	8
Central Darfur	5	0	5

West Darfur	4	0	4
TOTAL	**385**	**61**	**446**

*Health facilities designated as BEmONC by the State working groups but proposed as designated CEmONC by the support team

4.5. Functionality of the BEmONC and CEmONC health facilities in the 18 States (as proposed by the State stakeholders)

The monitoring of the use of healthcare services and the management of obstetric emergencies is partly done through the analysis of the EmONC signal functions. These signal functions are also 'proxy' of the quality of care provided but it is important to note that the set-up of a network of functional EmONC health facilities is only one step towards the improvement of the quality of the management of obstetric complications. It only reflects that the basic conditions are in place in order to strengthen quality of care. A signal function needs to be available 24h/7d and be performed in the last 3 months. This definition implies that an EmONC health facility needs to have sufficient obstetric activity in order to manage obstetric emergencies each quarter. The regular management of emergency situations and obstetric complications is essential for the provision of quality care. The gap in signal functions therefore also reflects the quality and organization of services.

Based on the EmONC Assessment of 2018, there were 127 functioning EmONC health facilities in Sudan (112 CEmONC and 15 BEmONC health facilities). However, as highlighted in the limitations of the EmONC Needs Assessment report, the lack of proper registers and data records in many health facilities surveyed did not allow to cross-check the self-assessment of the performance of the signal functions by health facility staff with the essential medicines and equipment to perform these signal functions, with the minimum availability of staff to perform care 24h/7d (minimum 3 midwives based on the national norm of Sudan), and with the number of direct obstetric complications managed – as described in Figure 6 below . As mentioned earlier, the State level prioritization workshops were therefore an opportunity for the State Working Group to perform these cross-checks based on updated information at the time of the workshops and based on their knowledge of the health facilities.

Figure 6: Consistency checks for the performance of EmONC signal functions

Signal functions	Consistency checks (to be included in analysis tool – eg. DHIS2)		
	Number of cases	Availability of essential medicines	Availability of equipment
Administer parenteral antibiotics		- Ampicillin - Metronidazole - Gentamicin	
Administer uterotonic drugs		- Oxytocin	
Administer parenteral anticonvulsants	- Number of cases of (pre) eclampsia/ eclampsia managed >0	- Magnesium Sulfate	
Remove retained products			- Manual Vacuum Aspiration (MVA) kit
Perform assisted vaginal delivery	- Number of deliveries done with vacuum extractor >0		- Vacuum extractor
Perform basic neonatal resuscitation (with bag and mask)	- Number of basic neonatal resuscitation performed >0		- Bag and mask
Perform Caesarean section	- Number of C-sections performed >0		

Source: UNFPA, Implementation Manual for Developing a National Network of Maternity Units – Improving EmONC, UNFPA, 2020 - https://www.unfpa.org/sites/default/files/pub-pdf/UNFPA_Implementation_Manual_for_EmONC_facility_network_Sept_2020_web.pdf

Based on their analysis, the State working group considered that 68 EmONC health facilities were functioning in Sudan in 2018, with 64 functioning CEmONC and 4 functioning BEmONC health facilities (cf. Table 7). The State working groups included 55 of these 68 functioning EmONC health facilities in their designated EmONC network and the support team included 63 functioning EmONC health facilities. For the support team, the remaining 5 functioning EmONC health facilities were not functioning in light of their obstetric activity and availability of essential medicine and equipment. The monitoring of the national EmONC network will be the opportunity to set a new baseline of the functionality of the EmONC network using these cross-checks in the analysis. The very limited number of functional BEmONC health facilities highlights the critical importance to support these health facilities and ensure the deployment of midwives with pre-service education aligned to international standards (WHO/ICM) for the provision of quality EmoNC 24h/7d. None of the States have a fully functional network of EmONC health facilities.

Table 7: Functionality of the EmONC health facilities in the 18 States (based on the EmONC Needs Assessment and the additional analysis of the State working groups by cross-checking the performance of the signal function with the readiness of essential medecines, equipment and staff and with the related number of direct obstetric complications managed)

States	**Number of functioning health facilities**		
	Functioning CEmONC	**Functioning BEmONC**	**Total**
North Kordofan	2 Elobeid Maternity Hospital, Om Ruwaba Teaching Hospital	0	2

Blue Nile	1 Damazin Maternity Hospital	0	1
Sinnar	5 Wd Elniel Hospital, Sinnar Hospital, Sukkar Sinnar Hospital, Asoki Hospital, Sinja Hospital	0	5
Gedarif	2 Eltaheli Hospital, Elshowak Hopital	0	2
Kassala	3 Halfa Aljadeda Hospital, Kassala Saudi Hospital, Khashum Elgirba Hospital	0	3
Red Sea	2 Red Sea Hospital, Sinkat General Hospital	0	2
River Nile	5 Shendi Hospital, Atabra Hospital, Elmatama Hospital, Elmak Nimir Hospital, Elketiab Hospital	0	5
Khartoum	15 Saad Abu Elila Hospital, Omdurman Maternity Hospital, Jebel Awlia Hospital, Elsheikh Ali Elfadul, Khartoum North Hospital, Haf Alsafi Hospital, Turkish, Hospital Khartoum, Shawamikh Hospital, Dar Aelilag Hospital, Royal Care Hospital, Elsaudi Hospital, Elrajaa Specialized Clinic, Soba Hospital, Ribat Police Hospital, Om Doanban	0	15
El Gazira	14 Medenai Maternity Hospital, Alhasahesa Hospital, Almanagil Hospital, Algurashi Hospital, Alhosh Hospital, Elhuda Hospital, Eljamosi Hospital, Elazazi Hospital, Tabat Hospital, Elmusalmea Hospital, Almehariba Hospital, Alhikma Clinic, Eila Specialized Hospital, Jiad Specialized Hospital	0	14
White Nile	3 Kinana Hospital, Tandalti Hospital, Elkiteina Hospital	1 Arawat Hospital	4
South Kordofan	2 Kalogli Hospital	1 Aldepepat Hospital	3

	Al-Abasia Hospital, Aldepepat Hospital		
West Kordofan	3 Almaglad Hospital, Alnhood Teaching Hospital, Gebiash Hospital	0	3
Northern	1 Karima Hospital	0	1
North Darfur	3 Elfasher Hospital, Kutum Rural Hospital, Altwesha Hospital	1 Taweela Hospital	4
East Darfur	0	0	0
South Darfur	2 Nyala Teaching Hospital, Kass Hospital	0	2
Central Darfur	0	0	0
West Darfur	1 Genina Hospital	1 Kerenik Hospital	2
TOTAL	**64**	**4**	**68**

4.6. Infrastructure and equipment of the BEmONC and CEmONC health facilities in the 18 States (as proposed by the State stakeholders)

Table 8 below provides a summary of the major gaps in infrastructure and equipment described by the State stakeholders during the prioritization workshops. For the CEmONC health facilities, major issues relate to the functioning of the blood banks, the operating theatre infrastructure and equipment, including for anesthesia, and the equipment for laboratories. For the BEmONC health facilities, the infrastructure are usually too small to adequately fill-in the mission of a BEmONC health facility, including the lack of an appropriate laboratory in BEmONC health facilities. These health facilities are also often missing vacuum extractors and equipment for basic neonatal resuscitation. In addition, many designated EmONC health facilities are missing appropriate sterilization equipment, waste management and reliable water and electricity supply.

These gaps are supportive arguments for reducing the number of designated EmONC health facilities in order to equip the 167 health facilities designated by the State working groups with the required infrastructure and equipment needed for performing quality EmONC 24h/7d.

Table 8: Gaps in infrastructure and equipment in the EmONC health facilities in the 18 States as highlighted by the State stakeholders

States	Number of EmONC health facilities with gaps	Summary of gaps described by the State level stakeholders

	in essential infrastructure and equipment, medicine	
North Kordofan	11	Vacuum extractors missing accross the State; need renovations of delivery room/theatre in many EmONC facilities;
Blue Nile	7	No maternity ICU or HDU Equipments; supply shortage of Oxygen; shortage in surgical equipments, MVA, assisted vaginal delivery kits; lack of stable/grid electricity sources; lack of latrines
Sinnar	10	Lack of over head light; delivery table and set of delivery; portable ultrasound; autoclave; blood bank refrigerator; and computer
Gedarif	8	Shortage of vacuum extractors, ventilators, incubators and mask/ambu bag;oxygen concentrator;three facilities are missing functional ambulances; two facilities need rehabilitation of theatre and two of neonates ward
Kassala	2	Lack of infection prevention control
Red Sea	6	Missing equipment for neonatal resuscitation (bag and masks) and vacuum extractors; shortage in water supply and electricity; missing internet access
River Nile	7	Missing delivery table, vacuum extractors, stock-outs of blood products, missing autoclave, hot air oven, no specific neonatal care corner, no communication means, no oxygen concentrator, inadequate anesthesia machine, shortage in water supply and poor sewage system
Khartoum	3	No blood bank, stock-outs of magnesium sulfate
El Gazira	20	Shortage of cardiotocograph; portable ultrasound machines; vacuum extractors; surgical instruments sets; neonatal resuscitation set; mechanical ventilators; anaesthetic machine, ambulances missing in four health facilities
White Nile	9	Shortages in equipment, maintenance and technicians in both blood bank and laboratory; shortage in oxygen supply; need maternity ward rehabilitation, need ambulances (in Kosti Hospital and Eljebelein Hospital), electricity shortage (in Rabak Hospital)
South Kordofan	7	No blood component extractor and lack of lab devices (eg: bleeding profiles); shortages in electricity and water supply and poor sanitation; lack of lab equipment; no blood banks in most health facilities
West Kordofan	6	No blood bank; no ICU; no doppler; no nursery, shortages in water and electricity supply; need rehabilitation for maternity ward and labs

Northern	6	Lack of vacuum extractors; neonatal warmer; Continuous Positive Airway Pressure - CPAP; operating table; blood bank products; infection prevention materials; neonatal incubator; cardiotocography; lab equipment (CBC etc); infusion pumps; blood pressure monitor (stand sphygmomanometer); no blood banks in two health facilities (Dongla Specialized Hospital, Wadi Halfa Hospital)
North Darfur	11	No suction pumps in labour room; no MVA; and no neonatal warmer/heater available; sterilization equipment only available in half the facilities; lack of neonate warmer/heater; ultrasounds, no oxygen in Saraf Omoa Rural Hospital, Om Kaddada Rural Hospital, Taweela Hospital; lack of vacuum extractors; water and electricity shortages many health facilities depend upon generators for electricity; no ambulance in Elfasher Hospital
East Darfur	5	Lack of blood banks equipment (for packed cell, plasma separation, platelets) in CEmONC health facilities and surgical sets; no neonatal resuscitation equipment in Ysen Rural hospital; poor water supply system, poor sewage system, no standard medical storage facilities; lack of incinerator;
South Darfur	11	Lack of blood banks in CEmONC health facilities, shortage of water and electricity power
Central Darfur	6	Lack of blood banks equipment (eg. CBC test machine,in CEmONC health facilities and Cardiotocography; portable ultrasounds; anesthesia machine; shortage of electricity and water supplies; non functioning ambulances in Zalingi Teaching Hospital
West Darfur	5	Missing equipment for the blood bank; stock outs of some consumables (reagent); rely on solar system refrigerator (shortage of electricity supplies)

4.7. Management of the BEmONC and CEmONC health facilities in the 18 States (as perceived by the State stakeholders)

The prioritization workshops had not the objective to evaluate the sensitive question of the quality of the management of the health facilities. Such evaluation requires a specific methodology, which was not used in these workshops. Here the objective was just to have the participants reflect on the importance of the management for ensuring the development of the EmONC network and the implementation of the actions needed to improve the quality of care. Table 9 gives a summary of the managerial strengths and weaknesses identified by the State stakeholders for each designated EmONC health facility. These are only the perceptions of the participants of the workshops.

Many health facilities have regular staff meetings but they are not institutionalized in all health facilities and across regions. With few exceptions, all the health facilities across the States are missing

registers and processes for data monitoring and use. The review of maternal deaths is also generally only taking place in the major health facilities. Four regions have highlighted the absence of support from NGOs or international organizations and in many regions the technical and financial support is only provided to few health facilities in each State and does not seem to have been a coordinated support to all EmONC health facilities at the scale of the State. The set-up of the network of EmONc health facilities should help improve such coordination.

Table 9: Perception by the State stakeholders of the management of the EmONC health facilities in the 18 States

States	Strengths	Weaknesses
North Kordofan	6 EmONC health facilities supported by the African Development Bank, maternal death reviews conducted in all health facilities except one	Limited staff meetings; weak local managerial capacities; lack of registers and data monitoring
Blue Nile	Staff coordination meetings; support by UNFPA, WHO, UNICEF; leadership by medical doctor	Lack of registers and data monitoring; lack of supportive supervision; maternal death reviews only in Damazin Maternity hospital
Sinnar	All health facilities conduct maternal death reviews except two	No support from NGOs or international organizations, lack of registers and data monitoring
Gedarif	Staff meetings	No support from NGOs or international organizations; maternal death reviews only in Eltaheli Hospital; lack of registers and data monitoring
Kassala	Halfa Aljadeda Hospital supported by UNFPA, UNICEF and IC; all health facilities conducting maternal death reviews	Lack of regular monitoring, follow-up and feedback; lack of ambulance maintenance and management of running cost; lack of staff retention and motivation
Red Sea	Health facilities supported by UNFPA, Italian Cooperation, Aispo; all health facilities conducting maternal death reviews	No staff meetings; turnover of health facility managers; lack of registers and data monitoring
River Nile	Staff meetings	Lack of registers and data monitoring, no support from NGOs or international organizations, only three health facilities conducting maternal death reviews
Khartoum	Staff meetings, maternal death reviews conducted in all health facilities except abodeleeg hospital and Asororab Hospital	No information provided by the working group
El Gazira	Maternal death reviews conducted in all	No regular staff meeting in 14 health facilities, lack of registers and data

	health facilities	monitoring, no support from NGOs or international organizations
White Nile	Weekly staff meetings; health facilities supported by UNFPA, UNICEF, UNDPA, Alimam Almahdi University, MSF Spain, African Development Bank	Lack of registers and data monitoring, high staff turnover, maternal death reviews only in four major hospitals
South Kordofan	Staff meeting, good community leadership participation in the management of some health facilities, board of trustees (community council, MSF supporting two health facilities (Elum Bakheeta Hospital, Habilla Hospital)	No clear TOR/SOPs, policies and protocols, lack of registers and data monitoring, maternal death reviews only in Kadogli Hospital and Elum Bakheeta Hospital
West Kordofan	Staff meeting, support for health facilities from UNICEF, Save the Children, UNHCR, Islamic Relief, Global Aid	Lack of registers and data monitoring, maternal death reviews only in Alnhood teaching hospital and Almaglad hospital
Northern	Local community support	Lack of registers and data monitoring, lack of in-service training and mentorship, maternal death reviews only in four major hospitals
North Darfur	No information provided by the working group	Few health facilities supported by NGOs or international organizations, only Allaeet Hospital by UNHCR and Taweela Hospital by MSF, no maternal death reviews conducted
East Darfur	Good community involvement, health facilities supported by ARC, UNFPA, WHO, UNICEF, UNHCR, CIS, Almanar	Weak hospital management system, doctors are not trained on hospital administration, maternal death reviews only in Alda'ain Teaching Hospital
South Darfur	Few health facilities supported by NGOs, maternal death reviews conducted in all CEmONC health facilities	No information provided by the working group
Central Darfur	Some health facilities supported by partners (IMC, UNFPA, UNICEF, and WHO - International and NMSF, HIF - National)	Lack of registers and data monitoring, no regular staff meetings, maternal death reviews only in Zalingi Teaching Hospital
West Darfur	All health facilities supported by partners (IMC, UNFPA,SCI)	Lack of registers and data monitoring, no regular staff meetings, maternal death reviews only in Geneina Hospital

V State level analysis and results

1. North Kordofan State

State description

The State of North Kordofan is located in the central part of the country and is bordered to the north by the Northern State, to the east by the States of Khartoum and White Nile, to the south by the States of South Kordofan and West Kordofan, and to the east by the State of North Darfur.The surface area of the State is 188,048 square kilometers, or 10% of the country's total surface area. It consists of plains and desert with no permanent rivers It is composed of 8 localities (Bara, El Rahad, Gebrat El Sheikh, Gharb Bara, Sheikan, Soudari, Um Dam Haj Ahmed, Um Rawaba) and has a population of 2,510,795 people.

Institutional deliveries are estimated at 18% (EmONC NA 2017) and contraceptive prevalence rate is 14.2% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
2 510 795	25	12	**10**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Elobeid Maternity Hospital	CEmONC	1 556 239	0	240
Abu Haraz Hospital	BEmONC	1 205 755	3	10
Kazgel Hospital	BEmONC	1 365 474	2	10
Bara Hospital	CEmONC	1 291 842	2	54

Om Ruwaba Hospital	CEmONC	1 439 644	0	596
Wad Ashana Hospital	BEmONC	1 645 613	5	20
Shirkela Hospital	BEmONC	1 140 152	2	18
Kjamar Hospital	BEmONC	329 481	NA	10
Jabrat Elsheik Hospital	BEmONC	230 169	3	20
Arahad Hospital	BEmONC	1 605 420	2	68

Two of the four functioning EmONC facilities according to the EmONC Need Assessment have been included in the proposed EmONC network by the working group. Arahma Clinic and Mama Dar Alsalam Clinic were not included as they were not considered functional by the working group due to stock out of magnesium sulfate for both Arahma and Mama Dar Alsalam Clinics and stock out of oxytocin for Arahma Clinic (accoridng to the EmONC NA database).

Within this proposed EmONC network, the three most common gaps in signal functions are deliveries assisted by vacuum extraction, administration of anticonvulsants, and removal of retained products (manual vacuum extraction, curettage).

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for graduate midwives** (take into account the graduate and nurse midwives)	**Long-term need for graduate midwives** (does not take into account nurse midwives)
Elobeid Maternity Hospital	8	0	17	0	14	0	8
Abu Haraz Hospital	3	0	0	1	0	3	0
Kazgel Hospital	3	0	0	1	0	3	0
Bara Hospital	4	0	1	3	1	3	1
Om Ruwaba Hospital	20	0	8	12	3	12	8

Wad Ashana Hospital	3	0	1	2	0	2	1
Shirkela Hospital	3	0	0	3	0	3	0
Kjamar Hospital	3	0	0	1	0	3	0
Jabrat Elsheik Hospital	3	0	1	1	0	2	1
Arahad Hospital	3	0	3	3	1	0	3
Total need in midwives (without redeployment)						**31**	**22**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife and per month.

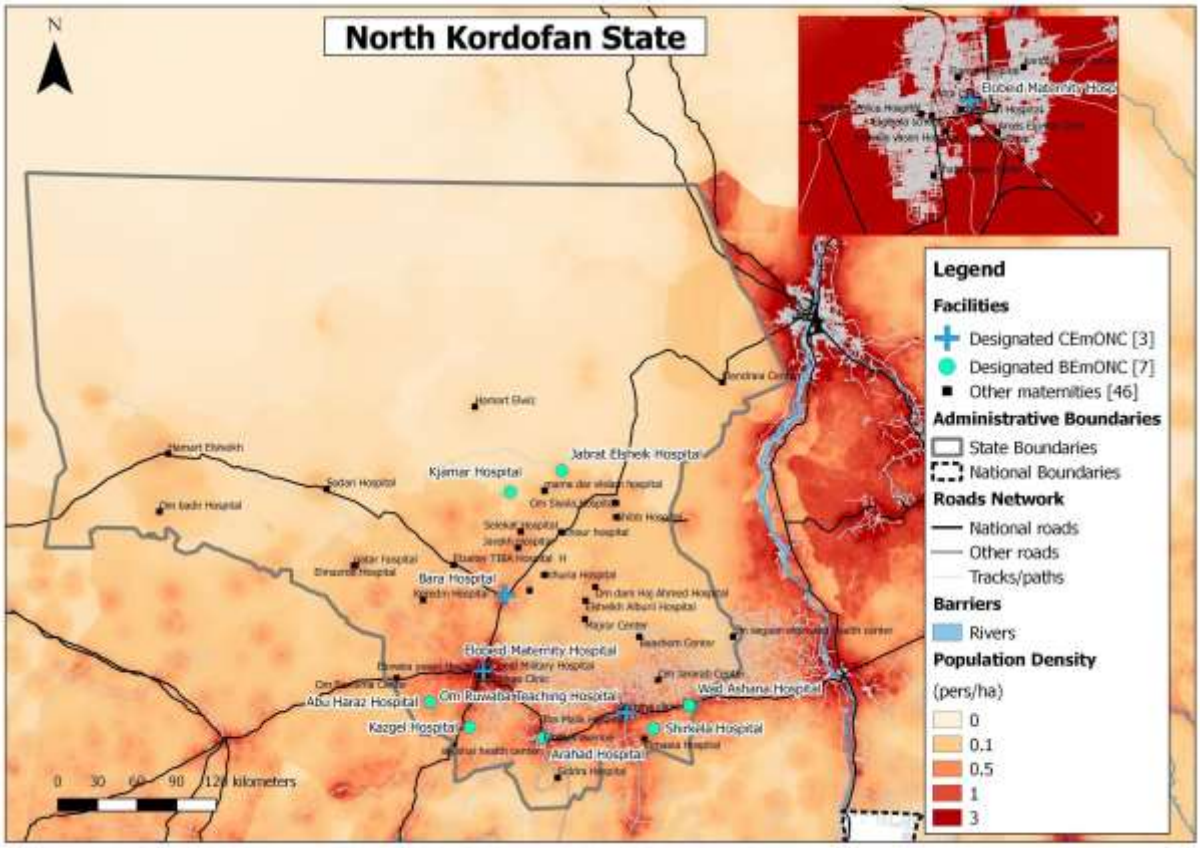
1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Elobeid Maternity Hospital	Abu Haraz Hospital	1h	1h30	financial barriers (no specific estimates available)
	Kazgel Hospital	1h	1h	
	Arahad Hospital	1h	1h	
Bara Hospital	Kjamar Hospital	1h30	2h	financial barriers (no specific estimates available)
	Jabrat Elsheik Hospital	1h	1h	
Om Ruwaba Hospital	Wad Ashana Hospital	40 min	1h	financial barriers (no specific estimates available)
	Shirkela Hospital	40 min	1h15	

The working group proposed a network with overall good referral linkages between BEmONC and CEmONC facilities, within 2 hours of travel time. Motorized vehicles, including taxis are the most common means of transportation in the State. For three maternities, financial barriers are highlighted as a challenge for good referral.

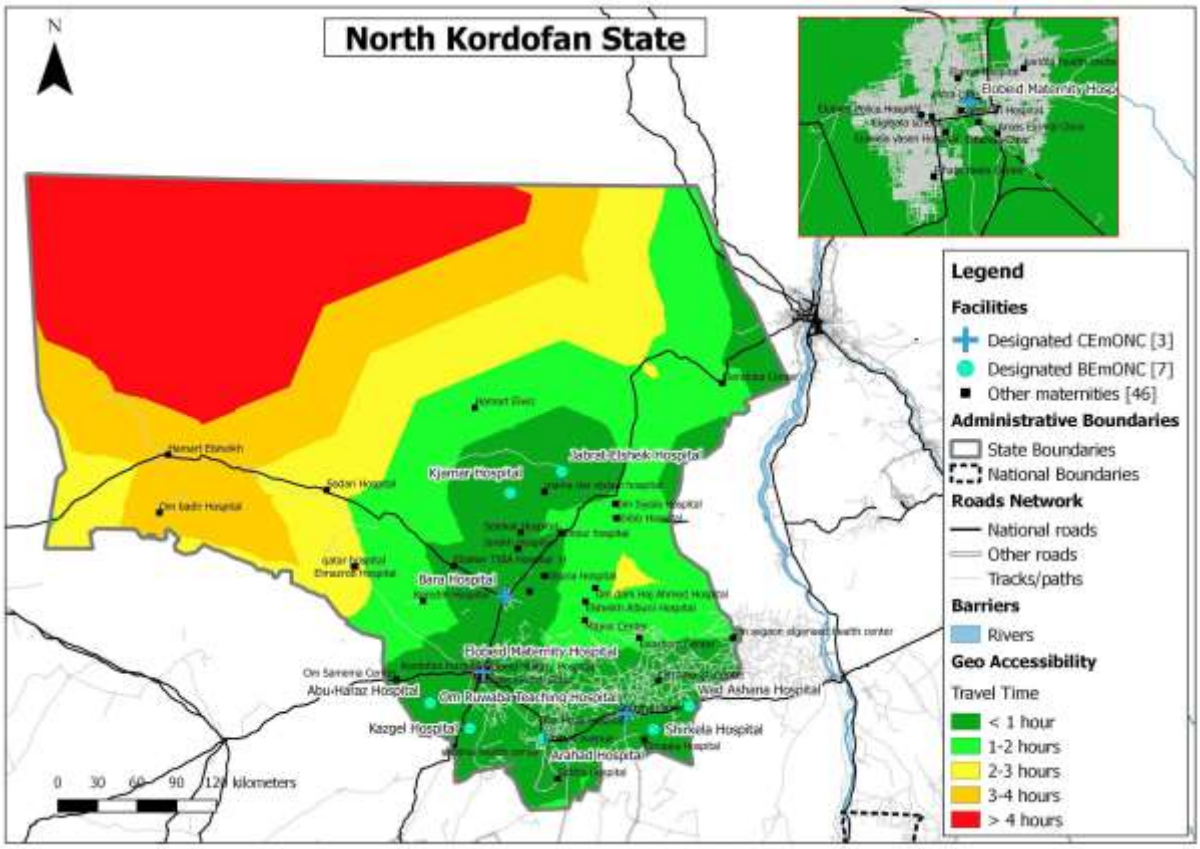
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



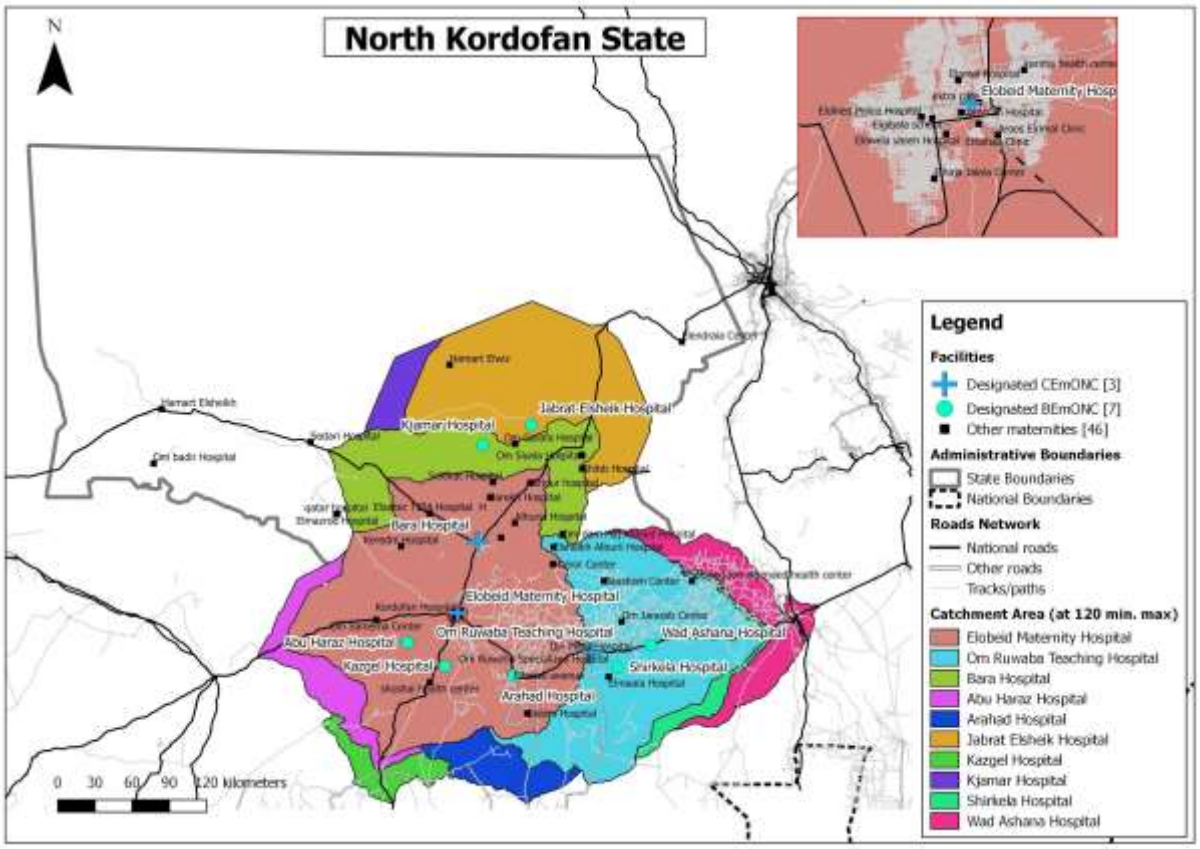
The population of the State is concentrated mostly in the Southern part of the State where the majority of the EmONC facilities proposed by the working group are located.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



The Northeastern part of the State (in red color), means that the population located in these areas are at over 4 hours to the closest EmONC facility suggested by the working group. However, these areas are sparsely populated and most of the population of the State is located in green zones, meaning that they can access the closest EmONC facility suggested by the working group within 2 hours journey.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		Coverage of the population by the EmONC network proposed by the working group within 2h travel time	
State	With bordering States	State	With bordering States
94.9%	95.7%	77.1%	83.4%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The network selected by the working group consists of three CEMONC facilities and seven BEmONC facilities. Only two CEmONC facilities are functioning according to the 2018 EmONC Needs Assessment (Elobeid Maternity Hospital and Om Ruwaba Hospital). Five rural hospitals (Abu Haraz Hospital, Kazgel Hospital, Shirkela Hospital, Wad Ashana Hospital, Kjamar Hospital, Jabrat Elsheik Hospital) suggested as BEmONC facilities by the working group have limited obstetric activity ranking from 10 to 68 deliveries per month and important gaps in signal functions.

The state registered also an important shortage in qualified midwives, with 26 midwives needed in the short/medium term and 26 additional midwives needed in the long term. Four of the ten proposed health facilities urgently need midwives to ensure 24h/7d EmONC provision. In the short/medium term, Om Ruwaba Hospital would need 12 midwives.

The referral linkages between BEmONC facilities and their CEmONC facilities are overall good within two hours journey time. Financial barriers are highlighted by the working group for three BEmONC facilities (Abu Haraz Hospital, Kjamar Hospital, Wad Ashana Hospital).

In terms of infrastructure, the delivery rooms of most health facilities need to be renovated, including the ones of the three CEmONC. The working group has also highlighted a gap of HDU/ICU in CEmONC health facilities. Regarding equipment, all health facilities experience shortage of vacuum extractors. All health facilities, except Kjamar Hospital, carry out maternal deaths reviews and five health facilities, including the three CEmONC facilities, get financial support from the African Development Bank (Elobeid Maternity Hospital, Bara Hospital, Om Ruwaba Hospital, Wad Ashana Hospital, Arahad Hospital).

1.2.3 Proposed State EmONC network: Support team analysis

While the FMoH suggests a maximum of 12 EmONC facilities for this first EmONC network, the working group designated only 10 EmONC facilities (3 CEmNOC and 7 BEmONC). Two designated CEmONC health facilities (Om Ruwaba Hospital and Elobeid Maternity Hospital) are functioning and register an important obstetric activity, respectively of 596 and 240 deliveries per month. The third designated CEmONC health facility registered only 54 deliveries per month and a gap of 2 signal functions.

Among the seven designated BEmONC health facilities, only Arahad Hospital has an important obstetric activity with 68 deliveries per month. In addition, it has an OBGYN and 19 C-sections are performed per month. It should therefore be deisgnated as a CEmONC health facility rather than a BEMONC health fcaility. The other designated BEmONC health facilities have a lower obstetric activity, particularly Kjamar Hospital Abu Haraz Hospital, and Kagzel Hospital with 10 deliveries per month each. These health facilities also have 2-3 gaps in signal functions. All the designated BEmONC health facilities are within 2h of travel time from the closest CEmONC health facility and most of them within 1 hour of travel time. In addition, most of the designated BEmONC health facilities are in the catchment area of a designated BEmONC health facility and does not complement it. Jabrat Elsheik Hospital is the only BEmONC health facility, which has a catchment area that complements well the one of the CEmONC Bara Hospital. Efforts should be made to increase its obstetric activity and its functionality. In addition, the CEmONC Om Ruwaba Hospital has an important obstetric activity and a BEmONC health facility could be considered close to it in order to discharge some of its activities. Among the designated BEmONC health facilities, the Shirkela Hospital seems to be the best candidate with only two gaps in signal functions compared to the five gaps of Wad Ashana Hospital.

As shown by the accessibility map, populations in the West part of the State are at more than 3 hours of travel time from the closest EmONC health facility. The health facility Sodari Hospital could be included as a designated BEmONC health facility (with reference in 3 hours to Bara Hospital) in order to expand the coverage of the population by the EmONC network in the West part of the State. Despite a low activity of 20 deliveries per month, it has a catchment area covering an estimated population of 375,600 within 2 hours of travel time. There is therefore a potential for increasing the obstetric activity.

Furthermore, the working group has not retained four health facilities with a good obstetric activity which could be designated as BEmONC health facilities: Om dam Haj Ahmed Hospital registers 37 deliveries per month and a catchment area that could expand the coverage on the east part of the State; Aroor Elrimal Hospital with 49 deliveries per month, and Kordofan Hospital with 54 deliveries per month could also be considered to discharge some of Elobeid Maternity Hospital activities.

In light of this analysis, the support team recommends the following selection: 4 CEmONC (Om Ruwaba Hospital, Elobeid Maternity Hospital, Arahad Hospital, and Bara Hospital) and 6 BEmONC (Jabrat Elsheik Hospital, Shirkela Hospital, Sodari Hospital, Om dam Haj Ahmed Hospital, Aroor Elrimal Hospital and Kordofan Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
10	10	77%	84%	67%	67%	31	23	22	22

All the maternities of the State cover 95% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 96%.

Ten health facilities have been designated by the working group to be included in the EmONC network. They cover 77% of the population within 2 hours travel time. Among them, two health facilities are functioning and cover 67% of the population within 2 hours of travel time.

The support team suggests selecting ten EmONC health facilities for this programmatix cycle, which would cover 84% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle is to ensure that all ten designated EmONC facilities function 24h/7d with quality of care.

2. Blue Nile State

State description

The State of Blue Nile is located in the Southeast part of the country and is bordered to the north by the Sinnar State, to the west by South Sudan and to the east by Ethiopia. The surface area of the State is 38,146 square kilometers (2% of the country's total surface area). The Blue Nile State is a high rainfall savannah. It is composed of 7 localities (Baw, Ed Damazine, El Kurmuk, El Roseiris, El Tadamon, Geisan, Wad El Mahi) and has a population of 1 049 366 people.

Institutional deliveries are estimated at 2% (EmONC NA) and contraceptive prevalence rate is 6.9% (MICS 2014).

Since 2011, several areas of the State are facing insecurity.

2.1. Results of the group work

2.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
1 049 366	10	5	**7**

2.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Aggdi Center	BEmONC	364 920	2	93
Damazin Maternity Hospital	CEmONC	435 393	0	352
Abdulkhalag Hospital	BEmONC	6 690	5	16
Badoos Hospital	BEmONC	5 647	1	75
Boutt Hospital	CEmONC	52 016	1	82
Wad Elmahy Rural Hospital	BEmONC	124 649	NA	45
Elmidin 10	BEmONC	300 169	NA	34

One of the two functioning EmONC facilities according to the EmONC Need Assessment has been included in the proposed EmONC network by the working group. Roseris Hospital was not included as it was not considered functional by the working group due to the absence of instrumental deliveries (according to the EmONC NA database).

Within the proposed EmONC network, the most common gaps in signal functions are deliveries assisted by vacuum extraction, and performance of basic neonatal resuscitation.

2.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives**	**Long-term for midwives** (does not take into account nurse midwive)
Aggdi Center	4	0	0	1	0	4	0
Damazin Maternity Hospital	12	14	12	15	3	0	0
Abdulkhalag Hospital	3	0	0	1	0	3	0
Badoos Hospital	3	0	0	1	0	3	0
Boutt Hospital	3	0	0	1	0	3	0
Wad Elmahy Rural Hospital	3	0	0	1	0	3	0
Elmidin 10	3	0	0	0	0	3	0
Total need in midwives (without redeployment)						**19**	**0**

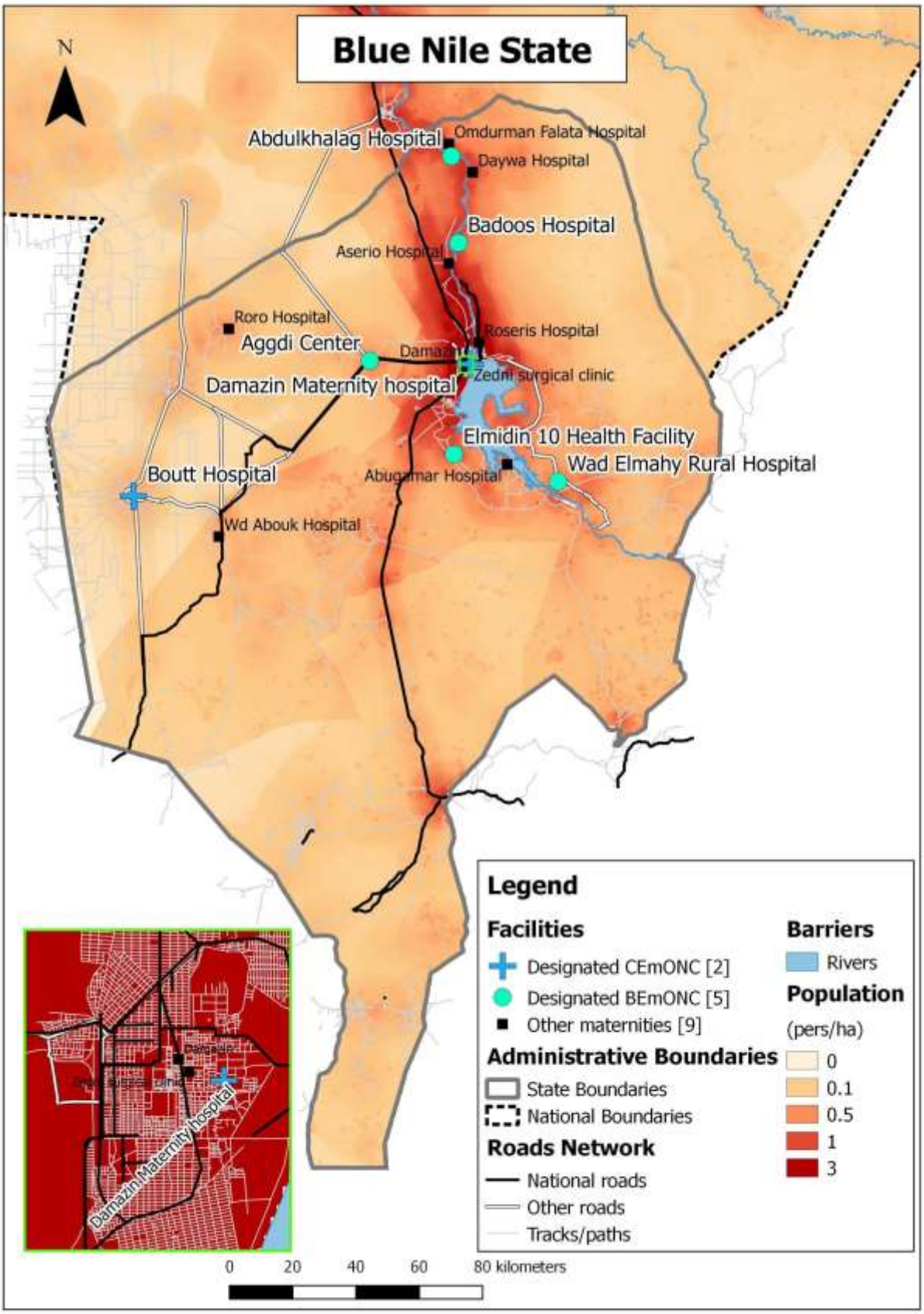
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

2.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Damazin Maternity Hospital	Aggdi Center	1h	4h	Financial barriers: average cost of referral (50 to 100 USD) Physical obstacles: poor roads (unpaved) especially during heavy rainy season and region with several mountains
	Elmidin 10	1h	2h	Financial barriers: average cost of referral (50 to 100 USD) Physical obstacles: poor roads (unpaved) especially during heavy rainy season and region with several mountains
	Abdulkhalag Hospital	1h30	>4h	Financial barriers (average cost of 50 to 100 USD), Physical obstacles: roads are unpaved, heavy rain season, mountain nature
	Badoos Hospital	1h	4h	Financial barriers (average cost of 50 to 100 USD), Physical obstacles: roads are unpaved, heavy rain season, mountain nature
	Wad elmahy rural hospital	2h30	3h30	Financial barriers, Physical obstacles: roads unpaved heavy rain season, mountain nature
Boutt Hospital	no referral possible from BEmONC facilities			
Wad Elnile (in Sinnar State)	Abdulkhalag Hospital	40 min	2h30	Financial barriers, Physical obstacles: roads unpaved heavy rain season, mountain nature

2.1.5 Maps of the State EmONC network

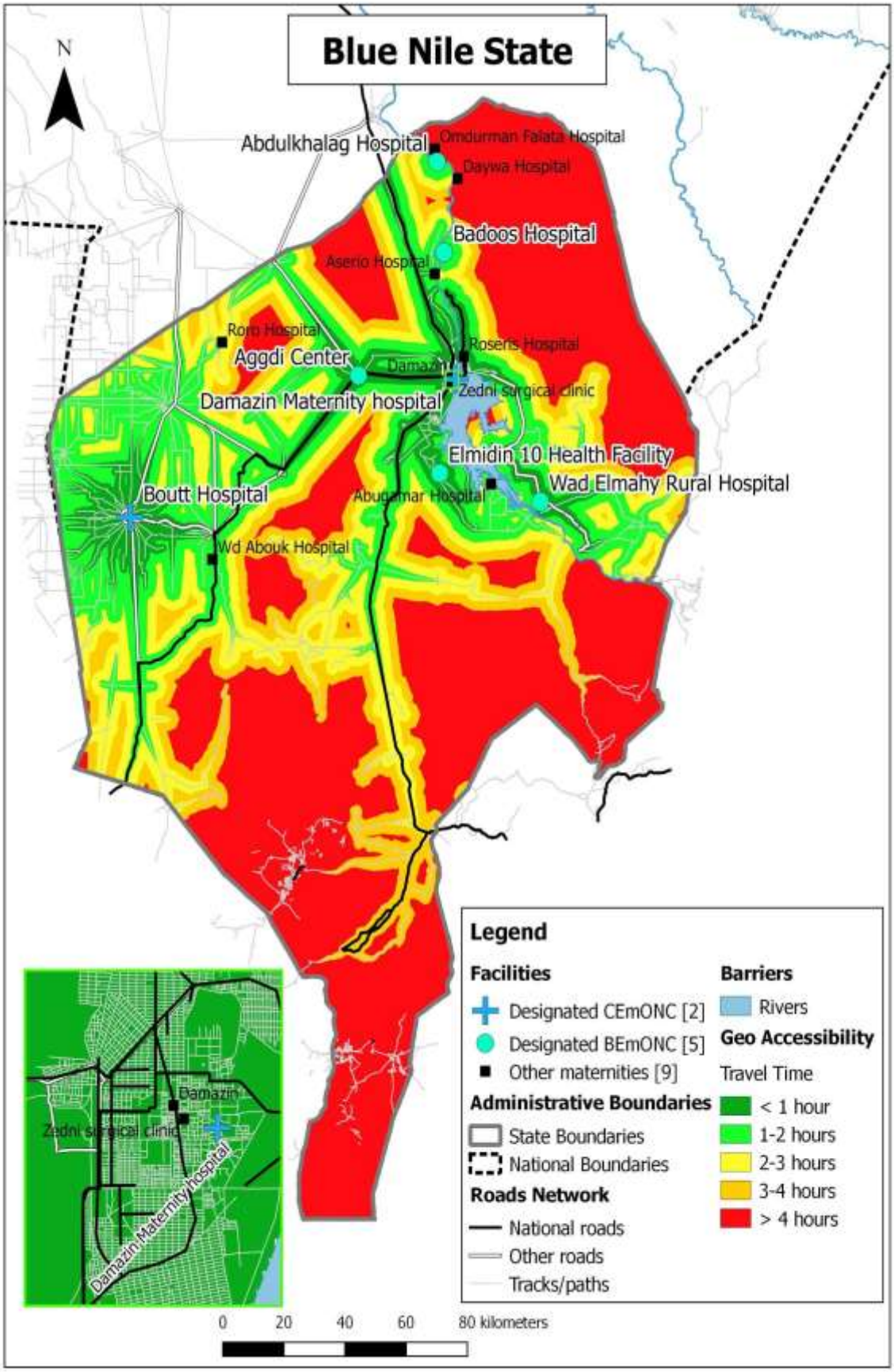
Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*


Blue Nile State
N
Abdulkhalag Hospital
Omdurman Falata Hospital
Daywa Hospital
Badoos Hospital
Aserio Hospital
Roro Hospital
Aggdi Center
Roseris Hospital
Damazin
Zedni surgical clinic
Damazin Maternity hospital
Elmidin 10 Health Facility
Wad Elmahy Rural Hospital
Boutt Hospital
Abugamar Hospital
Wd Abouk Hospital
Damazin Maternity hospital
Legend
Facilities
Designated CEmONC [2]
Designated BEmONC [5]
Other maternities [9]
Administrative Boundaries
State Boundaries
National Boundaries
Roads Network
National roads
Other roads
Tracks/paths
Barriers
Rivers
Population
(pers/ha)
0
0.1
0.5
1
3
0
20
40
60
80 kilometers

Blue Nile State has a low population density except in the central and northern part of the State along the Blue Nile. The working group has identified EmONC facilities in the most densely populated areas. The State is crossed by two major national roads but the East and South parts of the State do not have a dense secondary road network.

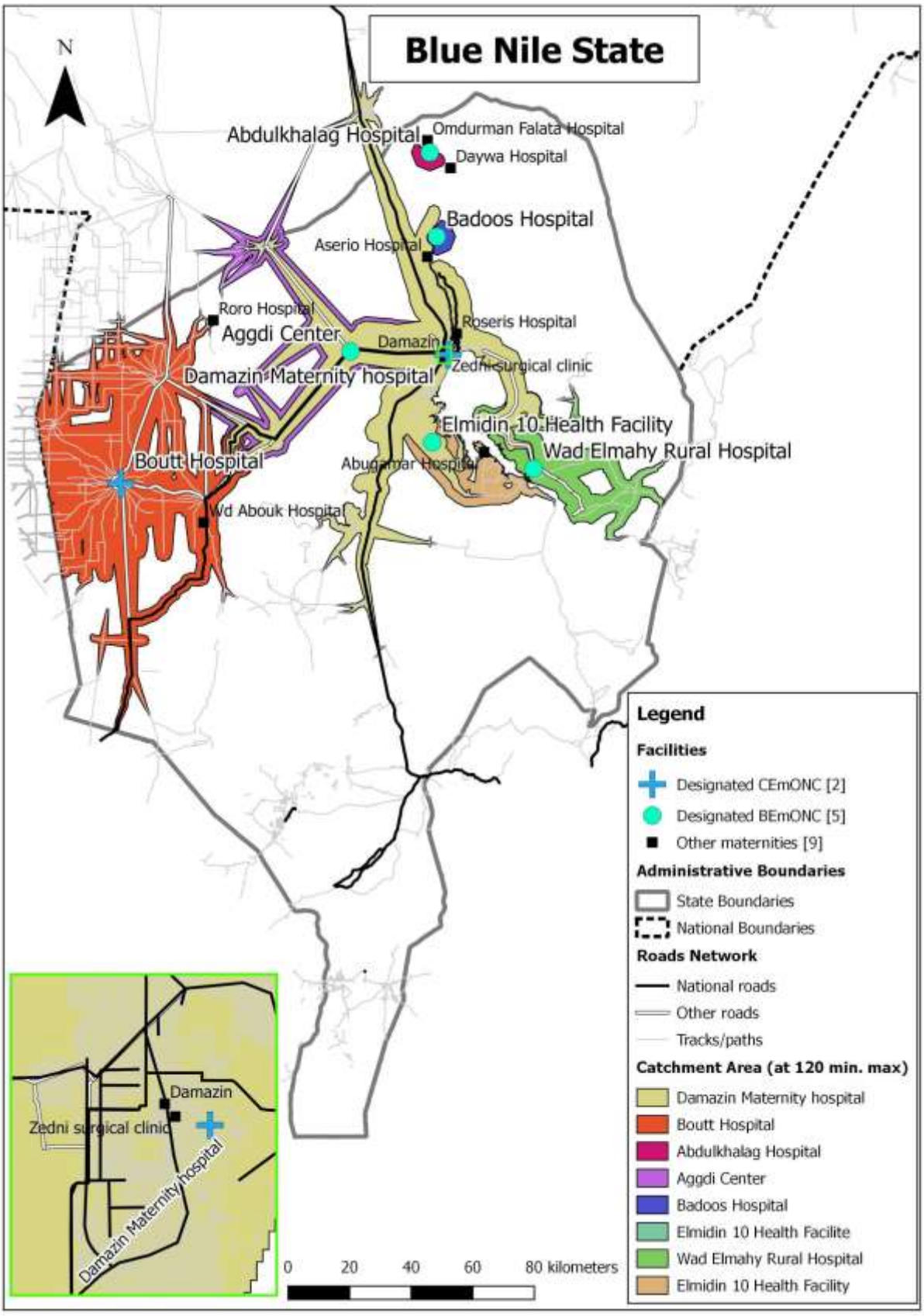
Furthermore, the South part of the State is facing security issues which highly impact travels, including for accessing Boutt hospital. No EmONC health facilities were designated in these areas due to lack of access.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



The areas with a high density of population are within 2 hours of travel time for an EmONC health facility proposed by the working group. The north-east part of the State and an area on the west of the Badoos Hospital are located at more than 2 hours of the closest designated EmONC health facility but have low density of population. Furthermore, all the South part of the region, which also contains several densely populated areas, are located more than 2 hours from the closest EmONC health facility, and for the majority of the areas in the South at more than 4 hours travel time.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover about half of the population of the State within 2 hours travel time. The catchment areas of the designated EmONC health facilities within 2 hour travel time cover many of the high population density areas but the East and South parts of the

State are not covered by the EmONC network. The working group has not identified BEmONC health facilities in these areas as they are less populated and due to significant security issues in the South of Blue Nile State which does not allow access to the area.

2.2. Analysis of the EmONC network

2.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		Coverage of the population by the EmONC network proposed by the working group within 2h travel time	
State	With bordering States	State	With bordering States
52.6%	52.9%	48.8%	49.3%

2.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Blue Nile State has selected 7 health facilities to be part of the EmONC network, including 2 CEmONC (Damazin Maternity Hospital and Boutt Hospital) and 5 BemONC (Aggdi Center, Abdulkhalag Hospital, Badoos Hospital, Wad Elmahy Rural Hospital, Elmidin 10). This number is below the international recommendation but above the expected number set by the FMoH of 5 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities are difficult due to financial barriers, poor road network especially during the heavy rainy season, and insecurity. The BEmONC health facility Abdulkhalag Hospital can refer to the CEmONC Wad Elnile in Sinnar State).

In terms of human resources, there are only graduate nurse midwives and nurse midwives in the Damazin Maternity Hospital. Most designated health facilities have a doctor, with Damazin having 12 doctors and 3 OBGYNs. Elmidin 10 is the only health facility without any doctor. There is an important gap of 14 midwives to be filled-in in the short/medium term in order to ensure the provision of services 24h/7d. Other major gaps identified by the working group are the absence of anesthetists and neonatologists in the major hospital (Damazin) and the absence of anesthetists and OBGYN in the Boutt Hospital.

In terms of infrastructure and equipment, the Damazin hospital has a functioning laboratory for advanced tests and three other hospitals have a functioning laboratory for basic tests (Aggdi Center, Badoos Hospital, Boutt Hospital). Major gaps include the absence of ICU and HDU, shortage in surgical equipment, Oxygen supply, equipment for assisted vaginal delivery. The lack of latrines and electricity have also been highlighted in most health facilities.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of supportive supervision, health facility register, and monitoring dashboard. However coordination staff meetings are held in all designated facilities, led by the medical doctor(s). Four designated EmONC health facilities are supported by UNFPA, WHO, and UNICEF (Aggdi Center, Damazin Hospital, Badoos Hospital, Boutt Hospital, Abdulkhalag Hospital).

2.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is slightly above the expected number set by the FMoH for this first EmONC network. The two designated CEmONC health facilities have a good obstetrical activity, particularly Dalmazin which is also the only functioning EmONC facility in the State according to the EmONC survey. The other CEmONC (Boutt) covers the west part of the State and only presents one gap in signal function and could therefore become functioning in the short term. There is however an urgent need for staffing an OBGYN in this facility and anaesthetists in both designated CEmONC.

Among the designated BEmONC health facilities, Aggdi and Badoos have a good obstetrical activity and limited gaps in signal functions. They are also positioned in areas with a high population density. They are in the catchment area of Dalmazin hospital but they contribute to limit its overload.

However, the designated BEmONC health facility Abdulkhalag Hospital is only doing 16 deliveries per month, has important gaps in signal functions and has a small catchment area.

Finally, the designated BEmONC health facility Wad Elmahy Rural Hospital has a fair obstetric activity and has a catchment area covering the east part of the State with a fair referral to Damazin.

The support team recommends to select the 2 CEmONC (Damazin Hospital and Boutt Hospital) and 4 BEmONC (Aggdi Center, Badoos Hospital, Wad Elmahy Rural Hospital and Elmidin 10).

2.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
7	6	49%	48%	38%	38%	19	17	0	0

All the maternities of the State cover 52.6% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 53%.

Seven health facilities have been designated by the working group to be included in the EmONC network. They cover 49% of the population within 2 hours travel time. Among them, only one health facility is functioning and covers 38% of the population within 2 hours of travel time.

The support team suggests selecting six EmONC health facilities for this programmatix cycle, which would cover 48% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle is to ensure that all six designated EmONC facilities function 24h/7d with quality of care.

Sinnar State

State description

The State of Sinnar is located in the south-east part of the country and is bordered to the south by the Blue Nile State, to the south-west by the Upper-Nile State, to the West by the White-Nile State, to the north by the El-Gezira State, and to the east by the Gedaref State. The surface area of the State is 39,340 square kilometers, or 2% of the country's total surface area. It is a low rainfall savannah and has a diverse ecosystem that includes the Dinder National Park as well as rivers, khors and a semi alluvial plain. It is composed of 7 localities (Abu Hujar, Ed Dinder, El Dali, Es Suki, Sennar, Sharg Sennar, Sinja) and has a population of 1 777 982 people.

Institutional deliveries are estimated at 25% (EmONC NA) and contraceptive prevalence rate is 13.4% (MICS 2014).

According to the 2018 EmONC Need Assessment six health facilities are functioning - providing all the EmONC signal functions: Sinja Hospital, Wad Elniel Hospital, Sinnar Hospital, Jebel Moya, Sukkar Sinnar Hospital, Asoki Hospital.

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
1 777 982	17	8	**10**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Wad Elniel Hospital	BEmONC	1 178 789	0	60
Sinnar Hospital	CEmONC	2 735 896	0	363
Sukkar Sinnar Hospital	BEmONC	2 410 697	0	80
Wad Elabas Hospital	CEmONC	1 294 787	1	127
Wad taktok Hospital	BEmONC	1 007 512	3	38

Doba Hospital	BEmONC	2 589 781	1	38
Dinder Hospital	BEmONC	1 253 406	1	103
Karkoj Hospital	BEmONC	915 886	1	33
Asoki Hospital	BEmONC	1 042 083	0	52
Sinja Hospital	CEmONC	1 352 808	0	300

Five of the six functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the proposed EmONC network by the working group. Jebel Moya was not included as it was not considered functional by the working group due to stock out in magnesium sulfate (according to the EmONC NA database).

Within this proposed EmONC network, the three most common gaps in signal functions are deliveries assisted by vacuum extraction, manual extraction of the placenta, and basic neonatal resuscitation.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives**	**Long-term for midwives** (does not take into account nurse midwives)
Wad Elniel Hospital	3	0	1	3	1	2	1
Sinnar Hospital	13	0	11	6	7	2	11
Sukkar Sinnar Hospital	3	0	2	5	1	1	2
Wad Elabas Hospital	5	0	0	1	1	5	0
Wad taktok Hospital	3	0	0	2	0	3	0
Doba Hospital	3	0	0	1	1	3	0

Dinder Hospital	4	0	3	7	2	4	0
Karkoj Hospital	3	0	5	1	1	0	3
Asoki Hospital	3	0	4	3	2	0	4
Sinja Hospital	11	0	7	18	4	4	7
Total need in midwives (without redeployment)						**24**	**28**

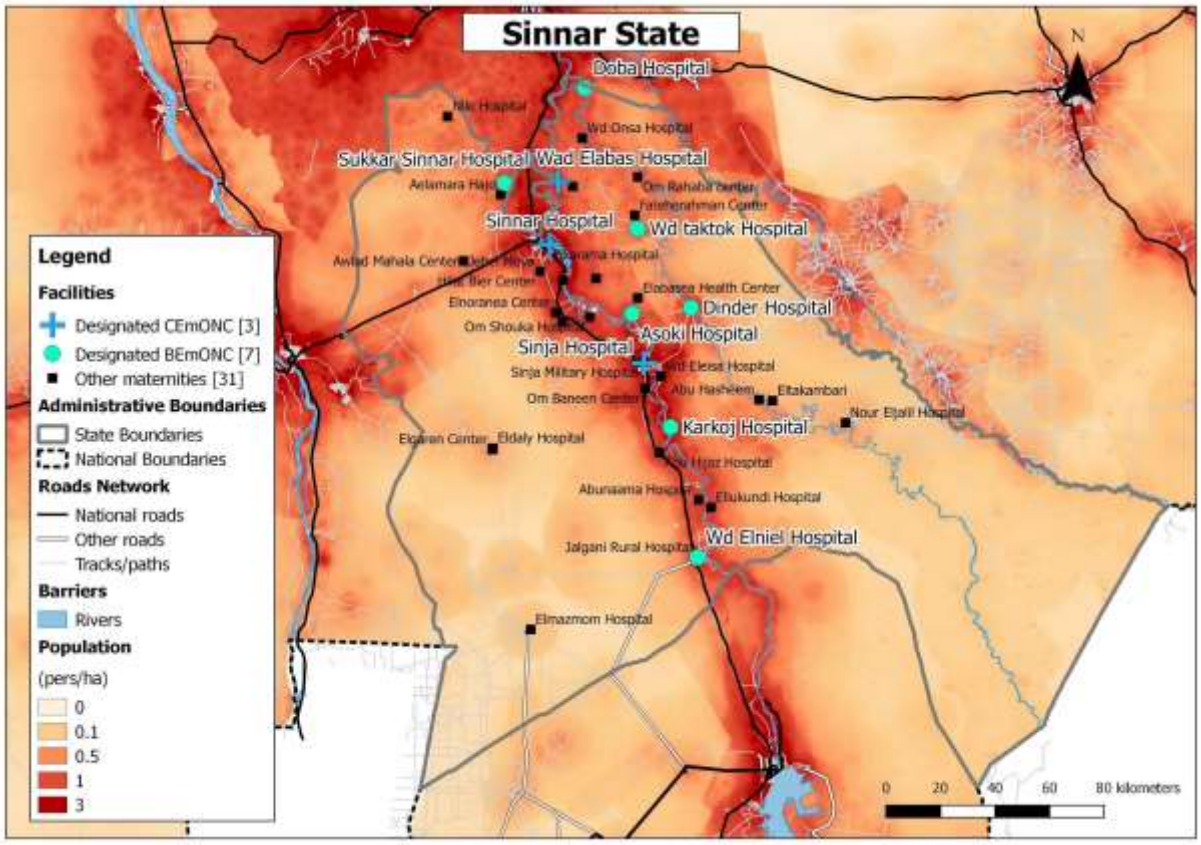
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Sinnar Hospital	Assuki hospital	45 min	1h30	Poor road and fuel shortage, cost of referral for patients 30 USD
	Sukar sinnar hospital	60 min	1h30	cost of referral for patients 30 USD
Sinja Hospital	Dinder hospital	30 min	45 min	Poor road, cost of referral for patients 20 USD
	Karkoj hospital	45 min	1h30	Poor road and fuel shortage, cost of referral for patients 25 USD
	Wad Elniel Hospital	1h15	1h30	Poor road, cost of referral for patients 30 USD
Wad Elabas Hospital	Wad Taktok hospital	45 min	2h	Poor road, cost of referral for patients 35 USD
	Doba hospital	30 min	2h30	Fuel shortage, cost of referral for patients 40 USD

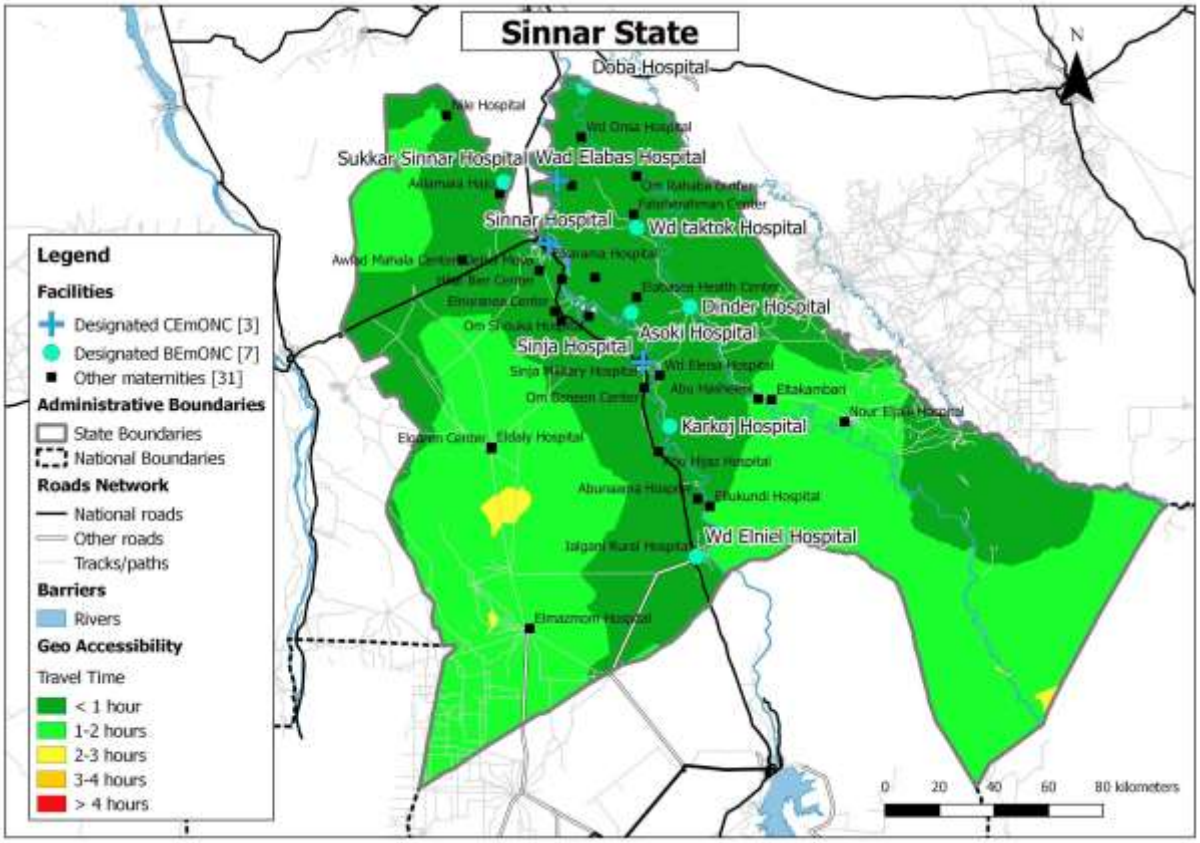
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



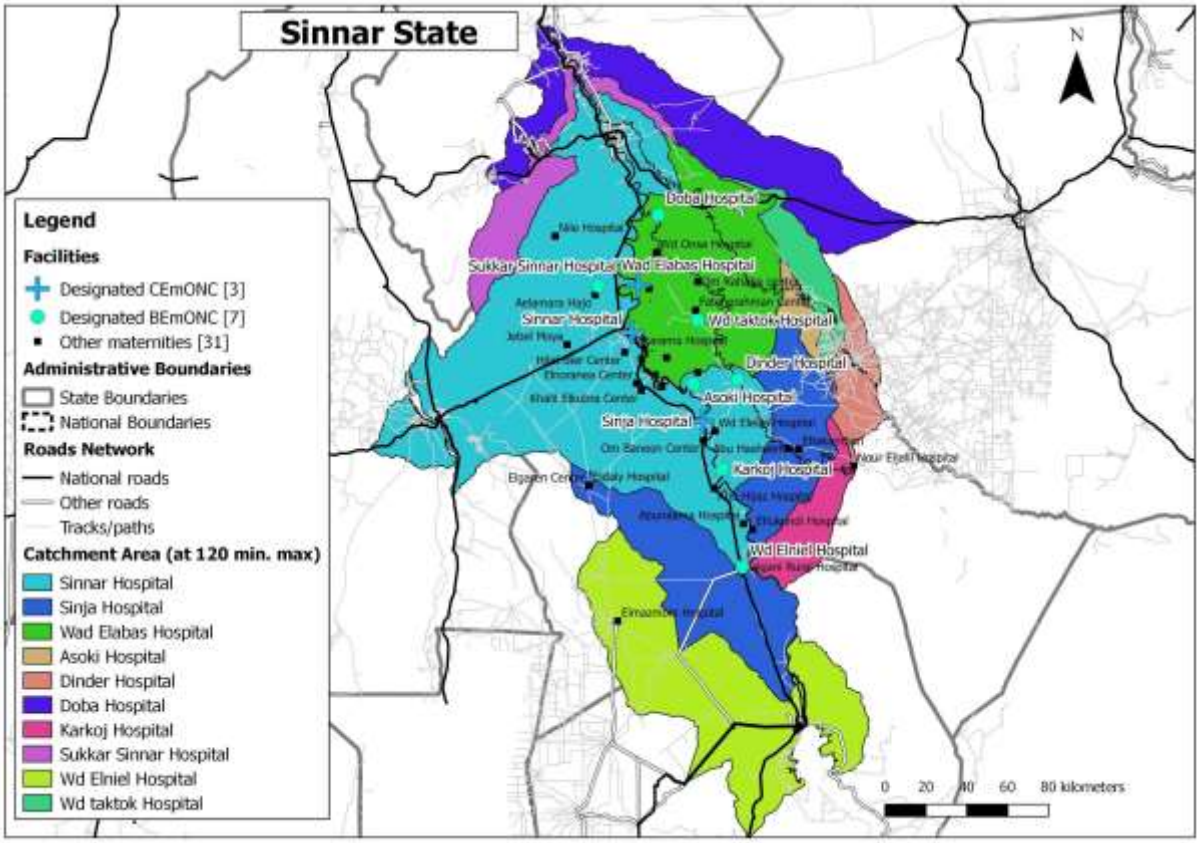
Sinnar State has a high population density concentrated in its central part close to the Nile and in its northern part, particularly in the north east. There is also densely populated areas on the west side of the State. Sinnar is crossed by two major national roads but both the South East and South West parts of the State do not have a dense secondary road network.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the areas of the Sinnar State are located within 2 hours of travel time of an EmONC health facility proposed by the working group. Despite the absence of major roads in the South part of the State, there are only two areas located in the South East and extreme South West where population is between 2 to 3 hours travel time from the closest proposed EmONC health facility. However, these areas are less populated.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover about 91% of the population of the State within 2 hours travel time. The catchment areas of the three designated CEmONC health facilities within 2 hour travel time cover most of the high population density areas of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		Coverage of the population by the EmONC network proposed by the working group within 2h travel time	
State	With bordering States	State	With bordering States
96.9%	99.9%	90.9%	99.8%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Sinnar State has selected 10 health facilities to be part of the EmONC network, including 3 CEmONC (Sinnar Hospital, Wad Elabas and Sinja Hospital) and 7 BEmONC (Wad Elniel Hospital, Sukkar Sinnar Hospital, Wad taktok Hospital, Doba Hospital, Dinder Hospital, Karkoj Hospital, Asoki Hospital). This number is below the international recommendation but above the expected number set by the FMoH of 8 designated EmONC health facilities.

Financial barriers, poor road network, and fuel shortage makes referral difficult for BEmONC health facilities.

In terms of human resources, the State does not have any graduate nurse midwife in the designated EmONC health facilities. Most designated health facilities have nurse midwives, except Wad Elabas Hospital, Wad taktok Hospital, and Doba Hospital. All designated health facilities have at least one doctor, with important concentrations in the two CEmONC health facilities (Sinnar and Sinja Hospitals - with OBGYNs) and in two BEmONC health facilities (Dinder and Sukkar Sinnar Hospitals). The CEmONC health facility Wad Elabar Hospital has one OBGYN while five designated BEmONC health facilities also have OBGYNs in their staff (Wad Elniel Hospital, Sukkar Sinnar Hospital, Doba Hospital, Karkoj Hospital, Asoki Hospital). There is an important gap of 7 midwives to be filled-in in the short/medium term in order to ensure the provision of services 24h/7d. Other major gaps identified by the working group are the absence of anesthetists in the CEmONC health facilities and the high turnover of staff.

In terms of infrastructure and equipment, all health facilities have functioning ambulances and the three CEmONC health facilities have functioning blood banks. Major gaps include autoclaves for sterilization in all health facilities, lighting, delivery tables and delivery sets, and portable ultrasounds.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of supportive supervision, health facility register, and monitoring dashboard. Maternal deaths reviews are conducted most designated EmONC health facilities, except two BEmONC health facilities (Wad Taktok and Doba Hospitals). None of the designated EmONC health facilities are supported by NGOs or other international partners.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is slightly above the expected number set by the FMoH for this first EmONC network. The three designated CEmONC health facilities have a good obstetrical activity, particularly Sinnar and Sinja Hospitals that have respectively 363 and 300 deliveries per month. They are also both functioning according to the EmONC survey. Wad Elabas Hospital has a lower obstetric activity but still of 127 deliveries per month and only one gap in signal function (assisted vaginal delivery). There is however, an urgent need for staffing midwives in Wad Elabas and anaesthetists in all designated CEmONC.

Among the designated BEmONC health facilities, three health facilities Karkoj, Doba, and Was Taktok Hospitals have less obstetric activities even if they are located in areas with high population density, especially Doba Hospital. They are all situated in catchment areas within 2 hours of a CEmONC health facility but Doba and Was Taktok Hospitals complement the catchment areas of CEmONC health facilities on the east side. Karkoj and Doba hospitals have only one signal function missing while Was Taktok Hospital has three signal functions missing. Furthermore, both Doba and Was Toktok Hospitals require additional staff in the short term to ensure 24h/7d availability of services. In light of the important gap in signal function for Was Taktok Hospital and its low activity, which makes it challenging to become functioning in the current programmatic cycle, it could be considered in the next programmatic cycle.

In addition, four health facilities designated as BEmONC health facilities by the State working group have OBGYNs and an important number of C-sections (Dinder Hospital with 2 OBGYNs and 62 C-sections per month, Wad Elniel Hospital with 1 OBGYN and 31 C-sections per month, Asoki Hospital with 2 OBGYNs and 18 C-sections per month, and Sukkar Sinnar Hospital with 1 OBGYN and 18 C-sections per month). Three of these four health facilities are functioning CEmONC health facilities according to the EmONC Assessment (Wad Elniel Hospital, Asoki Hospital, and Sukkar Sinnar Hospital). These four health facilities should be designated as CEMONC health facilities. Doba and Was Toktok Hospitals also have each 1 OBGYN but only 7 C-sections per month in Doba and no C-sections in Was Toktok. In light of their capacities and resources and the lower number of deliveries and C-

sections per month, they should be kept as designated BEmONC health facilities and the need for OBGYNs in these health facilities should be further analyzed by the FMoH.

The support team recommends therefore to select the 7 CEmONC (Sinnar Hospital, Sinja Hospital, Wad Elabas Hospital, Sukkar Sinnar Hospital, Dinder Hospital, Asoki Hospital, and Wad Elniel Hospital) and 2 BEmONC (Doba Hospital and Karkoj Hospital).This proposed network is exceptionally just above the maximum number of 8 health facilities suggested by the MoH.

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
10	9	91%	91%	84%	84%	24	21	28	25

All the maternities of the State cover 97% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 100%.

Ten health facilities have been designated by the working group to be included in the EmONC network. They cover 91% of the population within 2 hours travel time. Among them, five health facilities are functioning and cover 84% of the population within 2 hours of travel time.

The support team suggests selecting eight EmONC health facilities for this programmatix cycle, which would cover 89% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle is to ensure that all eight designated EmONC facilities function 24h/7d with quality of care.

Gedarif State

State description

The State of Gedarif is located in the south-east part of the country and is bordered to the south by the Sinnar State, to theWest by the El-Gezira and Karthoum States, to the North by the Kassala State, and to the east by Ethiopia and Eritrea. The surface area of the State is 57,384 square kilometers, or 3% of the country's total surface area. It consists of high lands in the south-eastpart of the State on the Sudan-Ethiopia border, as well as some mountains and hills isolated chains. There are two main rivers: the Atbara and Rahad rivers. It is composed of 12 localities (Basunda, Eastern Galabat, El Fao, El Fashaga, El Mafaza, El Qureisha, El Rahad, Elbutana, Gala'a El Nahal, Gedaref Town, Middle Geddaref, Western Galabat) and has a population of 2 011 614 people.

Institutional deliveries are estimated at 20% (EmONC NA) and contraceptive prevalence rate is 9.2% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
2 011 614	20	10	**8**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Eltaheli Hospital	CEmONC	703 975	0	653
Om Alkhier Rural Hospital	BEmONC	239 148	2	15
Alhawata Rural Hospital	CEmONC	437 744	2	46
Almafaza Hospital	BEmONC	504 915	2	33
Alfaw Hospital	CEmONC	1 398 726	1	192
Elshowak Hospital	CEmONC	819 646	0	60
ElGuraisha Hospital	BEmONC	332 497	2	20

Doka Hospital	CEmONC	714 541	2	45

The two functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the proposed EmoNC network by the working group.

Within this proposed EmONC network, the three most common gaps in signal functions are deliveries assisted by vacuum extraction, administration of anticonvulsants, and basic resuscitation.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Eltaheli Hospital	23	0	30	28	10	0	23
Om Alkhier Rural Hospital	3	0	0	1	0	3	0
Alhawata Rural Hospital	3	0	4	2	2	0	3
Almafaza Hospital	3	0	2	1	1	1	2
Alfaw Hospital	7	0	4	14	2	3	4
Elshowak Hospital	3	0	0	5	1	3	0
ElGuraisha Hospital	3	0	0	2	0	3	0
Doka Hospital	3	0	0	4	1	3	0
Total need in midwives (without redeployment)						**16**	**32**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

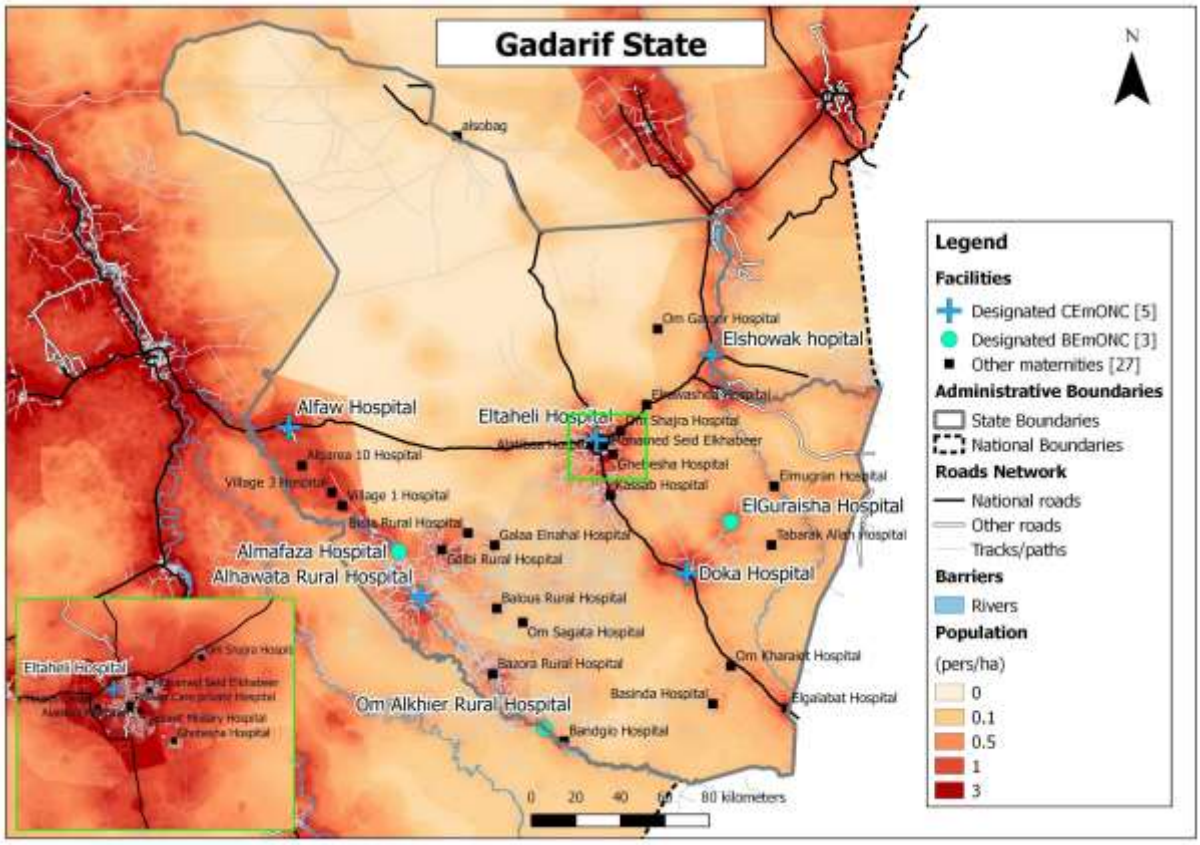
1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Etahili Hospital	ElGuraisha Hospital	2h	4h	Financial barriers, availability of ambulance, roads in poor condition in the rainy season (a lot of water way)
Doka Hospital	ElGuraisha Hospital	1h	1h30	Roads in poor condition in the rainy season (a lot of water way)
Alfaw Hospital	Almafaza Hospital	2h	4h	Financial barriers, availability of ambulance, roads in poor condition in the rainy season (a lot of water way)
Alhawata Rural Hospital	Almafaza Hospital	30 min	3h	Financial barriers, availability of ambulance, roads in poor condition in the rainy season (a lot of water way)
	Om Alkhier Rural Hospital	1h	3h	Roads in poor condition in the rainy season (a lot of water way)

The working group proposed a network with challenging referral linkages between BEmONC and CEmONC facilities, especially during the rainy season. The most common means of transportation in the State is motorized vehicles, including taxi, rksha, and motor boats. For all maternities, financial barriers are highlighted as a major challenge for good referral.

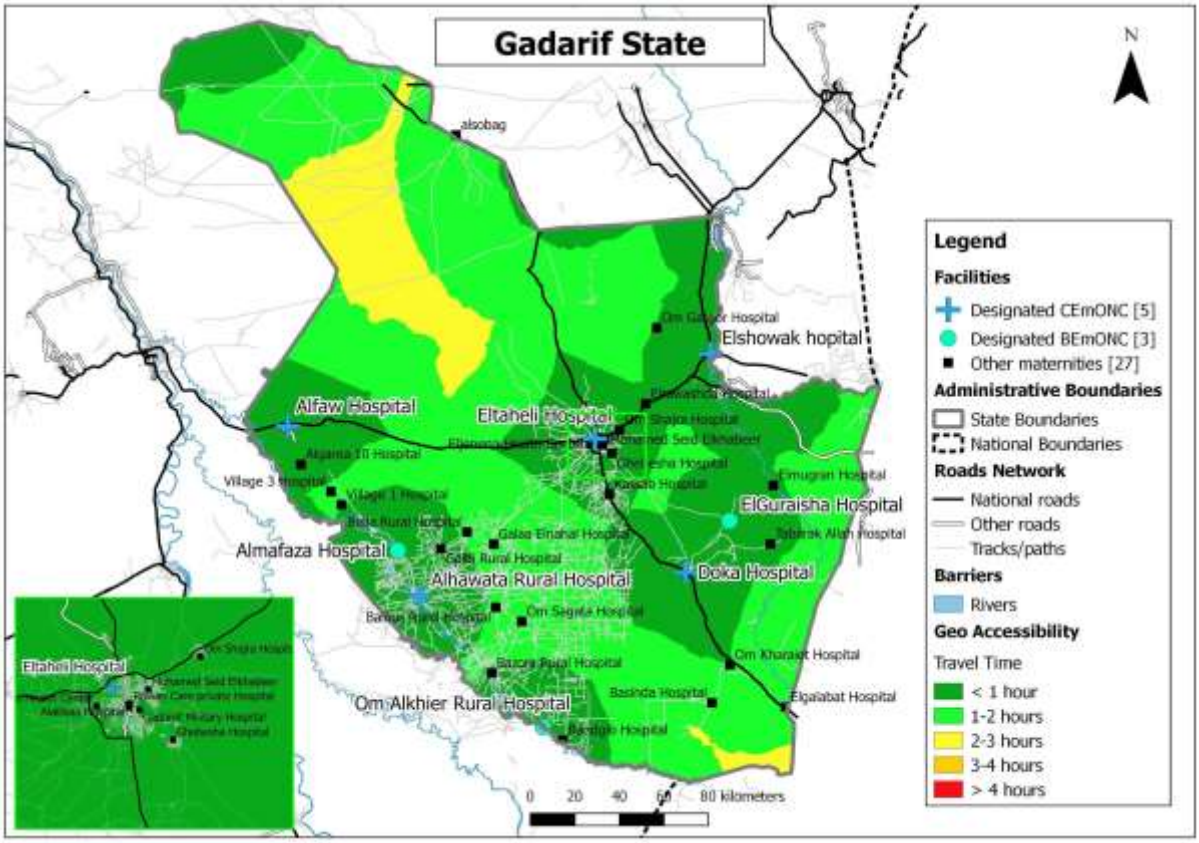
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



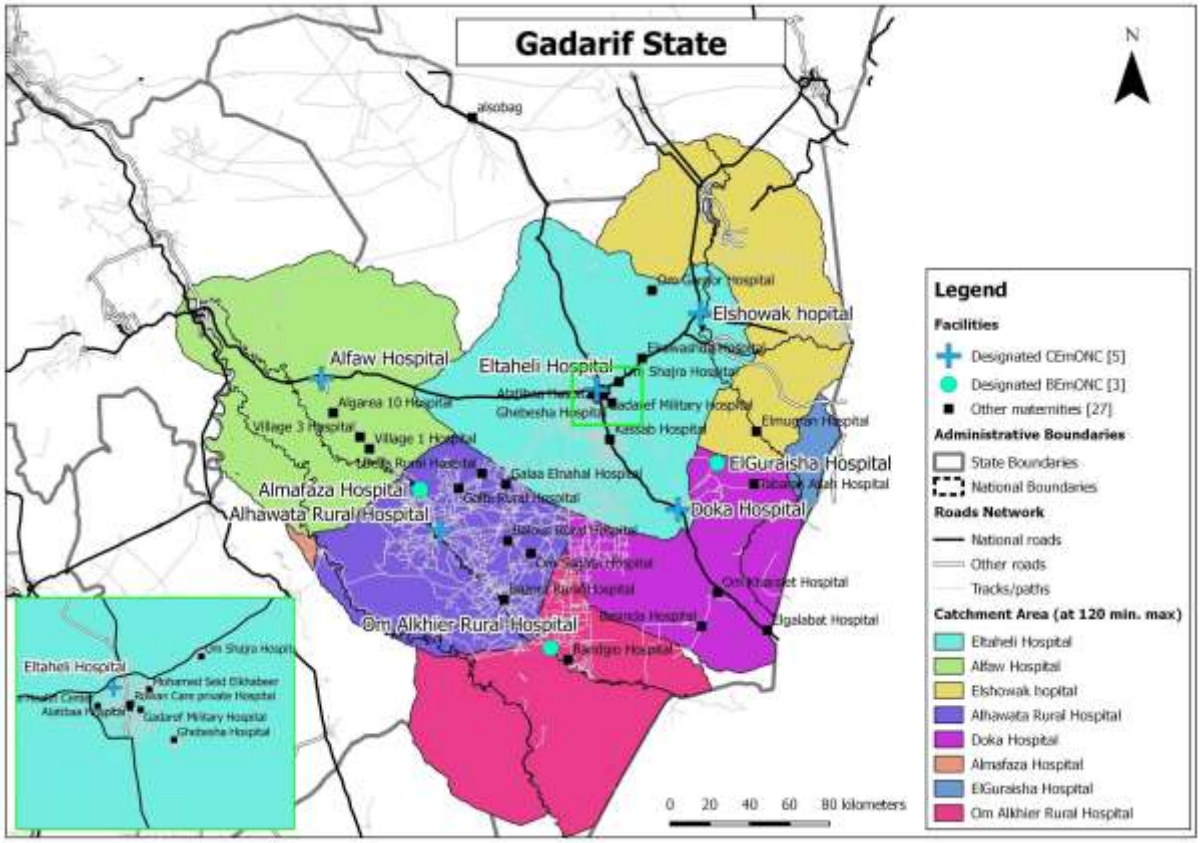
Gadarif State has a high population density concentrated in its west part at the border of Sinnar State. There is also densely populated areas on the center of the State and on the east part. Gadarif is crossed by two major national roads, crossing the State from South to North and from East to West. However, the highly populated area on the border with Sinnar State does not have national roads.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the areas of the Gadarif State are located within 2 hours of travel time of an EmONC health facility proposed by the working group. Despite the absence of major roads in many parts of the State, there are only two areas located in the South West and North where population is between 2 to 3 hours travel time from the closest proposed EmONC health facility. However, these areas are less populated.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover about 95% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most of the population of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
98.8%	99.8%	95.3%	98.9%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Gadarif State has selected 8 health facilities to be part of the EmONC network, including 5 CEmONC (Eltaheli Hospital, Alhawata Rural Hospital, Alfaw Hospital, Elshowak Hospital, Doka Hospital) and 3 BEmONC (Om Alkhier Rural Hospital, Almafaza Hospital, ElGuraisha Hospital). This number is below the international recommendation and the maximum number of designated EmONC health facilities set by the FMoH of 10 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities are overall challenging with most of the referrals above 2 hours travel time, and even reaching 4 hours travel time during the rainy season. In addition, financial barriers, poor road network, and shortages of ambulances makes referral difficult for the three designated BEmONC health facilities.

In terms of human resources, the State does not have any graduate nurse midwife in the designated EmONC health facilities. Half of the designated EmONC health facilities do not have nurse midwives, including two designated BEmONC health facilities (Om Alkhier Rural Hospital and ElGuraisha Hospital) and two designated CEmONC health facilities (Elshowak Hospital and Doka Hospital). However, Eltaheli Hospital has 30 nurse midwives. All designated health facilities have at least one doctor, with important concentrations in the two CEmONC health facilities (Eltaheli Hospital and Alfaw Hospital). There is an important gap of 16 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. Other major gaps identified by the working group are the absence of anesthetists in the CEmONC health facilities and the high turnover of staff.

In terms of infrastructure and equipment, the working group highlighted the absence of functioning ambulances in the designated BEmONC health facilities. Major gaps identified throughout the designated EmONC health facilities also include the lack of vacuum extractors, incubators and bag and masks for neonatal resuscitation in Om Alkhier Rural Hospital, Doka Hospital and Alhawata Rural Hospital.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of supportive supervision, health facility register, and monitoring dashboard. Maternal deaths reviews are conducted in Eltaheli Hospital. None of the designated EmONC health facilities are supported by NGOs or other international partners.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is below the maximum number set by the FMoH for this first EmONC network. Three designated CEmONC health facilities have an important obstetrical activity, particularly Eltaheli and Alfaw Hospitals that have respectively 653 and 192 deliveries per month. Eltaheli Hospital is functioning according to EmONC Assessment and Alfaw Hospital has one signal function missing (vacuum extractions). Elshowak Hospital has a lower obstetric activity with 60 deliveries per month and is functioning. The two remaining CEmONC health facilities (Doka Hospital and Alhawata Rural Hospital) have two gaps in signal function and a lower obstetric activity, respectively of 45 and 46 deliveries per month, but they are located in high density areas.

Among the designated BEmONC health facilities, two health facilities Almafaza Hospital and ElGuraisha Hospital are situated in catchment areas within 2 hours of a CEmONC health facility but their catchment areas are important. There is therefore the potential for an increase in their obstetric activity. Almafaza Hospital has an OBGYN but is doing 2 C-sections per month and should therefore be a designated BEmONC health facility. The need for an OBGYN in this health facility should be further analyzed by the FMoH.

The remaining BEmONC health facility (Om Alkhier Rural Hospital) is not in the catchment area of a CEmONC health facility and could increase the coverage of the population by the EmONC network but it has a very small activity and two gaps in signal functions. Furthermore, it requires 3 midwives in the short term and does not have a green referral linkage to the closest CEmONC health facility (Alhawata Rural Hospital). These three health facilities could therefore be considered for the EmONC network in the next programmatic cycle.

The support team recommends therefore to select the 5 CEmONC (Eltaheli Hospital, Alhawata Rural Hospital, Alfaw Hospital, Elshowak Hospital, Doka Hospital) and 2 BEmONC (Almafaza Hospital, ElGuraisha Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
8	7	95%	93%	49%	49%	16	13	32	32

All the maternities of the State cover 99% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 100%.

Eight health facilities have been designated by the working group to be included in the EmONC network. They cover 95% of the population within 2 hours travel time. Among them, two health facilities are functioning and cover 49% of the population within 2 hours of travel time.

The support team suggests selecting seven EmONC health facilities for this programmatix cycle, which would cover 93% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all seven designated EmONC facilities function 24h/7d with quality of care.

Kassala State

State description

The State of Kassala is located in the east part of the country and is bordered to the south by the Gedarif State, to the West by the River Nile and Karthoum States, to the North by the Red Sea State, and to the east by Eritrea.The surface area of the State is 51,311 square kilometers, or 3% of the country's total surface area. It has a semi desert zone in the northern part of the State and a low rainfall savannah zone in the southern part of the State. It is composed of 11 localities (Kassala Town, New Halfa, Refi Hamashkureib, Refi Kassla, Refi Nahr Atbara, Refi North Delta, Rural Aroma, Rural Khashm Elgirba, Rural Telkok, Rural Wad Elhilaiw, Rural Western Kassala) and has a population of 2 360 083 people.

Institutional deliveries are estimated at 14% (EmONC NA) and contraceptive prevalence rate is 7.3% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
2 360 083	23	11	**6**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Wd Elhileo Hospital	BEmONC	873 486	4	26
Halfa Aljadeda Hospital	CEmONC	656 416	0	442
Wagar Hospital	BEmONC	854 692	4	39
Talkook Hospital	BEmONC	901 643	5	8
Kassala Saudi Hospital	CEmONC	1 353195	0	671
Khashum Elgirba Hospital	CEmONC	1 504 287	0	173

The three functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the proposed EmONC network by the working group.

The three BEmONC health facilities have major gaps in signal functions. The most common gaps in signal functions are manual removal of the placenta, removal of retained products, deliveries assisted by vacuum extraction, and basic resuscitation.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Wd Elhileo Hospital	3	0	0	2	0	3	0
Halfa Aljadeda Hospital	16	0	11	13	4	5	11
Wagar Hospital	3	0	1	2	0	2	1
Talkook Hospital	3	0	0	1	0	3	0
Kassala Saudi Hospital	24	3	20	33	10	1	20
Khashum Elgirba Hospital	6	0	5	5	2	1	5
Total need in midwives (without redeployment)						**15**	**37**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

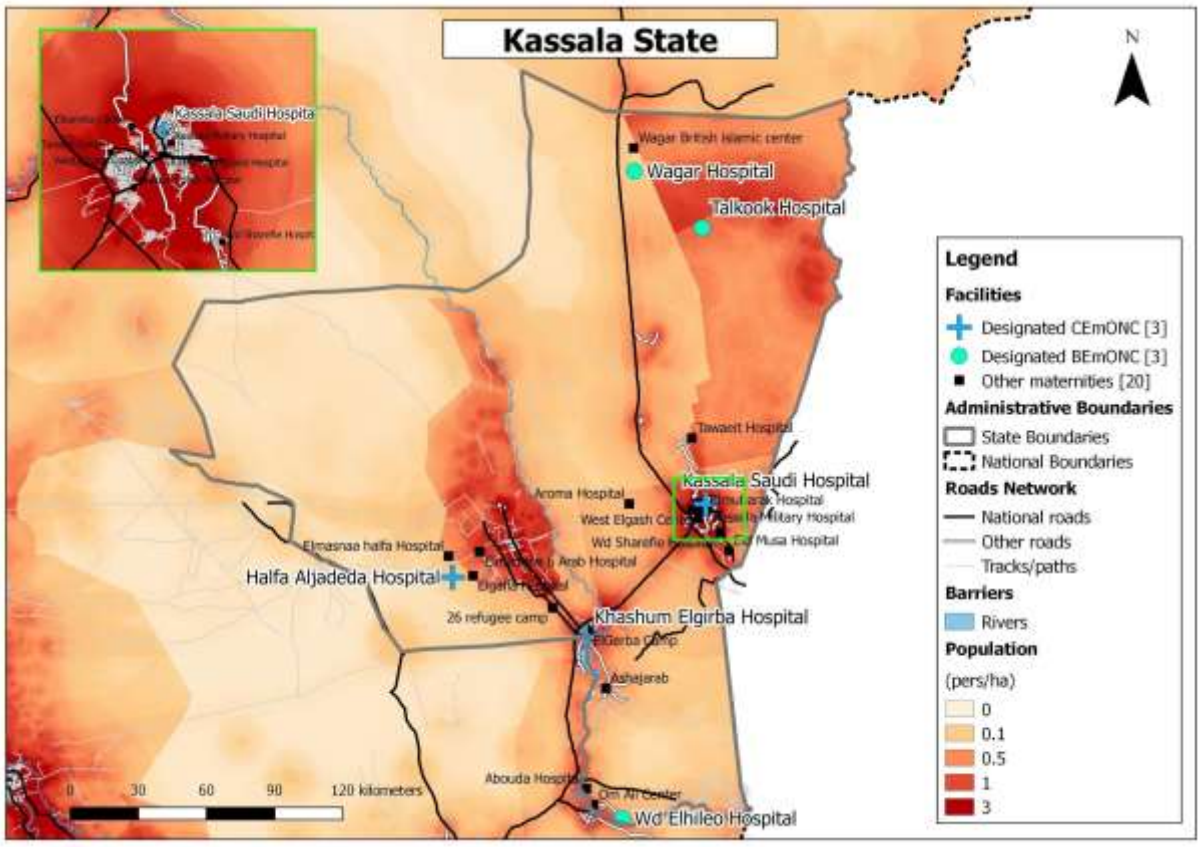
1.1.4 Referral link between EmONC facilities

CEmONC facility	**Name of BEmONC facility linked to the CEmONC facility**	**Average time for referral**		**Overall quality of the referral link**
		Dry season	**Rainy season**	
Kassala Saudi Hospital	Wagar Hospital	1h30	2h	Cost of referral: 20 USD
	Talkook Hospital	1h30	2h	Cost of referral: 40 USD
Khashum Elgirba Hospital	Wd Elhileo Hospital	2h	2h30	Cost of referral: 20 USD

Al Showak (ElGedarif State)	Wd Elhileo Hospital	30 min	50 min	Cost of referral: 15 USD

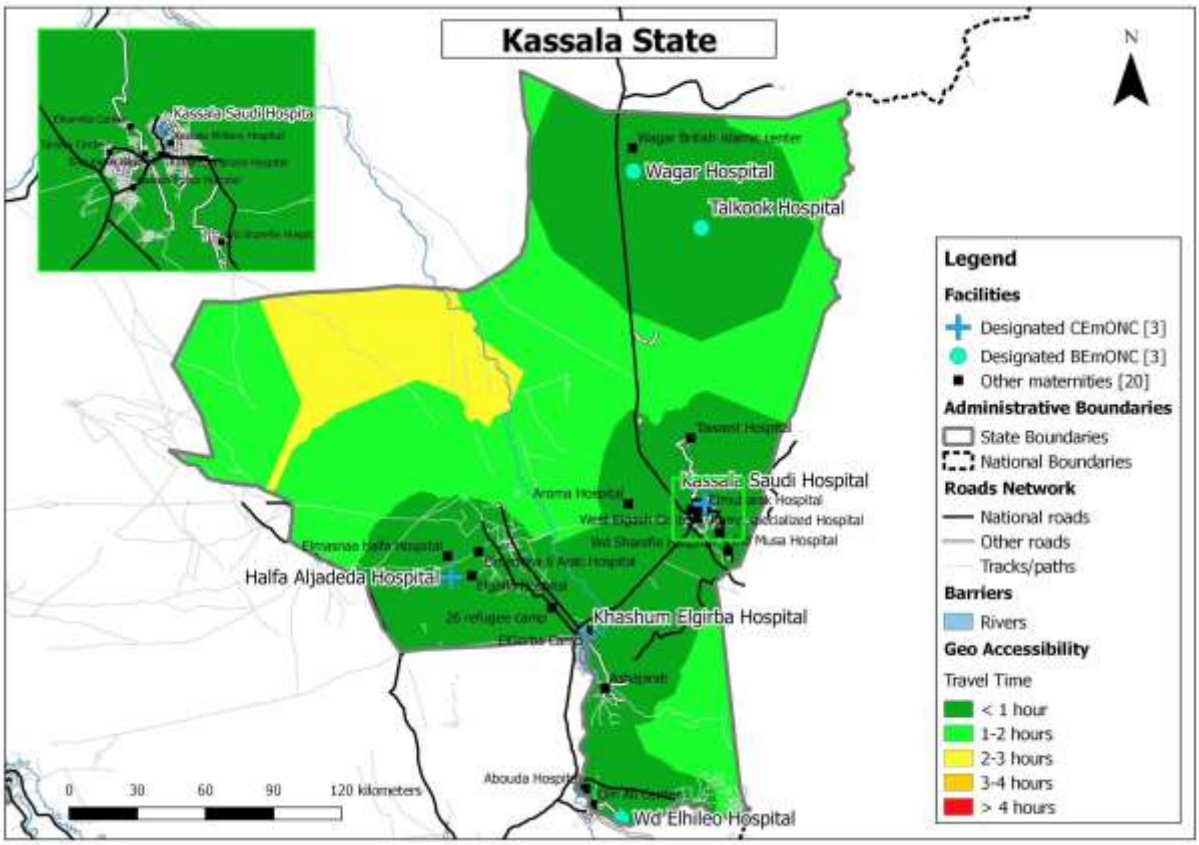
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



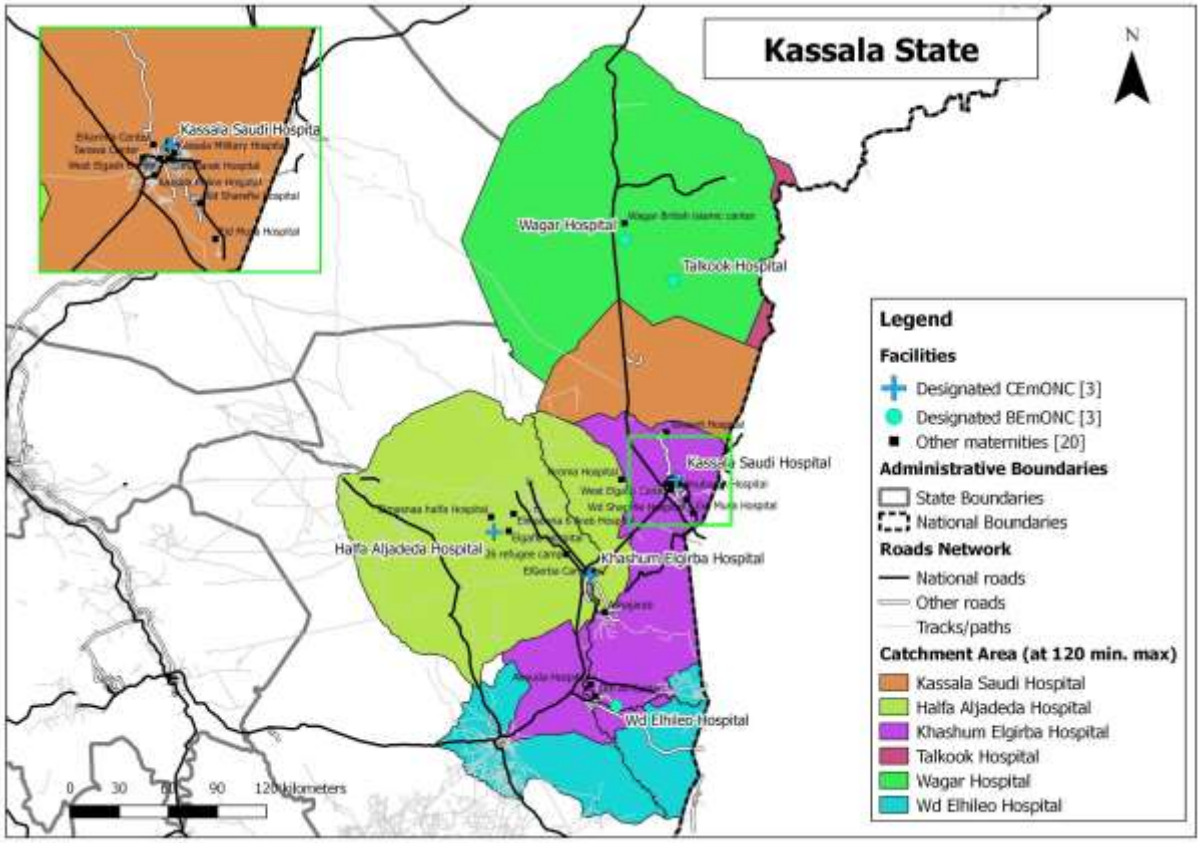
Kassala State has a high population density concentrated in its central and east parts (along the border with Eritrea). The State is crossed by one major national road, crossing the State from South to North. However, the highly populated areas do not have national roads and the east part of the State have limited roads.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the areas of the Kassala State are located within 2 hours of travel time of an EmONC health facility proposed by the working group. Despite the absence of major roads in many parts of the State, there is only one area located in the North West where population is between 2 to 3 hours travel time from the closest proposed EmONC health facility. This area includes pockets of high density population concentrated around the Atbara river.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover about 96% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2-hour travel time cover most of the population of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
98.2%	99.1%	96.2%	96.9%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Kassala State has selected 6 health facilities to be part of the EmONC network, including 3 CEmONC (Halfa Aljadeda Hospital, Kassala Saudi Hospital, Khashum Elgirba Hospital) and 3 BEmONC (Wd Elhileo Hospital, Wagar Hospital, Talkook Hospital). This number is below the

international recommendation and the maximum number of designated EmONC health facilities set by the FMoH of 11 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities are overall good within 2 hours of travel time. In addition, the group did not identify major financial barriers to referrals.

In terms of human resources, the State has only three graduate nurse midwives. Two designated BEmONC health facilities do not have nurse midwives (Wd Elhileo Hospital and Talkook Hospital). All designated health facilities have at least one doctor, with important concentrations of doctors and nurse midwives in the two CEmONC health facilities (Halfa Aljadeda Hospital and Kassala Saudi Hospital). There is an important gap of 18 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. The group also highlighted motivation and retention issue in Talkook Hospital.

In terms of infrastructure and equipment, the working group highlighted the absence of infection prevention and control equipment in two BEmONC health facilities (Wagar and Talkook Hospitals).The group also highlighted issues with maintenance of the ambulance in Wagar Hospital.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of health facility register and the lack of monitoring dashboard and supportive supervision in Wd Elhileo Hospital. Maternal deaths reviews are conducted in all designated EmONC health facilities. Halfa Aljadeda Hospital is supported by UNFPA, UNICEF, and Italian Cooperation.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is below the maximum number set by the FMoH for this first EmONC network. The three designated CEmONC health facilities have an important obstetrical activity, particularly Halfa Aljadeda Hospital and Kassala Saudi Hospital that have respectively 442 and 671 deliveries per month. All three CEmONC health facilities are functioning.

None of the designated BEmONC health facilities are situated in catchment areas within 2 hours of a CEmONC health facility but they have good referral linkages with CEmONC health facilities, including for Wd Elhileo Hospital to Al Showak (in ElGedarif State), which is recommended to be part of the EmONC network. One BEmONC health facilities has a very low obstetric activity, Talkook Hospital with only 8 deliveries per month. It is also close to another BEmONC health facility, Wagar Hospital. Furthermore, it has 5 gaps in signal functions and needs 3 midwives in the short term to ensure 24h/7d availability of services. It also has issues with staff motivation and retention. It could therefore be considered for the EmONC network in the next programmatic cycle.

The support team recommends therefore to select the 3 CEmONC (Halfa Aljadeda Hospital, Kassala Saudi Hospital, Khashum Elgirba Hospital) and 2 BEmONC (Wd Elhileo Hospital, Wagar Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
6	5	96%	95%	70%	70%	15	12	37	37

All the maternities of the State cover 98% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 99%.

Six health facilities have been designated by the working group to be included in the EmONC network. They cover 96% of the population within 2 hours travel time. Among them, three health facilities are functioning and cover 70% of the population within 2 hours of travel time.

The support team suggests selecting five EmONC health facilities for this programmatix cycle, which would cover 95% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all five designated EmONC facilities function 24h/7d with quality of care.

Red Sea State

State description

The State of Read Sea is located in the east part of the country and is bordered to the south by the Kassala State, to the West by the River Nile State, to the North by Egypt, and to the east by the Red Sea. The surface area of the State is 215,550 square kilometers, or 11% of the country's total surface area. It mostly consists of desert and has a 750-kilometer coastline characterized by numerous islands. It is composed of 10 localities (Agig, Dordieb, El Ganab Elawlaib, Gabaot Elma'aadin, Halaeeb, Haya, Port Sudan, Sinkat, Swakin, Tokar) and has a population of 1 445 353 people.

Institutional deliveries are estimated at 22% (EmONC NA 2017) and contraceptive prevalence rate is 9.6% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
1 445 353	14	7	**6**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Red Sea Hospital	CEmONC	930 179	0	581
Eltakadom Hospital	CEmONC	930 920	6	10
Tukar rural Hospital	BEmONC	615 275	2	27
Swaken Hospital	BEmONC	1 096 560	2	81
Hya General Hospital	BEmONC	543 446	3	17
Sinkat General Hospital	CEmONC	1 128 458	0	35

Two of the three functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the proposed EmoNC network by the working group.Osman Degna Hospital was not included as it was not

considered functional by the working group due to the absence of instrumental deliveries (using vacuum extractors - according to the EmONC NA database).

Within this proposed EmONC network, the three most common gaps in signal functions are the administration of anticonvulsants, deliveries assisted by vacuum extraction, manual extraction of the placenta, and basic neonatal resuscitation.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Red Sea Hospital	21	0	15	2	7	6	15
Eltakadom Hospital	3	0	1	7	2	2	1
Tukar rural Hospital	3	0	1	2	1	2	1
Swaken Hospital	3	0	3	3	1	0	3
Hya General Hospital	3	0	0	2	1	0	3
Sinkat General Hospital	4	0	0	2	1	4	0
Total need in midwives (without redeployment)						**14**	**23**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

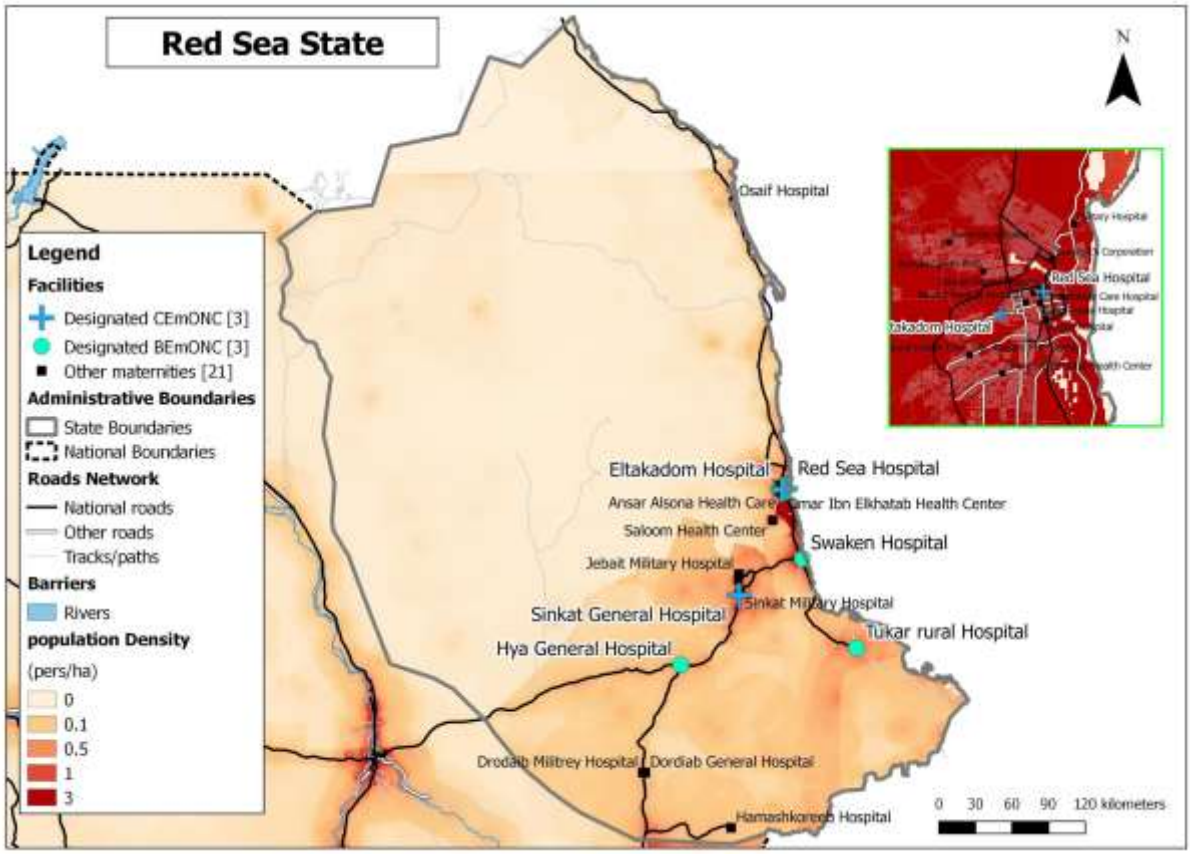
1.1.4 Referral link between EmONC facilities

CEmONC facility	**Name of BEmONC facility linked to the CEmONC facility**	**Average time for referral**		**Overall quality of the referral link**
		Dry season	**Rainy season**	
Red Sea Hospital	Swaken Hospital	30 min	1h	Potential barriers: Financial barriers about 6 USD, culture, habits

Sinkat General Hospital	Swaken Hospital	1h	1h30	Potential barriers: Financial barriers about 6 USD, culture, habits
	Hya General Hospital	1h30	2h	Potential barriers: Financial barriers about 6 USD, culture, habits
	Tukar rural Hospital	2h	3h	Financial barriers about 10 USD, culture, habits

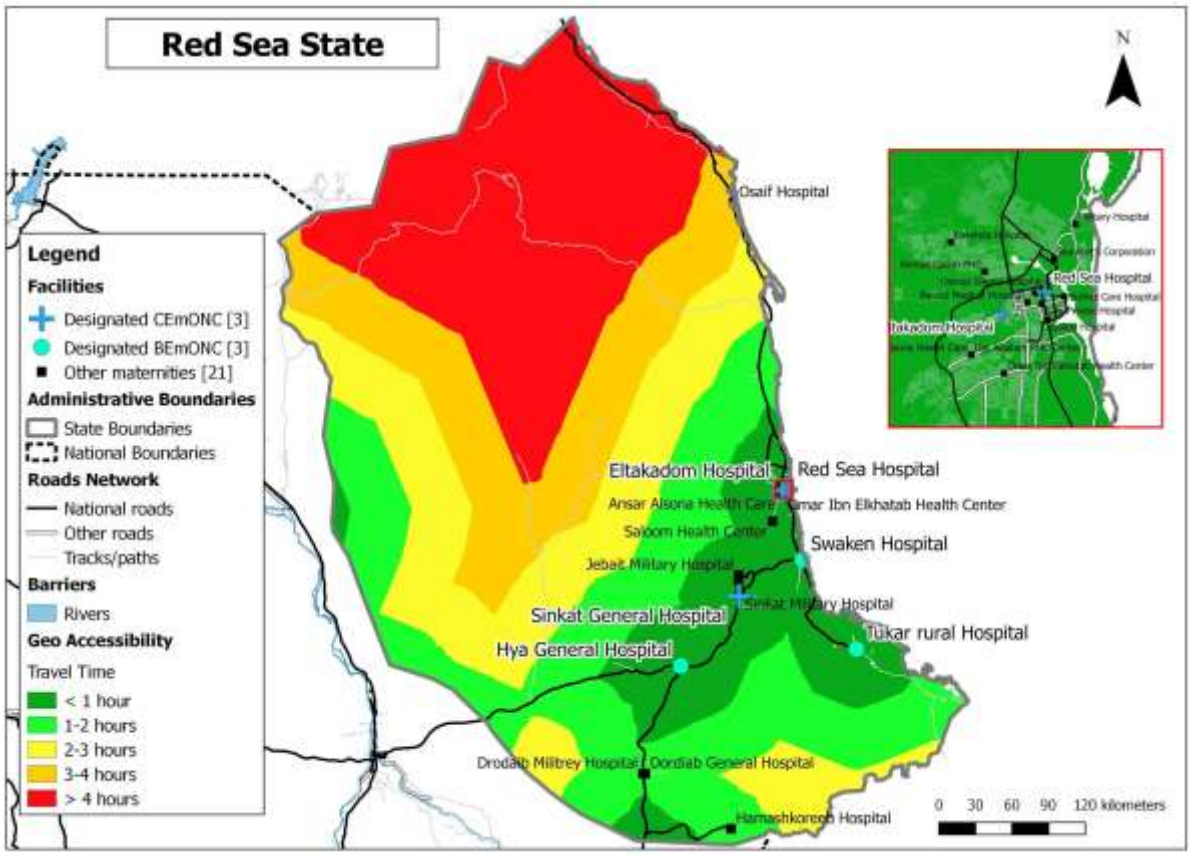
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



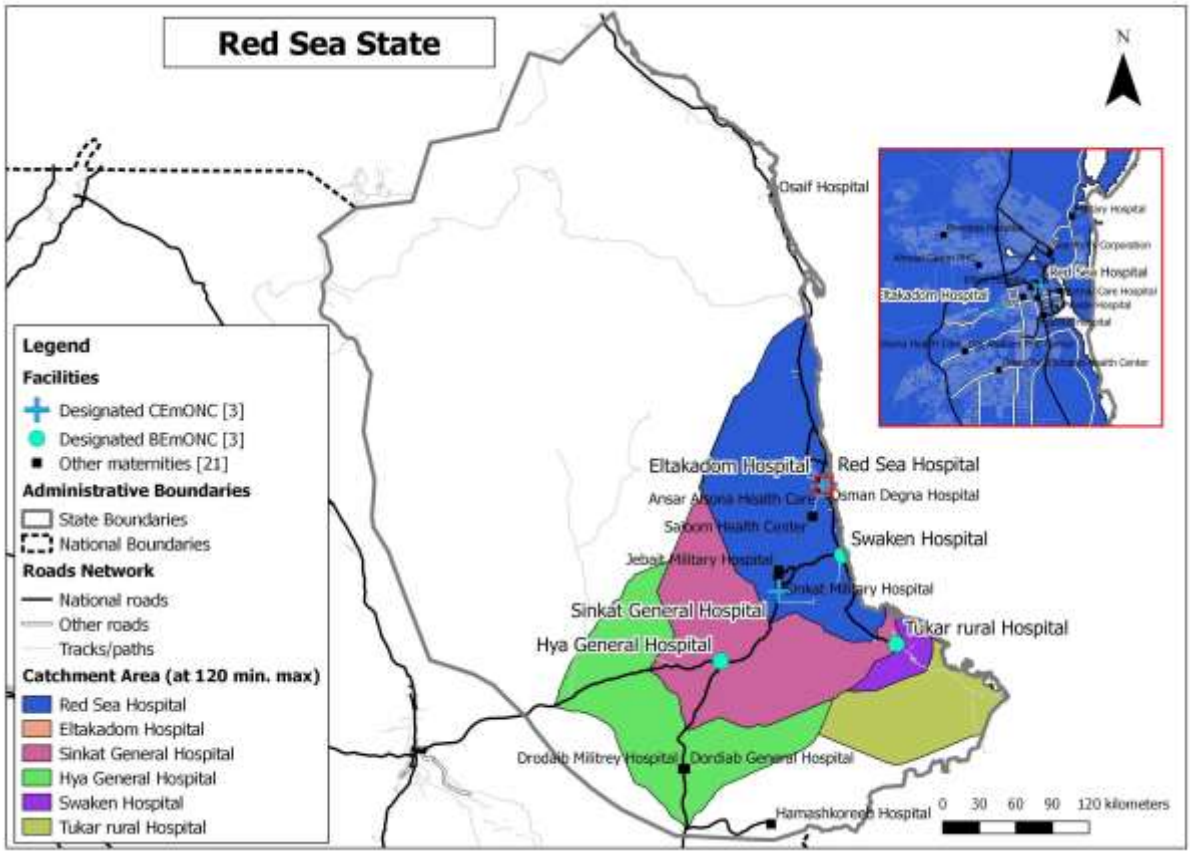
Red Sea State has a high population density concentrated in its southern part. The State is crossed by two major national roads in its southern part and by one national road along the coast, crossing the State from South to North. The populated area of the South-East does not have national roads. The West part of the State is the desert where population use different paths to circulate.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the populated areas of the Red Sea State are located within 2 hours of travel time of an EmONC health facility proposed by the working group. There is only two areas located in the populated southern part of the State where population is between 2 to 3 hours travel time from the closest proposed EmONC health facility. However, the health facilities close to these areas have a very low obstetric activity and are far away from the closest CEmONC health facility. They cannot be included in this first EmONC network. The northern part of the State has areas at more than 3 hours and even more than 4 hours from the closest EmONC health facility but these areas have very few population and where no EmONC facilities can be placed. Complementary strategies, such as maternity waiting homes, should then be considered to ensure that these population can access EmONC services.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover about 79% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most of the southern part of the States, where is located the majority of the population of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
90.2%	91.7%	79.3%	84.7%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Red Sea State has selected 6 health facilities to be part of the EmONC network, including 3 CEmONC (Red Sea Hospital, Sinkat General Hospital, Eltakadom Hospital) and 3 BEmONC (Hya General Hospital, Tukar rural Hospital, Swaken Hospital)[1]. This number is below the international recommendation and the maximum number of designated EmONC health facilities set by the FMoH of 7 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities are overall good within 2 hours of travel time, except for Tukar rural Hospital which is between 2-3h from Sinkat General Hospital . In addition, the group did not identify major financial barriers to referrals.

In terms of human resources, the State does not have graduate nurse midwives. Two designated EmONC health facilities (one CEmONC - Sinkat general Hospital - and one BEmONC - Hya General Hospital) do not have nurse midwives. All designated health facilities have at least two doctors. There is a gap of 14 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. The group also highlighted the need for in-service training for staff in all designated EmONC health facilities.

In terms of infrastructure and equipment, the working group highlighted the presence of functioning laboratory in four designated EmONC health facilities (Red Sea Hospital, Sinkat General Hospital, Tukar rural Hospital, Swaken Hospital) and blood bank in two designated CEmONC health facilities (Red Sea Hospital, Sinkat General Hospital). However the group highlighted the need for bag and mask for basic neonatal resuscitation and the need for vacuum extractors across all designated EmONC health facilities as well as the shortage of water supply and electricity across health facilities.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of health facility register and the lack of monitoring dashboard and supportive supervision and the lack of staff meetings and incentives for staff. Maternal deaths reviews are conducted in all designated EmONC health facilities. Red Sea Hospital is supported by UNFPA, Italian Cooperation, and Aispo, Tukar rural Hospital and Swaken Hospital are supported by UNFPA and Aispo, Sinkat General Hospital and Hya General Hospital are supported by Aispo,and Eltakadom Hospital is supported by the Italian Cooperation.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is below the maximum number set by the FMoH for this first EmONC network. One designated CEmONC health facilities has an important obstetrical activity, Red Sea Hospital with 581 deliveries per month. It is also functioning according to the EmONC Assessment. The Sinkat Hospital has a low obstetric activity (with 35 deliveries per month) but has an important catchment area within two hours of travel time and has therefore the potential to increase its activity. However, the third designated CEmONC health facility, Eltakadom Hospital, has a very low activity with only 10 deliveries per month and important gaps in signal functions. It is also located next to the Red Sea Hospital. In light of the challenge to make this CEmONC functioning with quality of care, it could be considered for the EmONC network in the next programmatic cycle.

The designated BEmONC health facilities have overall good referral linkages with CEmONC health facilities, except for Tukar rural hospital which has a referral between 2-3h to Sinkat general Hospital. Swaken hospital has a good obstetric activity (with 81 deliveries per month) and two gaps in signal functions. The two other BEmONC health facilities have a lower number of deliveries but have

[1] Mother Care Hospital and Sea Port Corporation Hospital were not selected by the working group as Mother Care is a private clinic and services in Sea Port are limited to families of those working at the Port.

important catchment areas, so a potential to increase their activity. In addition, their catchment areas expand the coverage of the EmONC network in populated areas.

In addition, Hya General Hospital, Tukar rural Hospital, and Swaken Hospital have each 1 OBGYN but a lower number of C-sections per month, with respectively 2 C-sections per month, 5 C-sections per year, and 3 C-sections per month. In light of their capacities and resources and the lower number of deliveries and C-sections per month, they should be kept as designated BEmONC health facilities and the need for OBGYNs in these health facilities should be further analyzed by the FMoH.

The support team recommends therefore to select the 2 CEmONC (Red Sea Hospital, Sinkat General Hospital) and 3 BEmONC (Hya General Hospital, Tukar rural Hospital, Swaken Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
6	5	79%	79%	61%	61%	14	12	23	22

All the maternities of the State cover 90% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 92%.

Six health facilities have been designated by the working group to be included in the EmONC network. They cover 79% of the population within 2 hours travel time. Among them, two health facilities are functioning and cover 61% of the population within 2 hours of travel time.

The support team suggests selecting five EmONC health facilities for this programmatix cycle, which would also cover 79% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all five designated EmONC facilities function 24h/7d with quality of care.

River Nile State

State description

The State of River Nile is located in the north-east part of the country and is bordered to the south by the Khartoum and Kassala States, to the West by the Northern State, to the North by Egypt, and to the east by the Red Sea State. The surface area of the State is 129,685 square kilometers, or 7% of the country's total surface area. It straddles both desert and semi-desert zones. It contains the River Nile, the River Atbra and a number of seasonal streams. It is composed of 7 localities (Abu Hamad, Atbara, Barbar, El Buhaira, El Damar, El Matama, Shendi) and has a population of 1 429 513 people.

Institutional deliveries are estimated at 46% (EmONC NA 2017) and the contraceptive prevalence rate is 19.9% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
1 429 513	14	7	**8**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Abu Hamad Hospital	CEmONC	77 677	1	72
Adamer Hospital	CEmONC	688 904	NA	369
Alkab Rural Hospital	BEmONC	50 355	1	27
Atabra Hospital	CEmONC	667 291	0	239
Elnorab Hospital	BEmONC	637 877	2	99
Shendi Hospital	CEmONC	1 126 793	0	148
Sidoon Hospital	BEmONC	592 039	1	31
Wd Hamid	BEmONC	1 020 252	3	45

Two of the 14 functioning EmONC facilities according to the EmONC NA have been included in the EmONC network proposed by the working group.

Barbar Hospital, Elageeda Hospital, Atbara Military Hospital, Siggadi Hospital, Sidoon Hospital were not considered as functional due to the absence of instrumental deliveries. Atbara Modern Hospital and Elgutbi Clinic were not considered functional due to stock outs of oxytocin and magnesium sulfate. In addition of Atabra Hospital and Shendi Hospital, three health facilities were considered functional by the EmONC NA and by the State working group: Elmatama Hospital, Elketiab Hospital, and Elmak Nimir Hospital. They were not selected by the State working group for the EmONC network but theit inclusion in the EmONC network is discussed below by the support team.

Within this proposed EmONC network, the three most common gaps in signal functions are the administration of anticonvulsants, deliveries assisted by vacuum extraction, manual extraction of the placenta, and basic neonatal resuscitation.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Abu Hamad Hospital	4	0	5	2	1	0	4
Adamer Hospital	14	0	9	2	7	5	9
Alkab Rural Hospital	3	0	1	1	0	2	1
Atabra Hospital	9	0	11	8	6	0	9
Elnorab Hospital	4	0	2	2	1	2	2
Shendi Hospital	5	0	8	4	2	0	5
Sidoon Hospital	3	0	1	2	0	2	1
Wd Hamid	3	0	2	1	1	1	2
Total need in midwives (without redeployment)						**12**	**33**

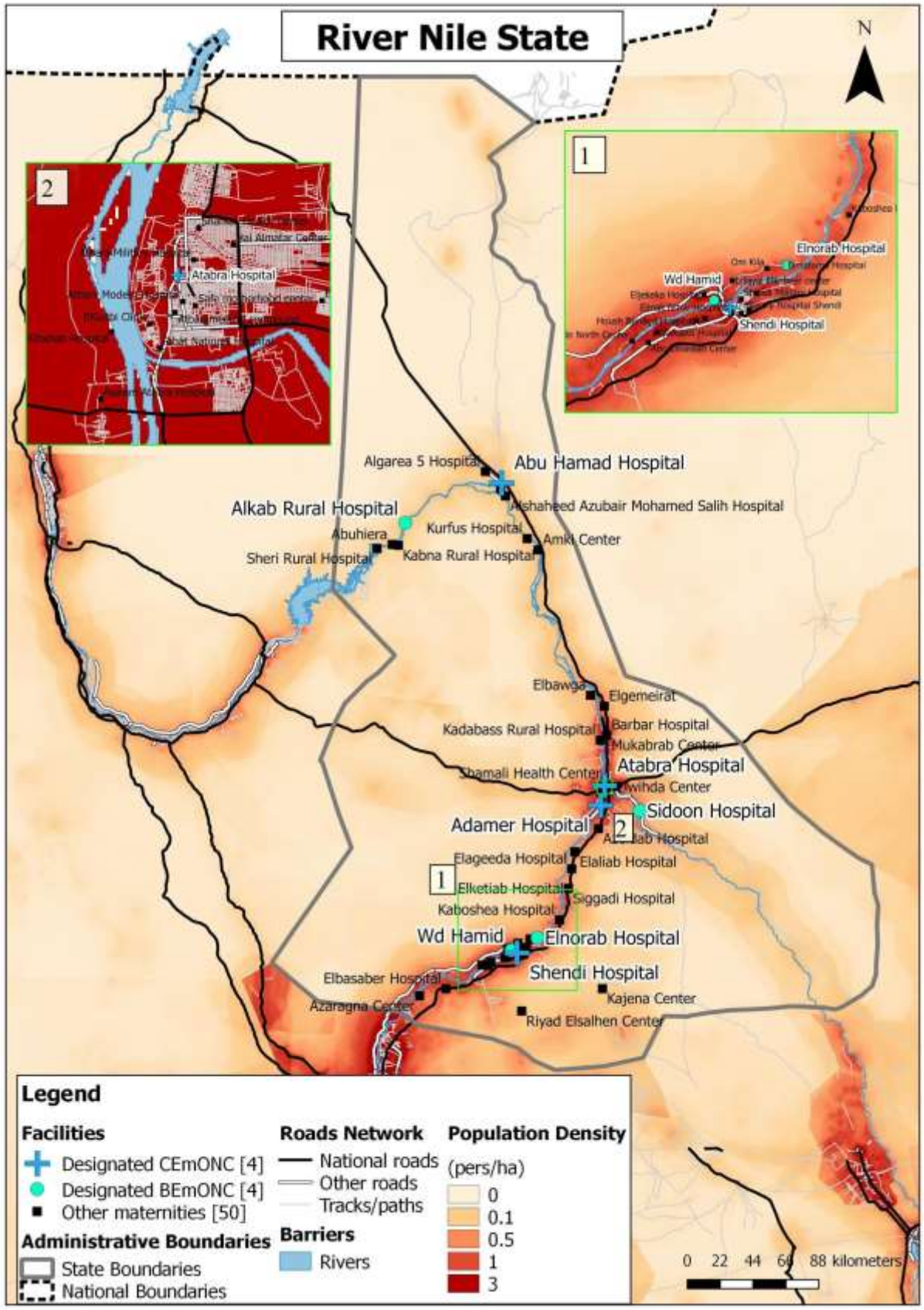
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Abu Hamad Hospital	Alkab Rural Hospital	1h15	1h15	financial barriers
Atabra Hospital	Sidoon Hospital	50 min	4h	Isolation from a designated CEmONC hospital during rainy season (2-3 months/year) financial barriers - 20 USD
Shendi Hospital	Elnorab Hospital	45 min	45 min	financial barriers -10 USD
	Wd Hamid	2h	2h	financial barriers -10 USD

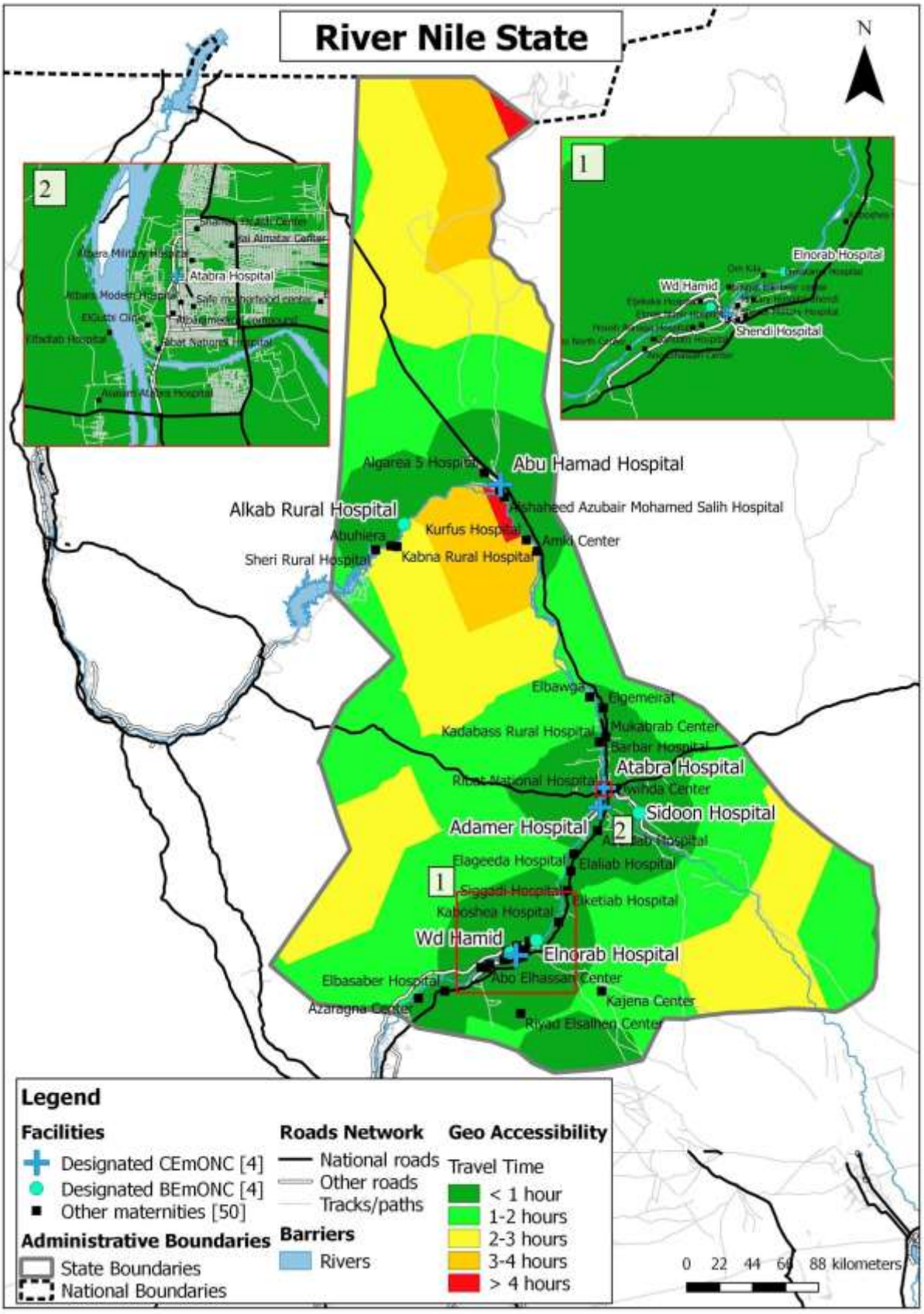
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



River Nile State has a high population density concentrated around the Nile river, particularly in the southern part of the State.

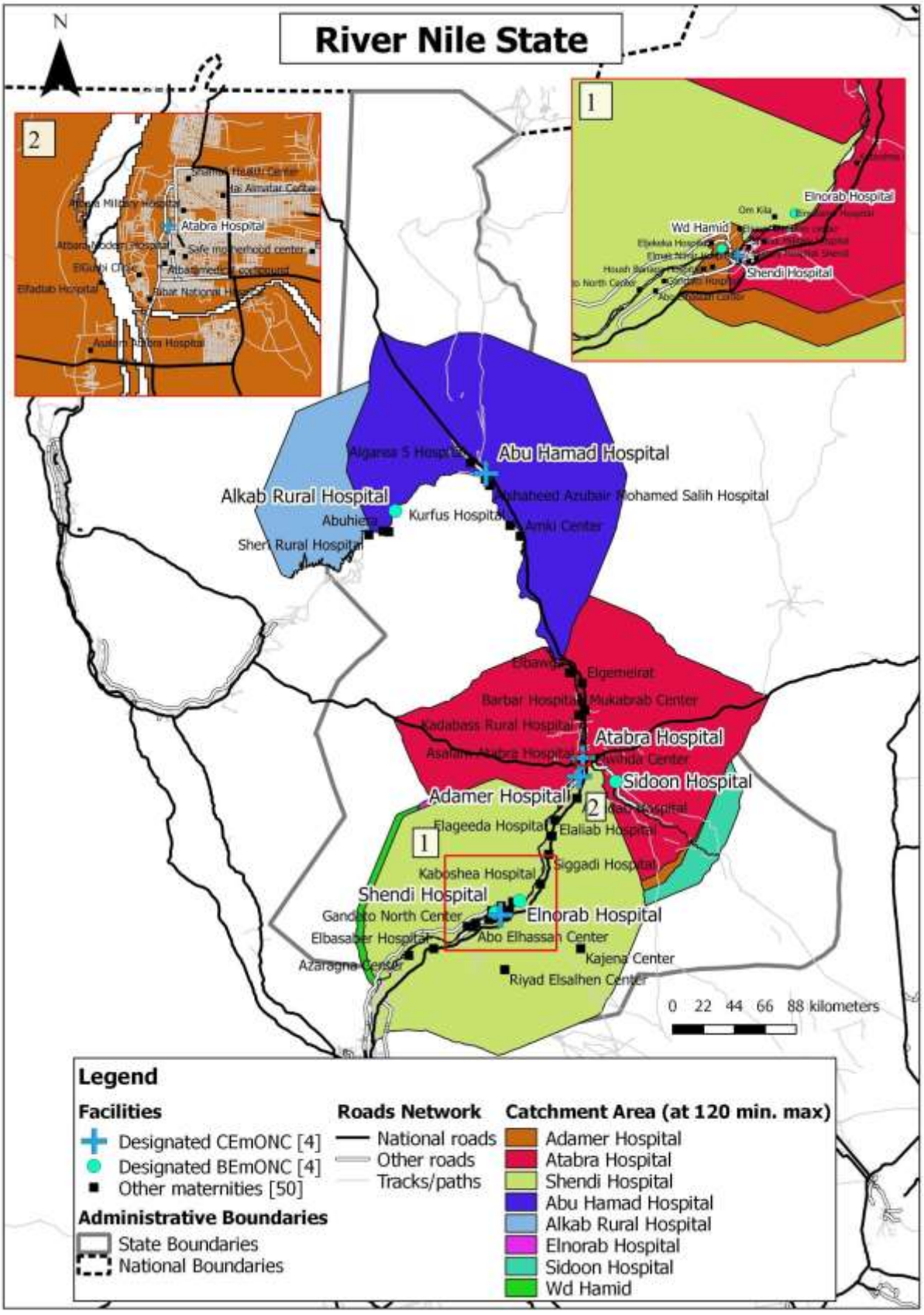
Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the populated areas of the Southern part of the River Nile State are located within 2 hours of travel time of an EmONC health facility proposed by the working group. Most of the regions located near the River Nile are accessible within 2 hours, except on the east side of the river near Abu Hamad Hospital as there is no bridge to cross the river and the only transportation mean is

There are only two areas located in the southern part of the State where population is between 2 to 3 hours travel time from the closest proposed EmONC health facility. However, there is a lower population density in these areas and no health facilities performing deliveries. The northern part of the State has areas at more than 2 hours and even more than 4 hours from the closest EmONC health facility but these areas have very few population and no health facilities performing deliveries. Complementary strategies, such as maternity waiting homes, should then be considered to ensure that these population can access EmONC services.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover about 84% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most of the southern part of the States and along the River Nile, where is located the majority of the population of the State. The west bank of the River Nile near Abu Hamad Hospital is the only area close to the River where population do not have access to the closest EmONC health facility within two hours of travel time.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		Coverage of the population by the EmONC network proposed by the working group within 2h travel time	
State	With bordering States	State	With bordering States
90.8%	94.2%	84.3%	88.6%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of River Nile State has selected 8 health facilities to be part of the EmONC network, including 4 CEmONC (Abu Hamad Hospital, Adamer Hospital, Atabra Hospital, Shendi Hospital) and 4 BEmONC (Alkab Rural Hospital, Elnorab Hospital, Sidoon Hospital, Wd Hamid). This number is below the international recommendation but just above the maximum number of 7 designated EmONC health facilities set by the FMoH.

The referral linkages between the selected BEmONC and CEmONC health facilities are overall within 2 hours of travel time, but with financial barriers. However, Sidoon Hospital is isolated (reference of 4 hours) from the CEmONC Atabra Hospital during the rainy season.

In terms of human resources, all the designated EmONC health facilities have at least one graduate nurse midwives and at least one doctor, with a higher concentration in Adamer Hospital, Atabra Hospital, and Shendi Hospital. There is a gap of 12 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. The group also highlighted the need for in-service training for staff in all designated EmONC health facilities and the high turnover among medical doctors and the fact that several graduate nurse midwives in Atabra Hospital and Adamer Hospital are going to retire soon.

In terms of infrastructure and equipment, the working group highlighted the presence of functioning laboratory in all designated health facilities, except Abu Hamad Hospital and Adamer Hospital. For the designated CEmONC health facilities, the group highlighted the presence of a functioning blood bank in Atabra Hospital. Abu Hamad and Shendi Hospitals have a blood bank but not functioning. The four CEmONC health facilities are all missing adequate equipment for the theatre room (such as anesthesia machine) and all health facilities are missing infection prevention equipment (such as autoclave, sink), delivery instruments and equipments (such as vacuum extractors, delivery tables) and dedicated areas for newborn resuscitation. In terms of infrastructure, the maternity units of Atabra and Siddon Hospitals are considered inadequate and the sewage system of these two hospitals and of Shendi Hospital are poor.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of health facility register and the lack of monitoring dashboard and supportive supervision and the lack of communication means in all designated EmONC health facilities. The group

also highlighted the lack of Standard Treatment Guidelines across all designated health facilities. Maternal deaths reviews are conducted in Shendi, Atabra, and Adamer Hospitals. None of the designated EmONC health facilities in River Nile Sea Hospital are supported by international or other organizations.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is just above the maximum number set by the FMoH for this first EmONC network. All four designated CEmONC health facilities have an important obstetrical activity, particularly Adamer Hospital with 367 deliveries per month, and Atabra Hospital with 239 deliveries per month. Abu Hamad Hospital has the lowest obstetric activity among the designated CEmONC health facilities with only 72 deliveries per month. All of them have limited gaps in signal function and Atabra Hospital is functioning.

The designated BEmONC health facilities have overall referral linkages with CEmONC health facilities, within two hours of travel time except for Sidoon Hospital during the rainy season. The others have a lower obstetric activity but have an important catchment area, except Alkab Rural Hospital. Siddon can discharge their closest CEmONC health facility. Even if its catchment area expands the coverage of the EmONC network, the designated BEmONC Alkab Rural Hospital has a small obstetric activity, a small catchment area, and a need of two graduate midwives to function 24h/7d. It could therefore be considered for another programmatic cycle.

In addition, Elnorab Hospital has a high obstetric activity (about 100 deliveries per month), six OBGYNs and is doing 22 C-sections per month. Wd Hamid has 1 OBGYN and is doing 13 C-sections per month. These two health facilities should be designated as CEMONC health facilities. Siddon has 1 OBGYN but no C-sections. It should be kept as designated BEmONC health facilities and the need for an OBGYN in this health facility should be further analyzed by the FMoH.

Finally, Elmatama Hospital, Elketiab and Elmak Nimir Hospital are two functioning CEmONC halth facilities according to the EmONC NA with respectively 58, 68 and 176 deliveries per month. These health facilities should therefore also be included in the EmONC network.

In light of the high number of functioning EmONC health facilities in River Nile State, the support team recommends to select the 9 CEmONC (Abu Hamad Hospital, Adamer Hospital, Atabra Hospital, Elnorab Hospital, Shendi Hospital, Wd Hamid, Elmatama Hospital, Elketiab Hospital and Elmak Nimir Hospital) and 1 BEmONC (Sidoon Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
8	10	84%	84%	79%	79%	12	11	33	41

All the maternities of the State cover 91% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 94%.

Eight health facilities have been designated by the working group to be included in the EmONC network. They cover 84% of the population within 2 hours travel time. Among them, two health facilities are functioning and cover 79% of the population within 2 hours of travel time. Three additional functioning CEmONC health facilities are suggested by the support team.

The support team suggests selecting ten EmONC health facilities for this programmatix cycle, which would also also cover 84% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all ten designated EmONC facilities function 24h/7d with quality of care.

Khartoum State

State description

The State of Khartoum is located in the central-east part of the country and is bordered to the south by the White Nile, El Gazira, and Gedarif Staes, to the West by the Kassala State, to the North by the River Nile and Northern States, and to the east by the North Kordofan State. is 21,207 square kilometers, or 1% of the country's total surface area. The northern region of the State is mostly desert whereas the other regions have semi-desert climates. It is composed of 7 localities (Bahri, Jebel Awlia, Karrari, Khartoum, Sharg Elneel, Um Bada, Um Durman) and has a population of 7,385,158 people.

Institutional deliveries are estimated at 43% (EmONC NA 2017) and contraceptive prevalence rate is 24.9% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
7,385,158	**73**	**36**	**25**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Eljazeera Slang (Slanj Island)	BEmONC	7 683 424	5	48

Ali Abdelfatah Hospital	CEmONC	8 140 894	1	143
Ban Jaded Hospital	CEmONC	8 369 405	1	473
Saad Abu Elila Hospital	CEmONC	8 453 331	0	157
Garri Hospital	BEmONC	7 268 201	3	16
Omdurman Maternity Hospital	CEmONC	8 277 036	0	1573
Jebel Awlia Hospital	BEmONC	8 116 904	0	175
Elsheikh Ali Elfadul	CEmONC	8 219 773	0	696
Khartoum North Hospital	CEmONC	8 385 248	0	571
Haf Alsafi Hospital	BEmONC	8 341 618	0	252
Wad Aljabal Hospital	BEmONC	7 781 898	3	21
Abodeleeg Hospital	CEmONC	553 760	2	52
Elfateh Hospital	BEmONC	7 697 472	3	91
Turkish Hospital Khartoum	CEmONC	8 268 907	0	539
`Om doanban	CEmONC	8 760 190	0	216
Bashair Public Hospital	CEmONC	8 480 865	1	257
Gareeb Algasee Public Hospital	BEmONC	8 127 585	NA	26
Elkhojabal Center	BEmONC	8 114 554	5	22
Wd Ubsalih Hospital	BEmONC	7 806 580	4	19
Asororab Hospital	CEmONC	7 598 016	4	21
Soba Hospital	CEmONC	8 586 870	0	222
Alacademy Hospital	BEmONC	8 463 907	NA	143
Elsadaga Hospital	CEmONC	8 175 107	NA	221
Ibrahim Malik Hospital	CEmONC	8 496 889	NA	214
Umbada Hospital	CEmONC	8 046 002	NA	247

Nine of the 23 functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

Bashair Private Hospital, Sabar Elsheikh Hospital, Elgimma Hospital, Healthcare Hospital, Queen Hospital were not considered functioning due to the absence of instrumental deliveries. Ban Jaded Hospital, Libya Hospital were not considered functioning due to stock outs of oxytocin and/or magnesium sulfate.

Shawamikh Hospital and Dar Aelilag Hospital were not included in the EmONC network by the State working group due to the very low number of deliveries per month or lack of information on the obstetric activity in the health facility.

In addition, four health facilities were considered functioning by the working group but not selected in the EmONC network: Royal Care Hospital, Elsaudi Hospital, Elrajaa Specialized Clinic, and Ribat Police Hospital. The inclusion of these health facilities in the EmONC network is discussed below by the support team.

Within this proposed EmONC network, most designated EmOC health facilities have limited gaps in signal functions (except three BEmONC health facilities - Slanj Island, Elkhojabal Center and Wd Ubsalih Hospital - and one CEMONC health facility Asororab Hospital). The most common gaps in signal functions are manual removal of the placenta, deliveries assisted by vacuum extraction, and basic neonatal resuscitation. Five health facilities identified by the working group were not included in the EmONC Needs Assessment.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Eljazeera Slang B	3		1	NA	NA	2	1
Ali Abdelfatah Hospital	6	1	4	20	5	1	5
Ban Jaded Hospital	17		12	15	18	5	12
Saad Abu Elila Hospital	7		11	NA	25	0	7
Garri Hospital B	3	1	4	1	NA	0	2

Omdurman Maternity Hospital	51	50 (most with temporary contracts)	34	85	20	0	1
Jebel Awlia Hospital B	6		4	12	5	2	4
Elsheikh Ali Elfadul	25		14	4	26	11	14
Khartoum North Hospital	21		13	9	15	8	13
Haf Alsafi Hospital B	9	4	5	50	10	0	5
Wad Aljabal Hospital B	3		1	8	2	2	1
Abodeleeg Hospital	3		2	4	1	1	2
Elfateh Hospital B	4		5	4	4	0	4
Turkish Hospital Khartoum	19		7	23	13	12	7
Om doanban	9		11	6	4	0	9
Bashair Public Hospital	10		3	11	2	7	3
Gareeb Public Hospital B	3		4	NA	NA	0	3
Elkhojabal Center B	3		1	3	2	2	1
Wd Ubsalih Hospital B	3		1	NA	NA	2	1
Asororab Hospital	3		1	NA	NA	2	1
Soba Hospital	9		29	9	7	0	9
Alacademy Hospital B	5		10	NA	NA	0	5
Elsadaga Hospital	9	1	9	NA	NA	0	8

Ibrahim Malik Hospital	9		22	NA	NA	0	9
Umbada Hospital	10		9	NA	NA	1	9
Total need in midwives (without redeployment)						**58**	**136**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

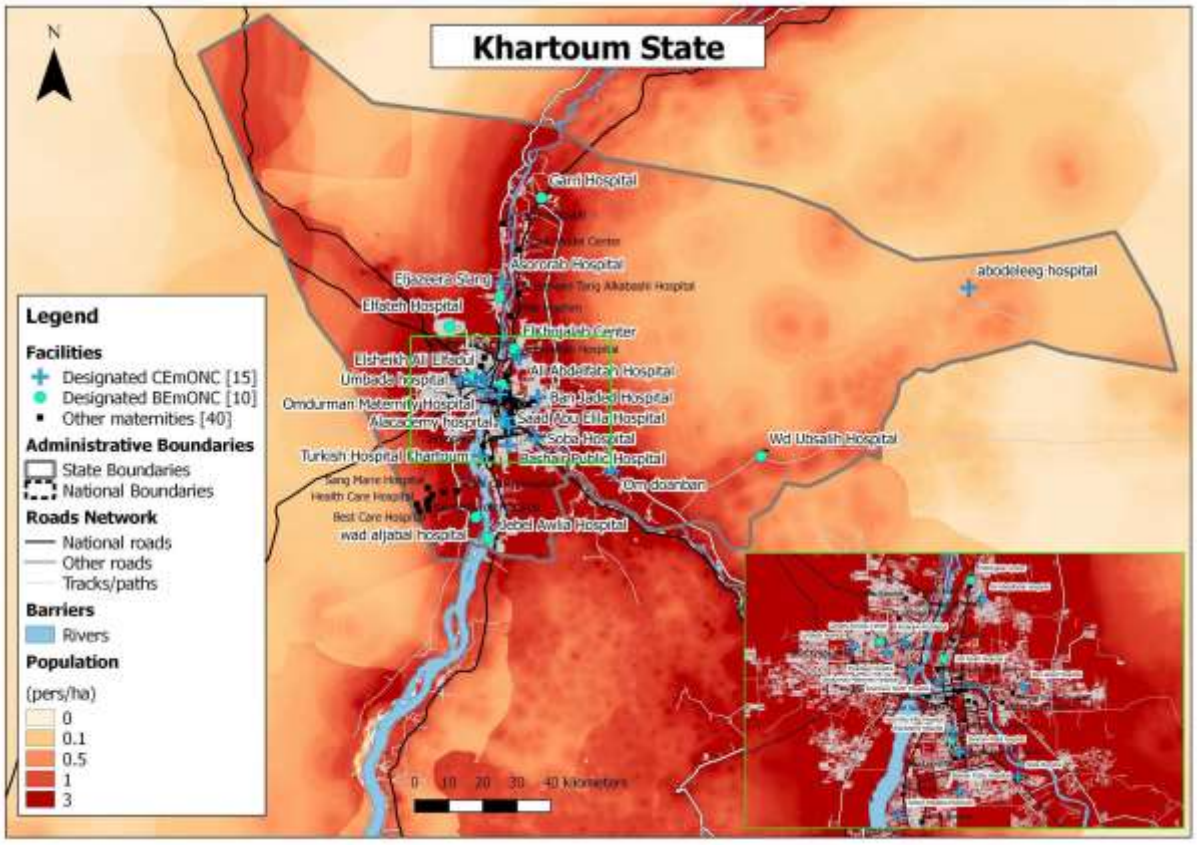
1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Ali Abdelfatah Hospital	Alkhojalab	<2h	<2 h	fuel 10 USD
	Garri	<2h	<2 h	fuel 10 USD
Ban Jaded Hospital	Wd Ubsalih	<2h	<2h	Geographical-15 USD
Saad Abu Elila Hospital	Alacademy	<2h	<2h	5 USD
	Jabal Awlya	<2h	<2h	5 USD
Soba Hospital	Alacademy	<2h	<2h	10 USD
	Jabal Awlya	<2h	<2h	10 USD
Omdurman Maternity Hospital	Elfateh Hospital-Algazira Isalanj	<2h	<2h	5 USD
Alshekh M. Fadul	Algazira Isalanj Wad elgabal Hospital	<2h	<2h	5 USD
abodeleeg hospital	wd Ubsalih -(Direct from community)	<2h	<2h	10 USD
Asororab Hospital	Algazira Isalanj	<2h	<2h	5 USD
Turkish Hospital Khartoum	Jabal -Awlya- wad algabal	<2h	<2h	5 USD
Om doanban	wd Ubsalih	<2h	<2h	10 USD
Bashair Public Hospital	Jabal Awlya- wad algabal	<2h	<2h	10 USD

Khartoum North Hospital	Haj alsafi - khogalab - Garri Hospital	<2h	<2h	5 USD
Umbada hospital	Gareeb Algasee health centre	<2h	<2h	5 USD
Elsadaga hospital	Elfateh Hospita-l Gareeb Algasee health centre	<2h	<2h	10 USD
Ibrahim Malik hospital	Jabal awlia	<2h	<2h	10 USD

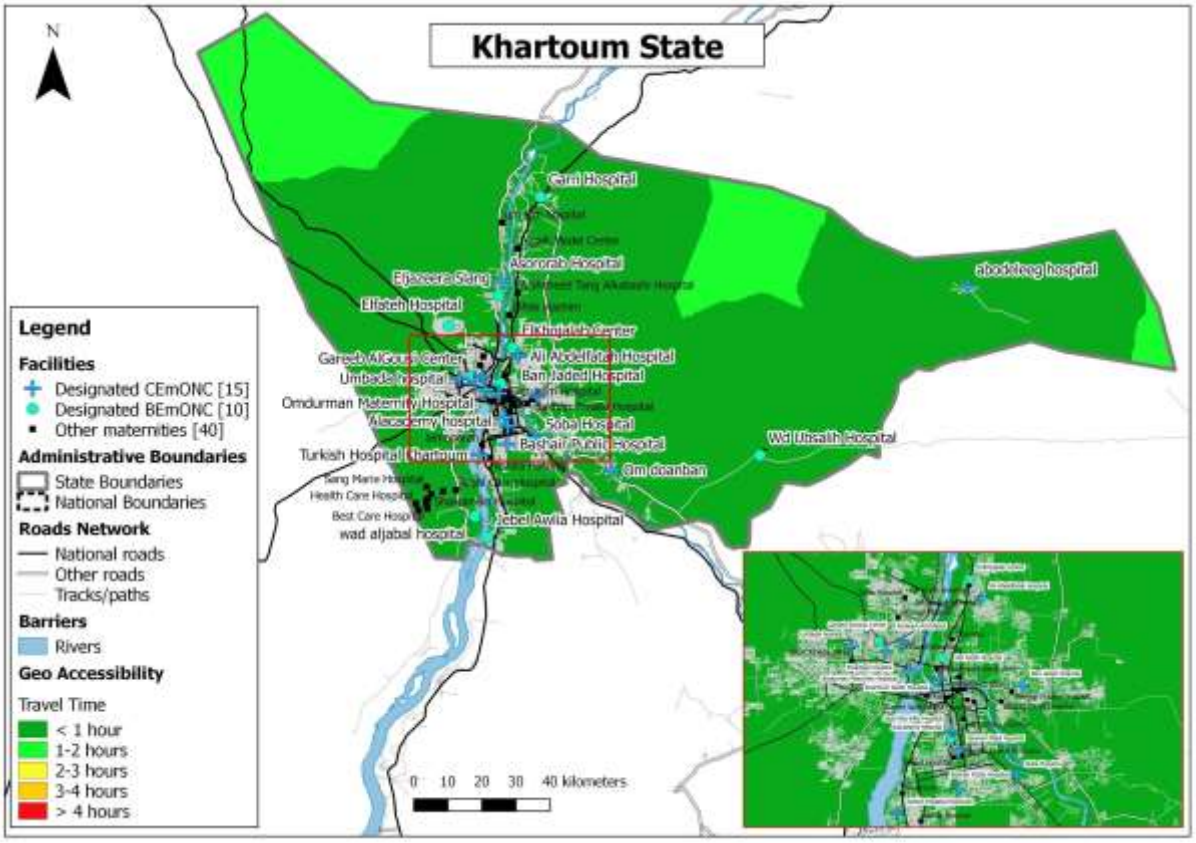
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



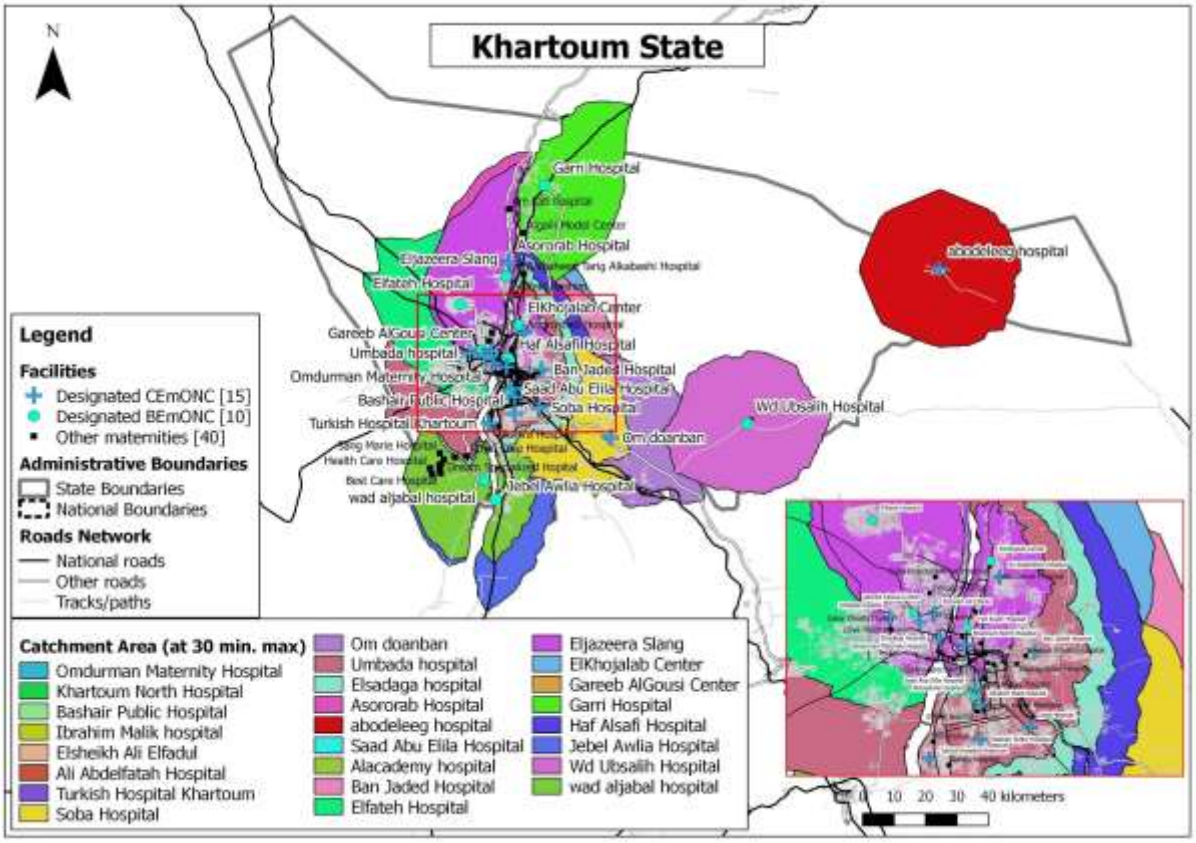
Khartoum State has a high population density concentrated around the Nile river, particularly around the city of Khartoum. The eastern part of the State is less populated.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Population of the Khartoum State is located within 2 hours of travel time of a designated EmONC health facility proposed by the working group, even the western region which is highly populated but does not have designated EmONC health facilities.

Map 3: Catchment areas within half an hour journey time of each EmONC facility proposed by the working group.



1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		Coverage of the population by the EmONC network proposed by the working group within 2h travel time	
State	With bordering States	State	With bordering States
100%	99.8%	100%	99.8%

Coverage of the population by all maternities of the State within 1h travel time		Coverage of the population by the EmONC network proposed by the working group within 1h travel time	
State	With bordering States	State	With bordering States
97.6%	97.8%	97.6%	97.6%

Coverage of the population by all maternities of the State within 30 min travel time		Coverage of the population by the EmONC network proposed by the working group within 30 minutes travel time	
State	With bordering States	State	With bordering States
92.9%	93.1%	91.7%	91.9%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Khartoum State has selected 25 health facilities to be part of the EmONC network, including 15 CEmONC (Ali Abdelfatah Hospital, Ban Jaded Hospital, Saad Abu Elila Hospital, Omdurman Maternity Hospital, Elsheikh Ali Elfadul, Khartoum North Hospital, Abodeleeg Hospital, Turkish Hospital Khartoum, Om doanban, Bashair Public Hospital, Asororab Hospital, Soba Hospital, Elsadaga Hospital, Ibrahim Malik Hospital, Umbada Hospital) and 10 BEmONC (Eljazeera Slang (Slanj Island), Garri Hospital, Jebel Awlia Hospital, Haf Alsafi Hospital, Wad Aljabal Hospital, Elfateh Hospital, Gareeb Public Hospital, Elkhojabal Center, Wd Ubsalih Hospital, Alacademy Hospital). This number is below the international recommendation and the maximum number of 36 designated EmONC health facilities set by the FMoH.

The referral linkages between the selected BEmONC and CEmONC health facilities are all good and within 2 hours of travel time, but with financial costs of at least 5 USD for many referrals.

In terms of human resources, only five designated EmONC health facilities have at least one graduate nurse midwives, with a very high concentration in higher concentration in Omdurman Maternity Hospital - but corresponding to the required number of midwives (according to national norms) for the 1500+ deliveries per month. In the Khartoum State, there is a gap of 58 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network.

In terms of infrastructure and equipment, the working group highlighted the presence of functioning laboratory in all designated health facilities. For the designated CEmONC health facilities, The group highlighted the presence of a functioning blood bank in most designated CEmONC health facilities, except Abodeleeg Hospital and Asororab Hospital. The CEmONC health facility Ban Jaded Hospital is missing magnesium sulfate. There are also gaps in delivery instruments and equipment (such as vacuum extractors, bag and mask for neonatal resuscitation.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of health facility register and the lack of monitoring dashboard and supportive supervision and the lack of communication means in all designated EmONC health facilities. Maternal deaths reviews are conducted in all CEmONC health facilities, except Abodeleeg Hospital and Asororab Hospital. None of the designated EmONC health facilities in Khartoum State are supported by international or other organizations but Soba Hospital is supported by Khartoum University.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is below the maximum number set by the FMoH for this first EmONC network. Thirteen designated CEmONC health facilities have an important obstetrical activity, particularly Omdurman Maternity Hospital with 1,573 deliveries per month, Elsheikh Ali Elfadul with 696 deliveries per month, Khartoum North Hospital with 571 deliveries per month, Turkish Hospital Khartoum with 539 deliveries per month, and Ban Jaded Hospital with 473 deliveries per month. Two designated CEmONC health facilities Abodeleeg Hospital and

Asororab Hospital have a very low obstetric activity, with respectively 52 and 21 deliveries per month. Seven designated CEmONC health facilities are functioning and the remaining have limited gaps in signal functions, except Asororab Hospital with 4 gaps in signal functions. Even if this health facility has an important catchment area (similar to all designated EmONC health facilities in the State), the efforts required to make it functioning with quality of care in the current programmatic cycle are important. It may therefore be considered for a future programmatic cycle.

However, four functioning CEmONC health facilities according to the EmONC NA were not selected by the State working group but have a good obstetric activity. The support team suggests to include them in the EmONC network: Royal Care Hospital with 108 deliveries per month, Elsaudi Hospital, Elrajaa Specialized Clinic with 78 deliveries per month, and Ribat Police Hospital with 347 deliveries per month.

The designated BEmONC health facilities have overall referral linkages with CEmONC health facilities, within two hours of travel time. Five designated BEmONC health facilities have a high obstetric activity (about 100 deliveries per month) and five have a low activity: Garri Hospital with 16 deliveries per month and 3 gaps in signal functions, Wad Aljabal Hospital with 21 deliveries per month and 3 gaps in signal functions, Gareeb Public Hospital with 26 deliveries per month, Elkhojabal Center with 22 deliveries per month and 5 gaps in signal functions, and Wd Ubsalih Hospital with 19 deliveries per month and 4 gaps in signal functions. Wad Aljabal Hospital is close to the designated BEmONC health facility Jebel Awlia Hospital which is a functioning BEmONC health facility with 175 deliveries per month. Wad Aljabal Hospital may therefore be considered for a future programmatic cycle. Similarly, Gareeb Public Hospital and Elkhojabal Center are close to designated CEmONC health facilities. They could help reduce the burden on the CEmONC health facilities but efforts required for this programmatic cycle are important to make them functioning 24h/7d with quality of care. While they have a small obstetric activity and several gaps in signal functions, Garry and Wd Ubsalih Hospitals complement the catchment areas of the designated CEmONC health facilities.

In addition, two health facilities designated as BEmONC health facilities by the State working group have OBGYNs and an important number of C-sections (Jebel Awlia Hospital with 5 OBGYNs and 64 C-sections per month, Haf Alsafi Hospital with 10 OBGYNs and 53 C-sections per month). These two health facilities are functioning CEmONC health facilities according to the EmONC Assessment. They should be designated as CEMONC health facilities. Three other designated BEmONC health facilities by the working group have OBGYNs and are doing C-sections (Eljazeera Slang Slanj Island with 3 OBGYNs and doing only 1 C-section per month; Wad Aljabal Hospital with 2 OBGYNs and doing 5 C-sections per month, and Elfateh Hospital with 4 OBGYNs and doing 2 C-sections per month). ElKhojalab Center has 2 OBGYNs but is not doing C-sections. In light of their capacities and resources and the lower number of deliveries and C-sections per month, these four health facilities should be kept as designated BEmONC health facilities and the need for OBGYNs in these health facilities should be further analyzed by the FMoH.

The support team recommends therefore to select 20 CEmONC health facilities (Ali Abdelfatah Hospital, Ban Jaded Hospital, Saad Abu Elila Hospital, Omdurman Maternity Hospital, Elsheikh Ali Elfadul, Khartoum North Hospital, Abodeleeg Hospital, Turkish Hospital Khartoum, Om doanban, Bashair Public Hospital, Soba Hospital, Elsadaga Hospital, Ibrahim Malik Hospital, Umbada Hospital, Jebel Awlia Hospital, Haf Alsafi Hospital, Royal Care Hospital, Elsaudi Hospital, Elrajaa Specialized Clinic, and Ribat Police Hospital) and 5 BEmONC (Eljazeera Slang (Slanj Island), Garri Hospital, Elfateh Hospital, Wd Ubsalih Hospital, Alacademy Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
25	25	100%	100%	99%	99%	58	62	136	180

All the maternities of the State cover 100% of the population within 2 hours of travel time.

Twenty-five health facilities have been designated by the working group to be included in the EmONC network. They cover 100% of the population within 2 hours travel time. Among them, nine health facilities are functioning and cover 99% of the population within 2 hours of travel time.

The support team suggests selecting twenty-five EmONC health facilities for this programmatix cycle, which would also also cover 99% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all twenty-five designated EmONC facilities function 24h/7d with quality of care.

Number of health facilities in the designated EmONC network		**Coverage of the population within 1h travel time by the designated EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Support team	State group work	Support team
25	25	98%	98%	58	62	136	180

Number of health facilities in the designated EmONC network	**Coverage of the population within 30 min travel time by the designated EmONC**	**Short/medium term need for graduate midwives**	**Long-term for graduate midwives** (does not take into

		network (without bordering states)				account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Support team	State group work	Support team
25	25	92%	91%	58	62	136	180

El Gazira State

State description

The State of El Gazira is located in the southern-east part of the country and is bordered to the north by the Khartoum State, to the West by the White Nile State, to the East by the Gedarif State, and to the south by the Sinnar State. The surface area of the State is 27,223 square kilometers, or 1% of the country's total surface area. It is Sudan's major agricultural region. It is composed of 8 localities (El Hassahisa, El Kamlin, El Manaqil, El Qurashi, Ganub Elgazira, Greater Medani, Sharg El Gezira, Um Elqura) and has a population of 4,759,764 people.

Institutional deliveries are estimated at 27% (EmONC NA 2017) and contraceptive prevalence rate is 11.9% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	**Number of EmONC recommended by the international norm (long term vision)**	**Maximum number of EmONC facilities for the first prioritization (50% of the norm)**	**Number of EmONC proposed by the working group**
4 759 764	47	23	**20**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	**Type (BEMONC/ CEmONC)**	**Estimated population in the catchment area within 2h travel time**	**# gaps in signal functions** (source EmONC Assessment 2018)	**# deliveries per month**
Medenai Maternity hospital	CEmONC	4 573 913	0	866

Alhasahesa Hospital	CEmONC	7 363 740	0	382
Elkamlen Hospital	CEmONC	8 726 802	4	98
Om Elgurra Hospital	CEmONC	3 601 560	2	60
Almanagil Hospital	CEmONC	3 888 900	0	452
Rufaa Hospital	CEmONC	6 978 982	1	84
Algurashi Hospital	CEmONC	3 573 505	0	93
Alhosh Hospital	CEmONC	3 256 052	0	72
Elhuda Hospital	BEmONC	3 889 468	0	50
Eljamosi Hospital	BEmONC	1 980 236	0	33
Elazazi Hospital	BEmONC	3 239 317	0	69
Tabat Hospital	BEmONC	4 503 987	0	95
Abogotta	BEmONC	5 287 310	2	107
Elmusalmea Hospital	BEmONC	4 563 173	0	32
Almehariba Hospital	BEmONC	7 505 986	0	31
Alrebie Hospital	BEmONC	7 505 986	2	64
Jiad Specialized Hospital	CEmONC	9 026 751	0	98
Wd Rawa Hospital	BEmONC	9 237 181	1	43
Wd Elfadl Hospital	BEmONC	7 722 208	2	28
Wd Elhadad	BEmONC	3 535 000	3	42

Twelve of the 17 functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

Alhikma Clinic and Eila Specialized Hospital were not considered as functioning due to the very low number of deliveries per month or lack of information on the obstetric activity in the health facility. Madeni Military Hospital, Alshaheed Majid Kamil Hospital were not considered functioning due to the absence of instrumental deliveries. Abo Usher Hospital was not considered functioning due to stock outs of oxytocin and/or magnesium sulfate.

Within this proposed EmONC network, the most common gaps in signal functions are deliveries assisted by vacuum extraction, administration of parenteral anticonvulsants, and basic neonatal resuscitation.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Medenai Maternity hospital	30	0	21	31	21	9	21
Alhasahesa Hospital	14	0	26	14	9	0	26
Elkamlen Hospital	4	0	3	5	2	1	3
Om Elgurra Hospital	4	0	3	4	1	1	3
Almanagil Hospital	17	0	9	NA	6	8	9
Rufaa Hospital	4	0	3	6	3	1	3
Algurashi Hospital	4	0	4	3	2	0	4
Alhosh Hospital	4	0	4	4	1	0	4
Elhuda Hospital	3	0	3	4	0	0	3
Eljamosi Hospital	3	0	1	1	1	2	1
Elazazi Hospital	3	0	1	4	1	2	1
Tabat Hospital	4	0	6	3	1	0	4
Abogotta	4	0	0	2	1	4	0
Elmusalmea Hospital	3	0	5	2	1	0	3
Almehariba Hospital	3	0	3	2	1	0	3
Alrebie Hospital	3	0	6	1	1	0	3

Jiad Specialized Hospital	4	0	12	14	4	0	4
Wd Rawa Hospital	3	0	3	1	1	0	3
Wd Elfadl Hospital	3	0	1	3	1	2	1
Wd Elhadad	3	0	4	4	1	0	3
Total need in midwives (without redeployment)						**30**	**102**

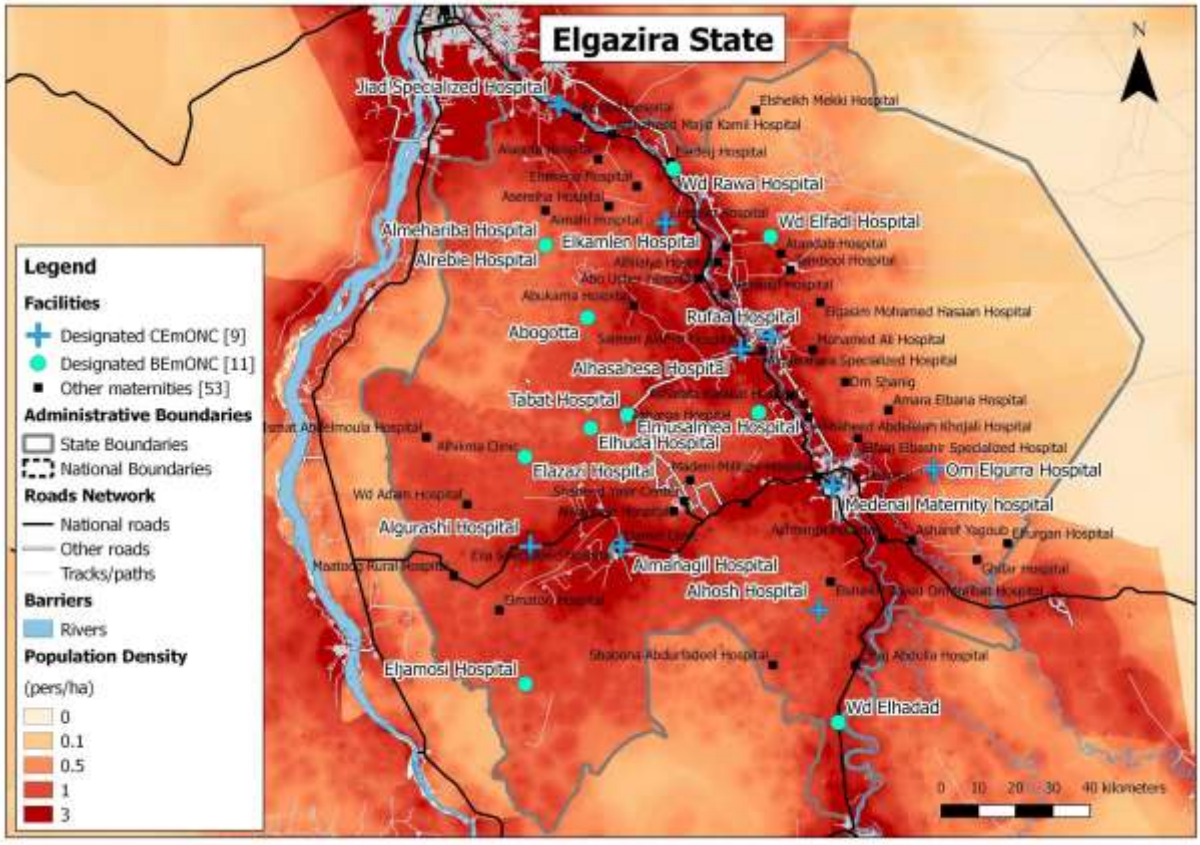
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Medenai Maternity hospital	Wd Elhadad	45 min	60 min	20 USD
Alhasahesa Hospital	Tabat Hospital	20 min	30 min	10 USD
	Elmusalmea Hospital	20 min	30 min	10 USD
	Abogotta	60 min	90 min	30 USD
Elkamlen Hospital	Almehariba Hospital	30 min	40 min	12 USD
	Alrebie Hospital	30 min	40 min	12 USD
Almanagil Hospital	Elhuda Hospital	30 min	60 min	14 USD
	Elazazi Hospital	30 min	60 min	10 USD
Rufaa Hospital	Wd Rawa Hospital	40 min	60 min	16 USD
	Wd Elfadl Hospital	20 min	30 min	10 USD
Algurashi Hospital	Eljamosi Hospital	60 min	90 min	12 USD

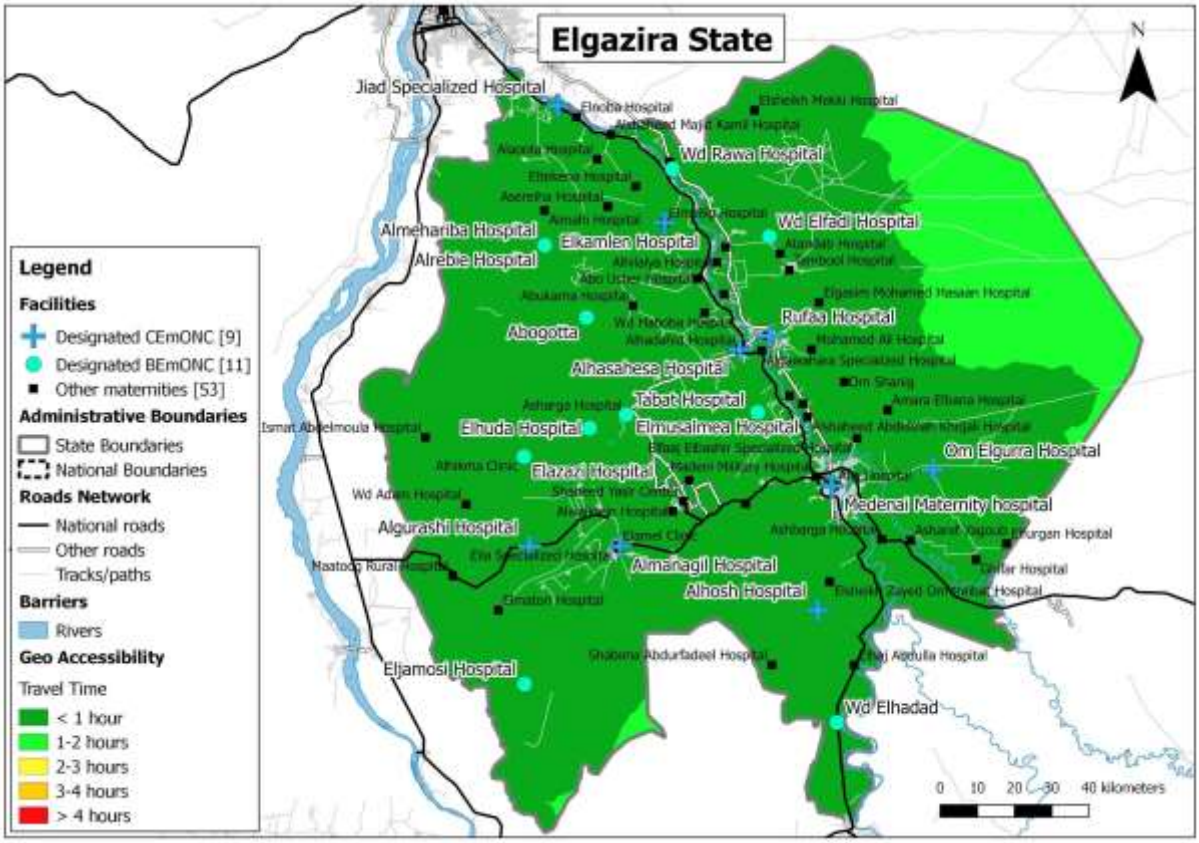
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



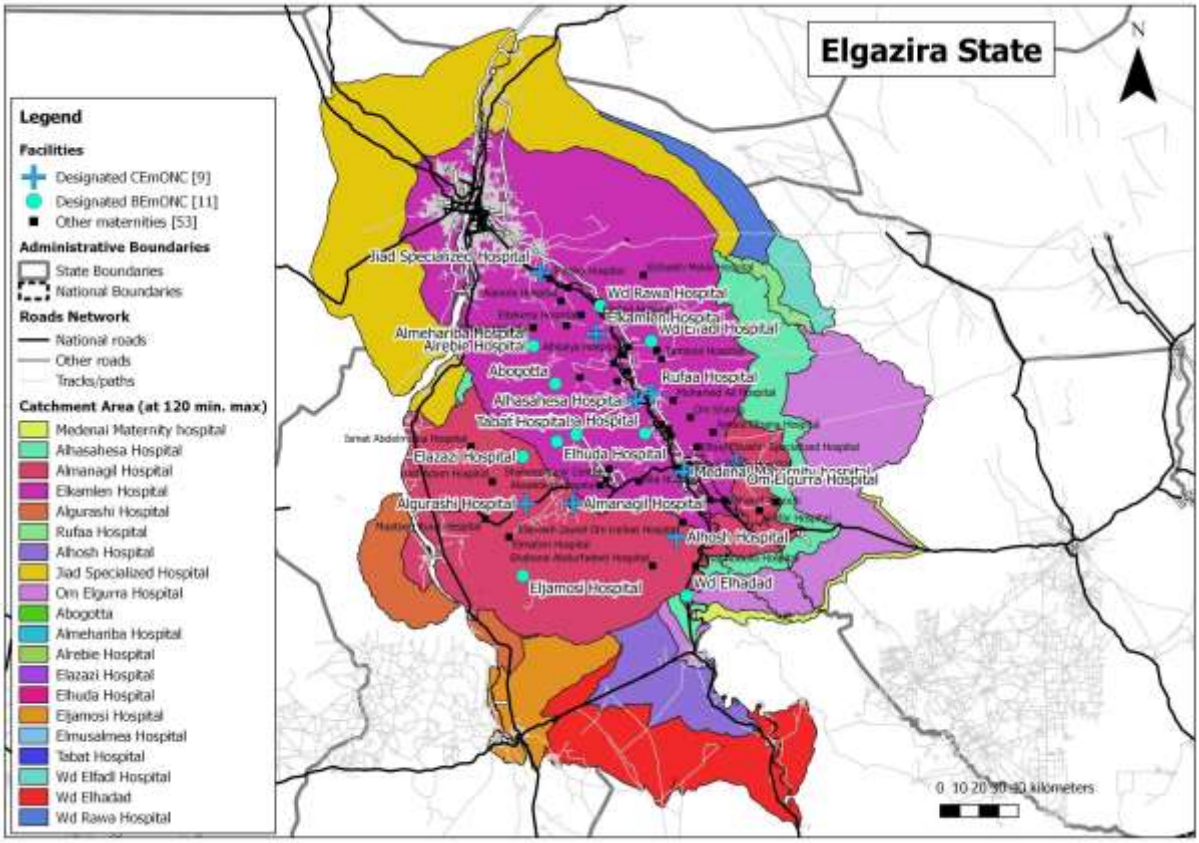
Elgazira State has a high population density across the state, except its eastern part. The State is crossed by two major national roads, crossing the State from South to North and from East to West (on the Southern part of the State).

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



All the population of the ElGazira State is located within 2 hours of travel time of an EmONC health facility proposed by the working group and most of the population is within 1 hour of travel time.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover 100% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
100.0%	100.0%	100.0%	100.0%

Coverage of the population by all maternities of the State within 1h travel time	**Coverage of the population by the EmONC network proposed by the working group within 1h travel time**

State	With bordering States	State	With bordering States
98.98%	99.4%	97.6%	99.0%

Coverage of the population by all maternities of the State within 30 minutes travel time		**Coverage of the population by the EmONC network proposed by the working group within 30 minutes travel time**	
State	With bordering States	State	With bordering States
90.4%	92.3%	77.8%	81.6%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of El Gazira State has selected 20 health facilities to be part of the EmONC network, including 9 CEmONC (Medenai Maternity hospital, Alhasahesa Hospital, Elkamlen Hospital, Om Elgurra Hospital, Almanagil Hospital, Rufaa Hospital, Algurashi Hospital, Alhosh Hospital, Jiad Specialized Hospital) and 11 BEmONC (Elhuda Hospital, Eljamosi Hospital, Elazazi Hospital, Tabat Hospital, Abogotta, Elmusalmea Hospital, Almehariba Hospital, Alrebie Hospital, Wd Rawa Hospital, Wd Elfadl Hospital, Wd Elhadad). This number is below the international recommendation and the maximum number of designated EmONC health facilities set by the FMoH of 23 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities are within 2 hours of travel time (and for most of the designated BEmONC health facilities within 1h) and no major financial barriers have been identified by the working group regarding the referrals.

In terms of human resources, all the designated EmONC health facilities have at least one nurse midwife and at least one doctor, with a higher concentration in Alhasahesa Hospital and Jiad Specialized Hospital. There is a gap of 30 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. The group also highlighted the need for more anaesthetists..

In terms of infrastructure and equipment, the working group highlighted the presence of functioning blood banks in the 9 CEmONC health facilities. The CEmONC health facilities are all missing adequate equipment for the theatre room (such as surgical instruments sets), portable ultrasounds, and all health facilities are missing vacuum extractors and neonatal resuscitation sets. In terms of infrastructure,Elhuda Hospital, Eljamosi Hopsital, Elmusalmea Hospital, and Alrebie Hospital are missing ambulances.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the absence of health facility register and the lack of regular staff meetings. Maternal deaths reviews were conducted in all designated EmONC health facilities. None of the designated EmONC health facilities were supported by international or other organizations at the time of the workshop. However The African Development Bank support selected EmONC health facilities since then.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is below the maximum number set by the FMoH for this first EmONC network. All designated CEmONC health facilities have an important obstetrical activity, particularly Medenai Maternity hospital with 866 deliveries per month,

Almanagil Hospital with 452 deliveries per month, and Alhasahesa Hospital with 382 deliveries per month. Om Elgurra Hospital has the lowest obstetric activity among the designated CEmONC health facilities with only 60 deliveries per month. All of them have limited gaps in signal function, except Elkamlen Hospital with four signal functions missing.

The designated BEmONC health facilities have referral linkages with CEmONC health facilities, within two hours of travel time. Six designated BEmONC health facilities have a lower obstetric activity (below 50 deliveries per month): Eljamosi Hospital with 33 deliveries per month, Elmusalmea Hospital with 32 deliveries per month, Almehariba Hospital with 31 deliveries per month, Wd Elfadl Hospital with 28 deliveries per month, Wd Rawa Hospital with 43 deliveries per month, and Wd Elhadad with 42 deliveries per month. Wd Elfadl Hospital has a catchment area that highly overlaps with three designated CEmONC health facilities and has two gaps in signal functions. It could therefore be considered for another programmatic cycle. However, Wd Elhadad has a catchment area that complements the one of Alhosh Hospital.

In addition, nine health facilities designated as BEmONC health facilities by the State working group have OBGYNs and an important number of C-sections (Elhuda Hospital with 1 OBGYN and 32 C-sections per month, Ejamosi Hospital with 1 OBGYNs and 12 C-sections per month, Elazazi Hospital with 1 OBGYN and 24 C-sections per month, Tabat Hodpital with 1 OBGYN and 43 C-sections per month, Abogotta with 69 C-sections per month, Elmusalmea Hospital with 1 OBGYN and 11 C-setions per month, Almehariba Hospital with 1 OBGYN and 12 C-sections per month, Wd Elhadad with 1 OBGYN and 30 C-sections per month, and Alrebie Hospital with 1 OBGYN and 40 C-sections per month). Six of these nine health facilities are functioning CEmONC health facilities according to the EmONC Assessment. These nine health facilities should be designated as CEMONC health facilities. Wd Rawa Hospital is another designated BEmONC health facilities by the working group having 1 OBGYN but only doing 4 C-sections per year. It should therefore be kept as a designated BEmONC health facility and the need for an OBGYN in this health facility should be further analyzed by the FMoH.

The support team recommends therefore to select the 18 CEmONC (Medenai Maternity hospital, Alhasahesa Hospital, Elkamlen Hospital, Om Elgurra Hospital, Almanagil Hospital, Rufaa Hospital, Algurashi Hospital, Alhosh Hospital, Jiad Specialized Hospital, Elhuda Hospital, Eljamosi Hospital, Elazazi Hospital, Tabat Hospital, Abogotta, Alrebie Hospital, Elmusalmea Hospital, Wd Elhadad and Almehariba Hospital) and 1 BEmONC (Wd Rawa Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
20	19	100%	100%	100%	100%	30	28	102	101

All the maternities of the State cover 100% of the population within 2 hours of travel time.

Twenty health facilities have been designated by the working group to be included in the EmONC network. They cover 100% of the population within 2 hours travel time. Among them, 12 health facilities are functioning and cover 100% of the population within 2 hours of travel time.

The support team suggests selecting 17 EmONC health facilities for this programmatix cycle, which would also also cover about 100% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all 17 designated EmONC facilities function 24h/7d with quality of care.

White Nile State

State description

The State of White Nile is located in the southern-east part of the country and is bordered to the north by the Khartoum State, to the West by the North Kordofan and South Kordofan States, to the East by the El Gazira and Sinnar States and to the south by the Republic of South-Sudan. The surface area of the State is 37,871 square kilometers, or 2% of the country's total surface area. It has different ecological zones ranging from sub-humid to semi-arid. It is composed of 9 localities (El Diwaim, El Gitaina, El Jabalain, Es Salam, Guli, Kosti, Rabak, Tendalti, Um Rimta) and has a population of 2,324,444 people.

Institutional deliveries are estimated at 24% (EmONC NA 2017) and contraceptive prevalence rate is 14.2% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
2,324,444	23	11	**9**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Abu Tugaba Hospital	BEmONC	1 727 329	3	20

Eljebelein Hospital	CEmONC	1 178 899	2	90
Tandalti Hospital	CEmONC	1 867 620	0	117
Kosti Hospital	CEmONC	2 159 626	1	450
Elkiteina Hospital	CEmONC	7 401 437	0	150
Rabak Hospital	CEmONC	2 289 042	2	300
Elshageg Hospital	BEmONC	677 923	1	25
Arawat Hospital	BEmONC	281 827	0	60
Eldowem Hospital	CEmONC	2 498 638	2	364

Three of the 12 functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

Kosti, Rabak, Eldowem, Eljebelein, Abu Tugaba Hospitals, Elmedina Clinic, Elmegeinis Hospital, Elkowa Hospital, Elalaga Hospital, Lina Center and Elshageg Hospital were missing vacuum extractions. In addition, Rabak Hospital had a gap for the signal function of basic neonatal resuscitation; Elsheikh Barbar Hospital, Eldowem, Abu Tugaba had stock-outs of parenteral administration of oxytocin; and Eljebelein, Elmedina Clinic, Elmegeinis Hospital, Elkowa Hospital, Gooz Elbeid Hospital, Abu Tugaba of parenteral administration of anticonvulsants (mg sulfate).

Kinana Hospital is a functioning CEmONC health facility according to the EmONC NA but it was not selected by the working group. The inclusion of this health facility in the EmONC network of White Nile is discussed below by the support team.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Abu Tugaba Hospital	3	7	0	1	0	0	0
Eljebelein Hospital	4	3	1	6	1	0	1
Tandalti Hospital	4	5	4	4	1	0	0

Kosti Hospital	16	16	32	25	7	0	0
Elkiteina Hospital	5	3	7	12	3	0	2
Rabak Hospital	11	15	16	20	4	0	0
Elshageg Hospital	3	0	0	2	0	3	0
Arawat Hospital	3	0	0	1	0	3	0
Eldowem Hospital	14	20	16	27	5	0	0
Total need in midwives (without redeployment)						**6**	**3**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

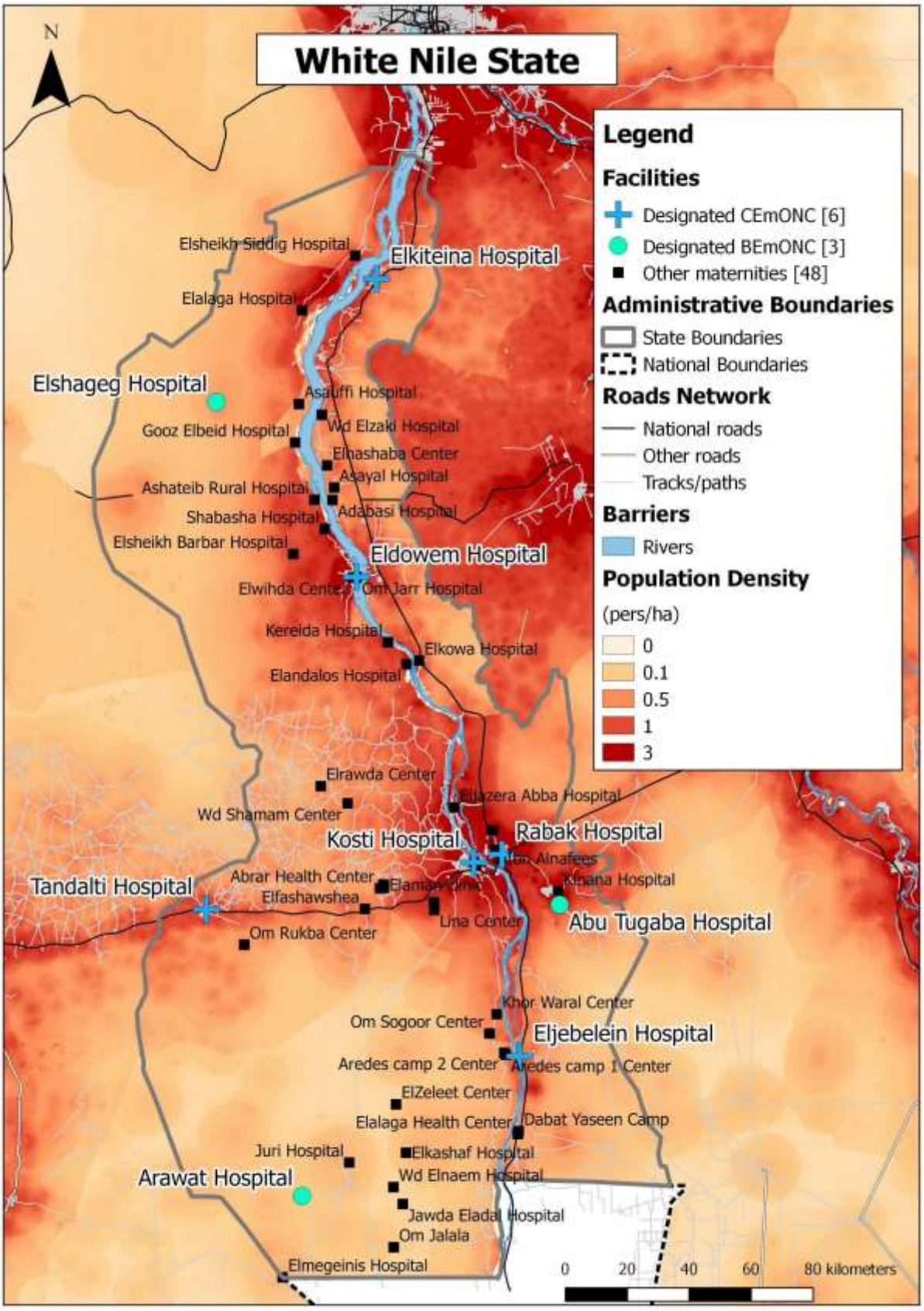
1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Kosti Hospital	Arawat hospital	1h	2h	Public transportation not available, direct road but in poor conditions in the rainy season, costly in rainy season (40 USD)
Rabak Hospital	Abu Tugaba hospital	30 min	40 min	
Eldowem Hospital	Elshageg Hospital*	1h	>4h	Public transportation not available, road in very poor conditions in the rainy season, costly in rainy season (50 USD)

*There is a referral option to ElKetina Hospital taking about 2 hrs but it requires crossing the river and the boats are not available 24h/7d.

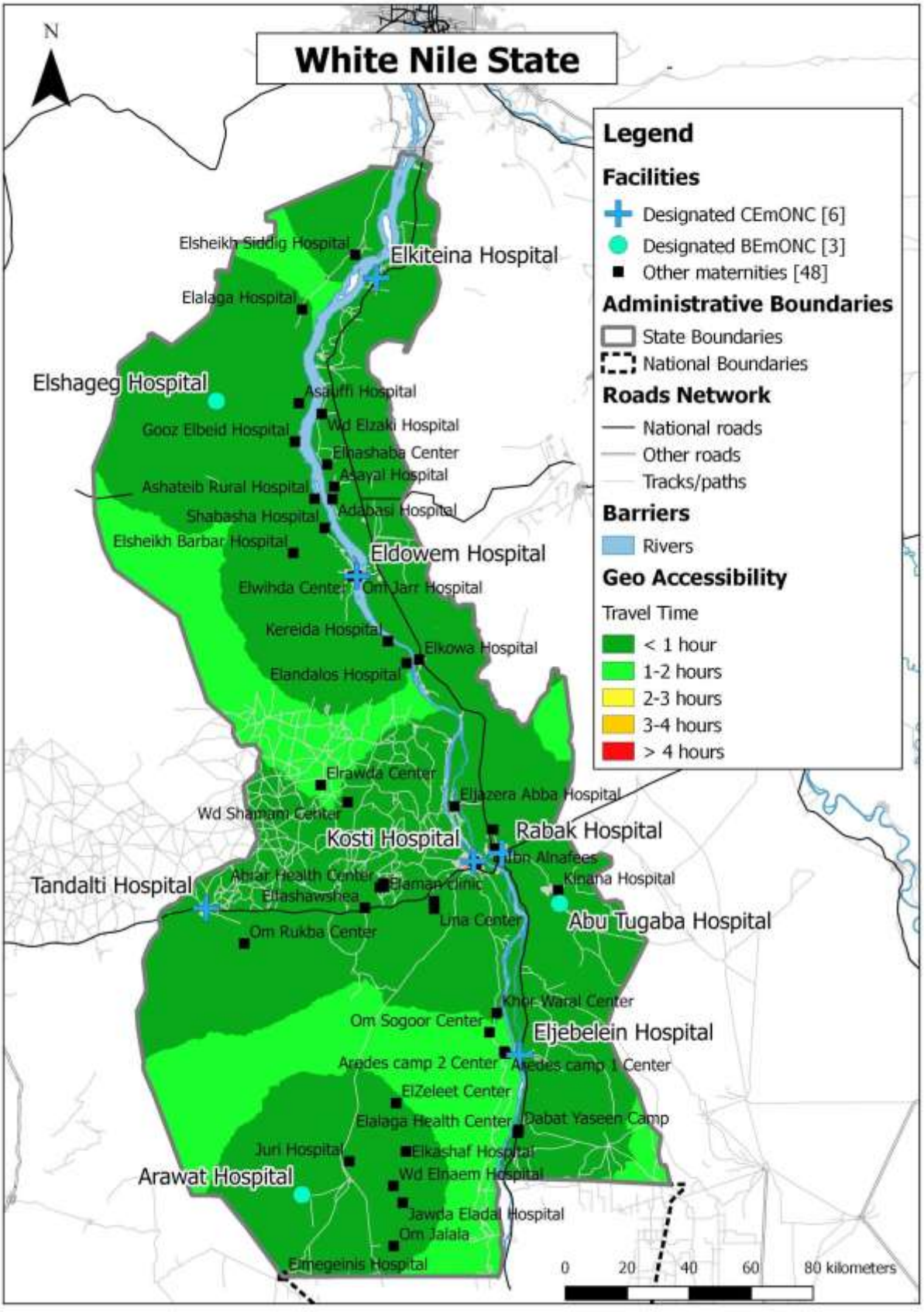
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



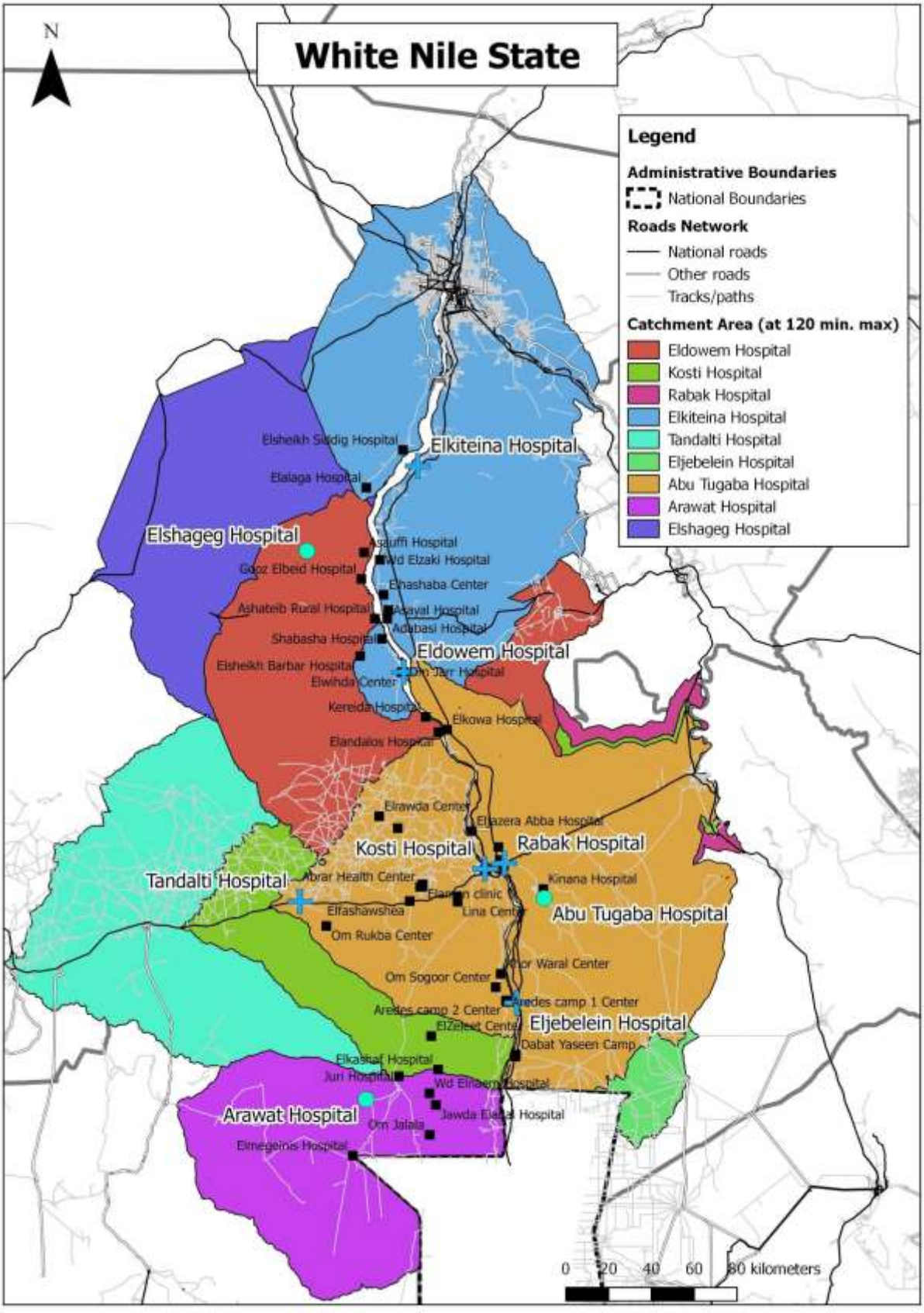
White Nile State has a high population density across the state, particularly along the Nile. The southern part of the State is less populated. The State is crossed by two major national roads, crossing the State from South to North and from East to West (on the Southern part of the State). Other roads are particularly important in the central part of the State.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



All the population of White Nile State is located within 2 hours of travel time of an EmONC health facility proposed by the working group and most of the population is within 1 hour of travel time.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover 100% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
100%	99.8%	100.0%	99.8%

Coverage of the population by all maternities of the State within 1h travel time		**Coverage of the population by the EmONC network proposed by the working group within 1h travel time**	
State	With bordering States	State	With bordering States
98.1%	98.5%	85.9%	88.7%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of White Nile State has selected 9 health facilities to be part of the EmONC network, including 6 CEmONC (Eljebelein Hospital, Tandalti Hospital, Kosti Hospital, Elkiteina Hospital, Rabak Hospital, and Eldowem Hospital) and 3 BEmONC (Abu Tugaba Hospital, Elshageg Hospital, Arawat Hospital). This number is below the international recommendation and the maximum number of designated EmONC health facilities set by the FMoH of 11 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities have difficulties for two of the three designated BEmONC health facilities While there is a direct road from Arawat Hospital to Kosti Hospital (the closest CEmONC), the working team qualified this link as orange due to the lack of public transport and due to financial barriers, particularly in the rainy season. For are within 2 hours of travel time (and for most of the designated BEmONC health facilities within 1h) and no major financial barriers have been identified by the working group regarding the referrals. The working group qualified red the referral from Elshageg Hospital to Eldowem Hospital as the road is difficult to use in the rainy season.

In terms of human resources, two BEmONC health facilities (Elshageg Hospital, Arawat Hospital) do not have graduate or nurse midwives. There are seven graduate midwives in the third designated BEmONC health facility (Abu Tugaba Hospital) and an important concentration of graduate and nurse midwives in three CEmONC health facilities (Kosti Hospital, Rabak Hospital, and Eldowem Hospital). There is a gap of 6 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. The group also highlighted the need for more

anaesthetists, even in the three major CEmONC health facilities of the State (Kosti, Rabak, and Edowem Hospitals) which only have assistant anaesthetists. The group also highlighted the shortage of lab technicians in Elkiteina Hospital due to high turnover (affecting also other cadres in that hospital). as well as in Eljebelein Hospital.

In terms of infrastructure and equipment, the working group highlighted that most CEmONC health facilities have good equipment, including in terms of laboratory and blood bank. However there are shortages in oxygen supplies, particularly highlighted in Kosti, Rabak, and Eljebelein Hospitals. The three designated BEmONC health facilities have a basic laboratory but are missing equipment. Few health facilities require rehabilitation and expansion, including Eldowem Hospital and Elkiteina Hospital. Eljebelein and Kosti Hospitals do not have ambulances.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the good leadership at the three major CEmONC health facilities (Eldowem, Kosti and Rabak Hospitals) and the regular staff meetings in all CEmONC health facilities. However, they highlightes for all the health facilities of the States the absence of health facility register and the high turnover of staff. Maternal deaths reviews are conducted in four designated CEmONC health facilities (Kosti, Rabak, Eldowem, Elkiteina Hospitals). Kosti Rabak, and Eldowem Hospitals are supported by UNFPA, UNDP, UNICEF, and Alimam Almahdi University (and by White Nile University for Rabak and Eldowem). Elkiteina and Eljebelein Hospitals are supported by UNFPA, UNICEF, UNDP (and MSF Spain for Eljebelein Hospital). Tandalti Hospital is supported by UNFPA and the African Development Bank Abu Tugaba is supported by UNFPA.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is below the maximum number set by the FMoH for this first EmONC network. All designated CEmONC health facilities have an important obstetrical activity, particularly Kosti Hospital with 450 deliveries per month, Eldowem Hospital with 364 deliveries per month, and Rabak Hospital with 300 deliveries per month. Eljebelein Hospital has the lowest obstetric activity among the designated CEmONC health facilities with 90 deliveries per month. All of them have limited gaps in signal function, except Elkamlen Hospital with four signal functions missing. Two designated CEmONC are functioning (Elkiteina Hospital and Tandalti Hospital) and the others have 1 or 2 gaps in signal functions (with 2 gaps for Rabak, Eljebelein, and Eldowem Hospitals)

The designated BEmONC health facility Arawat Hospital has a good obstetric activity with 60 deliveries per month, two gaps in signal functions and a catchment area that complement the ones of the CEmONC health facilities by covering the South West part of the State. The referral link to Tandalti Hospital presents some difficulties to be addressed, especially in the rainy season. The two other designated BEmONC health facilities (Abu Tugaba Hospital, Elshageg Hospital) have a lower obstetric activities, respectively of 20 and 25 deliveries per month. While Abu Tugaba Hospital has a good referral linkages with Rabak Hospital and has 7 graduate midwives and one medical doctor, it has 3 gaps in signal functions and with its low obstetric activity would need important efforts to make it functioning with quality of care in the current programmatix cycle. It could therefore be considered for another programmatic cycle and Kinana Hospital which is next to it and is a functioning EmONC health facility with an obstetric activity of 43 deliveries per month (including 5 C-section). It has an OBGYN but the low number of deliveries and C-section done suggest to consider it as a designated BEmONC health fcaility for the current programmatic cycle. The need for an OBGYN in this health facility should be further analyzed by the FMoH. Finally, Elshageg hospital has referral difficulties in the rainy season with Eldowem Hospital but only one gap in signal function and its catchment area covers the north-west part of the State. The support team suggests to keep it in the EmONC network for this programmatic cycle.

The support team recommends therefore to select the 6 CEmONC (Eljebelein Hospital, Tandalti Hospital, Kosti Hospital, Elkiteina Hospital, Rabak Hospital, and Eldowem Hospita) and 3 BEmONC (Arawat Hospital, Elshageg hospital and Kinana Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
9	9	100%	100%	76%	84%	6	6	3	3

All the maternities of the State cover 100% of the population within 2 hours of travel time.

Nine health facilities have been designated by the working group to be included in the EmONC network. They cover 100% of the population within 2 hours travel time. Among them, 3 health facilities are functioning and cover 76% of the population within 2 hours of travel time.

The support team suggests selecting 9 EmONC health facilities for this programmatix cycle, which would cover 84% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all 9 designated EmONC facilities function 24h/7d with quality of care.

South Kordofan State

State description

The State of South Kordofan is located in the southern part of the country and is bordered to the north by the North Kordofan State, to the West by the West Kordofan, to the East by the White Nile State and the Republic of South Sudan and to the south by the Republic of South-Sudan. The surface area of the State is 78,030 square kilometers, or 4% of the country's total surface area. The northern part of the State is a semi-dry low rainfall savannah while the south is a semi-humid high rainfall savannah. It is composed of 17 localities (Abassiya, Abu Jubaiha, Abu Karshola, Delami, Dilling, El Buram, El Leri, El Quoz, El Rashad, El Tadamon, Ghadeer, Habila, Heiban, Kadugli, Reif Shargi, Talodi, Um Durein) and has a population of 1,434,740 people.

Institutional deliveries are estimated at 11% (EmONC NA 2017) and contraceptive prevalence rate is 8.8% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
1,434,740	14	7	**7**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Kadogli Hospital	CEmONC	289 555	0	141
Elum Bakheeta Hospital	CEmONC	559 827	1	107
Habilla Hospital	BEmONC	370 109	2	22
Abujebaha Hospital	CEmONC	356 620	2	123
Rashad Hospital	BEmONC	466 725	1	103
Al-Abasia Hospital	BEmONC	682 106	0	47
Aldepepat Hospital	BEmONC	1 089 246	0	70

The three functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

Elum Bakheeta, Habilla, Abujebaha, and Rashad Hospitals are missing vacuum extractions. In addition, Abujebaha has a gap for the signal function of basic neonatal resuscitation; Habilla Hospital for the parenteral administration of anticonvulsants (mg sulfate).

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	Number of midwives required according to the national	Number of graduate nurse midwives/'sister' midwives	Number of nurse midwives (nursing certificate +	Number of doctors	Number of obstetricians	Short/medium term need for midwives	Long-term for midwives (does not take into

	recommendation*	(3 years nursing diploma + 1 year midwifery)	one year midwifery)		(including registrars)	(take into account the graduate and nurse midwives)	account nurse midwives)
Kadogli Hospital	6	0	15	20	1	0	6
Elum Bakheeta Hospital	5	0	8	4	1	0	5
Habilla Hospital	3	0	0	1	1	3	0
Abujebaha Hospital	6	0	4	6	2	2	4
Rashad Hospital	4	0	2	1	0	2	2
Al-Abasia Hospital	3	0	4	1	1	0	3
Aldepepat Hospital	3	0	1	1	0	2	1
Total need in midwives (without redeployment)						**9**	**21**

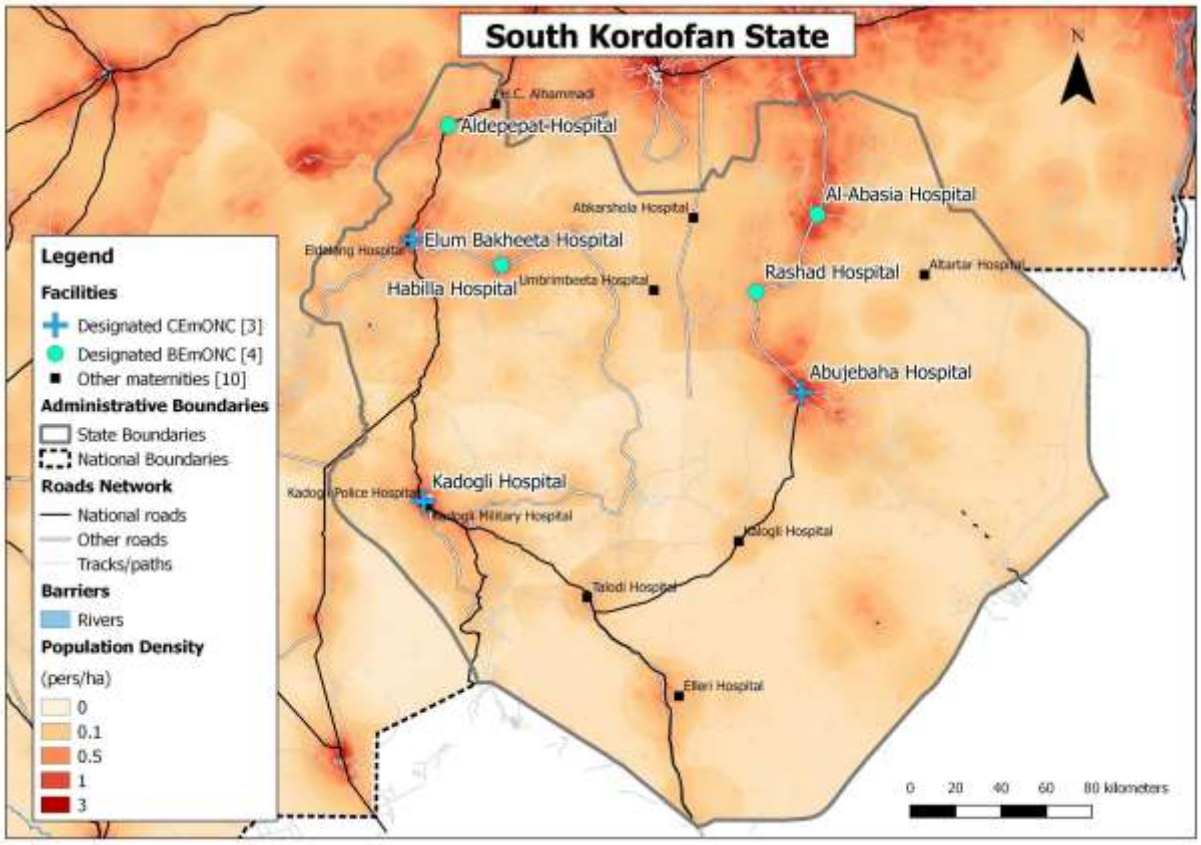
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Elum Bakheeta Hospital	Habilla Hospital	1h	2h30	financial barriers - ambulance cost 30 USD
	Aldepepat Hospital (refer sometimes to Elobeid Hospital in North Kordofan)	30	45	financial barriers 20 USD
Elobeid Hospital (North Kordofan)	Aldepepat Hospital			
Abujebaha Hospital	Rashad Hospital	90	90	Security Issues- financial - ambulance cost 40 USD
Om Ruwaba Hospital (North Kordofan)	Al-Abasia Hospital	90	90	financial barriers - ambulance cost 20 USD

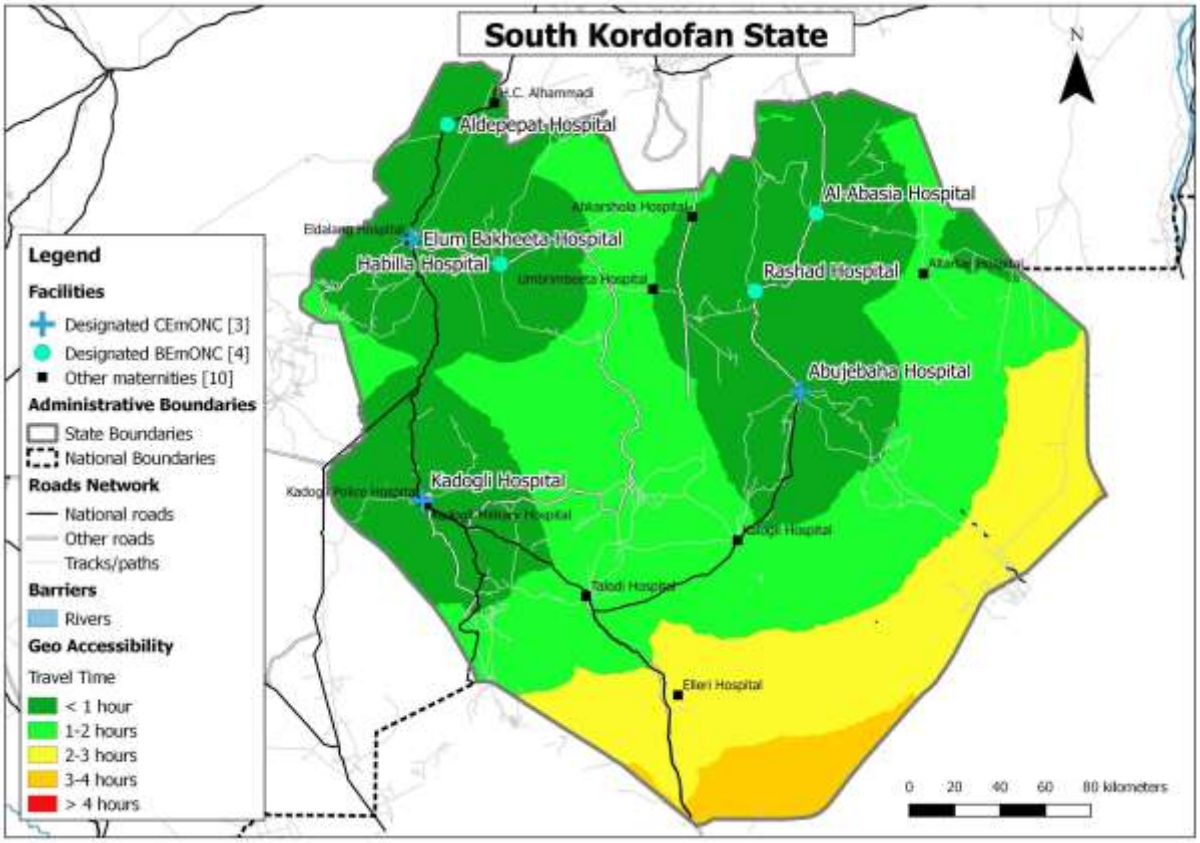
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



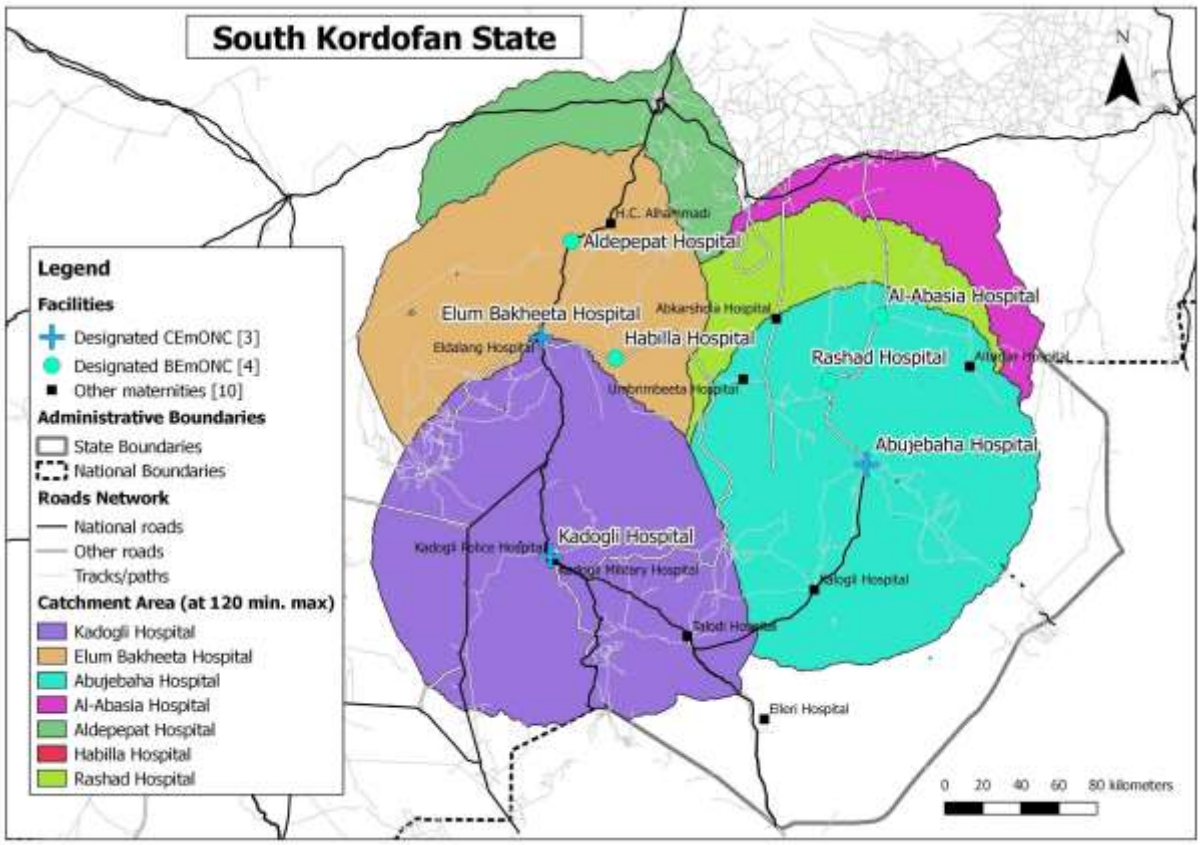
South Kordofan State has a low population density across the state, except for pockets of population along the major roads. The southern part of the State is less populated. The State is crossed by two major national roads, on the West side crossing the State from South to North and on the East side up to Abujebaha. The North East part of the State does not have national roads but other types of roads.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most the population of South Kordofan State is located within 2 hours of travel time of an EmONC health facility proposed by the working group and most of the population is within 1 hour of travel time. Population located in the South-East part of the State are at more than 2 hours from the closest EmONC health facility. The working group did not select any health facility in that area because of the important insecurity.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover 88% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		Coverage of the population by the EmONC network proposed by the working group within 2h travel time	
State	With bordering States	State	With bordering States
97.4%	97.7%	88.4%	89.3%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of South Kordofan State has selected 7 health facilities to be part of the EmONC network, including 3 CEmONC (Kadogli Hospital, Elum Bakheeta Hospital, Abujebaha Hospital) and

4 BEmONC (Habilla Hospital, Rashad Hospital, Al-Abasia Hospital, Aldepepat Hospital). This number is below the international recommendation and equals the maximum number of designated EmONC health facilities set by the FMoH of 7 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities are within 2 hours of travel time for most designated BEmONC health facilities but present financial barriers for two of the four designated BEmONC health facilities (Habilla and Rashad Hospitals). In addition, two designated BEmONC health facilities refer to CEmONC health facilities in North Kordofan.

In terms of human resources, there are no graduate nurse midwives in any of the designated EmONC health facilities and Habilla Hospital does not have any nurse midwives. There is an important concentration of nurse midwives in two CEmONC health facilities (Kadogli and Elum Bakheeta Hospitals). There is a gap of 9 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. The group also highlighted the need for more anaesthetists.

In terms of infrastructure and equipment, the working group highlighted that two CEmONC health facilities (Kadogli and Elum Bakheeta Hospitals) have blood banks and labs but are missing equipment and supplies. However Abujebaha Hospitals does not have a blood bank. The designated BEmONC health facilities do not have well equipped labs and Habilla Hospital has a shortage of electricity and water supply. All designated EmONC health facilities have ambulances.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted for all the health facilities of the States the absence of health facility register and protocols Elum Bakheeta, Habilla Hospitals are supported by MSF. Only Kadogli and Elum Bakheeta Hospitals are doing maternal deaths reviews.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group corresponds to the maximum number set by the FMoH for this first EmONC network. All designated CEmONC health facilities have an important obstetrical activity. All of them have limited gaps in signal function.

The designated BEmONC health facilities have referral linkages with CEmONC health facilities, within two hours of travel time. Rashad and Aldepepat Hospitals have a high obstetric activity (respectively 103 and 70 deliveries per month) and is functioning. Habilla Hospital is the only designated BEmONC health facility with a lower activity but with its catchment area it has the potential to increase the number of deliveries per month and its catchment also complements the one of Elum Bakheeta.

In addition, Al-Abasia has a good obstetric activity with almost 50 deliveries per month and is located in a densely populated area. However, it is a functioning CEmONC health facility according to the EmONC NA and it has 1 OBGYN doing 8 C-sections per month. It should therefore be designated as a CEMONC health facility. Aldepepat Hospital is a functioning CEmONC health facility according to the EmONC NA but it is not doing C-sections, so it should be kept as a designated BemONC health fcaility for this programmatic cycle.

Due to insecurity and difficulties to access the southeast area of the State, no health facilities were designated in this part of the State to be part of the network and the regular monitoring of EmONC health facilities.

The support team therefore recommends to select the 4 CEmONC (Kadogli Hospital, Elum Bakheeta Hospital, Abujebaha Hospital, Al-Abasia Hospital) and the 3 BEmONC (Habilla Hospital, Rashad Hospital, Aldepepat Hospital) identified by the working group.

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
7	7	88%	88%	80%	80%	9	9	21	21

All the maternities of the State cover 96% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 97%.

Seven health facilities have been designated by the working group to be included in the EmONC network. They cover 88% of the population within 2 hours travel time. Among them, three health facilities are functioning and cover 80% of the population within 2 hours of travel time.

West Kordofan State

State description

The State of West Kordofan is located in the southern part of the country and is bordered to the north by the North Kordofan State, to the West by North and East Darfur, to the East by the South Kordofan State and to the south by the Republic of South-Sudan. The surface area of the State is 114,938 square kilometers, or 6% of the country's total surface area. The northern part of the State is classified as semi-desert; the southern part of the state is classified as high rainfall woodland savannah. It is composed of 14 localities (Abu Zabad, Abyei, Babanusa, El Dibab, El Idia, El Meiram, El Nuhud, ElKhiwai, Elsunut, Es Salam, Ghubaish, Keilik, Lagawa, Wad Benda) and has a population of 1,178,537 people.

Institutional deliveries are estimated at 11% (EmONC NA 2017) and contraceptive prevalence rate is 6.1% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
1,178,537	11	5	**7**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Elodeia	BEmONC	691 127	2	29
Elsadaga hospital	CEmONC	606 523	2	82
Almaglad hospital	CEmONC	528 824	0	126
Alnhood teaching hospital	CEmONC	842 391	0	114
Gebiash hospital	CEmONC	754 738	0	68
Al. kharasan PHC	BEmONC	274 119	5	29
Dibab Hospital	BEmONC	249 849	na	60

Three of the eight functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

Almarum Health Center, Asago Hospital, and Kadam Health Centre were not considered as functioning due to the absence of instrumental deliveries and stock outs of oxytocin and/or magnesium sulfate. Babanosa Military Hospital was not considered as functioning due to the very low number of deliveries per month and the absence of instrumental deliveries.

Within the proposed EmONC network, Elsadaga Hospital, Elodeia are missing vacuum extractions and basic neonatal resuscitation. Al Kharasan only provides parenteral antibiotics.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Elodeia	3	0	0	3	0	3	0
Elsadaga hospital	4	0	4	6	2	0	4
Almaglad hospital	6	0	1	2	2	5	1
Alnhood teaching hospital	5	0	7	16	5	0	5
Gebiash hospital	3	0	1	5	1	2	1
Al. kharasan PHC	3	0	0	0	0	3	0
Dibab Hospital	3	0	0	2	0	3	0
Total need in midwives (without redeployment)						**16**	**11**

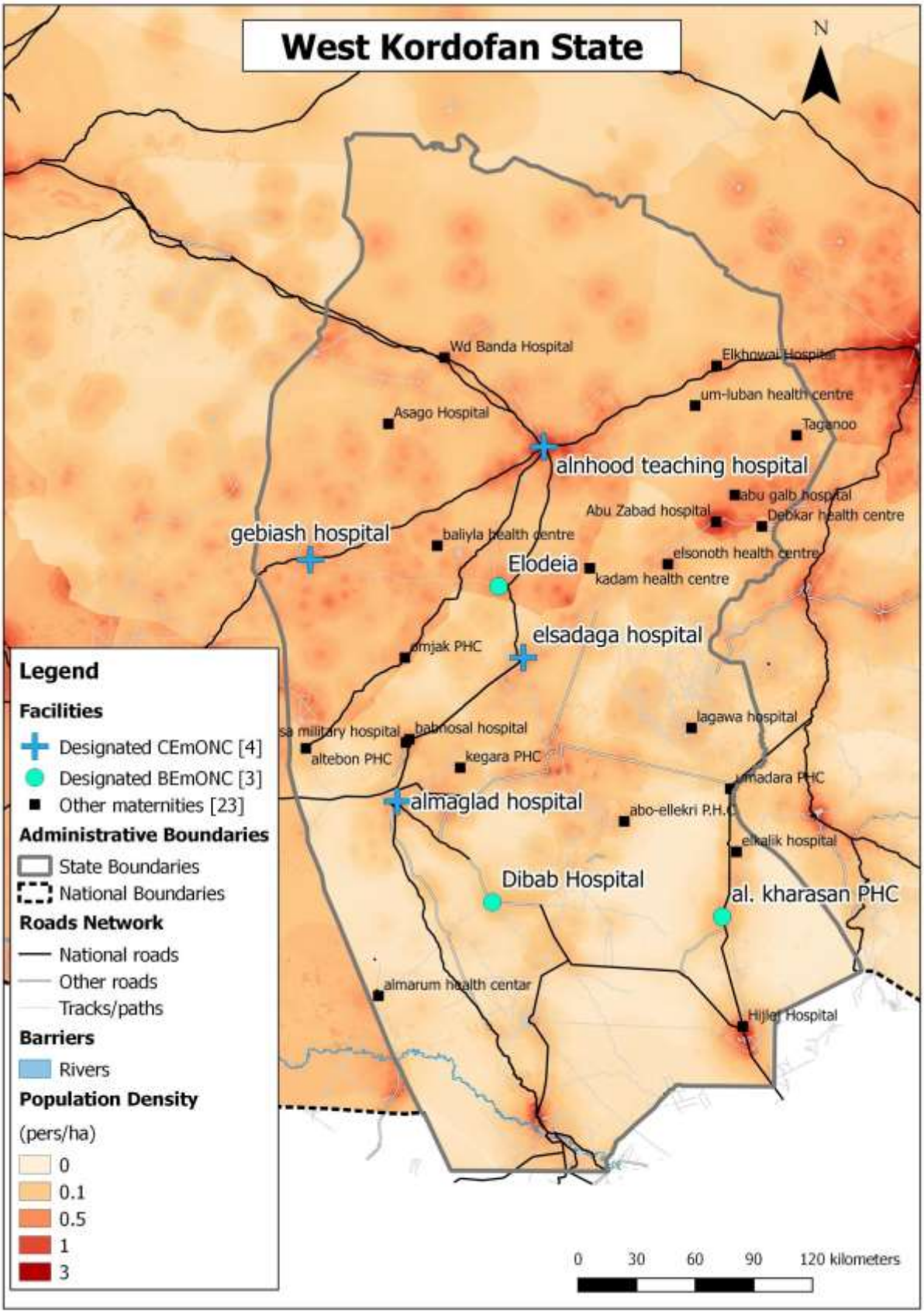
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Alnhood teaching hospital	Elodeia	1h30	2h	- financial barriers - road not in good condition
Elsadaga hospital	Elodeia			
Almuglad hospital	Aldebab (Dibab Hospital)	1h30	2h	- financial barriers (20 USD)
Kadogli Hospital (located in South Kordofan State)	al. kharasan PHC	1h30	2h	- financial barriers - road not in good condition

1.1.5 Maps of the State EmONC network

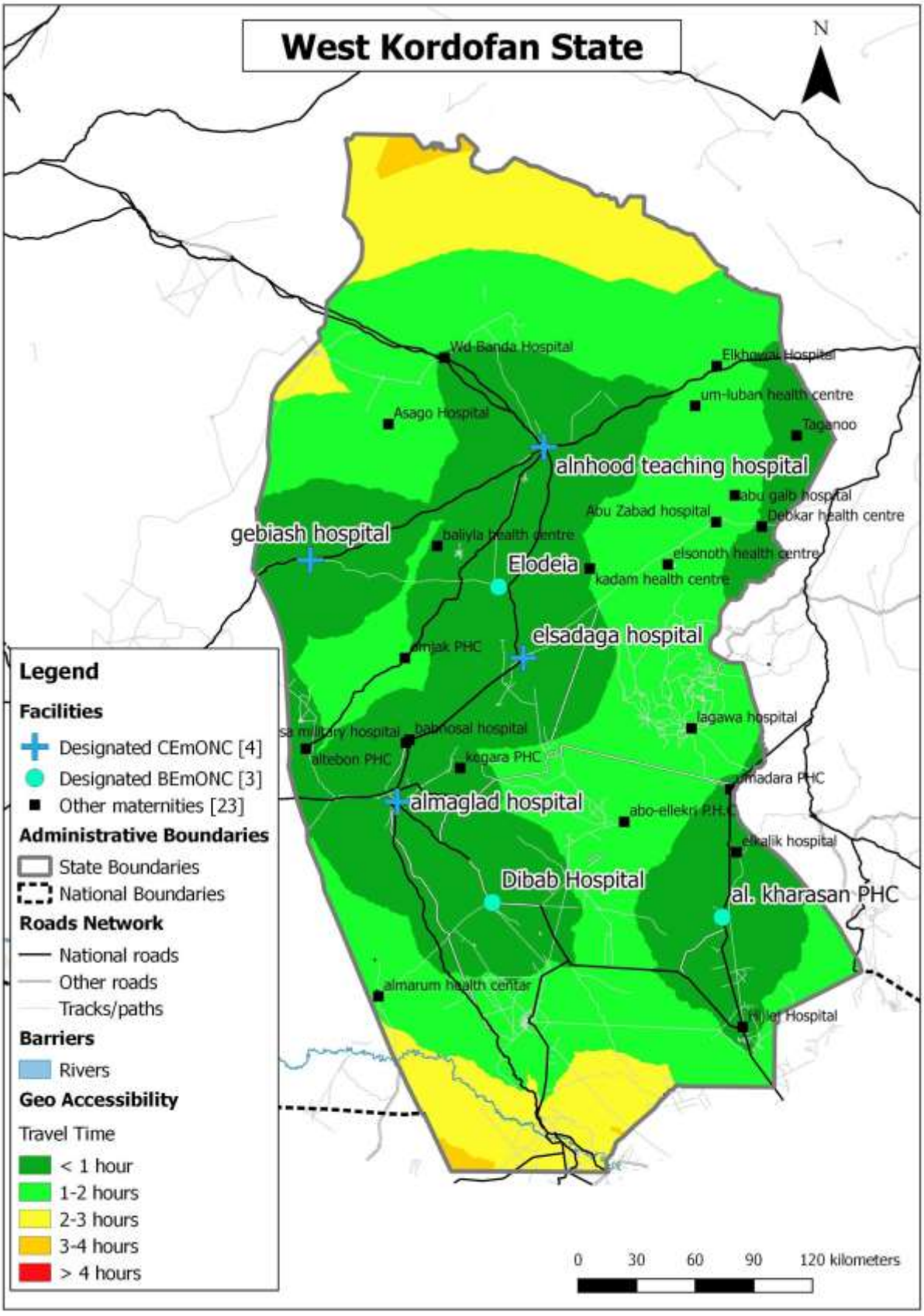
Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



West Kordofan State has a more important population density in its northern part. The State is crossed by two major national roads, one crossing the State on its eastern part from South to North, and one

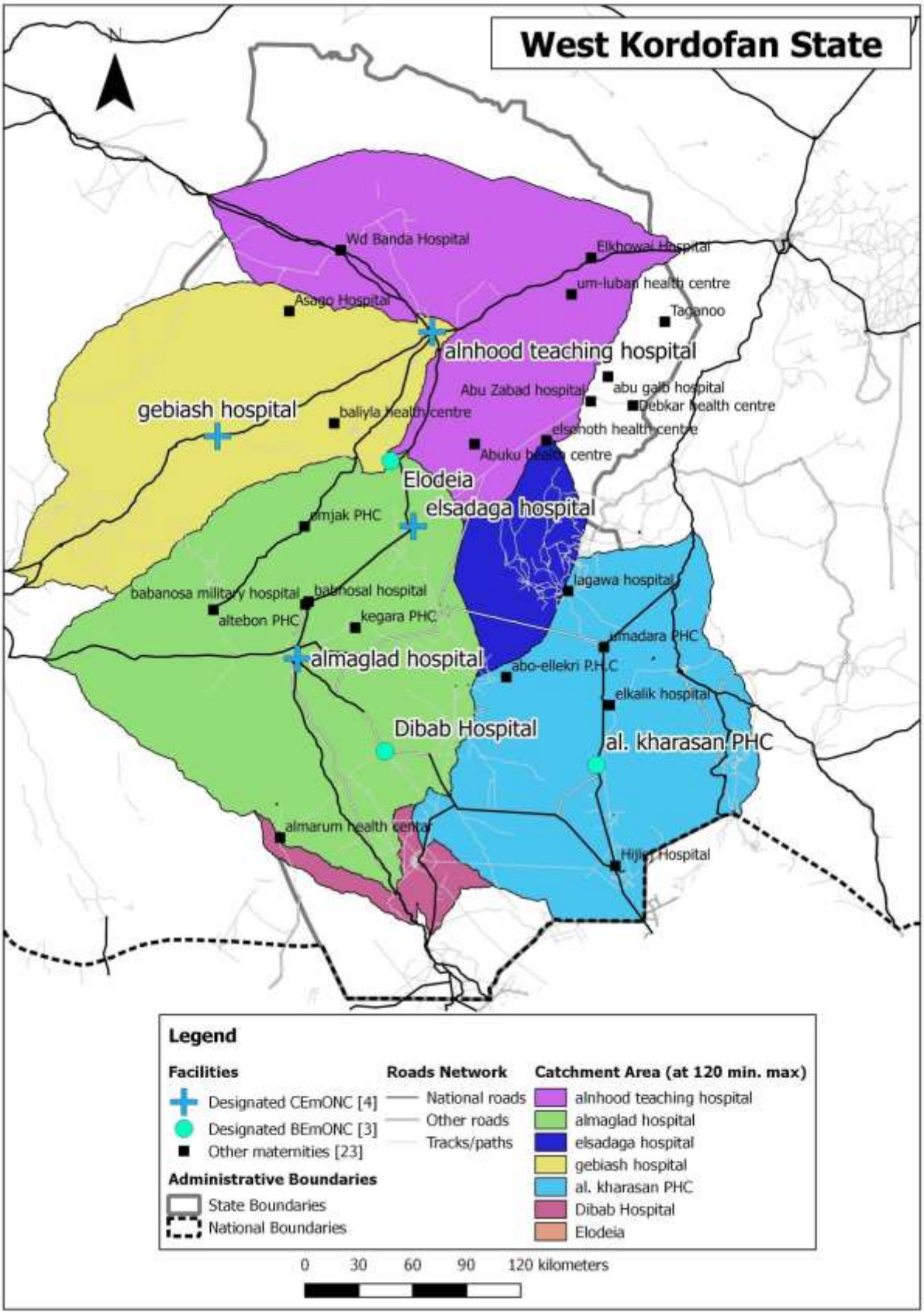
crossing the State in its northern part from East to West. The EmoNC health facilities identified by the working group are along the national roads.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the population of West Kordofan State is located within 2 hours of travel time of an EmONC health facility proposed by the working group and most of the population is within 1 hour of travel time. Population located in the South-West and extreme northern parts of the State are at more than 2 hours from the closest EmONC health facility.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover 82% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2-hour travel time cover most of the State, except the South-East part**.**

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
95.7%	97.2%	81.9%	89.9%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of West Kordofan State has selected 7 health facilities to be part of the EmONC network, including 4 CEmONC (Elsadaga hospital, Almaglad hospital, Alnhood teaching hospital, Gebiash hospital) and 3 BEmONC (Elodeia, Al. kharasan PHC, Dibab Hospital). This number is below the international recommendation but above the maximum number of designated EmONC health facilities set by the FMoH of 5 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities are within 2 hours of travel time for most designated BEmONC health facilities but present financial barriers and poor road conditions for two designated BEmONC health facilities (Elodeia and al. kharasan PHC). Al. kharasan PHC refers to a CEmONC health facilities in South Kordofan State.

In terms of human resources, there are no graduate nurse midwife in any of the designated EmONC health facilities and there is an important gap of nurse midwives in many designated EmONC health facilities: none of the three designated BEMONC health facilities have a nurse and two CEmONC health facilities (Almaglad hospital and Gebiash hospital) have only one nurse. There is an important concentration of doctors in four CEmONC health facilities, particularly in Alnhood teaching hospital. There is a gap of 16 midwives to be filled in the short/medium term in order to ensure the provision of services 24h/7d in the designated EmONC network. The group also highlighted the need for more anaesthetists and pediatricians.

In terms of infrastructure and equipment, the working group highlighted that the three of the designated CEmONC health facilities have functioning labs (except Gebiash hospital) as well as the designated BEmONC health facilities Dibab Hospital and Elodeia. However, there are major issues with availability of blood banks in all designated CEmONC health facilities and absence of no intensive care units for mothers and newborns. The group also highlighted that the theater of the Alnhood teaching hospital does not meet international standards and that all designated EmONC health facilities face a shortage of electricity and water supply.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted for all the health facilities of the States the absence of health facility register and protocols. Elsadaga hospital has support from UNICEF and UNHCR. Almaglad hospital has support from Save the Children, UNICEF, UNHCR. Alnhood teaching hospital has support from Save the Children. Gebiash hospital) and Al. kharasan PHC has support from UNICEF, UNHCR, Islamic Relief, Global Aid. , Dibab Hospital).

Only Almaglad and Alnhood teaching hospitals are conducting maternal deaths reviews.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is slightly above the maximum number set by the FMoH for this first EmONC network. All designated CEmONC health facilities have an important obstetrical activity. All of them have limited gaps in signal function.

The designated BEmONC health facilities have referral linkages with CEmONC health facilities, within two hours of travel time. Al Kharasan and Elodeia have a low obstetric activity of 29 deliveries per month and require 3 midwives each in the short term. Al Kharasan has major gaps in signal functions and is not located in a densely populated area, which is partly in the catchment area of the designated BEmONC health facility Dibab Hospital. Dibab has a more important obstetric activity with 60 deliveries per month and a referral linkage to Almaglad Hospital within 2 hours of travel time. Elodeia is in the catchment areas of both Alnhood Teaching Hospital and Elsadaga Hospital, which is a densely populated area and could be kept in the EmONC network.

The support team therefore recommends to select the 4 CEmONC (Elsadaga hospital, Almaglad hospital, Alnhood teaching hospital, Gebiash hospital) and 2 BEmONC (Elodeia and Dibab Hospital) identified by the working group.

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
7	6	82%	76%	70%	69%	16	13	11	11

All the maternities of the State cover 96% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 97%.

Seven health facilities have been designated by the working group to be included in the EmONC network. They cover 82% of the population within 2 hours travel time. Among them, three health facilities are functioning and cover 70% of the population within 2 hours of travel time.

Exceptionally, the support team recommends to exceed the maximum number set and to select six EmONC health facilities for this programmatix cycle, which would cover 70% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all six designated EmONC facilities function 24h/7d with quality of care.

Northern State

State description

The Northern State is located in the northern-west part of the country and is bordered to the north by Egypt, to the West by the North Darfur State and Libya, to the East by the River Nile and Khartoum States and to the south by the North Kordofan State. The surface area of the State is 365,665 square kilometers, or 19% of the country's total surface area. It is located in the heart of the desert zone and is characterized by low rainfall, extreme temperatures, and sparse vegetation. It is composed of 7 localities (Delgo, Dongola, El Burgaig, El Daba, El Golid, Halfa, Merwoe) and has a population of 887,011 people.

Institutional deliveries are estimated at 43% (EmONC NA 2017) and contraceptive prevalence rate is 19.7% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
887,011	8	4	**6**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Dongla Specialized Hospital	CEmONC	370 098	1	421
Elburgeg Hospital	BEmONC	311 529	1	179
Eldaba Hospital	BEmONC	326 017	1	153
Ibri Hospital	BEmONC	27 010	3	37
Karima Hospital	CEmONC	310 438	0	202
Wadi Halfa Hospital	CEmONC	15 254	5	47

One of the seven functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) has been included in the EmONC network proposed by the working group.

Dongola Police Hospital, Masho Hospital, Babanosa Military Hospital, Marawi Hospital, and Amrri Hospital were not considered as functioning due to the absence of instrumental deliveries. Marawi Military Hospital and Masho Hospital had stock outs of oxytocin and/or magnesium sulfate. Elghaba Hospital had no blood transfusion performed.

Within the proposed EmONC network, all the designated EmONC health facilities are missing vacuum extractions. In addition, Wadi Halfa has gaps for the administration of parenteral anticonvulsants, manual removal of the placenta, performance of basic neonatal resuscitation, and performance of blood transfusion.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Dongla Specialized Hospital	16	3	0	10	6	13	3
Elburgeg Hospital	6	2	0	3	1	4	2
Eldaba Hospital	6	4	0	4	2	2	4
Ibri Hospital	3	0	0	2	0	3	0
Karima Hospital	8	4	0	3	2	4	4
Wadi Halfa Hospital	4	0	0	4	1	4	0
Total need in midwives (without redeployment)						**28**	**13**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

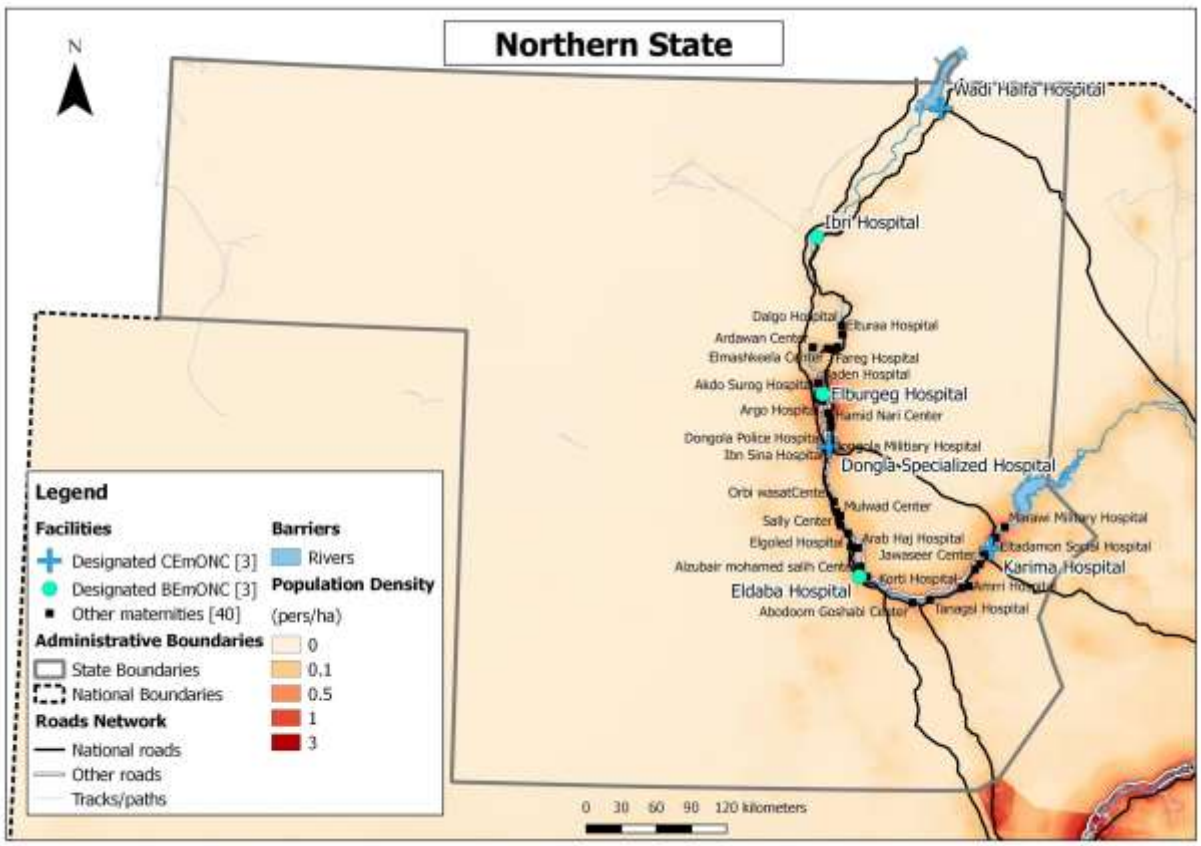
1.1.4 Referral link between EmONC facilities

CEmONC facility	**Name of BEmONC facility linked to the CEmONC facility**	**Average time for referral**		**Overall quality of the referral link**
		Dry season	**Rainy season**	
Karima Hospital	Eldaba Hospital	1h30	2h	financial barrier (20 USD)

Dongla Specialized Hospital	Elburgeg Hospital	1h	1h30	financial barrier (20 USD)
	Eldaba Hospital	2h	2h30	financial barrier (20 USD)
	Ibri Hospital	2h30	3h	financial barrier (20 USD)
Wadi Halfa Hospital	Ibri Hospital	2h30	3h	financial barrier (20 USD)

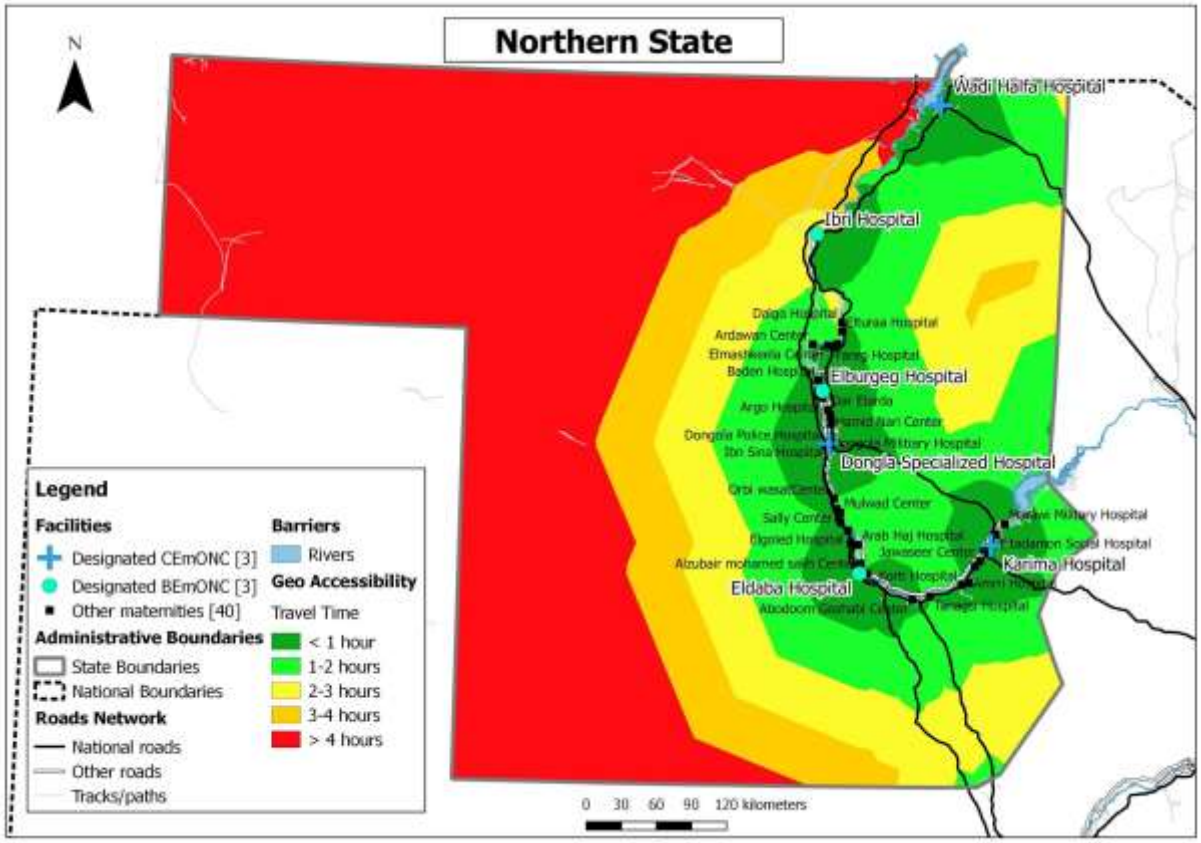
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



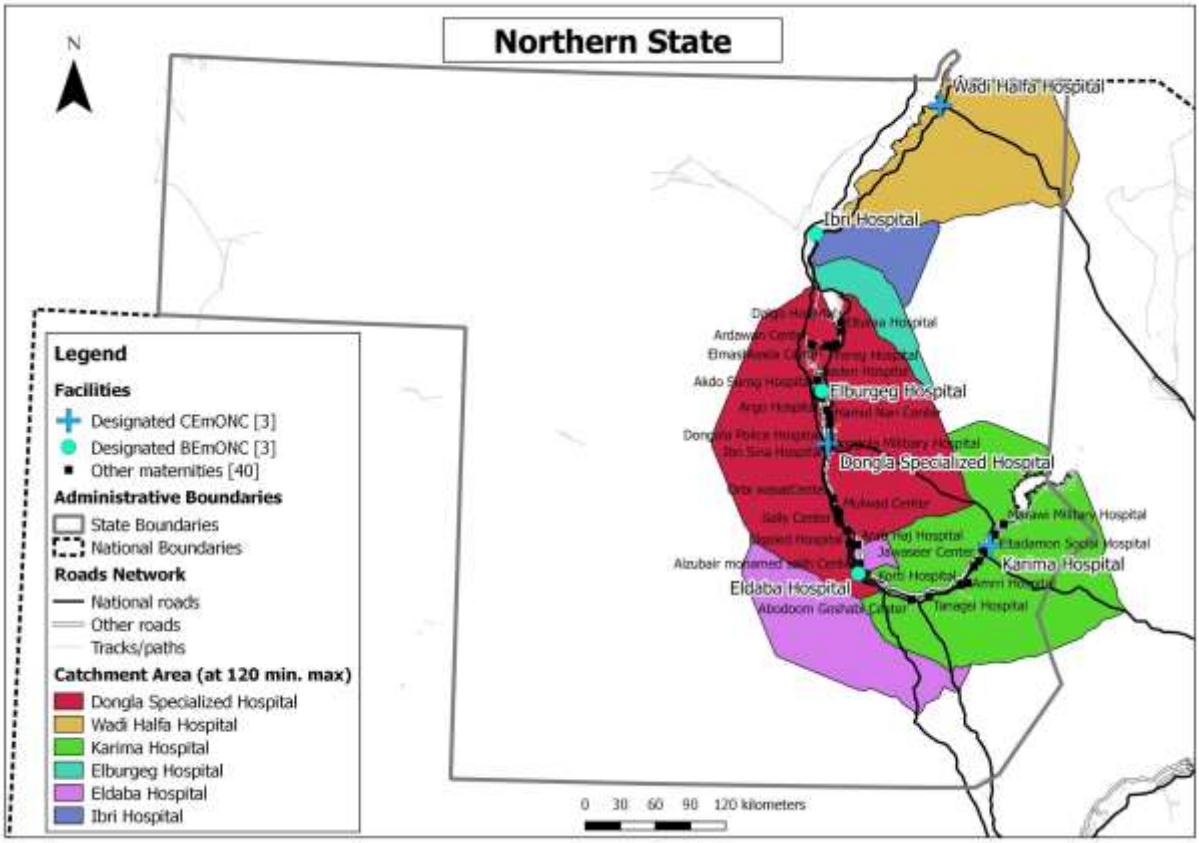
Northern State has a low population density across the state, with most of the population concentrated along the Nile. National roads are also along the Nile river. However, except in the rainy season, the population can use motorized vehicles on off road paths in the desert.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the population is located within 2 hours of travel time of an EmONC health facility proposed by the working group along the Nile River. The west part of the States is located at more than four hours from the closest designated EmONC health facility but it is very low populated. Alternative strategies need to be put in place to ensure access to quality EmONC by these population, such as maternity waiting homes.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover 83% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most the population along the River Nile but are well complemented by the catchment areas of the Ibri and Eldaba Hospitals.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
86%	86.9%	83.0%	83.9%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Northern State has selected 6 health facilities to be part of the EmONC network, including 3 CEmONC (Dongla Specialized Hospital, Karima Hospital, Wadi Halfa Hospital) and 3

BEmONC (Elburgeg Hospital, Eldaba Hospital, Ibri Hospital). This number is below the international recommendation but above the maximum number of designated EmONC health facilities set by the FMoH of 4 designated EmONC health facilities.

The referral linkages between the selected BEmONC and CEmONC health facilities present financial barriers for the three designated BEmONC health facilities, which makes all the links having difficulties (orange) despite some of the BEmONC health facilities being less than 2 hours from the closest CEmONC health facility. The most problematic referral links are the ones from Ibri Hospital to both Dongla Hospital and Wadi Halfa Hospital, with a duration of 2h30 to 3h.

In terms of human resources, two EmONC health facilities (Wadi Halfa and Ibri Hospitals) do not have graduate or nurse midwives. All designated EmONC health facilities require additional midwives in the short/medium term and there is an important gap of 13 midwives in Dongla Specialized Hospital. Overall, the State requires an additional 28 midwives to ensure that the EmONC health facilities will be functioning 24h/7d. The group also highlighted the need for more anaesthetists in all designated EmONC health facilities.

In terms of infrastructure and equipment, the working group highlighted that need for blood bank in Dongla Hospital, Wadi Halfa Hospital. The group also highlighted the need for vacuum extractors across health facilities, infection prevention, blood bank products, infant warmers, C-section sets, blood bank products and refrigerators.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the good linkages of designated health facilities with local communities and the good leadership in most health facilities. However, they highlighted the lack of data and absence of registers. Maternal deaths reviews are conducted in all designated EmONC health facilities, except in Elburgeg and Ibri Hospitals. None of the designated EmONC health facilities are supported by partners.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is above the maximum number set by the FMoH for this first EmONC network. All designated CEmONC health facilities have an important obstetrical activity, except Wadi Halfa Hospital with only 47 deliveries per month and important gaps in signal functions. Specific efforts will be required in the current programmatic cycle to make this CEmONC health facility functioning with quality of care, including ensuring linkages with communities to contribute to an increase in the obstetric activity.

The designated BEmONC health facilities Elburgeg and Eldaba Hospitals have a good obstetric activity and are respectively doing 54 and 46 C-sections per month. Elburgeg has one OBGYN and Eldaba Hospital two OBGYNs. These two health facilities should be designated as CEMONC health facilities. Ibri Hospital has a lower obstetric activity and will require specific efforts to make it functioning with quality of care and to improve referral linkages to the closest CEmONC health facilities. But it has a catchment area that complements well the ones of Wadi Halfa Hospital and Elburgeg Hospital.

Exceptionally, the support team recommends to exceed the maximum number set and to keep the selected 6 health facilities in the designated EmONC network, with 5 CEmONC (Dongla Specialized Hospital, Karima Hospital, Wadi Halfa Hospital, Elburgeg Hospital, Eldaba Hospital) and 1 BEmONC (Ibri Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
6	6	83%	83%	33%	33%	28	28	13	13

All the maternities of the State cover 86% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 87%.

Six health facilities have been designated by the working group to be included in the EmONC network. They cover 83% of the population within 2 hours travel time. Among them,one health facility is functioning and covers 33% of the population within 2 hours of travel time.

North Darfur State

State description

The North Darfur State is located in the west part of the country and is bordered to the north by the Northern State and Libya, to the West by Chad and West Darfur State, to the south by the States of Centyral Darfur, South Darfur, and East Darfur, and to the east by the States of West Kordofan, North Kordofan, and Northern State. The surface area of the State is 320,992 square kilometers, or 17% of the country's total surface area. With a semi-desert climate, North Darfur state is prone to drought and low rainfall. It is composed of 17 localities (Dar Elsalam, El Fasher, El Koma, El Lait, El Mahalha, El Serief, El Tawisha, El Tina, Kebkabiya, Kelemando, Kernoi, Kutum, Melit, Saraf Omra, Tawila, Um Baru, Um Kadada) and has a population of 2,280,885 people.

Institutional deliveries are estimated at 11% (EmONC NA 2017) and contraceptive prevalence rate is 3.7% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
2,280,885	**22**	**11**	**11**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Elfasher Hospital	CEmONC	1 047 027	0	484
Allaeet Rural Hospital	CEmONC	702 413	1	37
Kutum Rural Hospital	CEmONC	964 611	0	36
Kabkabia Rural Hospital	CEmONC	1 351 272	1	33
Om Kaddada Rural Hosp	CEmONC	372 451	2	15
Taweela Rural Hospital	BEmONC	1 362 839	0	41
Alseraif	BEmONC	1 422 545	1	37
Melit	BEmONC	879 378	2	35
Saraf Omoa Rural Hosp	BEmONC	1 446 107	1	19
Kalamando hospital	BEmONC	516,973	5	20
Elkomah Rural Hospital	BEmONC	800 206	4	7

Three of the six functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

Altwesha Hospital was not included in the EmONc network due to the very low number of deliveries per month and lack of information on the obstetric activity in the health facility. Jabeer Hospita and Alseraif were not considered functioning due to the absence of instrumental deliveries.

Within the proposed EmONC network, most of the designated EmONC health facilities are only missing one or two signal functions with the exception of Kalamando and Elkomah Hospitals with

important gaps of respectively 5 and 4 missing signal functions. The removal of retained products (missing in Allaeet Hospital, Kabkabia, Om Kaddada, Melit, Kalamando, Elkomah) and the performance of basic neonatal resuscitation (missing in Kalamando, Elkomah) are the most common gaps in signal functions across the designated EmONC health facilities. Gaps for the administration of parenteral anticonvulsants are also missing in Om Kaddada, Melit, and Elkomah and uterotonic drugs are missing in three BEmONC health facilities (Saraf, Kalamando, Elkomah).

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Elfasher Hospital	17	0	15	10	9	2	15
Allaeet Hospital	4	0	3	2	0	1	3
Kutum Rural Hospital	3	0	0	3	0	3	0
Kabkabia Rural Hospital	3	0	3	3	0	0	3
Om Kaddada Rural Hosp	3	0	1	1	0	2	1
Taweela Hospital	3	0	0	1	0	3	0
Alseraif Rural Hosp	3	0	0	4	0	3	0
Melit Hospital	3	0	3	3	0	0	3
Saraf Omoa Rural Hosp.	3	0	0	3	0	3	0
Kalamando hospital	3	0	0	1	0	3	0
Elkomah Rural hospital	3	0	0	1	0	3	0

Total need in midwives (without redeployment)	**23**	**25**

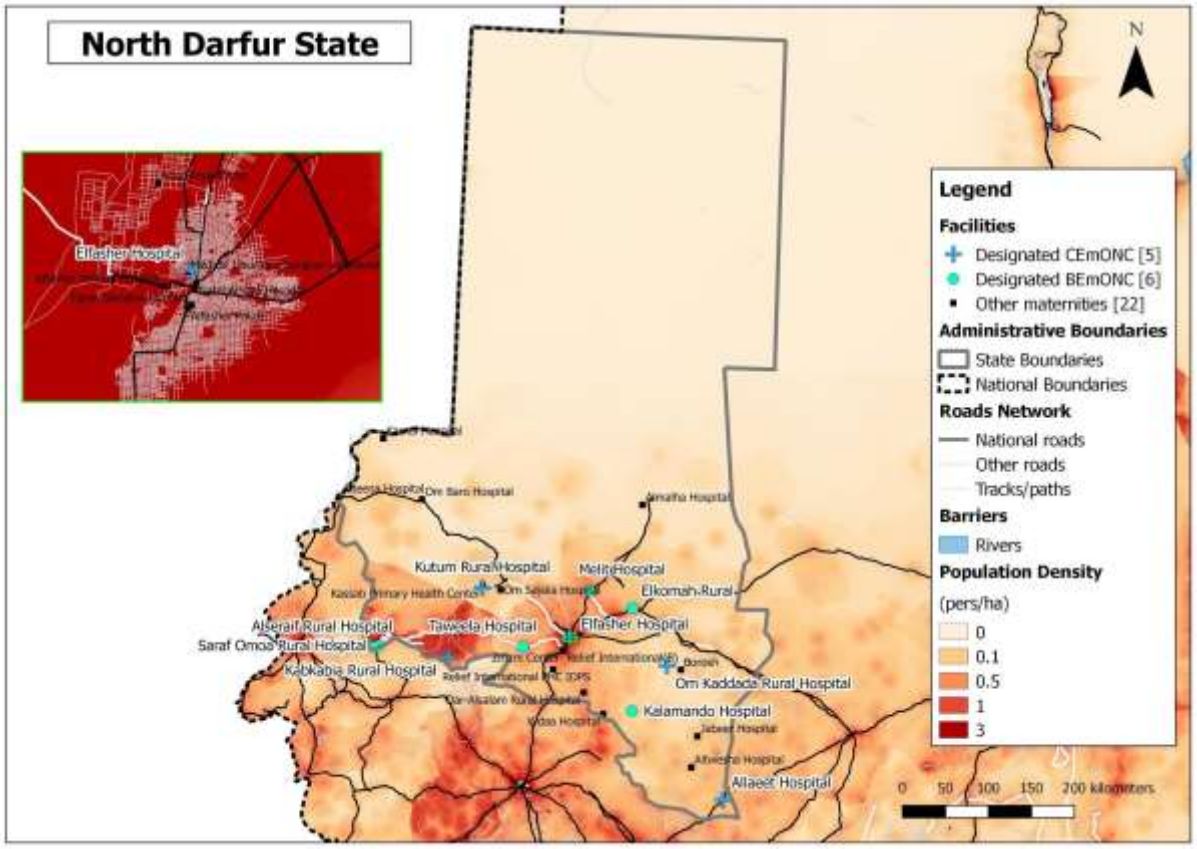
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Elfasher Hospital	Taweela Hospital	40 mn	60 mn	
	Melit Hospital	40 mn	60 mn	
	Kalamando hospital	40 mn	60 mn	Financial barriers (no information on cost estimates)
Om Kaddada	Elkomah	40 mn	60 mn	
Kabkabia	Alseraif	40 mn	60 mn	
	Saraf Omoa	40 mn	60 mn	Access issues due to valley

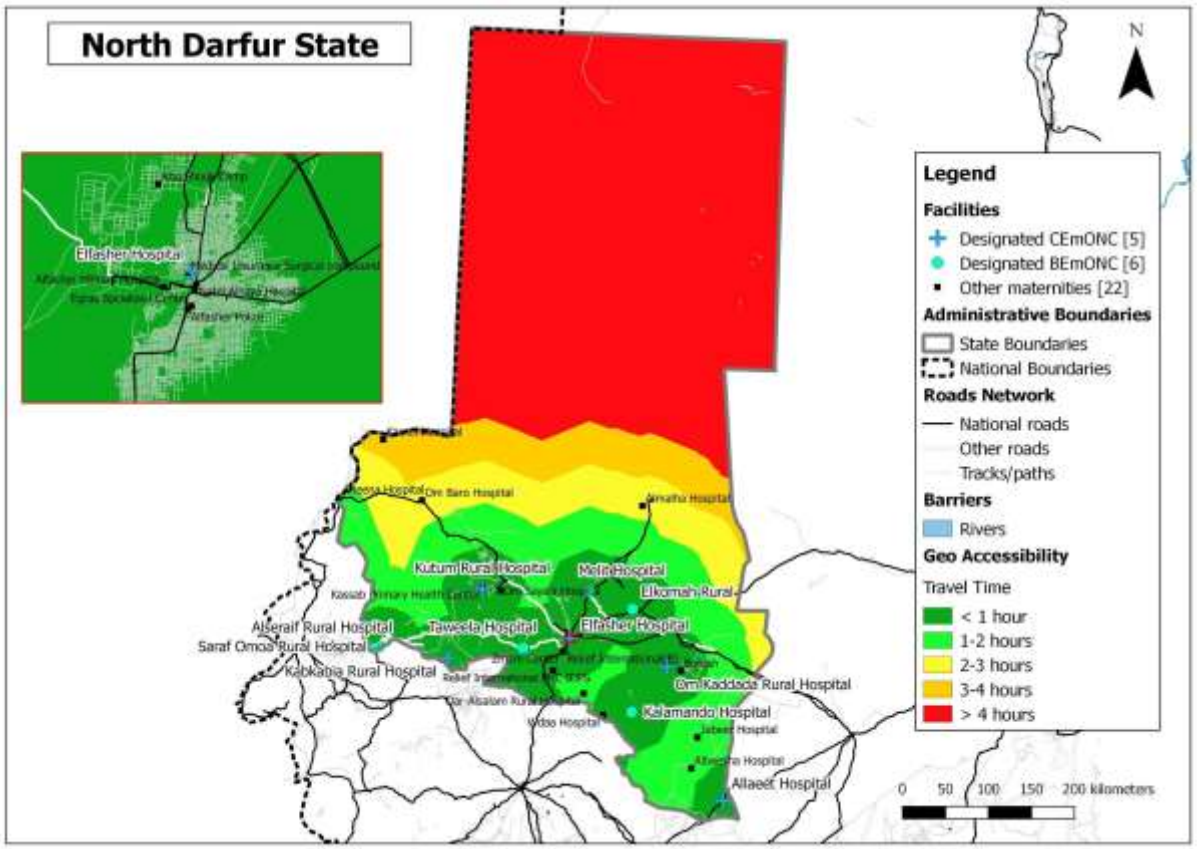
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



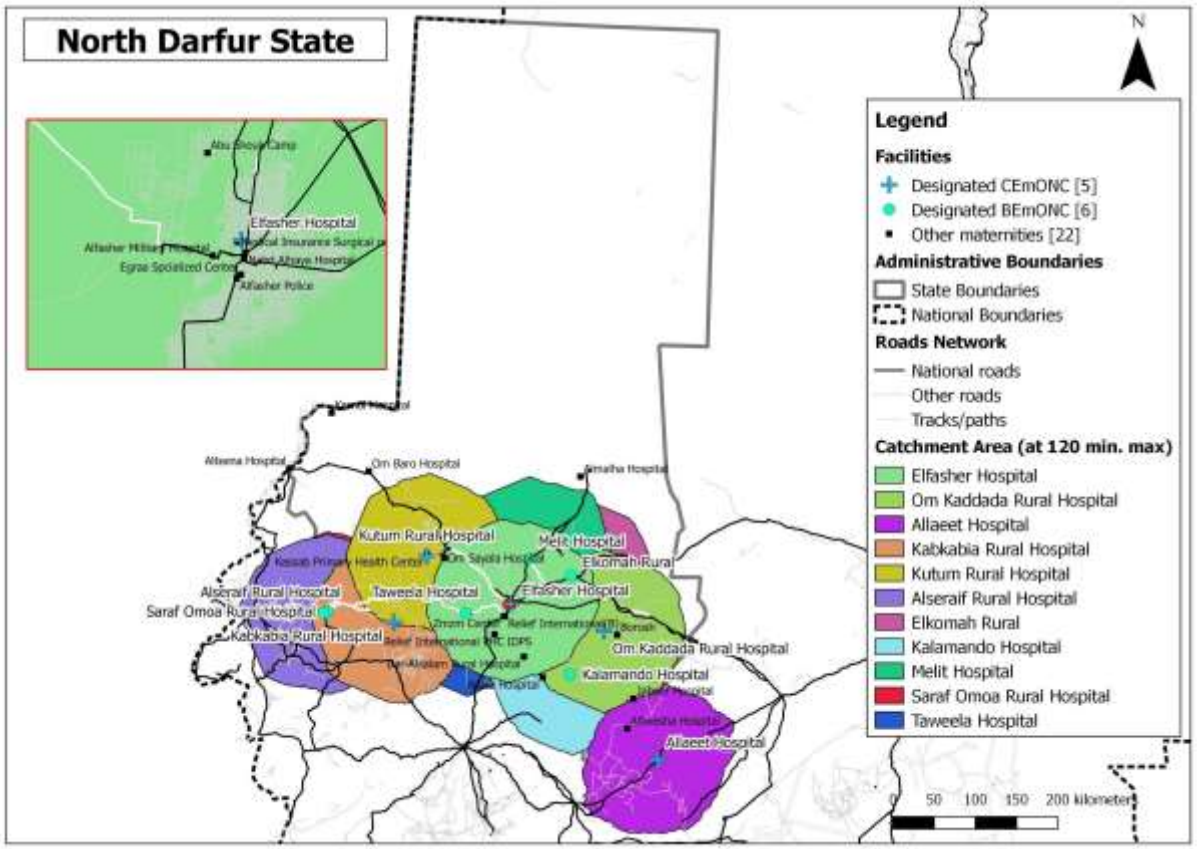
North Darfur State has a low population density across the state, with most of the population concentrated in the South part of the State. National roads are also concentrated in the South. However, except in the rainy season, the population can use motorized vehicles on off road paths in the desert.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the population is located within 2 hours of travel time of an EmONC health facility proposed by the working group. The North part of the States is located at more than four hours from the closest designated EmONC health facility but it is very low populated. Alternative strategies need to be put in place to ensure access to quality EmONC by these population, such as maternity waiting homes.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover 88% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most the population but are well complemented on the eastern part of the State by the catchment areas of the designated BEMONC health facilities: Saraf Omoa Rural Hospital and Alseraif Rural Hospital.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
94.7%	95.1%	88.0%	88.9%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of North Darfur State has selected 11 health facilities to be part of the EmONC network, including 5 CEmONC (Elfasher Hospital, Allaeet Rural Hospital, Kutum Rural Hospital, Kabkabia Rural Hospital, Om Kaddada Rural Hosp) and 6 BEmONC (Taweela Rural Hospital, Alseraif, Melit, Saraf Omoa Rural Hosp, Kalamando hospital, Elkomah Rural Hospital). This number is in line with the maximum number of designated EmONC health facilities set by the FMoH of 11 designated EmONC health facilities. Among the proposed designated EmONC health facilities, one CEmONC (Elfasher Hospital) and two BEmONC health facilities (Kutum Rural Hospital and Alseraif) are functioning.

The referral linkages between the selected BEmONC and CEmONC health facilities are good, except for Saraf Omoa Rural and Kalamando hospitals which present difficulties respectively in terms of financial barriers and geographic barriers. Motorized vehicles are the most common means of transportation in North Darfur. Finally, no EmONC health facility is referring to the CEmONC Allaeet Hospital and Kutum Rural Hospital.

In terms of human resources, none of the proposed EmONC health facilities have graduate or nurse midwives. Nine out of eleven designated EmONC health facilities require additional midwives in the short/medium term and the State requires an additional 23 midwives to ensure that the EmONC health facilities will be functioning 24h/7d in the short term. The group also highlighted the need for more anaesthetists in all designated EmONC health facilities. There is only 1 anesthetist in the State. EmoNC health facilities rely on assistant anesthetists.

In terms of equipment, the working group highlighted the need for manual vacuum aspirators, vacuum extractors, suction pumps in labor room, sterilization equipment (as available only in half of the designated EmONC health facilities), and neonatal warmer/heater. The group also highlighted that functioning blood banks are missing in two CEmONC health facilities, Allaeet Hospital, Om Kaddada Rural Hospital, meaning that the entire south east side of the region does not have functioning blood bank. On the positive sides, the group highlighted that all health facilities have basic delivery set and routine blood investigations available, and that oxygen is overall available, except in Om Kaddada Rural Hospital, Taweela Hospital, Alseraif Rural Hospital, Melit, Saraf Omoa Rural Hospital). In terms of infrastructure, all designated EmoNC health facilities have good building structures and each health facility has a functioning ambulance, except in Elfasher Hospital (State Hospital). The major infrastructure issue is the lack of electricity (high dependence of many health facilities on generators) and water supply.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted highlighted the lack of data and absence of registers. Only Allaeet Hospital and Taweela Hospitals are supported by partners (respectively UNHCR and MSF). Maternal deaths reviews are not conducted.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group corresponds to the maximum number set by the FMoH for this first EmONC network. Elfasher Hospital is the only designated CEmONC health facility with an important obstetric activity (484 deliveries per month). Three other CEmONC health facilities have about 35 deliveries per month but they have an important catchment area and limited gaps in signal functions (Kutum Rural Hospital is functioning). Specific efforts will be required in the current programmatic cycle to ensure that these CEmONC health facility function with quality of care, including ensuring linkages with communities to contribute to an increase in the obstetric activity. However, Om Kaddada Rural Hospital has a very low obstetric activity (15 deliveries per

month), two gaps in signal functions and a lower catchment area. It could therefore be considered for a future programmatic cycle.

Among the designated BEmONC health facilities, three health facilities have a low obstetric activity: Saraf Omoa Rural Hosp with 19 deliveries per month, Kalamando hospital with 20 deliveries per month, and Elkomah Rural Hospital with 7 deliveries per month. Saraf Omoa Hospital is close to Alseraif Hospital which has twice more obstetric activity and is functioning. Both Kalamando Hospital and Elkomah Rural Hospitals have important gaps in signal function (respectively 5 and 4 missing signal functions) which would require substantive efforts to make them functioning 24h/7d with quality of care in the current programmatic cycle and they are in the catchment area of the Elfasher Hospital (assuming the travel model in this region whereby vehicles can easily travel outside the main roads), so they may be included in the EmONC network in a future programmatic cycle.

The support team therefore recommends to select 4 CEmONC (Elfasher Hospital, Allaeet Rural Hospital, Kutum Rural Hospital, Kabkabia Rural Hospital) and 3 BEmONC (Taweela Rural Hospital, Alseraif, Melit) to be part of the EmONC network.

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
11	7	88%	80%	60%	60%	23	12	25	24

All the maternities of the State cover 95% of the population within 2 hours of travel time.

Eleven health facilities have been designated by the working group to be included in the EmONC network. They cover 88% of the population within 2 hours travel time. Among them, three health facilities are functioning and cover 60% of the population within 2 hours of travel time.

The support team suggests selecting seven EmONC health facilities for this programmatix cycle, which would cover 80% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all seven designated EmONC facilities function 24h/7d with quality of care.

East Darfur State

State description

The East Darfur State is located in the south-west part of the country and is bordered to the north by the North Darfur State, to the West by the South Darfur State, to the south by the Republic of South Sudan, and to the east by the State of West Kordofan. The surface area of the State is 54,182 square kilometers, or 3% of the country's total surface area. East Darfur falls into several climatic zones: semiarid in the northern areas; low rainfall savannah in the central areas; and high rainfall savannah in the southern areas. It is composed of 9 localities (Abu Jabra, Abu Karinka, Adila, Assalaya, Bahr El Arab, Ed Dain, El Firdous, Shia'ria, Yassin) and has a population of 1,119,451 people.

Institutional deliveries are estimated at 1% (EmONC NA 2017) and contraceptive prevalence rate is 5.8% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
1,119,451	**11**	**5**	**5**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Abu-Matarig Rural Hospital	CEmONC	1 065 979	1	17
Alda'ain Teaching Hospital	CEmONC	1 370 345	1	327
Sheireea Rural Hospital	CEmONC	1 530 076	2	34
Yasen Rural Hospital	BEmONC	1 934 714	NA	32
Adila Rural Hospital	CEmONC	768 456	NA	20

The only functioning EmONC facility of the State, according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance), has been included in the EmONC network proposed by the working group. However, it is not considered as functioning by the State working group due to the absence of instrumental deliveries and stock-outs of magnesium sulfate. The EmONC assessment only contains data for two other EmONC health facilities selected by the working group. These health facilities have one gap in signal function but this number may be underestimated for Abu-Matarig that has few deliveries per month. It is unlikely that height of the nine

signal functions could be performed with such low activity. The missing signal function in Alda'ain Teaching hospital is the performance of basic neonatal resuscitation with bag and mask.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Abu-Matarig Rural Hospital	3	0	0	2	0	3	0
Alda'ain Teaching Hospital	12	0	2	12	2	10	2
Sheireea Rural Hospital	3	0	0	1	0	3	0
Yasen Rural Hospital	3	0	0	1	0	3	0
Adila Rural Hospital	3	0	0	1	0	3	0
Total need in midwives (without redeployment)						**22**	**2**

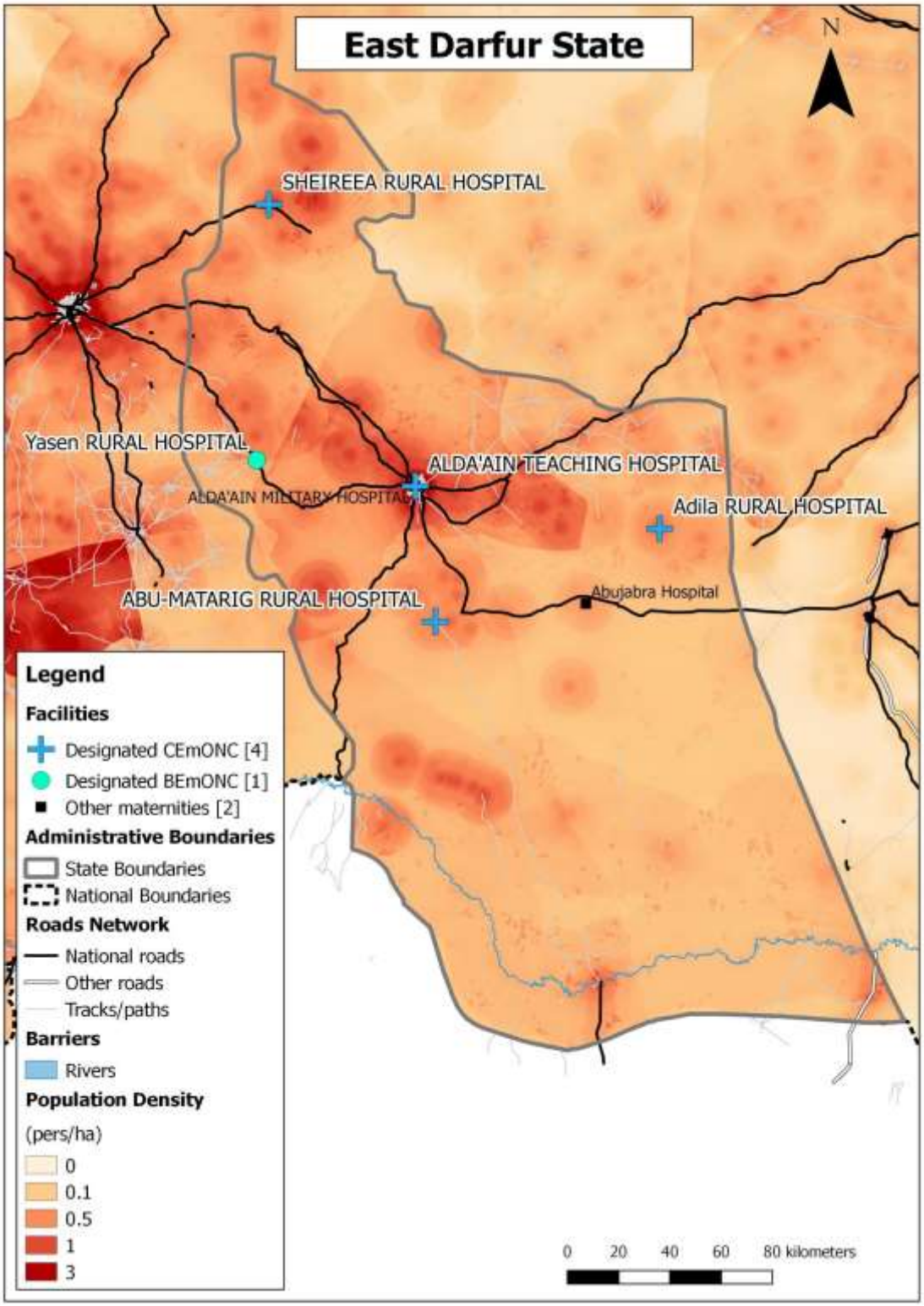
*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

CEmONC facility	**Name of BEmONC facility linked to the CEmONC facility**	**Average time for referral**		**Overall quality of the referral link**
		Dry season	**Rainy season**	
Alda'ain Teaching Hospital	Yasen Rural Hospital	1h30	2h	Financial barriers (40 USD for ambulance, 60 USD by taxi)

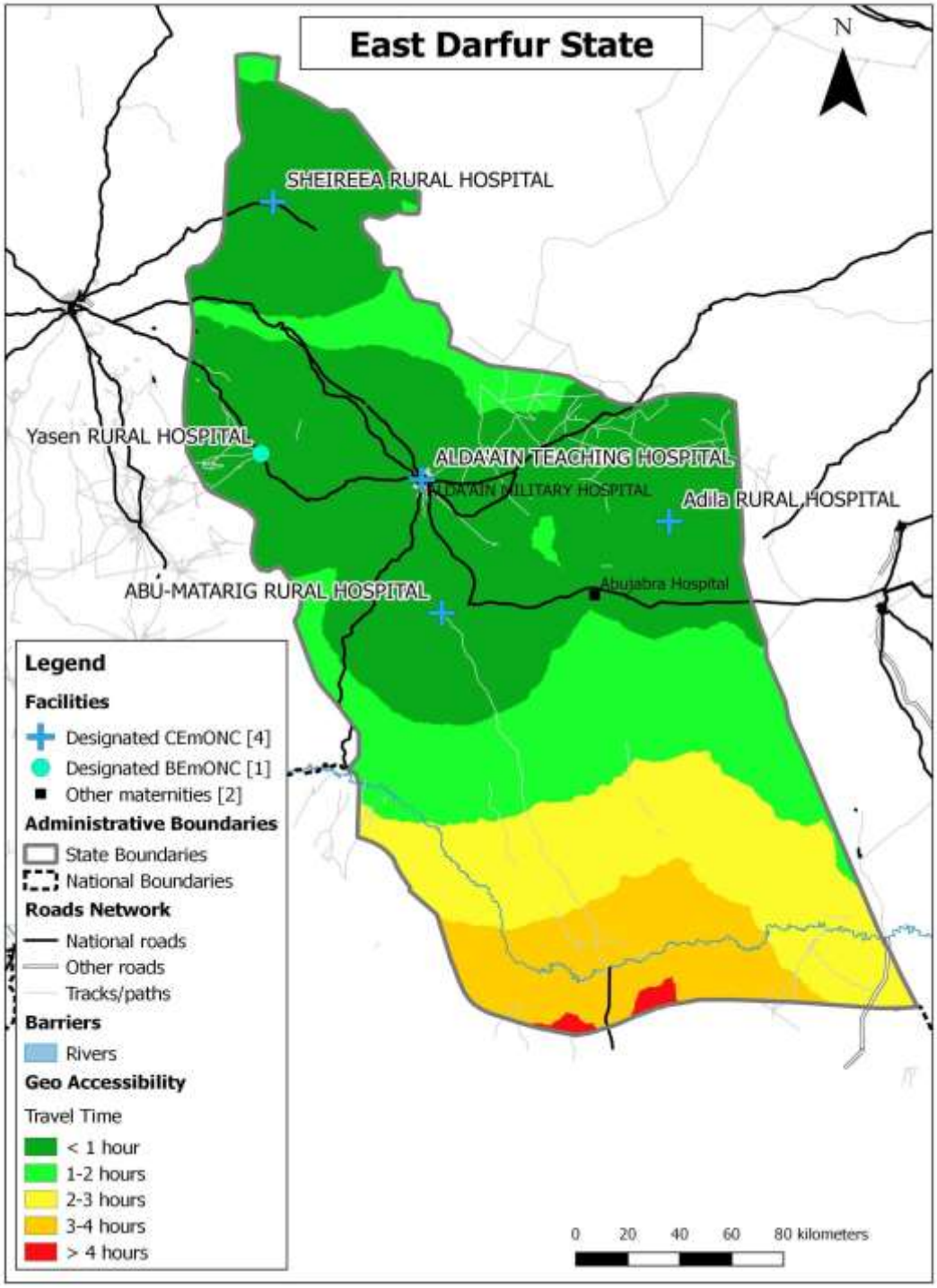
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



East Darfur State has a low population density across the state, with most of the population concentrated in the Central and North parts of the State with some pockets of dense population in the South West part of the State.. National roads are also concentrated in the North, crossing the State from East to West.

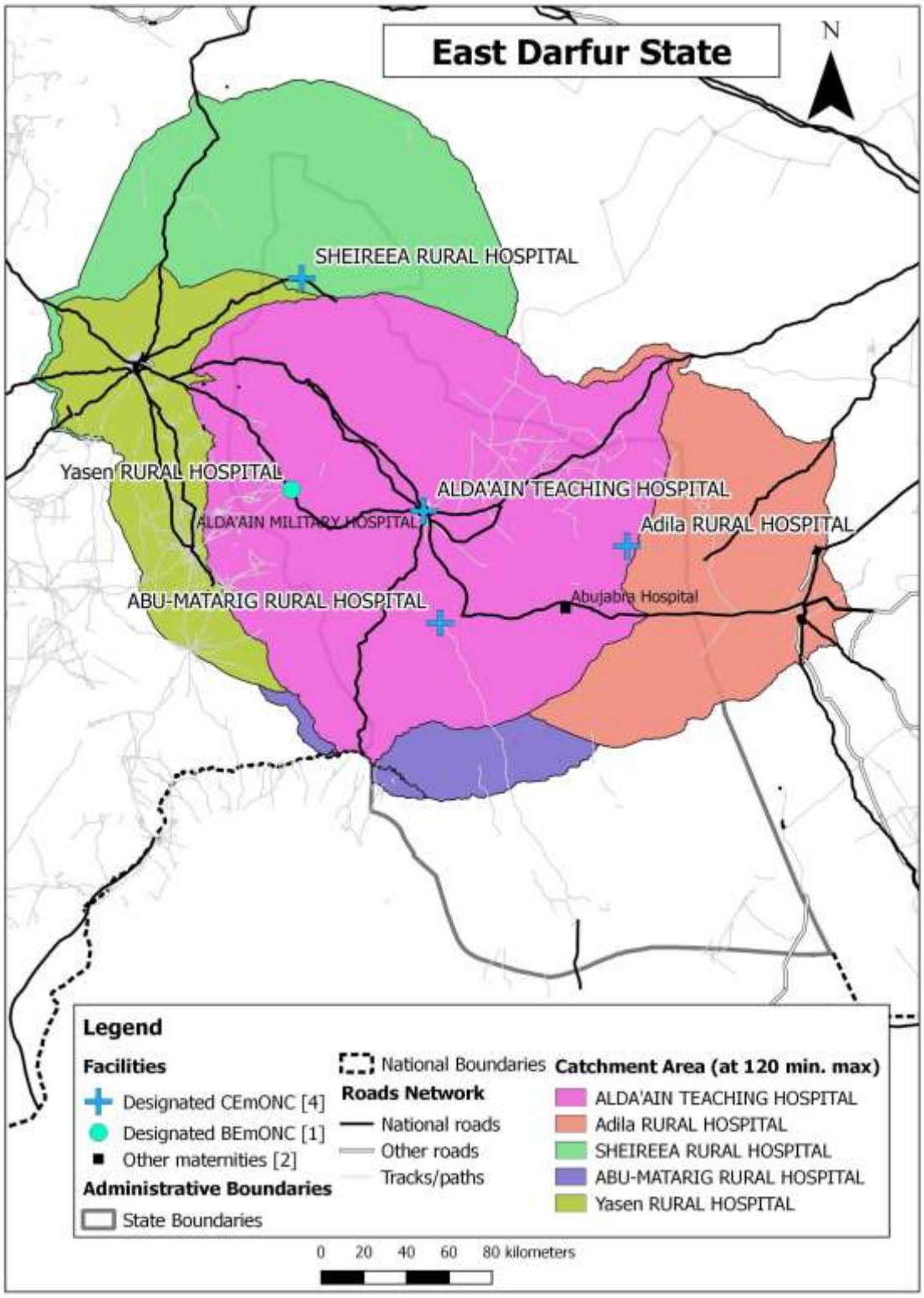
Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the population in the North and Central parts of the State are located within 2 hours of travel time of an EmONC health facility proposed by the working group. The working group has not identified any health facility in the South to be part of the EmONC network as no health facilities in this area have a sufficient obstetric activity to become functioning 24h/7d with quality of care in the current

programmatic cycle. Furthermore, the South part of the State is not densely populated, so there is low probability to significantly increase the obstetric activity of these health facilities. Alternative strategies need to be put in place to ensure access to quality EmONC by these population, such as maternity waiting homes.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover 81% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover the population of the Central and North parts of the State and beyond in neighboring States. However, the Southern part of the State is not covered by the designated EmONC health facilities within 2 hours of travel time.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
82.5%	90.1%	81.2%	82.3%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of East Darfur State has selected 5 health facilities to be part of the EmONC network, including 4 CEmONC (Abu-Matarig Rural Hospital, Alda'ain Teaching Hospital, Sheireea Rural Hospital, Adila Rural Hospital) and 1 BEmONC (Yasen Rural Hospital). This number is in line with the maximum number of designated EmONC health facilities set by the FMoH of 5 designated EmONC health facilities. Among the proposed designated EmONC health facilities, three CEmONC (Abu-Matarig Rural Hospital, Alda'ain Teaching Hospital, Sheireea Rural Hospital) are missing one signal function.

The referral linkages between the selected BEmONC and its referral CEmONC health facility (Alda'ain Teaching Hospital) is within two hours of travel time but presents difficulties in terms of financial barriers.

In terms of human resources, there is a major gap in midwives in East Darfur State with none of the proposed EmONC health facilities having graduate midwives and only the Alda'ain Teaching Hospital having two nurse midwives. The State requires an additional 22 midwives to ensure that the designated EmONC health facilities will be functioning 24h/7d in the short term. The group also highlighted the need for more OBGYN, anaesthetists in all designated CEmONC health facilities.

In terms of equipment, the working group highlighted the absence of any functioning blood bank in the designated EmONC health facilities and the limited number of surgical sets in Sheireea, Abu-Matarig, and Adila Hospitals. The group also highlighted the need for equipment for basic neonatal resuscitation in Yasen Hospital. In terms of infrastructure, all designated EmONC health facilities have good building structures but the group highlighted important issues in terms of electricity and water across all designated EmONC health facilities (except in Alda'ain Teaching Hospital for electricity). Finally, the group highlighted missing waste incinerators in Sheireea, Yasen, Abu-Matarig, and Adila Hospitals.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the lack of data and absence of registers. The working group also highlighted committed teams in all designated EmONC health facilities but pointed out the weak hospital management system and the lack of training of medical staff on management. Alight is supporting Yasen and Adila Hospitals

and UNFPA, WHO, UNICEF, UNHCR, CIS, Almanar are supporting Alda'ain Teaching Hospital. Maternal deaths reviews are only conducted in Alda'ain Teaching Hospital.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group corresponds to the maximum number set by the FMoH for this first EmONC network. Alda'ain Teaching Hospital is the only designated CEmONC health facility with an important obstetric activity (327 deliveries per month). The three other CEmONC health facilities (Abu-Matarig Rural Hospital, Sheireea Rural Hospital, Adila Rural Hospital - located in an area with regular insecurity) have a low activity with respectively 17, 34, 20 deliveries per month. They have an important catchment area (complementing the one of the Alda'ain Teaching Hospital, respectively to the South, to the North, and to the East parts of the State) and Abu-Matarig and Sheireea have only one gap in signal function. However, substantial efforts will be required in the current programmatic cycle to ensure that these CEmONC health facility function with quality of care, including ensuring linkages with communities to contribute to an increase in the obstetric activity. Three midwives also need to be deployed in each of these health facilities to ensure that they function 24h/7d. In addition, these health facilities should be staffed with OBGYN and anesthetists.

The working group has identified one designated BEmONC health facilities, Yasen Hospital, which has 32 deliveries per month and is within two hours travel time from the Alda'ain Teaching Hospital. It also has a good catchment area and the potential to increase its activity, which could contribute to support the Alda'ain Teaching Hospital.

The support team therefore recommends to keep the selection of the working group: 4 CEmONC (Abu-Matarig Rural Hospital, Alda'ain Teaching Hospital, Sheireea Rural Hospital, Adila Rural Hospital) and the BEmONC (Yasen Rural Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
5	5	81%	81%	0%	0%	22	22	2	2

All the maternities of the State cover 83% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 90%.

Five health facilities have been designated by the working group to be included in the EmONC network. They cover 81% of the population within 2 hours travel time. Among them, no health facilities is considered functioning by the State working group.

South Darfur State

State description

The State of South Darfur is located in the western part of the country and one of five comprising the Darfur region. It is bordered to the north by the state of North Darfur, east by the state of East Darfur, to the west by Central Darfur and to the western south by the Central African Republic and to the South by the republic of South Sudan. The surface area of the State is 85,219 km² and it is characterized by mostly a Savannah areas that include several forests. It is composed of 21 localities (Beliel, Buram, Damso, Ed Elfursan, El Radoum, El Sunta, El Wihda, Es Salam, Gereida, Kas, Kateila, Kubum, Mershing, Nitega, Nyala North, Nyala South, Rehaid Elbirdi, Sharg El Jabal, Shattaya, Tulus, Um Dafoug) and has a population of 3,968,978 people, one of the most populous states of the country with about 30% of the population living in internally-displaced persons camps and hard-to-reach areas. The displaced, nomadic and returning populations' movement is adding to the strain on the weak health services delivery system.

Institutional deliveries are estimated at 2% and contraceptive prevalence rate is 5.3%.

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of recommended EmONC	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
3,968,978	**39**	**19**	**11**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Gereida rural Hospital	CEmONC	2 035 466	6	37
Burm Hospital	CEmONC	1 259 865	3	84
Tulus Hospital	CEmONC	1 619 500	8	40
Niteiga Hospital	BEmONC	1 459 910	2	13
Om Dafoug Hospital	CEmONC	419 851	3	62

Nyala Teaching Hospital	CEmONC	1 696 123	0	591
Kass Hospital	CEmONC	1 716 699	0	68
Elmalam Hospital	CEmONC	1 525 961	NA	7
Abu Ajora Hospital	BEmONC	2 312 997	5	38
Aradom Hospital	CEmONC	300 350	NA	48
Dirbat Clinic	BEmONC	1 249 763	NA	10

Two of the seven functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

Alabrar Clinic, Elmalam Hospital, Shifa Elabrar Center, Riheed Elbardi Hospital, and Nyala Maternal Hospital were not considered as functioning due to the absence of instrumental deliveries and stock outs in oxytocin and/or magnesium sulfate.

Within this proposed EmONC network, Niteiga Hospital is missing two signal functions (perform vacuum extractions and basic neonatal resuscitation). Om Dafoug hospital is missing three signal functions (administer of anticonvulsants, deliveries assisted by vacuum extraction, and basic neonatal resuscitation) and Burm Hospital is missing three signal functions (removal of retained products, vacuum extraction, basic neonatal resuscitation). The rest of the designated EmONC health facilities are missing more than 4 signal functions.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation ***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Gereida rural Hospital	3	0	5	1	0	0	3
Burm Hospital	3	0	8	2	0	0	3
Tulus Hospital	3	0	12	1	0	0	3

Niteiga Hospital	3	0	5	0	0	0	3
Om Dafoug Hospital	3	0	13	0	0	0	3
Nyala Teaching Hospital	21	0	11	14	7	10	11
Kass Hospital	3	0	8	2	1	0	3
Elmalam Hospital	3	0	0	1	0	3	0
Abu Agora / Abu AjoraHospital	3	0	5	0	0	0	3
Aradom Hospital	3	0	4	1	0	0	3
Dirbat Rural Hospital	3	0	0	0	0	3	0
Total need in midwives (without redeployment)						**16**	**35**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

1.1.4 Referral link between EmONC facilities

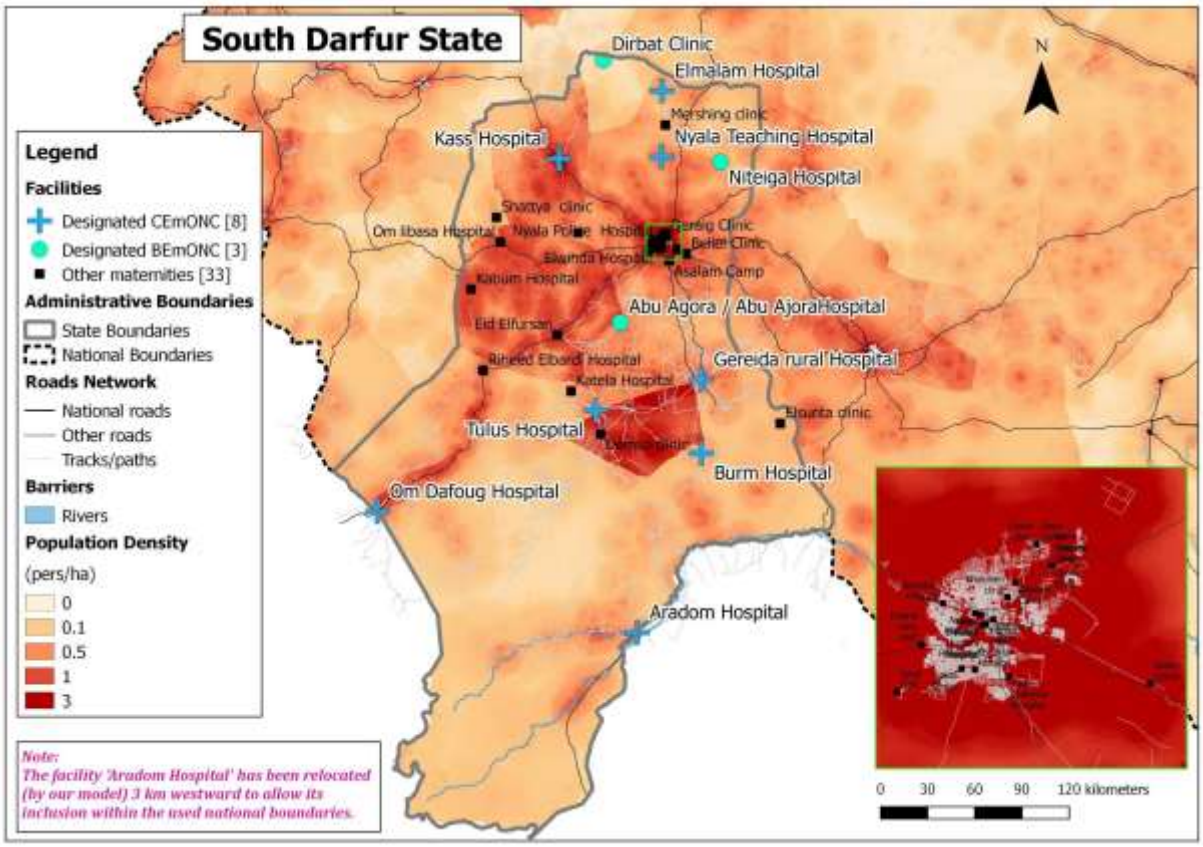
CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Elmalam Rural Hospital	Dirbat Rural Hospital	6h	7h	Financial and geographic (poor road conditions) barriers for access
Nyala Teaching Hospital	Abu Ajora Rural Hospital	3h	5h	Financial barriers (50 USD)
	Niteiga Rural Hospital	2h	2h	

The referral linkages between Dirbat and Elmalam Rural Hospital presents major challenges, with a referral time above 4 hours and with identified causes that are difficult to solve in the short term by the Ministry of Health (eg. poor road conditions). The referral linkages between Abu Ajora Rural and Nyala Teaching Hospitals also presents challenges in terms of travel time (above 3h) and important

financial barriers for patients to pay for ambulance transportation. Referral link between Niteiga and Nyala hospitals is good with no challenges in terms of physical and financial access. The most common means of transportation in the State is motorized vehicles.

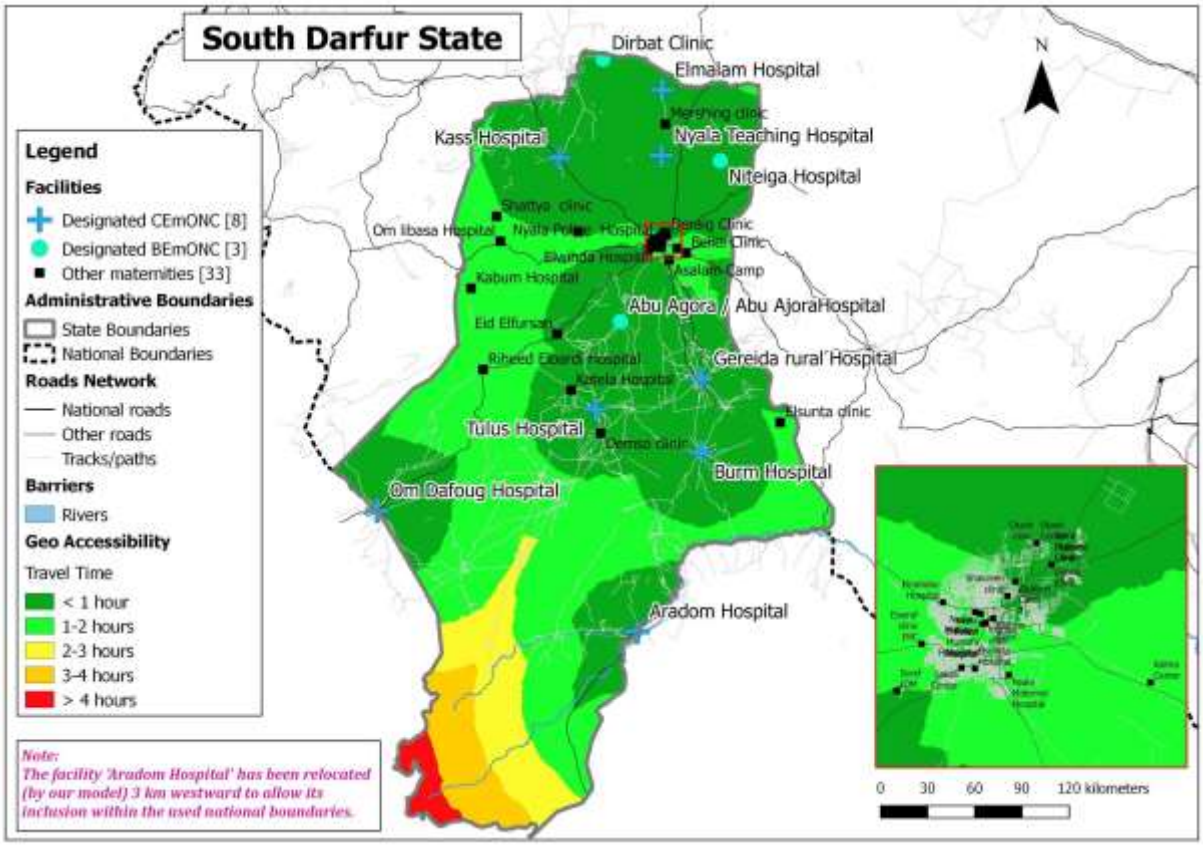
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



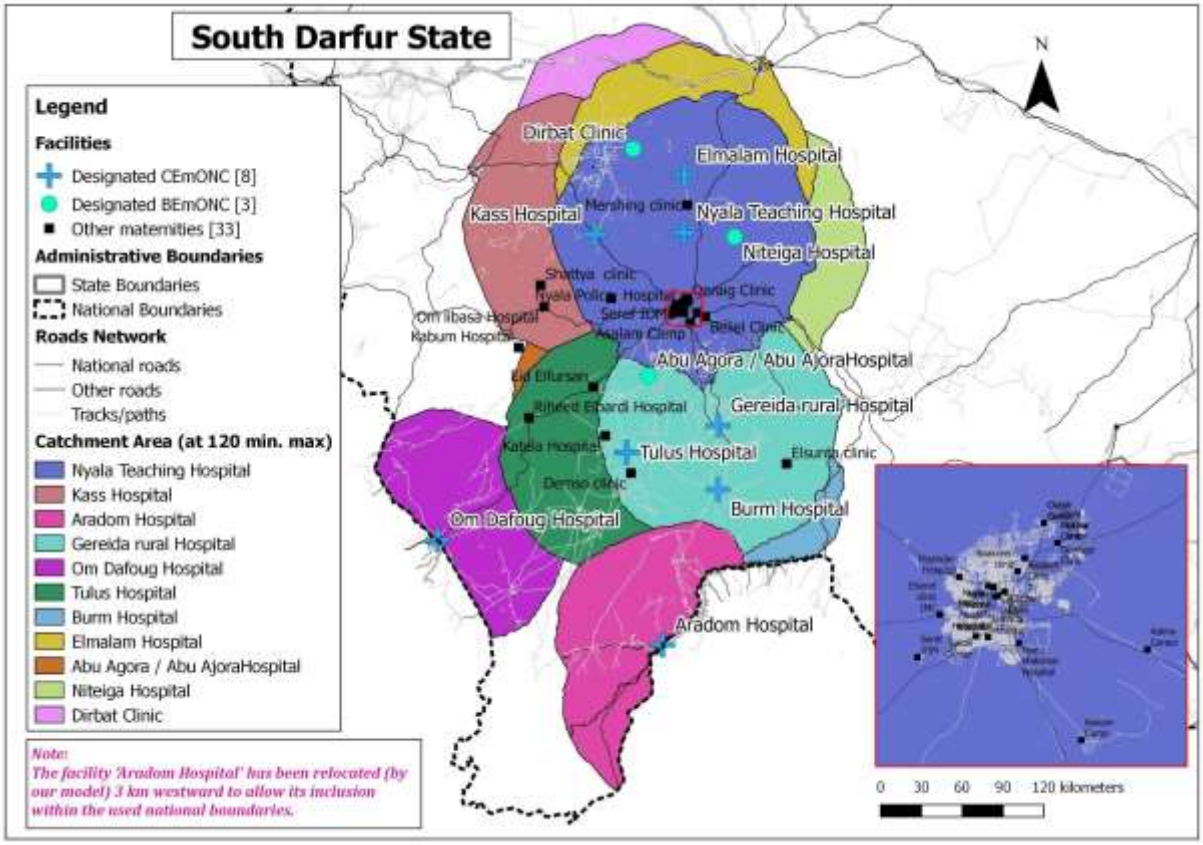
South Darfur State has a high population density concentrated in the North and central parts of the states, with population living in height internally-displaced persons camps.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



Most of the populated areas of the State are located within 2 hours of travel time of an EmONC health facility proposed by the working group. The southern part of the State has areas at more than 2 hours and even more than 4 hours from the closest EmONC health facility. However, there is a lower population density in these areas and no health facilities performing deliveries. Complementary strategies, such as maternity waiting homes, should then be considered to ensure that these populations can access EmONC services.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover about 94% of the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facilities within 2 hour travel time cover most of the central part of the States, where is located the majority of the population of the State. Populations located in the western southern part of the State have poor access to the closest EmONC health facility.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
96.3%	96.5%	95.1%	96.4%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of South Darfur State has selected 11 health facilities to be part of the EmONC network, including 8 CEmONC (Gereida rural Hospital, Burm Hospital, Tulus Hospital, Om Dafoug Hospital, Nyala Teaching Hospital, Kass Hospital, Elmalam Hospital, Aradom Hospital) and 3

BEmONC (Niteiga Hospital, Abu Ajora Hospital, Dirbat Clinic). This number is in line with the maximum number of designated EmONC health facilities set by the FMoH of 19 designated EmONC health facilities. Among the proposed designated EmONC health facilities, two CEmONC (Nyala Teaching Hospital, Kass Hospital) are functioning. A part of Nietiga, Elmalam and Dirbat Rural Hospitals, all the facilities proposed by the State working group have reasonable obstetric activity.

The referral linkage between Dirbat and Elmalam Rural Hospitals has major challenges: the identified causes are difficult to solve in the short term by the Ministry of Health, there are no paved roads (the roads are very poor) AND the referral is done in more than 4 hours travel time. The referral linkages between Abu Ajora Rural and Nyala Teaching Hospitals is challenged with financial barriers - high operating cost of ambulance that expect the patients to pay for the referral service. Only the referral link between Niteiga and Nyala hospitals does not have challenges (neither in terms of physical access, nor in terms of financial access). The most common means of transportation in the State is motorized vehicles.

In terms of human resources, there is a major gap in midwives in South Darfur State with none of the proposed EmONC health facilities having graduate midwives and only the Nyala Teaching Hospital having nurse midwives. The State requires an additional 40 midwives to ensure that the designated EmONC health facilities will be functioning 24h/7d in the short term. The group also highlighted the need for more OBGYN, anaesthetists in all designated CEmONC health facilities.

In terms of equipment, the working group highlighted the absence of functioning blood bank in the designated EmONC health facilities, except in the Nyala Teaching Hospital. In terms of infrastructure, most designated EmoNC health facilities have good building structures but the group highlighted important issues in terms of electricity and water across all designated EmONC health facilities.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the lack of data and absence of registers.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is below the maximum number set by the FMoH for this first EmONC network. Among the designated EmONC health facilities, three health facilities have a very low obstetric activity and important gaps in skilled attendants at birth: Niteiga Hospital, Dirbat Clinic and Elmalam Hospital with respectively 13, 7, and 10 deliveries per month.

The BEmONC health facility, Dirbat Clinic has major referral issues that would need to be solved outside the health system to make it become a potential BEmONC health facility. Despite its low obstetric activity, the suggested BEmONC Niteiga Hospital could support Nyala Teaching Hospital, with which it has a good referral linkage. In addition, its catchment area complements the one of Nyala on the east side of the State. However, the State and partners will need to prcovide sufficient resources and efforts to make this structure functioning with quality of care in the current programmatic cycle.

The efforts required to make Elmalam Hospital a functioning CEmONC health facility within the programmatic cycle are very important, including in terms of human resources as there is only one doctor as staff. Similarly, Tukus and Gereida Hospitals have major gaps in skilled attendants at births and in signal functions and only have 40 and 37 deliveries per month, which is low for a CEmONC health facility. Tulus has a catchment area expanding the coverage of the EmONC network to the southern-east part of the State. It could therefore be considered in the initial EmONC network but substantive efforts are needed to make it functioning with quality of care 24h/7d.

Aradom Hospital is a designated CEMONC with only 48 deliveries per month but efforts should be done to increase the activity of the health facility which is the only health facility covering the southern part of the State.

In addition of the EmONC health facilities designated by the working group, the support team also suggest to include other health facilities with an important obstetric activity: Otash Center with 165 deliveries per month, Shakreen Clinic with 120 deliveries per month and 2 OBGYNs, and Manna Clinic with 104 deliveries per month and 4 OBGYNs. Among them, only Otash Center is not yet performing c-sections. The working group also suggests adding Shefa Elabrar, which has 90 deliveries per month and 1 OBGYN. All these health facilities have good staffing and are located in highly populated areas.

The support team therefore recommends to select 12 EmONC health facilities: 9 CEmONC (Burm Hospital, Tulus Hospital, Om Dafoug Hospital, Nyala Teaching Hospital, Kass Hospital, Shakreen Clinic, Manna Clinic, Shefa Elabrar, Aradom Hospital) and 3 BEmONC (Abu Ajora Hospital, Niteiga, Otash Center).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
11	12	95%	95%	43%	43%	16	19	35	43

All the maternities of the State cover 96% of the population within 2 hours of travel time. By considering the bordering State, this coverage increases to 96%.

Eleven health facilities have been designated by the working group to be included in the EmONC network. They cover 95% of the population within 2 hours travel time. Among them, two health facilities are functioning and cover 43% of the population within 2 hours of travel time.

The support team suggests selecting twelve EmONC health facilities for this programmatix cycle, which would also cover 95% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all twelve designated EmONC facilities function 24h/7d with quality of care.

Central Darfur State

State description

The State of Central Darfur is located in the western part of the country and one of five comprising the Darfur region. It was created in January 2012 as a result of the ongoing peace process for the wider Darfur region. It is bordered to the north by the state of North Darfur, east by the state of South Darfur, to the west by West Darfur and Chad and to the south by the Central African Republic. The surface area of the State is 33,916 km² and it is characterized by mostly mountainous areas that include several valleys characterized by sandy lands and sandy clay on the banks of these valleys, which make them fertile for agriculture in the autumn and winter season. One of the most famous natural phenomena is Jebel Marra, which is one of the most fertile areas in Sudan. It is composed of 9 localities (Azum, Bendasi, Central Jebel Mara, Mukjar, Nertiti, North Jebel Mara, Um Dukhun, Wadi Salih, Zalingi) and has a population of 703.511 people,

Institutional deliveries are estimated at 56% and contraceptive prevalence rate is 2.7%.

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
703,511	7	4	**6**

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Zalingi Teaching Hospital	CEmONC	528 990	1	210
Garsilla Rural Hospital	CEmONC	424 729	2	90
Mukjar Rural Hospital	BEmONC	379 042	2	103
Um Dukhun Rural Hospital	CEmONC	156 408	2	35
Rokero Rural Hospital	CEmONC	593 998	NA	30
Golo Rural Hospital	CEmONC	647 226	1	25

The three functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group. However none of them were considered as functioning by the State working group: Garsilla Rural Hospital, Golo Rural Hospital, and Mukjar Rural Hospital had no instrumental deliveries. Garsilla Rural Hospital and Mukjar Rural Hospital presented stock-outs in magnesium sulfate.

Among the designated EmONC health facilities, two designated CEmONC health facilities have only one gap in signal function: the performance of basic neonatal resuscitation for Zalingi, and the manual removal of the placenta for Um Dukhum.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	**Number of midwives required according to the national recommendation***	**Number of graduate nurse midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	**Number of nurse midwives** (nursing certificate + one year midwifery)	**Number of doctors**	**Number of obstetricians** (including registrars)	**Short/medium term need for midwives** (take into account the graduate and nurse midwives)	**Long-term for midwives** (does not take into account nurse midwives)
Zalingi Teaching Hospital	8	4	15	7	3	0	4
Garsilla Rural Hospital	3	1	5	4	1	0	2
Mukjar Rural Hospital	4	0	NA	1	0	4	0
Um Dukhun Rural Hospital	3	0	NA	2	0	3	0
Rokero Rural Hospital	3	0	0	1	0	3	0
Golo Rural Hospital	3	0	0	1	1	3	0
Total need in midwives (without redeployment)						**13**	**6**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

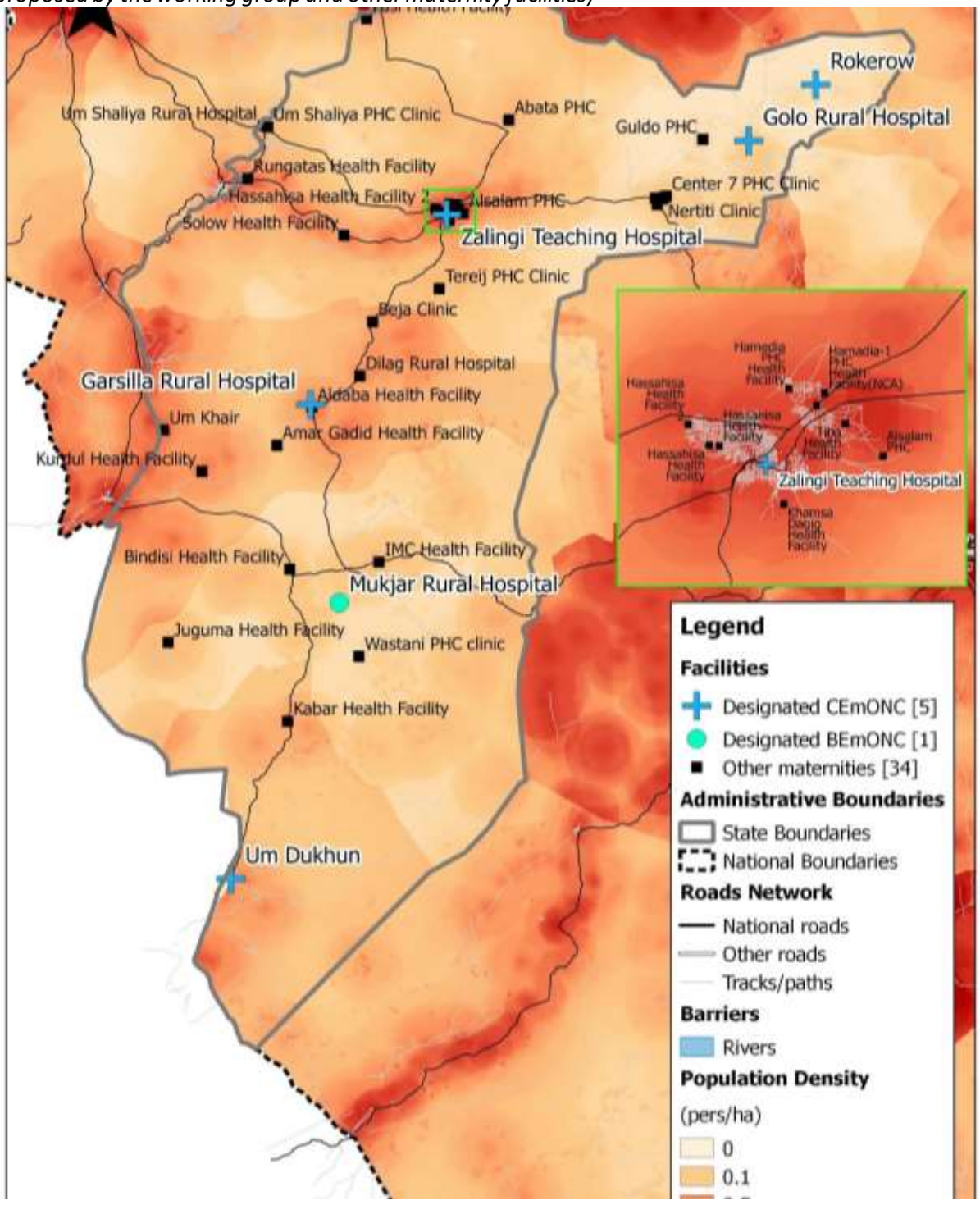
1.1.4 Referral link between EmONC facilities

CEmONC facility	Name of BEmONC facility linked to the CEmONC facility	Average time for referral		Overall quality of the referral link
		Dry season	Rainy season	
Garsilla Rural Hospital	Mukjar Rural Hospital	6	10	Very poor road conditions - geographic barriers and financial barriers

The working group proposed a network mostly composed of designated CEmONC health facilities. The proposed network includes only one BEmONC facility (Mukjar Rural hospital) which has major referral linkages challenges with the closest CEmONC (Garsilla Rural hospital) located at more than 4 hours travel time. The identified causes are difficult to solve in the short term by the Ministry of Health as the roads are in very poor conditions. There are also financial barriers for patients to pay for an ambulance. The most common means of transportation in the State is motorized vehicles. However the travel time between Mukjar Rural Hospitala and Um Dukhun is estimated at 110 minutes.

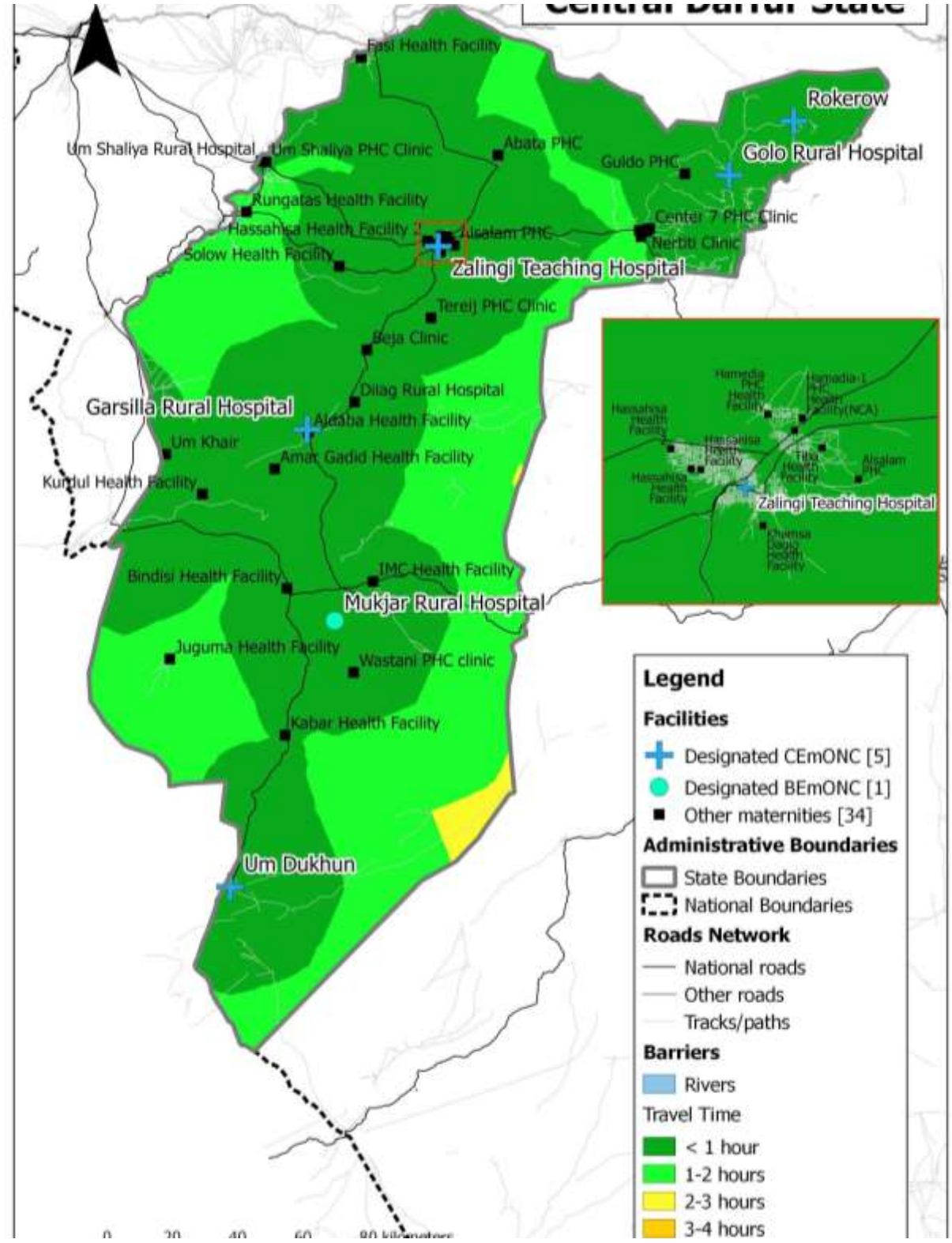
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



Central Darfur State has a low population density across the state, with most of the population concentrated in specific pockets in the Central and North parts of the State. There are several national roads in the State, crossing the State from North to South, and from East to West both in the Northern and Central parts of the State. However, many of these roads are in poor conditions, for example between Mukjar and Garsilla Rural Hospital.

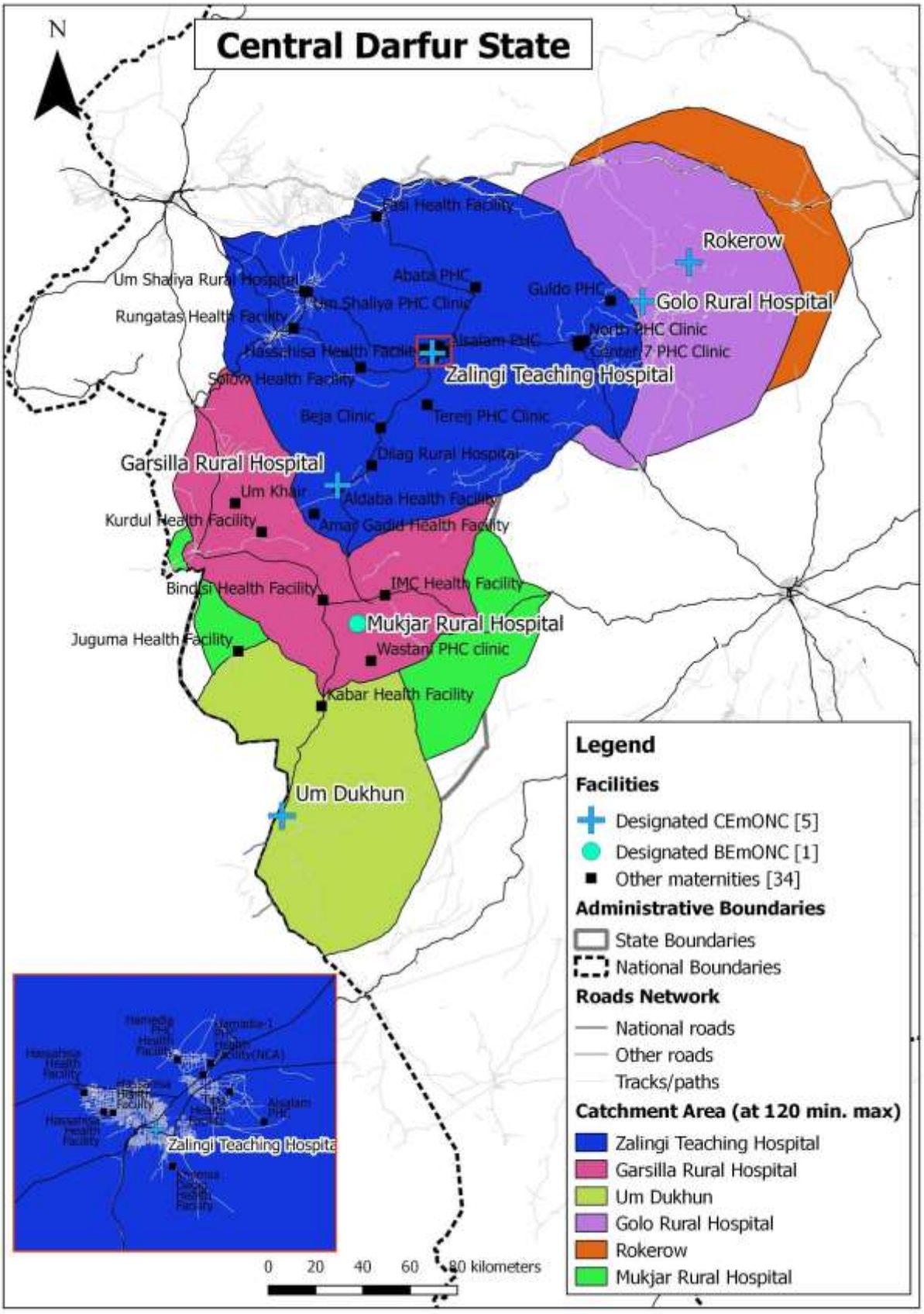
Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



The physical accessibility is mapped based on the travel scenarios defined by the State Working group for the entire State and the travel time indicated on the map may differ from the travel time of specific referral linkages between BEmONC and CEmONC of the previous section as the map does not take

into account the conditions of specific road segments, insecurity and other local conditions that may affect the travel time.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The catchment areas are mapped based on the travel scenarios defined by the State Working group for the entire State and the travel time indicated on the map may differ from the travel time of specific referral linkages between BEmONC and CEmONC of the previous section as the map does not take into account the conditions of specific road segments, insecurity and other local conditions that may affect the travel time.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		**Coverage of the population by the EmONC network proposed by the working group within 2h travel time**	
State	With bordering States	State	With bordering States
100%	100%	98.61%	99.21%

Coverage of the population by all maternities of the State within 1h travel time		**Coverage of the population by the EmONC network proposed by the working group within 1h travel time**	
State	With bordering States	State	With bordering States
88.04%	92.76%	49.27%	66.68%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of Central Darfur State has selected 6 health facilities to be part of the EmONC network, including 5 CEmONC (Zalingi Teaching Hospital, Garsilla Rural Hospital, Um Dukhun Rural Hospital, Rokero Rural Hospital, Golo Rural Hospital) and 1 BEmONC (Mukjar Rural Hospital). This number is above the maximum number of designated EmONC health facilities set by the FMoH of 4 designated EmONC health facilities. Among the proposed designated EmONC health facilities, even if it was selected by the working group as a BEmONC health facility, Mukjar Rural Hospital is a functioning CEmONC health facility according to the 2018 EmONC Needs Assessment. Three designated EmONC health facilities have a good obstetric activity (above 90 deliveries per month) but three health facilities have a low obstetric activity: Um Dukhun Rural Hospital (35 deliveries per month), Rokero Rural Hospital (30 deliveries per month), and Golo Rural Hospital (25 deliveries per month).

In terms of human resources, there is a shortage of qualified midwives in the State, with 17 midwives needed in the short/medium term. There are also major gaps in terms of OBGYN with only Zalingi Teaching Hospital and the Garsilla Rural Hospital being staffed with OBGYNs. The other designated health facilities have at least a medical doctor. None of the designated facilities have anaesthetists.

The referral linkage between Mukjar Rural Hospital and Garsilla Rural Hospital has major challenges: the identified causes are difficult to solve in the short term by the Ministry of Health, the roads are in very poor conditions AND the referral is done in more than 4 hours travel time. In addition, there are important financial barriers for patients for referral from the BEmONC to the CEmONC health

facility. Zalingi Hospital has two non-functioning ambulances while Garsilla has two functioning ambulances, and Golo Rural Hospital has one functioning ambulance.

In terms of infrastructure and equipment, Zalingi Teaching Hospital, Garsilla Rural Hospital and the Golo Rural hospital have adequate infrastructure with some of the essential equipment for the theatre and the lab but lacking necessary equipment for blood transfusion blood processing and storing equipment and electricity regulators. Most designated health facilities are facing water and electricity issues and there are fuel shortage for backup generators. The working group also highlighted the deficiency of portable ultrasound machines, Cardiotocography (CTG) machines, SOPs and regular maintenance. Major gaps include the absence of High Dependency and Intensive Care Unit, shortage in surgical and anesthesia equipment, Oxygen supply, equipment for assisted vaginal delivery, equipment for neonatal resuscitation, shortage and stock out of reagents. The working group also recommends establishing a solar power system to avoid the electricity shuts.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the high turnover of management staff, absence of supportive supervision, HIS need to be strengthened urgently. Apart from Zalingi Teaching hospital, in all designated facilities, there were no regular staff or medical meetings. All designated EmONC health facilities are supported by UNFPA, WHO, UNICEF and MSF (Zalingi is also supported by WR, IMC, NCA; Golo by IMC; Um Dukhum by IMC). Zalingi Teaching hospital is the only facility conducting regular maternal death review.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is above the maximum number of four set by the MoH for this first EmONC network. Among the designated EmONC health facilities, three health facilities have a very low obstetric activity: Um Dukhun Rural Hospital, Rokero Rural Hospital, and Golo Rural Hospital with respectively 35, 30, and 25 deliveries per month. Both Golo Rural Hospital and Rokero Rural Hospital have an important catchment area within 2 hours of travel time, around 1 million people. Um Dukhun Rural Hospital has a smaller catchment area of about 300,000 people which covers the southern part of the State. All designated EmONC health facilities have limited gaps in signal functions. Mukjar Rural Hospital is designated as a BEmONC health facility but it performs 8 C-sections per month. The support team therefore suggests to designate it as a CEmONC health facility. No information is available on the gaps in signal functions for Rokero Rural Hospital as it was not included in the EmONC assessment. In addition, this facility is close to another designated CEmONC health facility, Golo Rural Hospital, which has a low obstetric activity but has a bigger catchment area. Golo also has better infrastructure and equipment than Rokero based on the information provided by the working group, including stable water supply and a functioning ambulance. The support team therefore suggests to keep Golo Rural Hospital as a designated CEmONC health facility even if important efforts will be required to improve the quality of care and ensure an increase of the obstetric activity to make this health facility functioning with quality of care. Similarly, despite a low obstetric activity, the support team suggests to keep Um Dukhun Rural Hospital as a designated CEmONC health facility covering the South part of the State.

The support team therefore recommends selecting 5 CEmONC health facilities (Zalingi Teaching Hospital, Garsilla Rural Hospital, Um Dukhun Rural Hospital, Golo Rural Hospital and Mukjar Rural Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
6	5	99%	99%	0%	0%	13	10	6	6

All the maternities of the State cover 100% of the population within 2 hours of travel time.

Six health facilities have been designated by the working group to be included in the EmONC network. They cover 99% of the population within 2 hours travel time. Among them, none are functioning.

The support team suggests selecting five EmONC health facilities for this programmatix cycle, which would also cover 99% of the population within two-hours of travel time. In this State, the operational objective in the current programmatic cycle would be to ensure that all five designated CEmONC facilities function 24h/7d with quality of care.

West Darfur State

State description

The State of West Darfur is located in the western part of the country and one of five comprising the Darfur region. It is bordered to the west and north-west by the Republic of Chad, to the south-west by the Republic of Central Africa, to the east and southeast by the state of North and central Darfur respectively. The surface area of the State is 22,954 km² and it is characterized by sandy lands in the northern area and the southern, eastern and central parts are mountainous areas. The general shape of the state's geography is formed by a group of mountains, sandy hills and agricultural lands. The valleys, such as Wadi Kja, Zum, Bari and Tlolo, are part of the rich Savannah. It is composed of 8 localities (Beida, El Geneina, Foro Baranga, Habila, Jebel Moon, Kereneik, Kulbus, Sirba) and has a population of 971,515 people.

Institutional deliveries are estimated at 9% (EmONC NA 2017) and contraceptive prevalence rate is 3.9% (MICS 2014).

1.1. Results of the group work

1.1.1 Number of proposed EmONC facilities

Total population in 2018	Number of EmONC recommended by the international norm (long term vision)	Maximum number of EmONC facilities for the first prioritization (50% of the norm)	Number of EmONC proposed by the working group
971,515	9	4	5

1.1.2 Profile of the proposed EmONC facilities

Name of the health facility	Type (BEMONC/ CEmONC)	Estimated population in the catchment area within 2h travel time	# gaps in signal functions (source EmONC Assessment 2018)	# deliveries per month
Geneina Teaching Hospital	CEmONC	1 012 957	0	156
Kulbus Hospital	CEmONC	530 966	1	73
For Baranga Hospital	CEmONC	546 710	2	79
Beida Hospital	CEmONC	532 019	5	59
Kerenik Hospital	BEmONC	1 129 117	0	63

Two of the six functioning EmONC facilities according to the EmONC NA (based on the readiness to perform the signal function and not their actual performance) have been included in the EmONC network proposed by the working group.

However, Elmedina Center, Mileti Hospital and Sultan Tajeldin Hospital were not considered as functioning by the State working group due to the absence of instrumental deliveries. Elburhan Hospital also had no instrumental deliveries and had stock outs in magnesium sulfate.

In the health facilities selected by the working group, two designated EmONC health facilities had limited gaps in signal function: Kulbus Hospital was missing the performance of basic neonatal resuscitation and For Baranga Hospital was missing both the performance of basic neonatal resuscitation and vacuum extractions. Beida Hospital was however missing 5 signal functions, including the performance of c-section.

1.1.3 Need in midwives in the proposed EmONC network

Name of the health facility	Number of midwives required	Number of graduate nurse	Number of nurse midwives	Number of doctors	Number of	Short/medium term	Long-term for midwives

	according to the national recommendation*	**midwives/'sister' midwives** (3 years nursing diploma + 1 year midwifery)	(nursing certificate + one year midwifery)		**obstetricians** (including registrars)	**need for midwives** (take into account the graduate and nurse midwives)	(does not take into account nurse midwives)
Geneina Teaching Hospital	7	0	16	15	4	0	7
Kulbus Hospital	4	0	0	2	0	4	0
For Baranga Hospital	3	0	NA	3	0	3	0
Beida Hospital	3	0	0	1	0	3	0
Kerenik Hospital	3	0	0	1	0	3	0
Total need in midwives (without redeployment)						**13**	**7**

*minimum 4 midwives in CEmONC (urban) and 3 midwives in CEmONC (rural) and in BEmONC facilities (for ensuring availability of services 24h/7d) and maximum 30 deliveries per midwife per month.

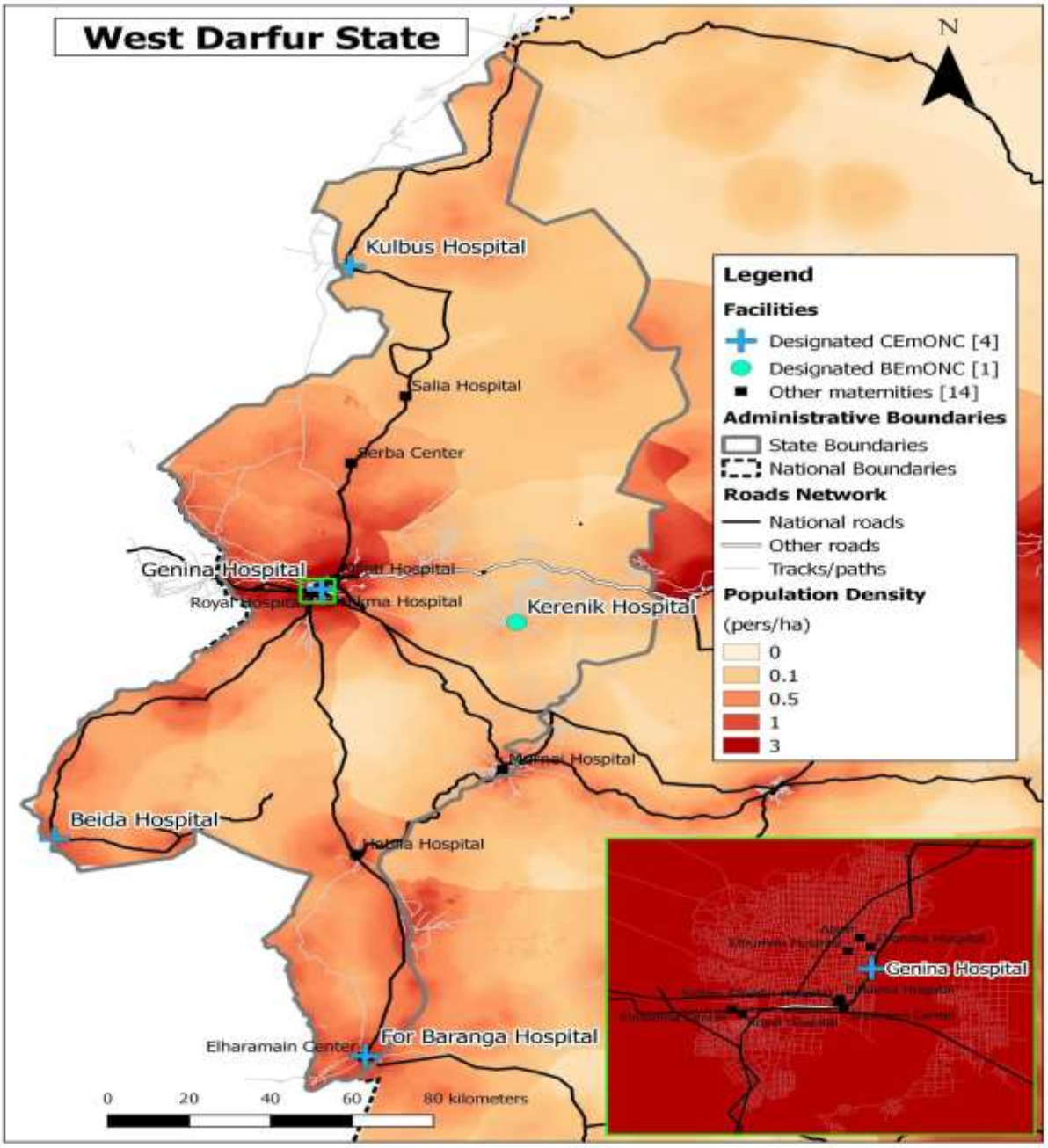
1.1.4 Referral link between EmONC facilities

CEmONC facility	**Name of BEmONC facility linked to the CEmONC facility**	**Average time for referral**		**Overall quality of the referral link**
		Dry season	**Rainy season**	
Geneina Teaching Hospital	Kerenik Hospital	1.5 hours	3 hours	Financial (40 USD for Fuel +20 USD for staff)

The designated EmONC network includes one BEmONC facility (Kerenik hospital), which is within 2 hours of travel time during the dry season but presents challenges for its referral to the Geneina teaching hospital (CEmONC) mostly related to financial barriers (high operating cost of ambulance that expect the patients to pay for the referral service) between BEmONC and CEmONC facilities. The most common means of transportation in the State is motorized vehicles.

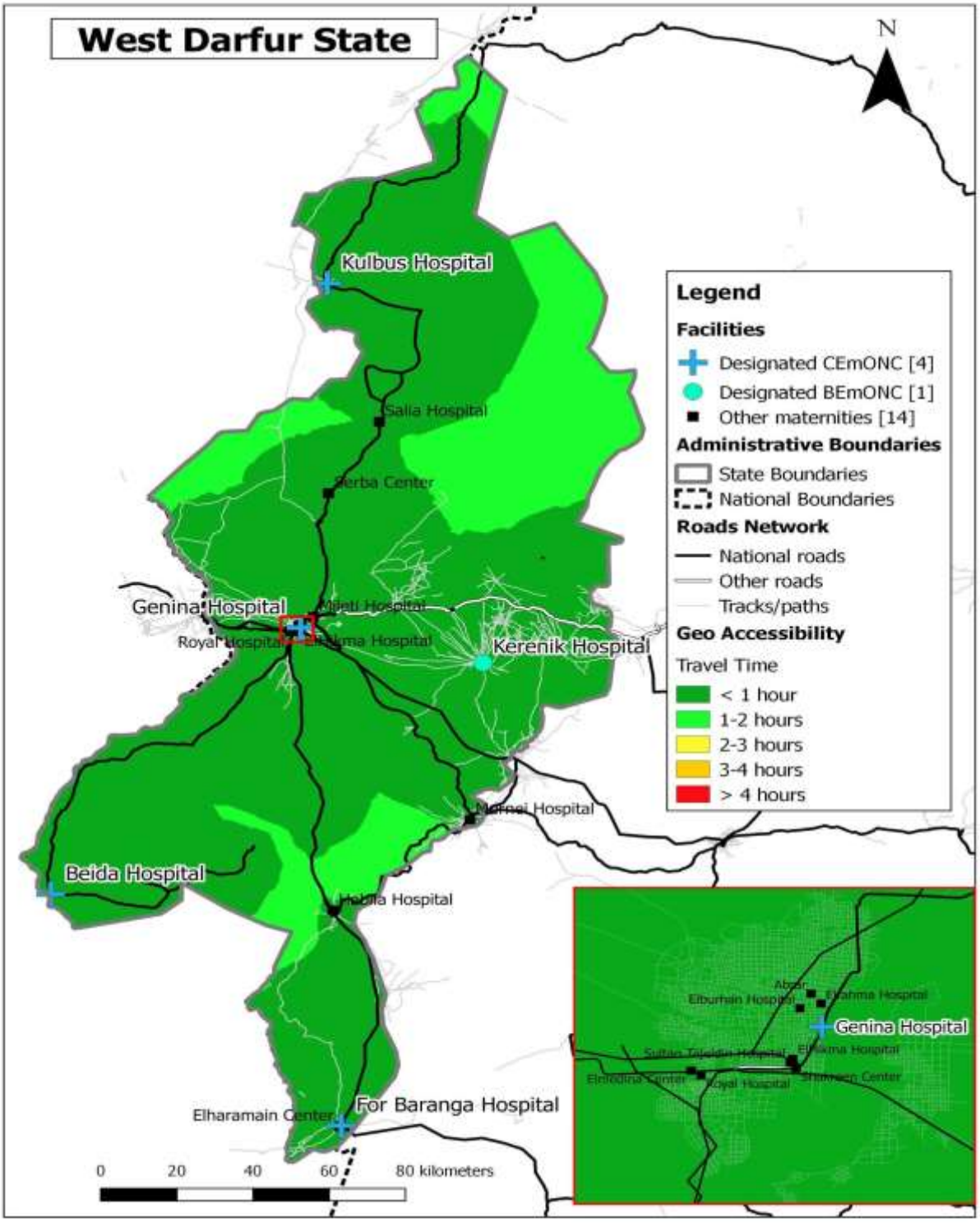
1.1.5 Maps of the State EmONC network

Map 1: *Population density and location of the maternity facilities in the State (BEmONC and CEmONC proposed by the working group and other maternity facilities)*



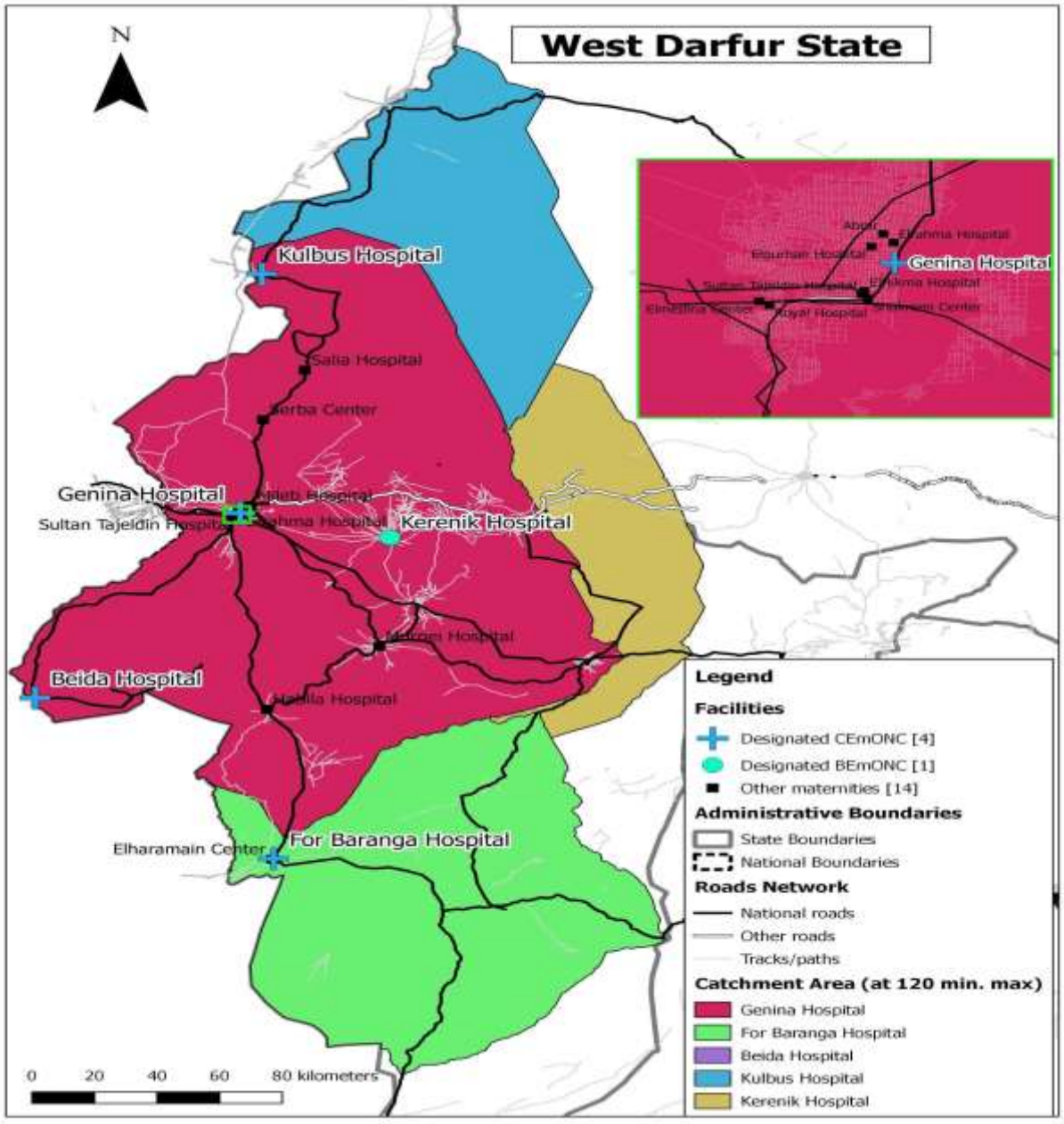
The population of the State is mostly concentrated around the capital of the State (Geneiana city) and the capital of the big localities where most of the EmONC facilities proposed by the working group are located. Most of the population is located in the Eastern and Southern parts of the State.

Map 2: *Physical accessibility map (up to one, two, three and above four hours journey time to the closest EmONC facility) for the BEmONC and CEmONC facilities proposed by the working group.*



This map indicates that the accessibility to the EmONC network is good, with all the population of the State having access to the closest designated EmONC health facility within 2 hours of travel time. The population located in the dark green can access the closest EmONC facility suggested by the working group within less than 1 hours journey.

Map 3: Catchment areas within two hours journey time of each EmONC facility proposed by the working group.



The EmONC health facilities designated by the working group cover all the population of the State within 2 hours travel time. The catchment areas of the designated CEmONC health facility Genina Hospital covers most of the central part of the States within 2 hours of travel time, where is located the majority of the population of the State.

1.2. Analysis of the EmONC network

1.2.1 Coverage of the population by the EmONC network

Coverage of the population by all maternities of the State within 2h travel time		Coverage of the population by the EmONC network proposed by the working group within 2h travel time	
State	With bordering States	State	With bordering States
100%	100%	100%	100%

Coverage of the population by all maternities of the State within 1h travel time		Coverage of the population by the EmONC network proposed by the working group within 1h travel time	
State	With bordering States	State	With bordering States
96.4%	97.7%	87.8%	88%

1.2.2 EmONC health facilities proposed by the working group (number of EmONC facilities, referral links, staff, strengths and weaknesses)

The working group of West Darfur State has selected 5 health facilities to be part of the EmONC network, including 4 CEmONC (Geneina Teaching Hospital, Kulbus Hospital, For Baranga Hospital, Beida Hospital) and 1 BEmONC (Kerenik Hospital). Two designated EmONC health facilities are functioning according to the EmONC Need Assessment, Geneina Teaching Hospital (CemONC health facility) and Kerenik Hospital (BEmONC health facility). Two designated CEMONC health facilities have limited gaps in signal function while Beida Hospital has an important gap of 5 missing signal functions. All designated EmONC health facilities have a good obstetric activity (above 59 deliveries per month) with 156 deliveries per month for Genina Hospital.

In terms of human resources, there is a shortage of qualified midwives in the State, with 20 midwives needed in the short/medium term as there are no graduate nurse midwives and nurse midwives in any of the State's designated EmONC health facilities. There are doctors in all designated EmONC health facilities but the working group highlighted major gaps in terms of OBGYN and anaesthetists, except in Genina Hospital.

The referral linkage between Kerenik Hospital and Genina Hospital presents financial barriers challenges.

In terms of infrastructure and equipment, Geniana and For barnga hospitals have a functioning laboratory for advanced tests and blood banks. The rest of the designated EmONC health facilities have a functioning laboratory for basic tests (Kulbus, Biada and Kerenik Hospitals). Major gaps include the absence of ICU and HDU, shortage in surgical equipment, Oxygen supply, equipment for assisted vaginal delivery, shortage and stock out of blood bank reagents and solar power system. The lack of latrines and regular electricity shut have also been highlighted in most health facilities.

In terms of management and monitoring of the designated EmONC health facilities, the working group highlighted the shortage of management staff, absence of supportive supervision, health facility register, and monitoring dashboard. There are regular staff meetings held in all designated facilities. All the designated EmONC health facilities are supported by UNFPA. In addition, IMC and SCI supports Baida and Kerenik hospitals respectively. Geniana teaching hospital is the only facility in the State's network conducting regular maternal death review.

1.2.3 Analysis by the support team of the State EmONC network proposed

The number of EmONC health facilities designated by the working group is above the maximum number of four set by the MoH for this first EmONC network. Among the designated EmONC health facilities, Beida Hospital has important gaps in signal functions (5 gaps) and is located in the catchment area of Genina Hospital. It also has the lowest obstetric activity among the designated EmONC health facilities with 59 deliveries per month and despite a good catchment area (estimated at 532.019 people), it would require substantive efforts to be functioning with quality of care 24h/7d in the current programmatic cycle.

In addition, the working group has not selected Salia Hospital in the designated EmONC network, while it is doing 123 deliveries per month. This health facility has the second most important obstetric activity in the State and should therefore be made functioning in the current programmatic cycle and retained in the EmONC network as a BEmONC health facility as it is not doing c-sections and blood transfusion. It referral time to Kulbus Hospital is 52 minutes and to Geneina Hospital is 56 minutes.

The support team therefore recommends selecting 3 CEmONC health facilities (Geneina Teaching Hospital, Kulbus Hospital, For Baranga Hospital) and 2 BEmONC health facilities (Salia Hospital and Kerenik Hospital).

1.2.4 Impact of the recommendations of the support team on the State EmONC network

Number of health facilities in the designated EmONC network		**Coverage of the population within 2h travel time by the designated EmONC network** (without bordering states)		**Coverage of the population within 2h travel time by the functional EmONC network** (without bordering states)		**Short/medium term need for graduate midwives**		**Long-term for graduate midwives** (does not take into account nurse midwives)	
State group work	Support team	State group work	Support team	State group work	Suppor t team	State group work	Support team	State group work	Support team
5	5	100%	100%	90%	90%	13	14	7	8

All the maternities of the State cover 100% of the population within 2 hours of travel time.

Five health facilities have been designated by the working group to be included in the EmONC network. They cover 100% of the population within 2 hours travel time. Among them, two health facilities are functioning and cover 90% of the population within 2 hours of travel time.

The support team suggests selecting five EmONC health facilities for this programmatix cycle, which would also cover 100% of the population within two-hours of travel time. In this State, the operational

objective in the current programmatic cycle would be to ensure that all five designated EmONC facilities function 24h/7d with quality of care.

CONCLUSIONS

Despite progress over the last decades, the maternal and neonatal health situation in Sudan is still a major issue. In 2017, the maternal mortality ratio (MMR) was still high, estimated at 295 [uncertainty interval 80%: 207; 408] per 100.000 live births. Most of the maternal deaths in Sudan are still from direct obstetric complications and the low availability of EmONC in Sudan suggests that the MMR may be on the upper side of this uncertainty interval, far away from the SDG3.1 target for Sudan of maximum 117 maternal deaths per 100,000 live births by 2030. Another data that is striking is the very low institutional delivery rate in health facilities estimated at 28 percent. In addition of the socio-cultural barriers to deliver in health facilities highighted by the State working groups during the prioritization workshops, this report also highlights two major reasons for women not to seek care in health facilities, and especially in EmONC health facilities:

1. The availability and quality of maternal health services, and EmONC in particular
2. The financial barriers, and specifically the important costs for women to be referred from a Basic to a Comprehensive EmONC health facility.

These two reasons are further detailed below. The geographic access to the closest designated EmONC health facility is overall good in Sudan with a coverage of the population within 2h travel time above 80% in all States except Blue Nile with only 49% coverage. This is mainly due to the insecurity in some areas of the State and to poor road conditions.

Availability and quality of maternal health services:

According to the 2018 EmONC Assessment and the additional analysis performed by the State working group during the prioritization workshops, only 68 EmONC health facilities are functioning in Sudan, with only 4 functioning BEmONC health facilities. This corresponds to an EmONC availability for the EmONC network designated by the State Working group of 33% (55/167) and a coverage of the population by functioning EmONC health facilities within 2h travel time of 74%. In addition, none of the States have all the designated EmONC health facilities functioning. This low EmONC availability in Sudan highlights the importance to limit the spread of scarce resources (including human resources such as midwives) to make these designated EmONC health facilities functioning 24h7d with quality of care. While the State teams have made an important prioritization effort, the support team suggests to slightly reducing the national designated EmONC network in Sudan from 167 designated EmONC health facilities to 158 EmONC health facilities (with 114 designated CEmONC health facilities and 44 designated BEmONC health facilities). The EmONC availability for the national designated EmONC network proposed by the Support Team is 41% (65/158). Among the 158 EmONC health facilities proposed by the support team, 139 were proposed by the State working group and among these, 21 health facilities are proposed as designated CEmONC instead of designated BEmONC health facilities. The slight reduction of the number of designated EmONC health facilities and the 19 different designated EmONC health facilities proposed by the support team is based on the prioritization criteria shared with the State working groups, for example avoid to select BEmONC health facilities located at more than 4 hours travel time from the related CEmONC health facility; avod to select BEmONC health facilities with low number of deliveries per month and a low population catchment area; avoid to select two BEmONC health facilities located next to each others; avoid to select a health facility which requires too much investments (eg. infrastructure, human resources) to be functioning.

The objective for the Ministry of Health and all maternal and newborn health stakeholders in Sudan should be to ensure that all the designated EmONC health facilities become functioning in the next 3-5

years and to continuously improve the quality of the care provided in these health facilitis in order to reach the an MMR of maximum 117 by 2030 (SDG 3.1. target for Sudan).

In order to reach this target, the FMoH should favor the quality on the quantity. The support team therefore recommends reducing the number of designated EmONC health facilities to 158 EmONC health facilities (with 114 designated CEmONC health facilities and 44 designated BEmONC health facilities) in order to focus the available resources on making these designated EmONc facilities functioning. There is particularly an important need to educate midwives to the international standards and to staff them in these 158 designated EmONC health facilities, where 332 midwives are missing in the short/medium term and 591 in the long term. These gaps in midwives impair the set-up of teams of healthcare providers in the designated EmONC health facilities, which can lead to burnouts and demotivations of staff and cannot guarantee the availability of EmONc 24h/7d.

Financial barriers to access EmONC health facilities:

This report highlights the important financial barriers faced by women and their families for being referred from a BEmONC to a CEmONC health facility. This major issue is present in all States of Sudan, including to a lesser extent in Khartoum and Al Gazira. In some States like in South Darfur, the cost for referral can reach 50 USD. Considering the very low income of families and the gender inequalities, these financial barriers are major obstacles for the well functioning of the EmONC health facility network, which should guarantee to every women and newborn treated in a BEmONC health facility the possibility to be referred to the closest CEmONC if needed. Financial barriers for referral are also experienced by women being referred from a peripheral health facility to a BEmONC or a CEmONC health facility. The support team suggests a specific analysis of the financial barriers to access EmONC, including the costs related to the referrals and to the care itself.

In order to accelerate the reduction of maternal mortality at scale, Sudan should identify innovative and effective approaches to improve the access, the availability and the quality of the reproductive, maternal and newborn care provided in the designated EmONC health facilities. The EmONC network should be embedded in the national and sub-national health plans and should be supported by all health stakeholders, from healthcare providers to sub-national and national health authorities and financial and technical partners. The country has now the opportunity to define for the next programmatic cycle (2022-2025) an official national network of EmONC health facilities and to monitor key indicators to make all the designated health facilities functioning with quality of care. This network should be reviewed at the end of the programmatic cycle based on the results obtained, the improvement of the road infrastructure and the evolution of the population.

KEY RECOMMENDATIONS in the considered programmatic cycle

1. This technical report should serve as a basis for the Federal Ministry of Health and State stakeholders to validate the official national network of EmONc health facilities in Sudan. Once validated, the network should be document in an official document of the FMoH and should serve as a reference to all stakeholders;
2. The FMoH and the State health authorities should include the national EmONc network and related analysis and population coverage in all operational health strategies and plans;
3. In each State, the designated EmONC health facilities should be supported by at least one technical and financial partner in order to improve the functionality and the quality of care in the EmONC health facilities in the next programmatic cycles
4. The FMoH should set-up a national and State quality improvement support teams and organize as soon as possible the first monitoring of the designated EmONC health facilities. The FMoH should also perform an analysis of the referral linkages between the designated EmONC health facilities and the peripheral health facilities (non EmONC)

5. The FMoH should develop a national reference document on the concept of EmONC health facilities in Sudan, including their mission, roles, required infrastructure. It should also ensure that national protocols and standards are aligned with recent WHO standards (http://apps.who.int/iris/bitstream/handle/10665/249155/9789241511216-eng.pdf?sequence=1)
6. Midwives should be valued as the essential workforce to ensure the functionality of the EmONC health facilities and the provision of quality EmONC. The pre-service education of midwives should be aligned to ICM/WHO standards and the status of midwives recognized as a specific health cadre. Midwives should be deployed in priority in the designated EmONc health fcailities, according to the national standards identified in Sudan during this EmONC network planning. A designated BEmONC health facility shoud be managed by a midwife.
7. The deployment of OBGYNs in the country should be analyzed based on the needs and the possible redeployment of the OBGYNs currently staffed in designated BEmONC health facilities could be further analyzed by the health authorities
8. The referral and management of obstetric and neonatal complications should be incuded in the financial protection mechanisms and in the Universal Health Coverage plan of Sudan
9. The FMoH should evaluate its supply programme for essential MNH medicines, equipment and for blood in order to improve the availability of blood supplies across the country and strengthen the management of post-partum heammorage
10. Coordination mechanism for maternal and newborn health should be strenghtened and include the Ministry of Finance, the Ministry of Infrastructure, and other key Ministries and partners, and representative of women and communities.

ANNEXES

Annex 1: List of designated EmONC health facilities by the State Working Group and by the support team

State	List of designated EmONC health facilities by the State working group		List of designated EmONC health facilities by the support team	
North Kordofan State	Elobeid Maternity Hospital	CEmONC	Elobeid Maternity Hospital	CEmONC
	Abu Haraz Hospital	BEmONC		
	Kazgel Hospital	BEmONC		
	Bara Hospital	CEmONC	Bara Hospital	CEmONC
	Om Ruwaba Hospital	CEmONC	Om Ruwaba Hospital	CEmONC
	Wad Ashana Hospital	BEmONC		
	Shirkela Hospital	BEmONC	Shirkela Hospital	BEmONC
	Kjamar Hospital	BEmONC		
	Jabrat Elsheik Hospital	BEmONC	Jabrat Elsheik Hospital	BEmONC
	Arahad Hospital	BEmONC	Arahad Hospital	CEmONC
			Sodari Hospital	BEmONC
			Om dam Haj Ahmed Hospital	BEmONC
			Aroor Elrimal Hospital	BEmONC
			Kordofan Hospital	BEmONC
Blue Nile State	Aggdi Center	BEmONC	Aggdi Center	BEmONC
	Damazin Maternity Hospital	CEmONC	Damazin Maternity Hospital	CEmONC
	Abdulkhalag Hospital	BEmONC		
	Badoos Hospital	BEmONC	Badoos Hospital	BEmONC
	Boutt Hospital	CEmONC	Boutt Hospital	CEmONC
	Wad Elmahy Rural Hospital	BEmONC	Wad Elmahy Rural Hospital	BEmONC
	Elmidin 10	BEmONC	Elmidin 11	BEmONC
Sinnar State	Wad Elniel Hospital	BEmONC	Wad Elniel Hospital	CEmONC
	Sinnar Hospital	CEmONC	Sinnar Hospital	CEmONC
	Sukkar Sinnar Hospital	BEmONC	Sukkar Sinnar Hospital	CEmONC
	Wad Elabas Hospital	CEmONC	Wad Elabas Hospital	CEmONC
	Wad taktok Hospital	BEmONC		
	Doba Hospital	BEmONC	Doba Hospital	BEmONC
	Dinder Hospital	BEmONC	Dinder Hospital	CEmONC
	Karkoj Hospital	BEmONC	Karkoj Hospital	BEmONC
	Asoki Hospital	BEmONC	Asoki Hospital	CEmONC
	Sinja Hospital	CEmONC	Sinja Hospital	CEmONC
Gedarif State	Eltaheli Hospital	CEmONC	Eltaheli Hospital	CEmONC
	Om Alkhier Rural Hospital	BEmONC		
	Alhawata Rural Hospital	CEmONC	Alhawata Rural Hospital	CEmONC
	Almafaza Hospital	BEmONC	Almafaza Hospital	BEmONC
	Alfaw Hospital	CEmONC	Alfaw Hospital	CEmONC
	Elshowak Hospital	CEmONC	Elshowak Hospital	CEmONC

	ElGuraisha Hospital	BEmONC	ElGuraisha Hospital	BEmONC
	Doka Hospital	CEmONC	Doka Hospital	CEmONC
Kassala State	Wd Elhileo Hospital	BEmONC	Wd Elhileo Hospital	BEmONC
	Halfa Aljadeda Hospital	CEmONC	Halfa Aljadeda Hospital	CEmONC
	Wagar Hospital	BEmONC	Wagar Hospital	BEmONC
	Talkook Hospital	BEmONC		
	Kassala Saudi Hospital	CEmONC	Kassala Saudi Hospital	CEmONC
	Khashum Elgirba Hospital	CEmONC	Khashum Elgirba Hospital	CEmONC
Red Sea State	Red Sea Hospital	CEmONC	Red Sea Hospital	CEmONC
	Eltakadom Hospital	CEmONC		
	Tukar rural Hospital	BEmONC	Tukar rural Hospital	BEmONC
	Swaken Hospital	BEmONC	Swaken Hospital	BEmONC
	Hya General Hospital	BEmONC	Hya General Hospital	BEmONC
	Sinkat General Hospital	CEmONC	Sinkat General Hospital	CEmONC
River Nile State	Abu Hamad Hospital	CEmONC	Abu Hamad Hospital	CEmONC
	Adamer Hospital	CEmONC	Adamer Hospital	CEmONC
	Alkab Rural Hospital	BEmONC		
	Atabra Hospital	CEmONC	Atabra Hospital	CEmONC
	Elnorab Hospital	BEmONC	Elnorab Hospital	CEmONC
	Shendi Hospital	CEmONC	Shendi Hospital	CEmONC
	Sidoon Hospital	BEmONC	Sidoon Hospital	BEmONC
	Wd Hamid	BEmONC	Wd Hamid	CEmONC
			Elmatama Hospital	CEmONC
			Elketiab Hospital	CEmONC
			Elmak Nimir Hospital	CEmONC
Khartoum State	Eljazeera Slang (Slanj Island)	BEmONC	Eljazeera Slang (Slanj Island)	BEmONC
	Ali Abdelfatah Hospital	CEmONC	Ali Abdelfatah Hospital	CEmONC
	Ban Jaded Hospital	CEmONC	Ban Jaded Hospital	CEmONC
	Saad Abu Elila Hospital	CEmONC	Saad Abu Elila Hospital	CEmONC
	Garri Hospital	BEmONC	Garri Hospital	BEmONC
	Omdurman Maternity Hospital	CEmONC	Omdurman Maternity Hospital	CEmONC
	Jebel Awlia Hospital	BEmONC	Jebel Awlia Hospital	CEmONC
	Elsheikh Ali Elfadul	CEmONC	Elsheikh Ali Elfadul	CEmONC
	Khartoum North Hospital	CEmONC	Khartoum North Hospital	CEmONC
	Haf Alsafi Hospital	BEmONC	Haf Alsafi Hospital	CEmONC
	Wad Aljabal Hospital	BEmONC		
	Abodeleeg Hospital	CEmONC	Abodeleeg Hospital	CEmONC
	Elfateh Hospital	BEmONC		
	Turkish Hospital Khartoum	CEmONC	Turkish Hospital Khartoum	CEmONC
	`Om doanban	CEmONC	`Om doanban	CEmONC
	Bashair Public Hospital	CEmONC	Bashair Public Hospital	CEmONC
	Gareeb Algasee Public Hospital	BEmONC		
	Elkhojabal Center	BEmONC		

	Wd Ubsalih Hospital	BEmONC	Wd Ubsalih Hospital	BEmONC
	Asororab Hospital	CEmONC		
	Soba Hospital	CEmONC	Soba Hospital	CEmONC
	Alacademy Hospital	BEmONC	Alacademy Hospital	BEmONC
	Elsadaga Hospital	CEmONC	Elsadaga Hospital	CEmONC
	Ibrahim Malik Hospital	CEmONC	Ibrahim Malik Hospital	CEmONC
	Umbada Hospital	CEmONC	Umbada Hospital	CEmONC
			Royal Care Hospital	CEmONC
			Elsaudi Hospital	CEmONC
			Elrajaa Specialized Clinic	CEmONC
			Ribat Police Hospital	CEmONC
			Elfateh Hospital	BEmONC
El Gazira State	Medenai Maternity hospital	CEmONC	Medenai Maternity hospital	CEmONC
	Alhasahesa Hospital	CEmONC	Alhasahesa Hospital	CEmONC
	Elkamlen Hospital	CEmONC	Elkamlen Hospital	CEmONC
	Om Elgurra Hospital	CEmONC	Om Elgurra Hospital	CEmONC
	Almanagil Hospital	CEmONC	Almanagil Hospital	CEmONC
	Rufaa Hospital	CEmONC	Rufaa Hospital	CEmONC
	Algurashi Hospital	CEmONC	Algurashi Hospital	CEmONC
	Alhosh Hospital	CEmONC	Alhosh Hospital	CEmONC
	Elhuda Hospital	BEmONC	Elhuda Hospital	CEmONC
	Eljamosi Hospital	BEmONC	Eljamosi Hospital	CEmONC
	Elazazi Hospital	BEmONC	Elazazi Hospital	CEmONC
	Tabat Hospital	BEmONC	Tabat Hospital	CEmONC
	Abogotta	BEmONC	Abogotta	CEmONC
	Elmusalmea Hospital	BEmONC	Elmusalmea Hospital	CEmONC
	Almehariba Hospital	BEmONC	Almehariba Hospital	CEmONC
	Alrebie Hospital	BEmONC	Alrebie Hospital	CEmONC
	Jiad Specialized Hospital	CEmONC	Jiad Specialized Hospital	CEmONC
	Wd Rawa Hospital	BEmONC	Wd Rawa Hospital	BEmONC
	Wd Elfadl Hospital	BEmONC		
	Wd Elhadad	BEmONC	Wd Elhadad	CEmONC
White Nile State	Abu Tugaba Hospital	BEmONC		
	Eljebelein Hospital	CEmONC	Eljebelein Hospital	CEmONC
	Tandalti Hospital	CEmONC	Tandalti Hospital	CEmONC
	Kosti Hospital	CEmONC	Kosti Hospital	CEmONC
	Elkiteina Hospital	CEmONC	Elkiteina Hospital	CEmONC
	Rabak Hospital	CEmONC	Rabak Hospital	CEmONC
	Elshageg Hospital	BEmONC	Elshageg Hospital	BEmONC
	Arawat Hospital	BEmONC	Arawat Hospital	BEmONC
	Eldowem Hospital	CEmONC	Eldowem Hospital	CEmONC
			Kinana Hospital	BEmONC
South Kordofan State	Kadogli Hospital	CEmONC	Kadogli Hospital	CEmONC
	Elum Bakheeta Hospital	CEmONC	Elum Bakheeta Hospital	CEmONC
	Habilla Hospital	BEmONC	Habilla Hospital	BEmONC

	Abujebaha Hospital	CEmONC	Abujebaha Hospital	CEmONC
	Rashad Hospital	BEmONC	Rashad Hospital	BEmONC
	Al-Abasia Hospital	BEmONC	Al-Abasia Hospital	CEmONC
	Aldepepat Hospital	BEmONC	Aldepepat Hospital	BEmONC
West Kordofan State	Elodeia	BEmONC	Elodeia	BEmONC
	Elsadaga hospital	CEmONC	Elsadaga hospital	CEmONC
	Almaglad hospital	CEmONC	Almaglad hospital	CEmONC
	Alnhood teaching hospital	CEmONC	Alnhood teaching hospital	CEmONC
	Gebiash hospital	CEmONC	Gebiash hospital	CEmONC
	Al. kharasan PHC	BEmONC		
	Dibab Hospital	BEmONC	Dibab Hospital	BEmONC
Northern State	Dongla Specialized Hospital	CEmONC	Dongla Specialized Hospital	CEmONC
	Elburgeg Hospital	BEmONC	Elburgeg Hospital	CEmONC
	Eldaba Hospital	BEmONC	Eldaba Hospital	CEmONC
	Ibri Hospital	BEmONC	Ibri Hospital	BEmONC
	Karima Hospital	CEmONC	Karima Hospital	CEmONC
	Wadi Halfa Hospital	CEmONC	Wadi Halfa Hospital	CEmONC
North Darfur State	Elfasher Hospital	CEmONC	Elfasher Hospital	CEmONC
	Allaeet Rural Hospital	CEmONC	Allaeet Rural Hospital	CEmONC
	Kutum Rural Hospital	CEmONC	Kutum Rural Hospital	CEmONC
	Kabkabia Rural Hospital	CEmONC	Kabkabia Rural Hospital	CEmONC
	Om Kaddada Rural Hosp	CEmONC		
	Taweela Rural Hospital	BEmONC	Taweela Rural Hospital	BEmONC
	Alseraif	BEmONC	Alseraif	BEmONC
	Melit	BEmONC	Melit	BEmONC
	Saraf Omoa Rural Hosp	BEmONC		
	Kalamando hospital	BEmONC		
	Elkomah Rural Hospital	BEmONC		
East Darfur State	Abu-Matarig Rural Hospital	CEmONC	Abu-Matarig Rural Hospital	CEmONC
	Alda'ain Teaching Hospital	CEmONC	Alda'ain Teaching Hospital	CEmONC
	Sheireea Rural Hospital	CEmONC	Sheireea Rural Hospital	CEmONC
	Yasen Rural Hospital	BEmONC	Yasen Rural Hospital	BEmONC
	Adila Rural Hospital	CEmONC	Adila Rural Hospital	CEmONC
South Darfur State	Gereida rural Hospital	CEmONC		
	Burm Hospital	CEmONC	Burm Hospital	CEmONC
	Tulus Hospital	CEmONC	Tulus Hospital	CEmONC
	Niteiga Hospital	BEmONC	Niteiga Hospital	BEmONC
	Om Dafoug Hospital	CEmONC	Om Dafoug Hospital	CEmONC
	Nyala Teaching Hospital	CEmONC	Nyala Teaching Hospital	CEmONC
	Kass Hospital	CEmONC	Kass Hospital	CEmONC
	Elmalam Hospital	CEmONC		
	Abu Ajora Hospital	BEmONC	Abu Ajora Hospital	BEmONC
	Aradom Hospital	CEmONC		
	Dirbat Clinic	BEmONC		
			Shakreen Clinic,	CEmONC

			Manna Clinic	CEmONC
			Shefa Elabrar	CEmONC
			Aradom Hospital	CEmONC
			Otash Center	BEmONC
Central Darfur State	Zalingi Teaching Hospital	CEmONC	Zalingi Teaching Hospital	CEmONC
	Garsilla Rural Hospital	CEmONC	Garsilla Rural Hospital	CEmONC
	Mukjar Rural Hospital	BEmONC	Mukjar Rural Hospital	CEmONC
	Um Dukhun Rural Hospital	CEmONC	Um Dukhun Rural Hospital	CEmONC
	Rokero Rural Hospital	CEmONC		
	Golo Rural Hospital	CEmONC	Golo Rural Hospital	CEmONC
West Darfur State	Geneina Teaching Hospital	CEmONC	Geneina Teaching Hospital	CEmONC
	Kulbus Hospital	CEmONC	Kulbus Hospital	CEmONC
	For Baranga Hospital	CEmONC	For Baranga Hospital	CEmONC
	Beida Hospital	CEmONC		
	Kerenik Hospital	BEmONC	Kerenik Hospital	BEmONC
			Salia Hospital	BEmONC

Annex 2: List of functioning EmONC health facilities included in the network proposed by the State Working Group and by the support team

State	Locality	Name of health facility	Functioning Health facility	Included in the EmONC network defined by the State working group?	Included in the EmONC network defined by the support team?
Red Sea	Port Sudan	Red Sea Hospital	CEmONC	yes	yes
Red Sea	Sinkat	Sinkat General Hospital	CEmONC	yes	yes
Kassala	Rural Khashm Elgirba	Halfa Aljadeda Hospital	CEmONC	yes	yes
Kassala	Kassala Town	Kassala Saudi Hospital	CEmONC	yes	yes
Kassala	Rural Khashm Elgirba	Khashum Elgirba Hospital	CEmONC	yes	yes
Gadarif	Gedaref Town	Eltaheli Hospital	CEmONC	yes	yes
Gadarif	El Fashaga	Elshowak Hopital	CEmONC	yes	yes
Sinnar	Abu Hujar	Wd Elniel Hospital	CEmONC	yes	yes
Sinnar	Sennar	Sinnar Hospital	CEmONC	yes	yes
Sinnar	Sennar	Sukkar Sinnar Hospital	CEmONC	yes	yes
Sinnar	Es Suki	Asoki Hospital	CEmONC	yes	yes
Sinnar	Sinja	Sinja Hospital	CEmONC	yes	yes
Blue Nile	Ed Damazine	Damazin Maternity Hospital	CEmONC	yes	yes
Jazeera	Greater Medani	Medenai Maternity Hospital	CEmONC	yes	yes
Jazeera	El Hassahisa	Alhasahesa Hospital	CEmONC	yes	yes

Jazeera	El Manaqil	Almanagil Hospital	CEmONC	yes	yes
Jazeera	El Qurashi	Algurashi Hospital	CEmONC	yes	yes
Jazeera	Ganub Elgazira	Alhosh Hospital	CEmONC	yes	yes
Jazeera	El Manaqil	Elhuda Hospital	CEmONC	yes	yes
Jazeera	El Manaqil	Eljamosi Hospital	CEmONC	yes	yes
Jazeera	El Qurashi	Elazazi Hospital	CEmONC	yes	yes
Jazeera	El Hassahisa	Tabat Hospital	CEmONC	yes	yes
Jazeera	El Hassahisa	Elmusalmea Hospital	CEmONC	yes	yes
Jazeera	El Hassahisa	Almehariba Hospital	CEmONC	yes	yes
Jazeera	El Qurashi	Alhikma Clinic	CEmONC		
Jazeera	El Manaqil	Eila Specialized Hospital	CEmONC		
Jazeera	El Kamlin	Jiad Specialized Hospital	CEmONC	yes	yes
White Nile	El Jabalain	Kinana Hospital	CEmONC		yes
White Nile	Tendalti	Tandalti Hospital	CEmONC	yes	yes
White Nile	El Gitaina	Elkiteina Hospital	CEmONC	yes	yes
White Nile	Es Salam	Arawat Hospital	BEmONC	yes	yes
North Kordofan	Sheikan	Elobeid Maternity Hospital	CEmONC	yes	yes
North Kordofan	Um Rawaba	Om Ruwaba Teaching Hospital	CEmONC	yes	yes
West Kordofan	Abyei	Almaglad Hospital	CEmONC	yes	yes
West Kordofan	El Nuhud	Alnhood Teaching Hospital	CEmONC	yes	yes
West Kordofan	Ghubaish	Gebiash Hospital	CEmONC	yes	yes
South Kordofan	Ghadeer	Kalogli Hospital	CEmONC	yes	yes
South Kordofan	Abassiya	Al-Abasia Hospital	CEmONC	yes	yes
South Kordofan	El Quoz	Aldepepat Hospital	BEmONC	yes	yes
South Darfur	Mershing	Nyala Teaching Hospital	CEmONC	yes	yes
South Darfur	Kas	Kass Hospital	CEmONC	yes	yes
West Darfur	El Geneina	Genina Hospital	CEmONC	yes	yes
West Darfur	Kereneik	Kerenik Hospital	BEmONC	yes	yes
Northern Darfur	El Fasher	Elfasher Hospital	CEmONC	yes	yes
Northern Darfur	Kutum	Kutum Rural Hospital	CEmONC	yes	yes
Northern Darfur	El Tawisha	Altwesha Hospital	CEmONC		
Northern Darfur	Tawila	Taweela Hospital	BEmONC	yes	yes
River Nile	Shendi	Shendi Hospital	CEmONC	yes	yes
River Nile	Atbara	Atabra Hospital	CEmONC	yes	yes
River Nile	El Matama	Elmatama Hospital	CEmONC		yes
River Nile	Shendi	Elmak Nimir Hospital	CEmONC		yes
River Nile	El Damar	Elketiab Hospital	CEmONC		yes
Northern	Merwoe	Karima Hospital	CEmONC	yes	yes
Khartoum	Khartoum	Saad Abu Elila Hospital	CEmONC	yes	yes
Khartoum	Um Durman	Omdurman Maternity Hospital	CEmONC	yes	yes
Khartoum	Jebel Awlia	Jebel Awlia Hospital	CEmONC	yes	yes
Khartoum	Um Durman	Elsheikh Ali Elfadul	CEmONC	yes	yes
Khartoum	Bahri	Khartoum North Hospital	CEmONC	yes	yes

Khartoum	Bahri	Haf Alsafi Hospital	CEmONC	yes	yes
Khartoum	Jebel Awlia	Turkish Hospital Khartoum	CEmONC	yes	yes
Khartoum	Um Durman	Shawamikh Hospital	CEmONC		
Khartoum	Khartoum	Dar Aelilag Hospital	CEmONC		
Khartoum	Khartoum	Royal Care Hospital	CEmONC		yes
Khartoum	Um Durman	Elsaudi Hospital	CEmONC		yes
Khartoum	Bahri	Elrajaa Specialized Clinic	CEmONC		yes
Khartoum	Khartoum	Soba Hospital	CEmONC	yes	yes
Khartoum	Khartoum	Ribat Police Hospital	CEmONC		yes
Khartoum	Sharg Elneel	Om Doanban	CEmONC	yes	yes

Annex 3: National EmONC monitoring sheet for Sudan

Federal Ministry of Health - SUDAN
Quarterly monitoring of maternal and newborn health services in Emergency Obstetric and Newborn Care (EmONC) facilities

Name of the health facility: *ID of health facility:* *Population (catchment area):*

State: *Locality :* *Date of data collection:* *Type: BEmONC / CEmONC* *Quarter:* *Year :*

1	Have the following signal functions been performed in the considered quarter?	*Yes*	*No**	2	Availability of other MNH services	*Yes*	*No**
1.1	*Administer parenteral antibiotics*			*2.1*	EmONC facility operating 24h/24h and 7d/7d		
1.2	*Administer uterotonic drugs (oxytocin)*			*2.2*	Routine use of partograph		
1.3	*Administer parenteral anticonvulsants (magnesium sulfate)*			*2.3*	Active Management of Third Stage of Labour		
1.4	*Manually remove the placenta*			*2.4*	Kangaroo Mother Care		
1.5	*Remove retained products (manual vacuum extraction)*			*2.5*	National package for clinical management of rape		
1.6	*Perform assisted vaginal delivery (vacuum extraction/forceps)*			*2.6*	Service for (a) EMTCT, (b) Syphilis, (c) HIV,(d) Hep. B&C (please specify)		
1.7	*Perform basic neonatal resuscitation (with bag and mask)*			*2.7*	Vaccination for newborn(a) BCG, (b) Polio 0 (please specify)		
1.8	*Perform C-section*			*2.8*	Number ofnewborns with post-natal visit within 48h		
1.9	*Perform blood transfusion*			*2.9*	Number of neonatal resuscitation with bag and mask		

***** If no, please provide one or more reasons among the following reasons:

1. Problem of availability of human resources (please circle a or b): (a)shortage, (b) not authorized to provide;
2. Problem of education : health provider not trained;
3. Problem of equipment / material / medicines (please circle a or b): (a) not available, (b) not functional;
4. Problem of protocols/procedures: the national protocols or the type of health facility does not allow to execute;
5. Problem of management: lack of supervision, cold chain, other;
6. No cases: no cases during the quarter requiring to execute the function;
7. Others (to specify at the back of the sheet).

3	Availability of EmONC essential medicines in the considered quarter (yes or no in the related box)																						
	Ocytocin		*Misoprostol*		*Magnesium Sulfate*		*Metronidazole IV*		*Phenobarbital*		*C section Kit*												
	IV Fluids		*Hydralazine*		*Cephalosporins IV*		*Dexamethasone*																
4	Availability of key human resources for EmONC *(specify the number or Not Available – 'NA')*	*Obstetrician*		*Surgeon*		*Anesthetist (MD/Nurse)*	/	*Medical doctor*		*Midwife*		*Nurse*		*Pediatrician*									
5	At the visit, the health facility has *(please circle)*	Water yes no		Electricity yes no		Lab.yesno		Fct.ambulanceyes no		Blood bank yesno													
6	Other Reproductive Health services					Number of cases		Other Reproductive Health services								Number of cases							

6.1	Women who gave birth leaving the health facility with a contraception method		6.3	Number of women receiving post-abortion care	
6.2	Implants / Intrauterine devices (IUDs)	/	*6.4*	Cervical cancer secondary prevention	

7	Number of births in the health facility in the quarter	7.1 Total Deliveries	7.2. Vaginal Deliveries			*7.3. C-sections*	*7.4. Referred*
			normal	*with vacuum extractor*	*with forceps*		

8	Number of direct obstetric complications	Number of patients Managed / Referred		Number of death in the health facility	Number of death notified	Number of death reviewed
8.1	Hemorrhage (ante partum)					
8.2	Hemorrhage (post partum)					
8.3	Ruptured uterus					
8.4	Severe pre-eclampsia or eclampsia					
8.5	Post-partum sepsis					
8.6	Prolonged labor or obstructed labor					
8.7	Complications of abortion					
8.9	Other direct obstetric complications					
9	Number of indirect obstetric complications					
10	Maternal deaths from unknown causes					
11	Neonatal complications	Number of patients Managed / Referred		Number of death in the health facility	Number of death notified	Number of death reviewed
11.1	Asphyxia					
11.2	Respiratory infection					
11.3	Low birth weight (≤ 2500g)					
12.1	Very early neonatal deaths (≤24H and ≥2500g)					
12.2	Low birthweight deaths (≤24H and ≤2500g)					
12.3	Stillbirths (Macerated / Fresh)			/		

13.1	Provide technical support to staff in peripheral health facilities (yes or no)		13.2	Community outreach in reproductive health (yes or no)	

Done by: …….. Approved by: …….. Validation date:……..

Annex 4: Travel scenario used for each State

Travel scenario for Blue Nile State

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	3	WALKING
20	shrubs	3	WALKING
30	herbaceous_vegetation	3	WALKING
40	cropland	3	WALKING
50	urban	3	WALKING

60	bare_sparse_vegetation	3	WALKING
80	permanent_water_bodies	3	WALKING
81	temporary_water_bodies	3	WALKING
90	herbaceous_wetland	3	WALKING
110	evergreen needleaf closed forest	3	WALKING
112	evergreen_broadleaf_closed_forest	3	WALKING
114	deciduous_broadleaf_closed_forest	3	WALKING
120	evergreen needleleaf open forest	3	WALKING
122	evergreen_broadleaf_open_forest	3	WALKING
124	deciduous_broadleaf_open_forest	3	WALKING
200	open_sea	0	MOTORIZED
1001	primary	60	MOTORIZED
1002	secondary	40	MOTORIZED
1003	tertiary	30	MOTORIZED
1004	road	30	MOTORIZED
1005	residential	30	MOTORIZED
1006	track	30	MOTORIZED
1007	pedestrian	30	MOTORIZED
1008	path	30	MOTORIZED

1009	footway	30	MOTORIZED
1010	trunk	60	MOTORIZED
1011	unclassified	30	MOTORIZED

Travel scenario for Khartoum _ El Gazira _ Red Sea States

class	label	Speed (in km/h)	mode
0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED

124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	80	MOTORIZED
1002	secondary	80	MOTORIZED
1003	tertiary	60	MOTORIZED
1004	road	60	MOTORIZED
1005	residential	60	MOTORIZED
1006	track	60	MOTORIZED
1007	pedestrian	60	MOTORIZED
1008	path	60	MOTORIZED
1009	footway	60	MOTORIZED
1010	trunk	80	MOTORIZED
1011	unclassified	60	MOTORIZED

Travel scenario for Gedarif State

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED

50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	50	MOTORIZED
1002	secondary	40	MOTORIZED
1003	tertiary	30	MOTORIZED
1004	road	30	MOTORIZED
1005	residential	30	MOTORIZED
1006	track	30	MOTORIZED
1007	pedestrian	30	MOTORIZED

1008	path	30	MOTORIZED
1009	footway	30	MOTORIZED
1010	truck	50	MOTORIZED
1011	unclassified	30	MOTORIZED

Travel scenario for Kassala State

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED

122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	70	MOTORIZED
1002	secondary	60	MOTORIZED
1003	tertiary	50	MOTORIZED
1004	road	50	MOTORIZED
1005	residential	50	MOTORIZED
1006	track	50	MOTORIZED
1007	pedestrian	50	MOTORIZED
1008	path	50	MOTORIZED
1009	footway	50	MOTORIZED
1010	trunk	70	MOTORIZED
1011	unclassified	50	MOTORIZED

Travel scenario for North Darfur State

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED

40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	60	MOTORIZED
1002	secondary	60	MOTORIZED
1003	tertiary	60	MOTORIZED
1004	road	60	MOTORIZED
1005	residential	60	MOTORIZED
1006	track	60	MOTORIZED

1007	pedestrian	60	MOTORIZED
1008	path	60	MOTORIZED
1009	footway	60	MOTORIZED
1010	trunk	60	MOTORIZED
1011	unclassified	60	MOTORIZED

Travel scenario for Northern _ River Nile States

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED

120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	80	MOTORIZED
1002	secondary	60	MOTORIZED
1003	tertiary	30	MOTORIZED
1004	road	30	MOTORIZED
1005	residential	30	MOTORIZED
1006	track	30	MOTORIZED
1007	pedestrian	30	MOTORIZED
1008	path	30	MOTORIZED
1009	footway	30	MOTORIZED
1010	trunk	80	MOTORIZED
1011	unclassified	30	MOTORIZED

Travel scenario for South Kordofan _ South Darfur States

class	label	Speed (in km/h)	mode
0	no data available	30	MOTORIZED
20	shrubs	50	MOTORIZED

30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	50	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	70	MOTORIZED
1002	secondary	40	MOTORIZED
1003	tertiary	30	MOTORIZED
1004	road	30	MOTORIZED
1005	residential	30	MOTORIZED

1006	track	30	MOTORIZED
1007	pedestrian	30	MOTORIZED
1008	path	30	MOTORIZED
1009	footway	30	MOTORIZED
1010	trunk	70	MOTORIZED
1011	unclassified	30	MOTORIZED

Travel scenario for Sinnar State

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED

114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	80	MOTORIZED
1002	secondary	60	MOTORIZED
1003	tertiary	40	MOTORIZED
1004	road	40	MOTORIZED
1005	residential	40	MOTORIZED
1006	track	40	MOTORIZED
1007	pedestrian	40	MOTORIZED
1008	path	40	MOTORIZED
1009	footway	40	MOTORIZED
1010	trunk	80	MOTORIZED
1011	unclassified	40	MOTORIZED

Travel scenario for Central Darfur State

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	30	MOTORIZED

20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	35	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	35	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	60	MOTORIZED
1002	secondary	40	MOTORIZED
1003	tertiary	30	MOTORIZED
1004	road	30	MOTORIZED

1005	residential	30	MOTORIZED
1006	track	30	MOTORIZED
1007	pedestrian	30	MOTORIZED
1008	path	30	MOTORIZED
1009	footway	30	MOTORIZED
1010	trunk	60	MOTORIZED
1011	unclassified	30	MOTORIZED

Travel scenario for West Kordofan _ East Darfur _ West Darfur States

class	**label**	**Speed** (in km/h)	**mode**
0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED

112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	80	MOTORIZED
1002	secondary	50	MOTORIZED
1003	tertiary	30	MOTORIZED
1004	road	30	MOTORIZED
1005	residential	30	MOTORIZED
1006	track	30	MOTORIZED
1007	pedestrian	30	MOTORIZED
1008	path	30	MOTORIZED
1009	footway	30	MOTORIZED
1010	trunk	80	MOTORIZED
1011	unclassified	30	MOTORIZED

Travel scenario for North Kordofan _ White Nile States

class	**label**	**Speed** (in km/h)	**mode**

0	no data available	30	MOTORIZED
20	shrubs	30	MOTORIZED
30	herbaceous_vegetation	50	MOTORIZED
40	cropland	30	MOTORIZED
50	urban	30	MOTORIZED
60	bare_sparse_vegetation	50	MOTORIZED
80	permanent_water_bodies	0	MOTORIZED
81	temporary_water_bodies	30	MOTORIZED
90	herbaceous_wetland	30	MOTORIZED
110	evergreen needleaf closed forest	15	MOTORIZED
112	evergreen_broadleaf_closed_forest	15	MOTORIZED
114	deciduous_broadleaf_closed_forest	15	MOTORIZED
120	evergreen needleleaf open forest	30	MOTORIZED
122	evergreen_broadleaf_open_forest	30	MOTORIZED
124	deciduous_broadleaf_open_forest	30	MOTORIZED
200	open_sea	0	MOTORIZED
1001	primary	80	MOTORIZED
1002	secondary	60	MOTORIZED
1003	tertiary	60	MOTORIZED

1004	road	60	MOTORIZED
1005	residential	60	MOTORIZED
1006	track	60	MOTORIZED
1007	pedestrian	60	MOTORIZED
1008	path	60	MOTORIZED
1009	footway	60	MOTORIZED
1010	trunk	80	MOTORIZED
1011	unclassified	60	MOTORIZED