ORIGINAL RESEARCH ARTICLE

Maternal and neonatal health care service utilisation in the wake of active conflict and socio-economic downturn in Torit County, Republic of South Sudan: a multimethod locally driven study

DOI: 10.29063/ajrh2021/v25i3s.4

Pontius Bayo[1], Loubna Belaid[2], Emmanuel Ochola[3], Elijo O. Tahir[4], Alexander Dimiti[5], Donato Greco[6], Christina Zarowsky[7]*

Department of Obstetrics and Gynecology, Torit State Hospital, South Sudan[1]; Department of Family Medicine, McGill University, Canada[2]; Department of public health, St, Mary's Hospital Lacor, Uganda[3]; State ministry of Health, Eastern Equotoria state, South Sudan[4]; Ministry of health, South Sudan[5]; School of public health, University of Rome, Italy[6]; School of Public Health, University of Montreal, Canada; and School of Public Health, University of the Western Cape, South Africa[7]

***For Correspondence:** Email: *pontiusby@gmail.com*; Phone: +211924 365571

Abstract

Recurrent conflicts and economic downturn hamper access to health care. We examined how renewed conflict in July 2016 in Torit County, South Sudan affected health facility utilization for pregnancy care. We analyzed key quantitative indicators before and since renewed conflict through monthly facility data covering January 2015 to December 2016 on Antenatal Care (ANC) visits, facility-based births, and major obstetric complications. A qualitative descriptive study explored perceptions on access through key informant interviews and focused group discussions. ANC visits declined by 21%; health facility births declined from 23.6% to 16.7% while the proportion of all obstetric complications treated declined from 58.9% to 43.9%. Lack of human resources, inadequate medicines supply, perceived poor quality of care and economic hardships were the main factors affecting access to care. Our multidisciplinary and multistakeholder approach and leadership by South Sudanese team members enhanced research quality and its potential impact on practice and policy. *(Afr J Reprod Health 2021; 25[3s]: 30-42).*

Keywords: South Sudan, conflict, Maternal and Neonatal health, health service utilization, global health research, health systems

Résumé

Les conflits armés récurrents et la récession économique entravent l'accès aux services de santé. Au mois de juillet 2016, des conflits armés ont repris au Soudan du Sud. Nous avons mené une étude mixte sur l'impact de la reprise des conflits armés de 2016 sur l'utilisation des services de santé maternelle dans le comté de Torit au Soudan du Sud. La composante quantitative a évalué les consultations prénatales, les accouchements en milieu hospitalier, et les complications obstétricales majeures. Nous avons consulté les données des établissements de santé durant la période de janvier 2015 à décembre 2016. La composante qualitative a exploré les perceptions de l'accès aux services de santé. Nous avons mené des entretiens individuels et des groupes de discussion avec des informateurs clés (ministère de la Santé du comté de Torit, gestionnaires et professionnels de la santé, membres d'organisations non gouvernementales).Les résultats quantitatifs ont montré que les consultations prénatales ont diminué de 21%. Les accouchements en milieu hospitalier sont passés de 23.6% à 16.7% tandis que la proportion des complications obstétricales majeures traitées est passée de 58.9% à 43.9%. L'absence des ressources humaines en santé, les problèmes d'approvisionnement en médicaments, la qualité perçue des soins, et le manque de ressources économiques des ménages sont les principaux facteurs influençant l'accès aux services de santé maternelle. L'implication des décideurs politiques, la multidisciplinarité de l'équipe de recherche et le leadership des membres de l'équipe sud-soudanaise ont contribué à améliorer la qualité de la recherche et à son impact potentiel sur les pratiques et les politiques sanitaires. *(Afr J Reprod Health 2021; 25[3s]: 30-42).*

Mots-clés: Soudan du Sud, conflit, santé maternelle et néonatale, utilisation des services de santé, santé mondiale, système de santé

Introduction

There were 303,000 maternal deaths globally in 2015, 1500 of which were in South Sudan alone[1]. Most maternal and neonatal deaths occur because of delays in or lack of access to quality health services. The recurrent episodes of conflict and violence in South Sudan continue to weaken the health system

further worsening the maternal health indicators[2]. Even when interventions for improving maternal and neonatal health are well known[3], progress in mortality reduction remains a challenge in South Sudan since the socio-economic environment resulting from (and contributing to) the conflict does not allow for quality maternal and neonatal health service delivery[4,5]. Training, deploying, and retaining skilled and motivated health staff is a major challenge, as is ensuring that health facilities are stocked adequately with essential commodities and supplies and maintaining a functional referral pathway and regular supportive supervision[5].

Skilled care during pregnancy, labour and delivery has been proven to avert most maternal and neonatal deaths[6]. However, in South Sudan 58% of pregnant women do not attend antenatal care and only 18% attend four or more times[7]; 81% of women deliver in their homes; while only 10% of deliveries occur under the care of skilled personnel[8].

After several decades of civil war and eventual signing of the comprehensive peace agreement with Sudan in 2005[9] and attainment of independence in 2011, South Sudan had started to build its health system structures but this was interrupted again by violent clashes in December, 2013[10]. Although these clashes started in the capital city of Juba, violence quickly spread to several parts of the country. Torit County in eastern Equatoria state was initially spared. However, in July 2016, the violence erupted again in Juba and this time it spread to involve Torit County[11]. Although the overt fighting did not last for long within Torit town, frequent violent roadside ambushes, inter-village clashes, and violent criminal offenses committed by other unknown gunmen continued. How these factors, coupled with extreme poverty, extreme depreciation of the currency and acute food shortages, affected access to, and the quality of maternal health services is not known. There is a heavy presence of humanitarian aid organisations in the country to help improve health service delivery but how acute conflict affects their practice and overall access to health service is poorly documented.

To our knowledge, there has been no systematic documentation of the extent to which utilization of maternal health services in South Sudan has been affected by the political and socio-economic environment of the current conflict, and none led by local practitioners, researchers and decision makers based in local institutions. This study sought to document the health system challenges as perceived by key health actors in Torit County and to compare key utilization indicators for maternal health services in 2015 (before the conflict) and in 2016 during the conflict. We compared visits for antenatal care services, number of facility deliveries, number of caesarean sections, major obstetric and early neonatal complications. This manuscript documents these findings and enables us to reflect on the implications for research, intervention design, policy and practice. This would enable the government and its health partners to innovate on strategies for maternal health service delivery not only during such crisis periods but also in the long-term after conflict. It may also contribute to efforts to decolonize global health research and ground it in local knowledge, with local teams.

Methods

Study design

A multi method study was conducted[12] using both quantitative and qualitative methods to obtain complementary data using the strengths of each method. A cross sectional analysis of facility-level data and explanatory qualitative methods were conducted simultaneously, while giving equal importance to qualitative and quantitative data. The study was part of a larger study (Mother Child Health Lacor-South Sudan- 'MoCHeLaSS') in South Sudan and Northern Uganda in which detailed contextual understanding was sought to inform the development and implementation of proposed participatory interventions with women, communities, and front- line health workers in areas affected by prolonged conflict. The study was designed in active partnership with South Sudanese research team members, informed by their contextual knowledge and led by these colleagues based at Torit Hospital, South Sudan, and data collection was largely undertaken by them. All team members contributed to interpretation of findings.

The scientific findings reported here were discussed in annual team meetings held in Gulu and Torit, in weekly teleconferences (when these were

possible in light of electricity and connectivity challenges), and in email exchanges informed by field diaries kept by the project coordinator during the active conflict.

Study setting

We conducted this study in health facilities of three Payams of Torit County in former Eastern Equatoria state, Republic of South Sudan: Kudo, Nyong and Himodonge. Payams in South Sudan are administrative areas that constitute counties which in turn constitute a state. The projected total population for the three payams in 2016 was 75,375[13]. Nyong Payam that hosts the state Capital Torit, had the highest population of 49,419 people while Kudo Payam had 14,078 and Himodonge Payam 11,878. However, it is worth noting that significant population movement occurred in and out of Torit County just before, during and immediately after the crisis. The pattern of the movement was mainly from the peri-urban areas to either town or deep into the villages in the rural areas, both of which were considered to be relatively secure and with some food supplies[14]. It is difficult to state accurately the numbers of displaced persons that occurred due to continued movement at the time, but 2400 people were estimated to have travelled from Juba into the villages in Himodonge payam[14]. About 1000 people were estimated to have moved from the peri-urban areas into Nyong payam in Torit town and an un-estimated number of people who had the means crossed the South Sudan borders into Kenya and Uganda. Despite all these movements, at least 88% of the population were believed to have remained within the county even if not at their original homes[14].

The public health system in South Sudan includes primary health care units (PHCUs) at the lowest level, the primary health care centres (PHCCs) at the next level corresponding to the Payam administrative level, then the county hospitals at the county level, the state hospitals at the state level and the national referral hospitals at the level of the national Ministry of Health. The study area has 11 public health facilities distributed throughout the three Payams. Only five including four PHCCs and one hospital can conduct deliveries and act as emergency obstetric and neonatal care (EmONC) centres. The other six facilities together with all the private facilities, which are mainly small clinics and drug shops do not conduct deliveries. EmONC facilities are of two types: basic and comprehensive[15] . PHCCs in South Sudan are basic EmONC facilities and are meant to provide the following EmONC services: administration of parenteral antibiotics for treating sepsis, administration of parenteral oxytocic for treatment of postpartum hemorrhage, administration of parenteral anticonvulsants for treatment of severe pre-Eclampsia and Eclampsia, assisted vaginal delivery, manual removal of the placenta, removal of retained products of conception and newborn resuscitation. The hospitals including the one in this study area are comprehensive EmONC centers and they provide all the basic functions above plus blood transfusion and caesarean section and/or laparotomy[15].

Study population

For the quantitative component, the study population was composed of pregnant women and neonates who attended public health facilities in 2015 and 2016 in three payams in Torit County for antenatal care, facility-based births, and treatment of major obstetric and early neonatal complications. The qualitative study was among key informants composed of members of communities (women, men, community leaders, traditional births attendants (TBA)), health providers, health managers, policy makers and NGO staff who are based in Torit County. Purposive sampling was used to select the participants for the individual interviews and for the focus group discussions (FGDs).

Data collection

Quantitative methods

The first author (BP) who is an obstetrician and gynecologist supervised the data collection. We reviewed the antenatal care (ANC) and admission registries on the maternity wards for 2015 and 2016. The data were extracted and recorded on weekly and then monthly basis to check for consistency with the health information reports; where there was inconsistency the registry figure was considered the correct one. The monthly data were used in the final recordings for analysis.

The key indicators recorded included number of visits for antenatal care services, facility- based deliveries, number of caesarean sections, major obstetric and neonatal complications treated. Neonatal deaths in facilities and still births from January 2015 to December 2016 were also recorded. The major obstetric complications included in this study are the ones defined by WHO and these are: haemorrhage (either during antepartum period or post-partum), prolonged and/or obstructed labour, abortion complications, postpartum sepsis, pre-eclampsia/eclampsia, ruptured uterus and ectopic pregnancy[15]. Early neonatal complications included in this study were complications known to cause early neonatal death (death of a newborn within the first 7 days of life)[16]. These included complications due to prematurity (birth before 34 completed weeks) and low birth weight (less than 2.5kgs), birth asphyxia, neonatal sepsis (that was defined by body temperature above 38^0C) and congenital abnormality or malformation. Gestation age at birth in weeks was calculated from the first day of the last menstrual period reported by the mothers and birth weight was measured by the birth attendant using a weighing scale.

Qualitative methods

Interviews with key informants from the State Ministry of Health (SMOH), healthcare facility managers and coordinators of international NGOs (n=19) were conducted at the county and at the national level (Table 1).

A mapping of key actors was conducted by our South Sudanese research team composed of a nurse, a midwife and a public health planner. Participants were selected based on their roles in strengthening the health system at the county and state levels. The participants were approached face-to-face. Interviews lasting 30 to 45 minutes were held at the offices of the agencies and at the SMOH and notes were taken concurrently as the interview took place as initial attempts to digitally record interviews were resisted by some respondents.

The interviews and the notes were taken by the same person. The interviews were conducted in English. The interview guide was developed based on literature review documenting health system research and the WHO building blocks, including in conflict and post-conflict settings, and the questions focused on the experiences and the perceptions of the health system and its challenges to implement maternal and newborn health packages.

Table 1: Numbers of interviews and Focus group discussions (FGD)

Data collection methods	Numbers	Data sources
In depth interviews	19	Key informants: policy makers (DG, MOH, SMOH, officers); NGO staff, health managers, health providers
FGDs	12 (8 to 20 per FGD)	Communities (n=8); health providers (n=3); policy makers (women's member of parliament) (n=1)

Twelve focus group discussions (FGDs) were organized at the community level discussing the perceptions on the health facilities, barriers to access to health care and the effects of conflicts. A guide was designed reflecting the research objectives and the Gabrysch and Campbell's conceptual framework on determinants of delivery service use[17]. The FGDs were composed of community members including both men and women some of whom were TBAs and local leaders. The FGDs were conducted in the villages.

For each FGD, between 8 to 20 participants attended. They were conducted by our South Sudanese research team members who speak the local language and know the social cultural context of the study. A moderator and two observers facilitated the FGDs while the observers took the notes. FGDs conducted with the communities were in the local language (Latuko) and were translated to English. The FGDs lasted between 30 to 45 minutes. FGDs with communities were not recorded. Notes were taken by the observers of the FGDs. The FGDs conducted with health providers and members of parliament were recorded.

Schedules for FGDs were set. The research assistants then moved from one community group to another conducting discussions, consents from participants were obtained before each discussion. The local leaders were informed about the conduct of FGDs. Women who attended the FGDs were of reproductive age. All of them have children. They were running small scale businesses such as making mandazi, alcohol, fetching firewood and grass for selling in the informal sector.

Table 2: Composition of FGDs groups

FGDs Communities	Gender	Composition of the groups
Ifwanyak Abalwa Boma, Nyang Payam	Women	Pregnant women, breastfeeding women
Mairo Fodofodo	Women	Pregnant women, breastfeeding women
Enyif Boma	Women	Pregnant women breastfeeding women, TBA, HHP, community leaders
Ibalany Hawai Messer Boma	Women	Pregnant women, breastfeeding women
Iluhum, Hawai Messer Boma	Women	TBA, Pregnant women breastfeeding women
Hai Lotuko village	Women	Pregnant women breastfeeding women, TBA, HHP
Hutiala Boma	Women	Pregnant women, breastfeeding women
Hilieu Boma	Women	Pregnant women, breastfeeding women
Health providers		
Nyong payam PHCC	Men, women	Clinical officers, nurses, midwives
Torit state Hospital	Men, women	Clinical officers, nurses, midwives
Himodonge-Hileu PHCC	Men, women	Clinical officers, nurses, midwives
Policy makers		
FGD	Women	Members of parliament (deputy chairperson, gender, education, youth)

Field notes based on non- participant observations were written[18]. The aim was to capture how people lived and coped with the political conflict. The field notes were written by the research coordinator of the study who is based in Torit. The second author (LB) gave important methodological support to the research coordinator on how to conduct the observations and write the ethnographic field notes. In total, five ethnographic assessments were conducted from July 2016.

Data analysis

Quantitative data analysis

Quantitative data were manually extracted from hospital records and entered into an Excel sheet and imported into SPSS version 16 for statistical analysis. A frequency table is used to present descriptive data for the two years being compared (2015-2016). Using the crude birth rate for South Sudan which was 36.315/ 1000 population in 2015 and 35.936/1000 population in 2016[19] the total number of expected pregnancies in each year were calculated. The proportions of these that were delivered in the facility were calculated for each year and the proportion that were delivered by caesarean section were also calculated.

According to WHO, 15% of all pregnancies get direct obstetric complications[15]. Using this WHO estimate, we calculated the number of major obstetric complications expected in each year and the proportion of these that were admitted and treated in the facility were also calculated to give the 'met EmOC need'. We assumed that because of the poor road network, lack of transport, insecurity and poor referral systems[5], the maternal health services in Torit state hospital were only used by the population in Torit county. The proportion of neonates with complications who died were also calculated.

Statistical significance of the difference in the proportions were tested using the chi-squared statistic and 95% confidence intervals (CIs) were calculated. All significance levels were set at $p \leq 0.05$.

Qualitative data analysis

In depth interviews and FGDs were translated, transcribed and coded with NVivo software. The second author (LB) conducted the qualitative analysis using thematic analysis where themes were generated from the data (i.e. inductive coding) and from the research question and conceptual framework (i.e. deductive coding)[20].

Triangulation of data sources (communities, health providers, health managers, NGO staff, policy makers) and data collection methods (in depth interviews, FGD, ethnographic notes) were conducted to enhance the credibility of the research[21,22].

Results

Utilization of maternal and newborn health services

A total of 2492 admissions were retrieved in 2015 and 2283 in 2016. Figure 1 shows the monthly trends of key maternal and neonatal health indicators which generally start to show a decline between December 2015 and February 2016 but there was a more drastic decline from July 2016 especially for the total ANC visits, total deliveries and major direct obstetric complications admitted and treated in the facility.

Table 3 shows the key maternal health indicators as a proxy measure for utilization of maternal and neonatal health services in the health facility. The proportion of all expected births in one year that occurred in the health facility declined significantly from 23.6% (95% CI= 22.4 - 24.8) in 2015 to 16.7% (95% CI= 15.7 – 17.7) in 2016 ($p< 0.001$). The proportion of all births expected that occurred by cesarean section also declined significantly from 2.4% (95% CI= 2.0- 2.8) in 2015 to 1.9% (95% CI= 1.5- 2.3) in 2016 ($p= 0.047$). The proportion of all major obstetric complications expected in one year that got treatment from the health facility declined significantly from 58.9% (95% CI= 55.4- 62.4) in 2015 to 43.9% (95% CI= 40.4-,47.4) in 2016 ($p<0.001$). Total ANC visits declined by 21% in absolute numbers from 4854 in 2015 to 3835 in 2016.

Challenges within South Sudan's health system

The following sections describe the challenges within South Sudan's health system, the perceptions of barriers of accessing health care services and of the July 2016 conflict. The findings on the challenges faced by South Sudan's health system are organized according to the health system building blocks.

Financing

In Torit, the health system is heavily dependent on external partners. A health pooled fund (HPF) from international donors is currently financing many activities of the health system. This fund is administered through implementing partners which are mainly international and local NGOs which work with the MOH to support primary health care services, improve the human resources and strengthen referral systems. Many NGOs are working in Torit; Catholic Organization of Relief and Development Aid (CORDAID) is the main implementing partner in Torit state hospital while Save the Children International (SCI) is the implementing partner for the services in the PHCCs and PHCUs in Torit County.

"If partners can add some payment to health staff in the hospital and other health partners, then they will be motivated to do a lot of work and can attract skillful employees who are working with international organizations to come and work in the hospital. If the state ministry of Health could be assisted by some partners to implement health programs, this will help, because the budget of the government is meagre (...). The government need to work as a team with partners. There is a political will, but we do not have enough money to implement designed health interventions, partners need to help the government" (FGD, Members of parliament).

After the July conflict, most international staff were evacuated from Torit. SCI and Cordaid staff left within one week of onset of the conflict but returned in September while staff of UN agencies were evacuated in August and most had returned by November 2016.

Health work force and medical products

The major concern even before the July violence was the lack of skilled health staff, especially midwives in health facilities. There is a critical shortage of midwives to provide maternal and neonatal healthcare. The shortage is so significant that NGOs have been forced to recruit midwives from other countries. This shortage is attributed in large part to the long civil war in South Sudan which disrupted the education sector and led to very few health workers been trained.

"Human resources are not enough, to implement maternal and newborn's health package" (IDI director 1 at the SMOH stated in an interview before July 2016).

The human resource problem has been compounded by inadequate and irregular salaries for some sections of staff. *"The human resource is inadequate and the salary for the government staff*

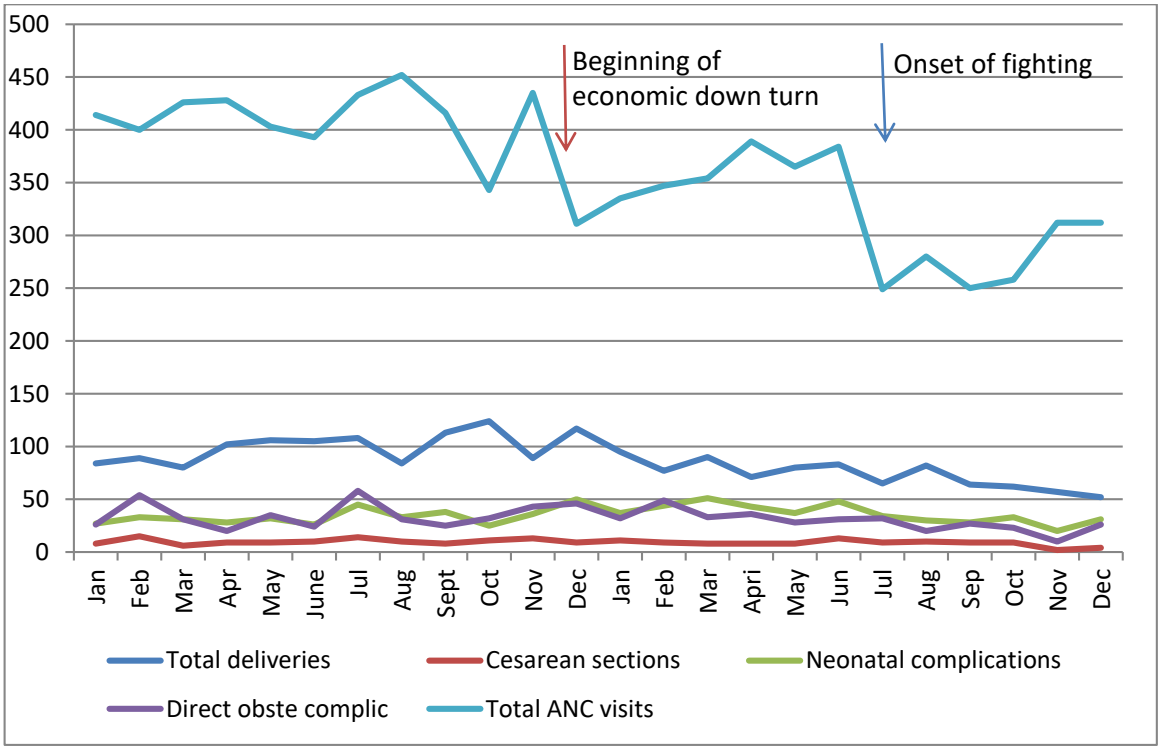

Figure 1: Monthly trends of maternal and neonatal health indicators from 2015 to 2016

is meager" (IDI director, Torit Hospital, before July 2016, Torit). In March 2016, it had been reported that health providers had not received their salary for three months. After the conflict of July, some staff moved away from the facilities due to insecurity and too little and delayed salaries- the unskilled staff were the ones remaining on the ground especially in health facilities along roads subject to ambushes.

Another challenge of the health system is the lack of drugs at the hospital and health facilities.

"There is inadequate medical equipment and drugs" (IDI, coordinator of humanitarian aid organisations Torit). The July conflict and the rampant road ambushes interrupted healthcare supplies reaching the facilities.

Health Information/ research

The County Health Department (CHD) collects healthcare data from the health facilities and transmits it to the State MOH. The implementing partners are supporting MOH to do supportive supervision and monitor quality of data in health facilities. However, it is difficult to obtain accurate and reliable data from PHCCs because of the lack of human resources at these facilities. According to the coordinator of the department of monitoring and evaluation at the MOH only "*45 to 55% of data are coming to the MOH because of the lack of qualified people for reporting data"* (IDI, before July 2016, Torit).

Barriers to service delivery

Economic barriers and perceived poor quality of care are the main obstacles for accessing health care. *"We cannot afford the soap and sweets needed at the maternity of the hospital, and then we prefer to deliver at home"* (FGD #1, women, Mairo fododo, Nyong payam).

"Those on night duty at the hospital just sleep and when you go to them, they just abuse you. We are harassed for many times. There is always delay in giving drugs when the prescription is not stamped" (FGD # 1, women, Mairo Fododo, Nyong payam).

The situation of Torit in July 2016

Based on the ethnographic field notes, heavy gun fire was reported on the eastern and southern outskirts of Torit on Monday, 11th July 2016. The town was seized with fear and many people took

Table 3: A comparison of key maternal and neonatal health indicators between Jan-Dec. 2015 and Jan-Dec. 2016

	Indicators		Numbers and proportions n (%)	95% CI	P Value
1.	**Population projections for Torit county from 2008 census**				
		2015	140,215		
		2016	146,046		
2.	**Expected births from the population in one year**				
		2015 (Crude birth rate 36.315/1000 population)	5,092		
		2016 (Crude birth rate 35.936/1000 population)	5,270		
3.	**Proportion of all births expected that occurred in the facilities n (%)**				
		2015	1201 (23.6)	22.4 – 24.8	
		2016	878 (16.7)	15.7 – 17.7	<0.001
4.	**Proportion of all births expected that occurred by caesarean section n (%)**				
		2015	122 (2.4)	2.0 – 2.8	
		2016	100 (1.9)	1.5 – 2.3	0.047
5.	**Major obstetric complications expected (15% of all expected births)**				
		2015	764		
		2016	791		
6.	**The proportion of major obstetric complications treated in the facilities n (%) (met EmOC need)**				
		2015	450 (58.9)	55.4 – 62.4	
		2016	347 (43.9)	40.4 – 47.4	<0.001
7.	**Neonatal complications admitted and treated within the facilities (n)**				
		2015	404		
		2016	436		
8.	**Proportion of the admitted neonates who died within the facilities n (%)**				
		2015	29 (7.2)	4.7 – 9.7	
		2016	27 (6.2)	3.9 – 8.5	0.278
9.	**Total ANC visits (n)**				
		2015	4,854		
		2016	3,835		

refuge at the UN compound in Torit. People stopped working. By Monday 18th July 2016 the situation had calmed down and most returned to work.

Prior to July, the communities had raised issues related to the impact of war on their lives in different FGDs. *"Our children did not have education. We cannot afford medical fees. Our farms were destroyed and there were terrible famines. Many people died. Roads were impassable and travelling is difficult" (*FGD #1, women, Mairo Fododo, Nyong payam). *"There was shortage of medicine. Health facilities were not enough and there was lack*

of food items" (FGD # 4, Enif community, Nyong Payam) *"War has worsened economic situation and malnutrition for children"* (FGD #5, women, Kudo Payam).

The July conflict has worsened the situation. Food items are extremely expensive, and many people are suffering from hunger due to the hyperinflation that reduce significantly purchasing power.

Discussion

Documenting and understanding the decline in service utilization

In this study, we have highlighted the significant decline in key maternal and neonatal health service utilization indicators in Torit Hospital between 2015 and 2016. Torit State Hospital is the only hospital and main health facility in Torit county offering maternity services with minimal contribution from the lower units as these facilities have no skilled midwives[23]. This means therefore, that although access to maternity services was already low in 2015, it got worse in 2016. It could be argued that the population was displaced by the conflict out of Torit county in 2016 and therefore, accessed services from elsewhere but an assessment done in October 2016 showed that 88% of the population remained within Torit county even if not in their original homes[14]. So even using the population that remained as the denominator, facility-based deliveries were still as low as 18.8% and the met EmOC need was only 49.6%. In another study in the same setting, we found a slightly higher met EmOC need (65.13%) in 2015[23]. However, that study included the populations for only three payams in Torit County. Moreover, the met EmOC need for the rural payams was low in that study: 16.4% in Kudo Payam and 24.6% in Himodonge payam compared to the urban Nyong payam which had a higher met EmOC need of 88.7%.

There is insufficient evidence on the barriers of maternal and neonatal service utilization in Torit County. A qualitative study in another part of the country listed a multitude of barriers to facility-based deliveries that included socio-cultural issues and conflict that led to insecurity leaving the health facilities inaccessible to the population[24]. This same study also outlined the community's perception of childbirth being natural and of low risk that did not require facility-based delivery. Another study attributed non-use of ANC services in South Sudan to polygamy status of the male partner, high illiteracy among pregnant mothers, limited knowledge on danger signs for their newborns and difficulty in access due to long distance from the services[7]. However, this study used data from a household survey conducted about seven years ago. Although the qualitative arm of the current study revealed similar barriers in accessing maternal and neonatal health services namely: perceived poor quality of services, lack of skilled motivated staff and costs of medical care, the decline in facility-based deliveries, ANC visits and the met EmOC need seen in this study between 2015 and 2016 is evidence of how the conflict and insecurity in Torit County have added to multiple other barriers to access to maternal health services. The year 2016 was a particularly difficult year for the population in Torit County with initially acute food shortages at the beginning of the year as a result of crop failure due to drought[25]. This, together with devaluation of the South Sudanese pounds profoundly affected the socio-economic status of the population and is perceived to have caused rampant armed robberies, road ambushes and banditry which displaced certain sections of the population to the neighboring countries[14]. When armed conflict erupted in July it simply worsened the humanitarian situation of the population in a county in which government partners were ill-prepared to respond as, for the previous two years, their focus had been on the parts of the country that had been affected by the 2013 conflict[26]. In addition, the qualitative interviews with health facility staff, informal conversations over the course of the research collaboration, and ongoing exchanges within the team highlighted additional upstream factors, notably the restructuring of the political organization of states within South Sudan and the ongoing financial crisis. These resulted in public sector staff not being paid at all for several months – a situation which is not conducive to optimal service provision and good staff morale.

Conflicts have already been shown to have inequitable health impacts related to differences in displacement, gender and financial capabilities[27].

Even if health facilities remain functional during conflicts as was the case for Torit State Hospital, populations in remote areas will find it difficult to access services; this was also demonstrated in a study in Liberia[28]. Access to health services may well depend on individual determinants such as level of education, age, parity and socio-economic status[5]but the capability of a community, which is usually destroyed during conflicts, significantly reduces access and utilization of maternal health services[29]. An interagency assessment done in August 2016[26] highlighted both community and health system factors. Key informants and focused group discussions in that assessment stressed the insecurity along the roads leading to and out of Torit town, the dwindling medical supplies, evacuation of the international specialist medical staff from the hospital including the obstetrician and gynecologist and the inability to pay for medical bills due to inflation as the main challenges to access to quality healthcare. Our qualitative and quantitative findings align with these analyses of the complex and sustained effects of conflict, drought, and poverty. They provide, to our knowledge, the first empirical evidence of the current humanitarian crisis in what had previously been considered a relatively peaceful region of South Sudan, and how this is reflected in the maternal health indicators at the heart of both the SDGs and the UHC agenda.

In South Sudan, the conflicts that are currently occurring and how they are affecting population's health are not expressed in the same way everywhere in the country and even across time[30]. The situation evolves rapidly. Thus, assessing the context using qualitative methods (such as the ethnographic diary) on a daily basis is important to implement informed strategies based on the current context[31].

Reflections on locally driven action-research

The study reported here is part of an ongoing implementation action-research collaboration between team members based in South Sudan, Northern Uganda, Canada, and Italy. The formative and ongoing qualitative research and informal exchanges which alerted the team to persistent cross-cutting challenges in human capacity, health system functioning, human resource management including paying staff, food security, and poverty would not have been possible without the active and equitable engagement of South Sudanese and Ugandan team members. The deep and highly practical contextual knowledge of the managers, clinicians, and senior Ministry of Health decision makers who were the core of the team was essential both to ask the right questions and find appropriate ways to answer them, and for the further application of these findings. The interventions with community women's groups were transformed based on these insights and findings. The engagement with and subsequent improvements in health facilities, including Torit Hospital, was made possible not by reporting or publishing the findings, but by virtue of the leadership and service delivery roles of the South Sudanese team members with the public health sector and with the major development partners who play such important roles in South Sudan. In turn, the capacity and confidence of the South Sudan team to transform their tacit knowledge and insights into sound qualitative and quantitative research practice and findings was made possible by active, long term commitment and engagement from the Canadian, Ugandan, and Italian team members. The project in which the study reported here is embedded, MoCHeLaSS (Mother-Child Health Lacor-South Sudan) has a full name which captures an intention and process – not always successful, and not complete, but serious and sustained:

"Learning how to implement integrated, community-focused reproductive and child health PHC in post-conflict settings", based on the principles and practices of Mutual Mobilization and Learning [32]. Neither the research reported here, nor the intervention with women's groups, the health system, and development partners, would have been possible without this mutual commitment to learning from and with each other, and to the leadership by locally based team members.

Limitations

This study had some limitations. First, it did not identify the socio-demographic characteristics of the women who were able to access the health services. This data may have shown the inequities resulting from the conflict based on geographical location, economic status, education status or even age. Secondly, other confounding factors that could

have affected the decline of facility utilisation other than the fighting were not analysed. However, the qualitative arm of this study has explored several explanatory factors to support the quantitative findings. Thirdly, the qualitative arm lacked depth, as some of the field researchers were not experienced. However, a basic training was provided on how to conduct focus group discussions and individual interviews by the second and last authors (LB, CZ) and ongoing support was provided at a distance by LB. Some interviews were not recorded, and this could have resulted into loss of information. However, the use of multiple sources of data and data collection methods has contributed to the richness of the data in this study, and its interpretation.

Conclusion

This study highlights, for the first time in Torit, the importance of regular collection of accurate and easy to use contextual maternal and neonatal health data during crises to offer a situation analysis which helps decision making for an effective response from government and its humanitarian aid organizations. It demonstrates that in the context of an ongoing multidisciplinary, multisectoral, and multi-country collaboration, local staff, many affected by the impacts of prolonged and acute conflict on training, continuing education, and precarious employment, are both capable of conducting good-quality fieldwork under extreme conditions and critical to the contextual knowledge and insights that enable both research and its uptake into practice to occur. While we have experienced many challenges and some conflicts along the way, we are convinced that this grounding of global health research – indeed of all health research – in diverse local knowledge and local teams should be the norm.

Maternal and neonatal health service utilization indicators showed a significant decline in Torit county between 2015 and 2016 with facility-based deliveries, ANC visits and the met EmOC need all declining. This decline has been due to not only economic and directly conflict-related hardships that made access to any care difficult, but also to the sequelae of long term conflict and poverty on the health system: the perceived poor quality of services, lack of skilled motivated staff and costs of medical care, all of which seemed to get worse with the conflict and compound the ensuing economic hardships. This could have affected certain sections of the population more than others especially the rural and poorer communities, as well as health workers themselves. There is need for the state MOH and its humanitarian aid organizations to monitor these indicators regularly and accurately so as determine access difficulties and assess the communities most affected so as to implement adequate strategies to improve access to health care services.

Ethical consideration

Ethical approvals for this study were obtained from the ethical committee of the Ministry of Health, Republic of South Sudan, the Uganda National Council for Science and Technology and the Research Center of hospital Center of the University of Montreal (CRCHUM Canada). Written consent was obtained from all participants for the interviews and permission to review hospital records was granted by the facility in-charges after giving them written information about the study.

Availability of data and materials

The datasets generated and/or analysed during the current study are available in the Dryad repository, DOI: 10.5061/dryad.bj550.

Competing interests

The authors declare that they have no competing interests.

Funding

This work was carried out with a grant from the Innovating for Maternal and Child Health in Africa initiative, co-funded by Foreign Affairs, Trade and Development Canada (DFATD), the Canadian Institutes of Health Research (CIHR) and Canada's International Development Research Centre (IDRC).

Disclaimer: The views expressed herein do not necessarily represent those of IDRC or its Board of Governors.

Authors' contributions

PB and LB designed the study and supervised data collection, DG did the statistical analysis of the quantitative data while LB analyzed the qualitative data and drafted the manuscript with PB; CZ, AD, EOT and EO participated in intellectual content analysis, methodological review and also reviewed the final version of the manuscript for consistency. All authors read and approved the final manuscript.

Acknowledgement

The authors are grateful to Osawa Rex, Clementina Luboya, Mary Mania and Sarah Kainza whose insights and important contributions to collection of both quantitative and qualitative data were and remain essential. We also owe a debt of gratitude to the participants in this study as well as to the management of the health facilities involved in this study, their cooperation was invaluable.

References

1. Alkema L, Chou D, Hogan D, Zhang S, Moller A, Gemmill A, Fat DM, Boerma T, Temmerman M, Mathers C and Say L. "Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group", Lancet (London, England) 2016, vol. 387, no. 10017, pp. 462-474.
2. Kevlihan R. Providing health services during a civil war: the experience of a garrison town in South Sudan. Disasters. 2013;37(4):579-603.
3. Lassi ZS, Salam RA, Das JK and Bhutta ZA. Essential interventions for maternal, newborn and child health: background and methodology. Reproductive Health. 2014;11(Suppl 1):S1-S.
4. Rai R, Ramadhan A and Tulchinsky T. Maternal & Child Health Journal Prioritizing Maternal and Child Health in Independent South Sudan; 2012: 16(6):1139-42.
5. Lawry L, Canteli C, Rabenzanahary T, and Pramana W. A mixed methods assessment of barriers to maternal, newborn and child health in Gogrial West, South Sudan. Reproductive Health. 2017;14(1):12.
6. Karkee R, Lee AH, and Binns CW. Birth preparedness and skilled attendance at birth in Nepal: Implications for achieving millennium development goal 5. Midwifery. 2013;29(10):1206-10.
7. Mugo NS, Dibley MJ, and Agho KE. Prevalence and risk factors for non-use of antenatal care visits: analysis of the 2010 South Sudan household survey. BMC Pregnancy and Childbirth. 2015;15(1):68.
8. Mugo NS, Agho KE, Zwi AB, and Dibley MJ. Factors associated with different types of birth attendants for home deliveries: an analysis of the cross-sectional 2010 South Sudan household survey. 2016. 2016;9.
9. Aalen L. Making Unity Unattractive: The Conflicting Aims of Sudan's Comprehensive Peace Agreement. Civil Wars. 2013;15(2):173-91.
10. Omer R. South Sudan: From Independence to a Detrimental Civil War Harvard International Review 2016;37(3):11-2.
11. Sweeney M. The spoiling of the world: in South Sudan decades of civil war led to independence--and yet more war. MHQ: The Quarterly Journal of Military History 2016;1(76).
12. Morse JM. Principles of mixed methods and multimethod research design. In: Tashakkori A, Teddlie C, editors. Handbook of mixed methods in social & behavioral research. Thousand Oaks, CA: Sage; 2003 p. 189-208.
13. NBS. Population Projections for South Sudan by Payam: 2015-2020. 2015 2015. Avalable: https://data.humdata.org › Dataset
14. REACH. Situation Overview: Displacement and Intentions in Eastern Equatoria State 2016. Available: https://www.humanitarianresponse.info › files › files
15. Bailey P, Lobis S, Fortney J and Maine D. Monitoring emergency obstetric care : a handbook Geneva, Switzerland: World Health Organization,; 2009, Available: https://apps.who.int › iris › 9789241547734_eng
16. Oza S, Lawn JE, Hogan DR, Mathers C and Cousens SN. Neonatal cause-of-death estimates for the early and late neonatal periods for 194 countries: 2000–2013. Bulletin of the World Health Organization. 2015;93(1):19-28.
17. Gabrysch S and Campbell OM. Still too far to walk: Literature review of the determinants of delivery service use. BMC Pregnancy and Childbirth. 2009;9(34):1-18.
18. Emerson R, Fretz R and Shaw L. Writing Ethnographic Fieldnotes. 2 ed. Chicago University of Chicago Press; 2011.
19. World Bank. Crude Birth Rate for the Republic of South Sudan [SPDYNCBRTINSSD], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/SPDYNCBRTINSSD, June 29, 2018. 2018.
20. Miles M and Huberman M. Analysis of qualitative data 2ed. Belgium De Boeck University; 2003.
21. Mays N and Pope C. Rigour and qualitative research. BMJ. 1995;311.
22. Laperrière A. The criteria of scientificity of qualitative methods . In J . Poupart LH, Groulx JP, Deslauriers A. Laperrière , R . Mayer & AP Pires (eds .), Qualitative research epistemological and methodological issues 1997; (pp. 376-389). Boucherville Gatan Morin editor.
23. Bayo P, Itua I, Francis SP, Boateng K, Tahir EO and Usman A. Estimating the met need for emergency obstetric care (EmOC) services in three payams of Torit

County, South Sudan: a facility-based, retrospective cross-sectional study. BMJ Open. 2018;8(2).

24. Wilunda C, Scanagatta C, Putoto G, Takahashi R, Montalbetti F, Segafredo G and Betran AP. "Barriers to Institutional Childbirth in Rumbek North County, South Sudan: A Qualitative Study", PLOS ONE. 2016;11(12):e0168083.
25. Lokale P. Famine fuels cycle of violence in Eastern Equatoria. The Niles. 2016.Availabe: https://www.ohchr.org › session34 › documents
26. ReliefWeb. Multi-Sector Rapid Needs Assessment: Imatong State Phase 1 Report: Torit County, South Sudan 2016. Available: https://reliefweb.int › report › south-sudan › multi-secto...
27. Bornemisza O, Ranson MK, Poletti TM and Sondorp E. Promoting health equity in conflict-affected fragile states. Social Science & Medicine. 2010;70(1):80-8.
28. Kentoffio K, Kraemer JD, Griffiths T, Kenny A, Panjabi R, Sechler GA, Selinsky S and Siedner MJ. "Charting health system reconstruction in post-war Liberia: a comparison of rural vs. remote healthcare utilization", BMC Health Services Research. 2016;16(1):478.
29. Paina L, Vadrevu L, Hanifi SMM, Akuze J, Rieder R, Chan KS and Peters DH. "What is the role of community capabilities for maternal health? An exploration of community capabilities as determinants to institutional deliveries in Bangladesh, India, and Uganda", BMC Health Services Research. 2016;16(7):621.
30. Luedke AE and Logan HF. 'That thing of human rights': discourse, emergency assistance, and sexual violence in South Sudan's current civil war. Disasters. 2018;42:S99-S118.
31. Tappis H, Koblinsky M, Winch PJ, Turkmani S and Bartlett L. Context matters: Successes and challenges of intrapartum care scale-up in four districts of Afghanistan. Global Public Health. 2016;11(4):387-406.
32. Jahn T, Bergmann M and Keil F. 'Transdisciplinarity: Between mainstreaming and marginalization', *Ecological Economics*, 2012 79: 1–10.