

## The unmet need of pit latrine use by disabled people

- Outcomes of Neonatal Respiratory Distress Syndrome
- Extra-pulmonary TB in a county/regional hospital
- Sanitation resources for disabled individuals
- Portable pit latrine seats for disabled individuals
- Double uterus in women delivered by Caesarean Section
- Giant ossifying fibroma of the mandible
- Fever is a syndrome and not just pyrexia

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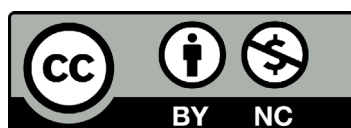
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**FRONT COVER:** Student, Hudson Oyanga, sitting on a newly constructed toilet seat to test its robustness. See page 20.

# The unmet need of pit latrine use by disabled people: a practical solution

The papers by Schmachtenberger et al<sup>[1]</sup> and Hey et al<sup>[2]</sup>, published in this issue, identify the unmet need of assistive technologies for people living in rural communities in Lira, Northern Uganda in accessing the use of pit latrines, and describe a new range of portable toilet seats. These toilet seats, designed by the University of San Diego Mechanical Engineering under-graduate senior students in California, and built by local carpenters in Lira, appear to help persons with disabilities to access pit latrines.

Use of a pit latrine requires the user to be able to squat and align their bottom with the opening of the pit latrine. This is a challenging undertaking for some people with disabilities, leaving them with the undesirable alternative of open defaecation.

The novel engineering solution described in the second paper is a welcome cooperation between engineering, medicine and social care. The affordability and local expertise to manufacture the portable seats are two important features which facilitate the rolling out of these toilet seats to other parts of Uganda, and indeed, to various parts of the developing world.

Current medicine in South Sudan addresses the needs of the acutely ill, but not the rehabilitation of the disabled. It is possible that the situation in Lira is similar. Rehabilitation Medicine is largely unknown in South Sudan and most other developing countries and, as such, there are no specialists leading multidisciplinary teams to advocate for the needs of disabled people. This is most likely one reason why the need for the provision of these toilet seats was not identified earlier. Rehabilitation is a team process which entails a partnership with a range of health and social care professionals to address any restriction or lack of activity resulting from loss of an anatomical structure (such as limb loss) or physiological function.<sup>[3]</sup> Rehabilitation is a dynamic process by which a disabled person is helped to acquire knowledge and skills in order to maximise physical, social and psychological function<sup>[4]</sup> enabling them to live as normal a life as possible in their community.

The prevalence of disability in South Sudan due to limb loss from land mine injuries, diabetes mellitus, gun shots, falling from trees, road traffic accidents and various medical conditions is unknown. The needs of this segment of society needs attention and inclusion in the national health strategy. The novel toilet seats will be valuable in South Sudan, given their affordability and potential for local manufacture. Further studies to assess uptake, limitations and provision are needed.

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# Determinant factors of immediate outcomes of Neonatal Respiratory Distress Syndrome in Gondar, Ethiopia

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## ABSTRACT

**Introduction:** Respiratory Distress Syndrome (RDS) is a frequent neonatal emergency worldwide. The prevalence varies with gestational age (GA) being higher among preterm babies. Preterm birth is the world's primary cause of newborn deaths and RDS is the leading cause of death in premature infants, including in Ethiopia.

**Objectives:** To identify the determinant factors of the immediate outcomes of RDS in the neonatal intensive care unit (NICU), University of Gondar Specialized and Comprehensive Hospital (UoGSCH).

**Method:** A hospital-based prospective descriptive analytical cross-sectional study was conducted from February to September 2020.

**Results:** A total of 162 neonates were enrolled; there were 87 (53.7%) males and 75 (46.3%) females. Of these 106 (65.4%) were discharged with improvement, 4 (2.5%) discharged with complications, and 52 (32.0%) died; 50% of deaths occurred within the first 24 hours of age. The odds of mortality for those admitted below 6 hours of age was 6.14 times higher (AOR=6.14, 95% CI:1.63 23.03) than those admitted aged 6 hours and above. Babies born to primiparous mothers were more than twice as likely to die (AOR=2.49, 95% CI:1.05 5.87) than babies born to multiparous mothers. Neonates who were delivered in other facilities had 3.78 times increased odds of mortality (AOR=3.78, 95% CI: 1.23 11.57).

**Conclusion:** Age at admission, site of referral, parity and gestational age (GA) had a significant association with neonatal mortality due to RDS.

**Keywords:** Respiratory Distress Syndrome, preterm, neonatal mortality, Ethiopia.

## INTRODUCTION

Annually about 15 million preterm babies are born around the world and more than one million die soon after birth mainly due to respiratory complications.<sup>[1]</sup> Respiratory Distress Syndrome (RDS) is a common and serious complication of preterm birth accounting for 50% of preterm deaths.<sup>[1]</sup> RDS is responsible for 30-40% of admissions in the neonatal period.<sup>[2]</sup> The prevalence of RDS varies with gestational age (GA), 30% among preterm, and 20% among post terms to 4% in term babies.<sup>[3]</sup>

A large multicentre study, done in 2016-2018 in Ethiopia, reported the mortality related to RDS of 45%.<sup>[4]</sup> However, determinate outcome factors were not clearly addressed, other than the use of continuous positive airways pressure (CPAP), hypothermia and X-ray findings.

Therefore, in our study multiple determinant factors (gestational age (GA), birth weight, mode of delivery, steroids given to the mother, if the baby was grunting,

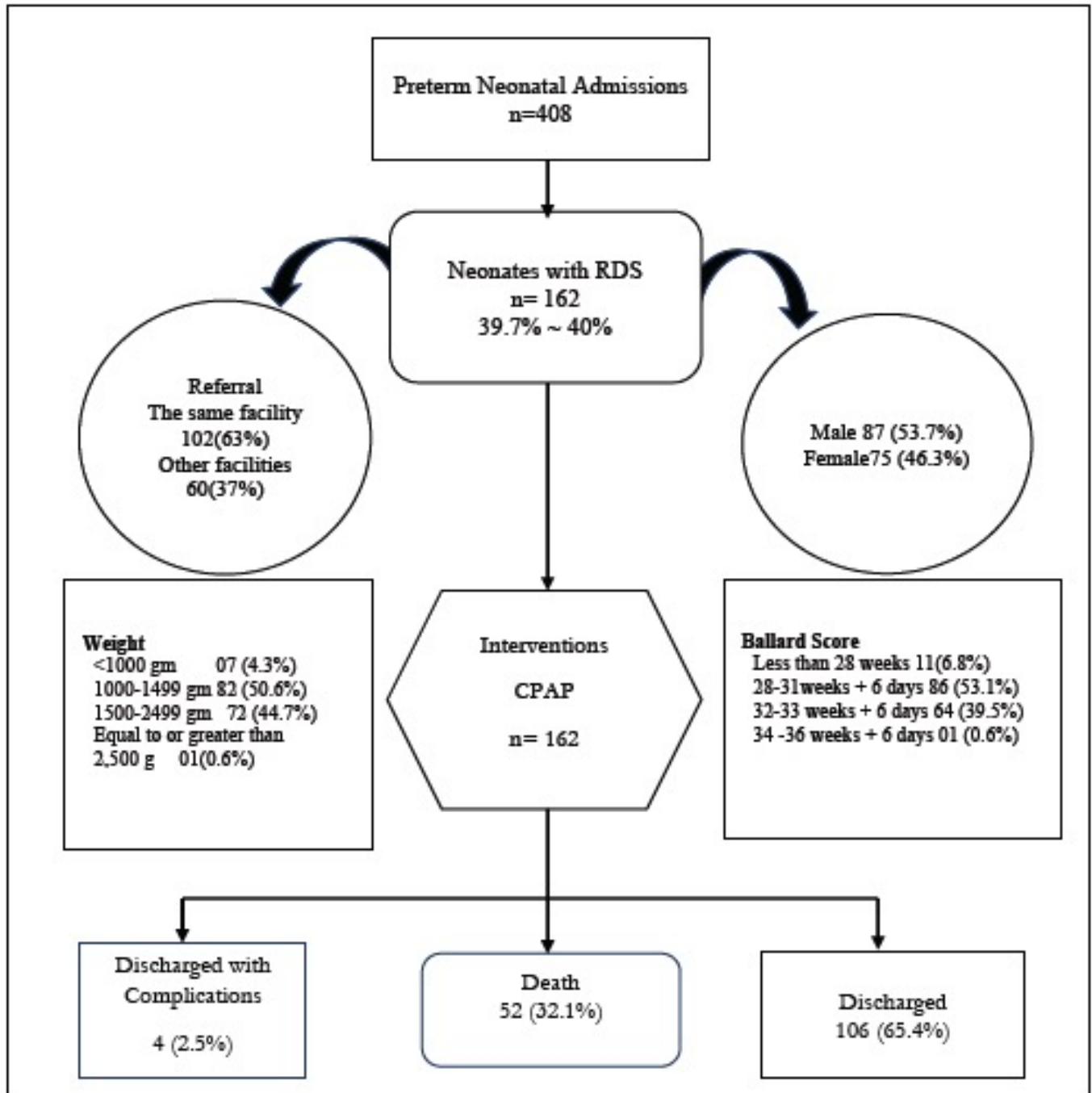


Figure 1. Flow diagram of the study

apnoea, maternal diabetes mellitus, multiple pregnancy and use of CPAP) were recorded. These findings may lead to future improvements in care.

**METHOD**

This was a hospital-based prospective descriptive and analytical cross-sectional study conducted to assess determinant factors and immediate outcomes of RDS in preterm neonates that were hospitalized in the neonatal intensive care unit (NICU) of University of Gondar Specialized and Comprehensive Hospital (UoGSCH),

Ethiopia from 1 February 2020 to 30 September 2020. All preterm neonates with RDS seen during the study period were included. The sample size was calculated according to the equation:  $N = Z^2(PQ)/d^2$ .

Using the prevalence of RDS 7% from a previous study<sup>[5]</sup> and 95% CI, and 4% margin of error, the final sample size became 156.

Where: N=sample size; Z=statistical certainty (1.96 at 95% level of confidence); P=prevalence =7% or 0.07, Q= probability of failure =1-P = 1 - 0.07= 0.93; d= desired margin of error = 0.04 or 4%;  $N = (1.96)^2 \cdot 0.07(1 - 0.07) / (0.04 \times 0.04) = 156$ .

Table 1. Socio-demographic characteristics

Variable		n (%)
<b>Neonatal age on admission(hours)</b>	Below 6 hours	119(73.5)
	6-11.9 hours	14(8.6)
	12-23.9 hours	19(11.7)
	24 hours and above	10(6.2)
<b>Sex</b>	Male	87(53.7)
	Female	75(46.3)
<b>Residence</b>	Urban	72(44.4)
	Rural	90(55.6)
<b>Sites of referral</b>	The same facilities	102(63)
	Other hospital	22(13.6)
	Local health centres	34(21)
	Home	4(2.5)
<b>Maternal age</b>	Below 18 years	0(0)
	18 - 25 years	5(3.1)
	25 - 30 years	80(49.4)
	30 -35 years	49(30.2)
	Above 35 years	28(17.3)

The actual sample size was 162 as this was the number admitted with RDS.

A pretested and later modified questionnaire was filled in daily. The information (demographic data and detailed history) was collected after informed consent was obtained and was cross-checked with that in the medical files. A physical examination was carried out and cross-checked for completeness and accuracy and the results of investigations such as chest X-ray, random blood sugar (RBS), and complete blood count (CBC) were collected from the patients' files. After the data were compiled and data quality was cross-checked, coded and entered it into EpiData version 3.1(8), it was analysed by Adjusted Odds Ratio by using SPSS Version 20.

## RESULTS

Figure 1 summarizes the interventions and outcomes of this study.

From a total of 408 preterm neonates admitted over the study period, 162 with clinical picture of RDS were included in this study (i.e. more than the determined sample size of 156). Neonates with severe congenital anomalies, malformations or dysmorphic features (due to

Table 2. Clinical and maternal Characteristics

Variable		n (%)
<b>Chief complaint/ Reason for referral</b>	Prematurity and LBW	88 (54.3)
	Fast breathing	67 (41.4)
	Fast breathing with grunting	30 (18.5)
	Twin evaluation	20 (12.3)
<b>Gestational age</b>	Triplet evaluation	4 (2.5)
	Unknown	7 (4.3)
	Less than 28 weeks	14 (8.6)
	28 weeks -31 weeks plus 6 days	67 (41.4)
<b>Parity</b>	32- weeks33 weeks plus 6 days	51 (31.5)
	≥34 weeks	23 (14.2)
	Primiparous	47 (29.0)
<b>Mode of delivery</b>	Multiparous	115 (71.0)
	Spontaneous vaginal delivery	128 (79.0)
	Caesarean section	28 (17.3)
	Induced	3 (1.9)
<b>Problems during pregnancy</b>	Assisted	3 (1.9)
	Antepartum haemorrhage	15 (9.3)
	Pregnancy Associated Hypertension	11 (6.8)
	Gestational diabetes mellitus	2 (1.2)
<b>Previous obstetrics history</b>	Urinary tract infections	3 (1.9)
	Chorioamnionitis	7 (1.8)
	Early neonatal death	7 (4.3)
<b>Duration of labour</b>	Premature birth	9 (5.6)
	Normal (18 hours or less)	147 (90.7)
	Prolonged (above 18 hours)	15 (9.3)
<b>Rupture of membrane</b>	Normal (18 hours or less)	151 (93.8)
	Prolonged (above 18 hours)	10 (6.2)

**Table 3. Newborn characteristics**

Variable		n (%)
<b>Conscious level</b>	Conscious	114 (70.4)
	Lethargic	46 (28.4)
	Comatose	2 (1.2)
	Cardio-Respiratory distress	162 (100)
	Cyanosis	34 (21)
	Apnoea	20 (12.3)
	Pallor	13 (8)
	<b>Respiratory rate</b>	
	Less than 60 BPM	51 (31.5)
	60-80 BPM	105 (64.8)
	More than 80 BPM	6 (3.7)
<b>Weight of the neonate</b>	Less than 1,000 g	7 (4.3)
	1,000-1,499 g	82 (50.6)
	1,500-2,499 g	72 (44.7)
	Equal to or greater than 2,500 g	1 (0.6)
	<b>Ballard score*</b>	
	Less than 28 weeks	11 (6.8)
	28-31weeks + 6 days	86 (53.1)
	32-33 weeks + 6 days	64 (39.5)
	34 -36 weeks + 6 days	1 (0.6)

\*see <https://perinatology.com/calculators/Ballard.htm>

other contributory factors for the distress) or those who died before settling the cause of RD were excluded.

The highest rate of admissions was of those aged below 6 hours 119 (73.5%) (Table 1); 53.7% were males, with a male:female ratio of 1.2:1. There were 102 (63%) referred from within the facility. Neonates whose mothers resided in rural areas accounted for 90 (55.6%) of referrals (Table 1).

The main reason for referral or chief complaint was prematurity and low birth weight (LBW) 88(54.3%), followed by fast breathing 67(41.4%) and fast breathing with grunting 30(18.5%); 45.2% of neonates had a GA between 28 weeks to 31 weeks and 6 days, while 34.4% were between 32 weeks to 33 weeks plus 6 days (Table 2).

Nearly three-quarters (74.1%) of newborns cried immediately after delivery, and 28.4%, 21.0%, 12.3% and 8.0% were lethargic, cyanosed, apnoeic or pale respectively at time of admission.

Note the time of admission was not always immediately after delivery because we had referrals from other facilities. Reasons for apnoea could include prematurity or immature lungs as in case of RDS. Usually we found

**Table 4. Systemic review**

Variable		n (%)
<b>Pattern of breathing</b>	Normal	22 (13.6)
	Laboured	129 (79.6)
	Gasping	06 (3.7)
	Apnoeic	5 (3.1)
	Cyanosis	34 (21)
	Nasal flaring	133 (82.1)
	Grunting	135 (83.3)
	Intercostal retraction	158 (97.5)
	Subcostal retraction	156 (96.3)
	Bilateral decreased breath sounds	162 (100)
<b>Central nervous system</b>	Alert	133 (82.1)
	Lethargic	28 (17.3)
	Comatose	1 (0.6)
<b>Neonatal reflexes</b>	Intact	3 (1.9)
	Depressed	157 (96.9)
	Absent	2 (1.2)
	32-33 weeks + 6 days	64 (39.5)
	34 -36 weeks + 6 days	1 (0.6)

2-3 signs of distress in one patient, for instance increased respiratory rate, cyanosis, and/or grunting.

About half of the newborns (50.6%) had birth weights between 1,000 g and 1,499g (Table 3).

At admission, 79.6% of neonates had a laboured breathing pattern, while 3.7% of them were gasping (note some babies were admitted more than 1 hour after delivery); 83.3% were grunting, and all of them had decreased breath sounds bilaterally (Table 4).

Results of chest X-Rays done for 18 (11.1%) of the neonates showed that 10 (6.2%) were normal, 5 (3.1%) were Stage I, 3 (1.9%) were Stage II and none were Stage III or IV, where Stage I=Reduced lung volume, II=Air bronchograms, III=Reticulogranularity, IV=Increased lung opacification.<sup>[6]</sup> Taking chest X-rays was challenging due to the critical condition of the neonates and lack of portable X-Ray. For more information see Trotter et al.

**Final outcomes**

Out of 162 admitted neonates with RDS, 106 (65.4%) were discharged improved, 4 (2.5%) were discharged with complications, and 52 (32%) died.



Table 5. Final outcomes

Variable	n (%)	
<b>Final outcomes</b>	Discharged with improvement	106 (65.4)
	Discharged with complication	4 (2.5)
	Death	52 (32.1)
<b>Discharged with complications</b>	Asphyxia with encephalopathy	3 (1.9)
	Discharged against medical advice	1 (0.6)
<b>Immediate cause of death</b>	Respiratory failure	41 (25.3)
	Multiple organ failure	6 (3.7)
	Pulmonary Haemorrhage	4(2.5)
	Severe sepsis with disseminated intravascular coagulation (DIC)*	1(0.6)
	RDS	45 (27.8)
<b>Underlying cause of death</b>	Asphyxia with encephalopathy	4 (2.5)
	Severe sepsis	1 (0.6)
	Severe sepsis with DIC	1 (0.6)
	Severe sepsis or/and Hospital Acquired Sepsis **	1 (0.6)
	Severe sepsis with necrotising enterocolitis stage III	1 (0.6)
	Absent	2 (1.2)
	32-33 weeks + 6 days	64 (39.5)
	34 -36 weeks + 6 days	1 (0.6)

\*Evidence suggesting DIC was bleeding from umbilical stump and complete blood count (Reference value (SI)) showed WBCs of  $2.4 \times 10^9$  cells/L, Haematocrit 0.28, platelet  $65 \times 10^9$  /L)

\*\*A diagnosis of sepsis based on clinical judgement, systemic inflammatory response syndrome (SIRS) Criteria and complete blood count.

Further details of the causes of death and outcomes are given in Table 5. The immediate causes of death were 41(25.3%) due to respiratory failure, and 6 (3.7%), 4 (2.5%), 1(0.6%) were due to multiple organ failure (MOF), pulmonary haemorrhage and severe sepsis with disseminated intravascular coagulation (DIC) respectively.

The identified underlying causes of death were RDS, perinatal asphyxia (PNA) with hypoxia ischaemic encephalopathy (HIE) (where the baby's brain does not get enough oxygen around the time of birth) and sepsis which were constituted 45(27.8%), 4(2.5%), 4(2.5%) respectively. Half (50%) of the deaths occurred within 24 hours of age and 32.7% died within 24 to 72 hours.

#### Factors associated with mortality

From logistic regression analysis parity, place of delivery, tachypnoea, age at admission, GA and mode of delivery were associated with neonatal mortality in bivariate analysis (p value 0.2). In the multivariate analysis parity, tachypnoea, GA and place of delivery had a statistically significant association with mortality (p value 0.05). Thus, in neonates below six hours of age, the odds of mortality were 6.14 times higher than those aged six hours and above at admission (AOR=6.14, 95% CI:1.63 - 23.03). Neonates from primipara mothers had risks of mortality 2.49 times higher than neonates from multiparous mother (AOR 2.49, 95% CI:1.05 - 5.87).

Babies delivered in other facilities had 3.78 times greater risk of death (AOR= 3.78, 95% CI:1.23 - 11.57). Compared to GA less than 28 weeks, those between 28-31 weeks plus 6 days, 32-33 weeks plus 6 days and above 34 weeks, had decreased odds of mortality by 90%, 92%, and 86% respectively. Similarly, if the neonate was tachypnoeic the risk of death decreased by 69% compared to non-tachypnoeic (AOR= 0.31, 95% CI: 0.14 - 0.71). Table 6.

#### DISCUSSION

In this study the proportion of preterm deaths due to RDS was 31.5%, which is lower than studies done in Tanzania (52%)<sup>[7]</sup>, Jimma, Ethiopia (41%)<sup>[8]</sup> and a multi-Centre Prospective Observational Study in Ethiopia (Study of illness in preterm) (45%).<sup>[5]</sup> This might be due to earlier interventions like CPAP but this finding is higher than a study done in Italy which showed a mortality of 24%.<sup>[9]</sup>

This study showed those preterm neonates who were delivered and referred from other facilities had a 3.78 times higher risk of mortality than those who were delivered and referred from the same facility (UoGSCH); this finding was supported by a study done in the United States which showed a reduction in mortality from 63% in the late-treated infants to 21% in early-treated infants.<sup>[10]</sup> A study conducted in Jimma-Ethiopia showed that those who resided outside of Jimma had significantly higher mortality rates.<sup>[8]</sup> This may be due to the distance and no CPAP on referral.

Neonates who were admitted within 6 hours of age have 6.14 times higher risk of mortality than those above six hours of age at admission (AOR= 6.14, 95% CI:1.63 -

Table 6. Factors associated with mortality

Characteristics	Mortality	COR 95% CI*	AOR 95% CI*	p-value	
	Yes	No			
<b>Parity</b>					
Primipara	24	23	3.24 (1.58-6.61)	2.49 (1.05-5.87)	0.037
Multipara	28	87	1	1	
<b>Place of delivery</b>					
The same facility	32	70	1	1	
Other facilities	20	40	1.09 (0.55-2.15)	3.78 (1.23-11.57)	0.020
<b>Tachypnoea</b>					
Yes	28	83	0.37 (0.18-0.76)	0.31 (0.14 - 0.71)	0.006
No	24	27	1	1	
<b>Age of neonate at admission</b>					
Below 6 hours	46	73	3.88 (1.52 - 9.92)	6.14 (1,63-23.03)	0.007
6 hours and above	6	37	1	1	
<b>Gestational Age</b>					
Below 28 weeks	11	3	1	1	
Between 28 weeks and 31 weeks and 6 days	19	48	0.10 (0.02 - 0.43)	0.10 (0.02-0.48)	0.004
Between 32 weeks and 33 weeks and 6 days	12	39	0.08 (0.02 - 0.35)	0.08 (0.018-0.42)	0.003
Between 34 weeks and 36 weeks and 6 days	6	17	0.09 (0.01 - 0.46)	0.14 (0.025-0.85)	0.032
<b>Mode of delivery</b>					
Caesarean section	9	19	1.0 (0.41 - 2.39)	1.55 (0.54-4.42)	0.408
Vaginal	43	91	1	1	

\*COR 95% CI = Crude odds ratios and its 95% confidence interval. AOR = Adjusted odds ratio and its 95% confidence interval

23.03), which was a surprising result that may be due to underlying problems, or a comorbid condition like perinatal asphyxia.

This study showed that mortality is inversely related to GA, and being male is associated with increased risk of death which is in line with a study done in Italy<sup>[9]</sup> and Tanzania.<sup>[7]</sup> This is related to prematurity of the lungs and less surfactant production.

This study showed that primiparous pregnancy is associated with 2.49 times increased risk of mortality compared to multipara mothers, and this is in line with a study done in Italy.<sup>[9]</sup>

This study showed the odds of mortality decreased by 69% in tachypnoeic babies as compared to non-tachypnoeic (AOR=0.31, 95% CI:0.14 0.71). This finding was surprising; it demonstrates the value scaling of early interventions and strict follow up and use of CPAP.

This study showed that those delivered through Caesarean

section had 1.5 times risk of mortality as compared to their counterpart who delivered through vaginal delivery, the association was not statistically significant. (AOR= 1.55, 95% CI:0.54 4.42). Similarly, maternal diabetes, birth weight and giving women in premature labour steroids to mature the baby’s lungs were not associated with significant risk of mortality in neonates with RDS.

### CONCLUSION

RDS is the major cause of mortality in preterm neonates. The main reasons for referral were prematurity and LBW followed by tachypnoea. Mortality due to RDS was significantly associated with the age of the baby at admission, parity, gestational age and place of delivery. It is interesting to speculate whether primiparous women have difficulty in accessing quick appropriate care when in premature labour.

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## Gordon Memorial College Trust Fund (GMCTF) Applicants 2022/2023

This is to remind applicants for GMCTF grants for the academic year 2022/2023 that applications for grants close on 28th February 2022.

All applications must be made online through the following website [www.gmctf.org](http://www.gmctf.org), and must be accompanied with two letters of reference one of which must be from a referee in the area of study.

Those applying for the first time must have admission to a postgraduate course in a recognised university outside the Sudan and South Sudan. For those already holding a grant who wish to renew their grants for a year or more must demonstrate progress in their studies. This category of applicants should append a letter of recommendation from their course supervisor, Head of Department or the Dean of the Faculty where the studies are undertaken.

**Dr. Eluzai Hakim**

Member, Executive Committee of the GMCTF

# One year's experience of extra-pulmonary TB in a county/regional hospital in South Sudan

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## ABSTRACT

**Introduction:** Although *Mycobacterium tuberculosis* (TB) is becoming rare in the “first” world, it continues to be a killer in South Sudan. The lungs are the most commonly infected organs but extra-pulmonary TB is not uncommon.

**Objective:** To determine the value and limitations of the TB diagnostic aids available at the county/regional hospital.

**Methods:** This paper reports on a series of patients with TB attending a county/regional hospital in one year between 1 September 2020 and 31 August 2021 and alerts clinicians to the more unusual presentations. We also discuss the application of diagnostic techniques that are available in South Sudan or will be available in the near future.

**Results:** In this 12-month period, 162 patients were diagnosed with TB and 40 with EP TB.

**Conclusion:** Good clinical evaluation plus ultrasound and widely available laboratory studies can lead to the diagnosis of TB, resulting in a good clinical outcome rather than an ill, consumptive patient who continues to spread the disease prior to an untimely death.

**Key words:** Extra-pulmonary TB, case histories, ultrasound, South Sudan

## INTRODUCTION

*Mycobacterium tuberculosis* (TB) competes with malaria for being the greatest killer of all time. Much of the first world has TB under control, but that is not true in South Sudan. The first world has the best diagnostic techniques, but where they are most needed, these are lacking. Most TB is in the lungs, but it is certainly not rare in other areas of the body (extrapulmonary) (EP TB).

## METHOD

We describe cases of EP TB seen over a year at St Mary Immaculate (SMI) Hospital. SMI Hospital, Mapuordit, Yirol West County, Lakes State, South Sudan is operated by The Comboni Missionary Brothers under the auspices of the Diocese of Rumbek. Although designated as a county hospital, it receives patients from the entire Lakes State and the surrounding regions. Arkangelo Ali Association (AAA) is an NGO dedicated to the treatment of patients with TB and/or HIV in numerous sites throughout South Sudan. SMI and AAA have been working together for over a decade seeking to eradicate TB.

In SMI Hospital we use X-ray, common laboratory tests such as ESR (erythrocyte sedimentation rate), ultrasound and Gen-X PCR to aid in diagnosing pulmonary and EP TB. Below we report our experience between 1 September 2020 and 31 August 2021 to show the value and limitations of these diagnostic aids.

## RESULTS

In this 12-month period, 162 patients were diagnosed with *Mycobacterium*

**Table 1. Prevalence of HIV in TB by presentation**

Breakdown of TB	Total	HIV (+)	HIV (-)
	n	n	n
<b>Pulmonary TB (smear +)</b>	32	19	13
<b>Pulmonary TB (smear -)</b>	76	28	48
<b>Children</b>	14	9	5
<b>Extra-Pulmonary TB</b>	40	13	27
<b>Total</b>	162	69	93

*tuberculosis* (TB) and 40 with EP TB – Table 1.

In this report, we discuss several sites of EP TB and describe patients who demonstrated important features.

### **TB of the hip (3 cases seen)**

AA was a 13-year-old female who presented with left hip pain for 9 months. She used a pole to walk and required the help of a family member. She had marked swelling in her left buttock and substantial pain on rotation of the left hip. The right hip was normal. Her ESR was 93. X-ray showed loss joint space in the acetabulum and markedly atrophied femoral head. After two months of RHZE (Rifampicin, Isoniazid, Pyrazinamide, and Ethambutol), she had gained 5 kg, walked without a limp, though she continued to complain of pain with prolonged walking.

Comment: Isolation of a patient with TB of the hip is impractical unless there is a joint effusion. Typically, TB of the hip is unilateral, and painful with a reduced range of motion. Permanent arthritis of the hip is likely, but some function is often restored. The longer the delay in diagnosis, the poorer the prognosis. Elevated ESR, unilateral disease, and destruction of the hip joint on x-ray assist in making the diagnosis.

### **TB of the spine (5 cases seen)**

KM was a 30-year-old male who presented as an emergency with wound dehiscence. On his right flank, a surgical incision had opened up, though the drainage from the wound was small. He also had a gibbus at L4 and was unable to walk without assistance. On further questioning, he reported hospitalization in Khartoum 5 months earlier where he had an extensive workup including an MRI and plain films of the lumbar region showing erosion of the vertebral bodies in L2-L4 and a paraspinal infection. He had surgical drainage of the paravertebral pus. He had been started on RHZE in Khartoum but left against medical advice. In SMI hospital he was restarted on RHZE and was able to walk alone with the aid of a walker after three weeks of therapy.

Comment: TB of the spine is a frustrating diagnosis. The patient with back pain and a gibbus may show no

neurological deficit, but obtaining a definitive diagnosis is rare; CT scan or MRI of the spine are virtually diagnostic, but not widely available in South Sudan. A gibbus is a reduction of the normal protrusion of the spinous process secondary to collapse of adjacent vertebral bodies. If untreated, the collapsed vertebrae worsen to become wedge-shaped and result in sharp-angled kyphosis, and the patient may become paraplegic with a neurogenic bladder, and bowel incontinence. An elevated ESR is helpful, but a normal ESR does not rule-out TB of the spine.

### **Peritoneal TB (4 cases seen)**

BM was a 40-year-old female who presented with prostration, abdominal distension, and spiking fever, typically nocturnal. Her weight was 42 kg and standing was difficult. On examination, she had wasting, especially of the extremities, and abdominal distension. Her chest was clear and there was no significant adenopathy. Ultrasonography showed a multi-cystic mass with minimal ascites. 20ml of straw-coloured fluid were aspirated from the cysts. The aspirated fluid failed to demonstrate TB by PCR, but after 2 months' trial of RHZE, her weight increased to 49 kg and her strength was markedly increased. Her abdominal distension had reduced.

AM was a 38-year-old HIV-positive male with ascites that failed to respond to diuretics. Paracentesis yielded purulent and blood-stained fluid. A PCR was positive for TB. Several paracenteses were performed, each yielding 4-6 l of fluid of the same character as the initial aspiration. The patient also had evidence of Kaposi sarcoma of the soft palate and died after three weeks in hospital.

**Comment:** The presentation of TB in the peritoneum has many forms. We have isolated TB aspirated from a similar appearing multi-cystic mass using the Gen-X PCR machine, and this patient's response suggests she also had TB. TB peritonitis is common, but difficult to diagnose. If the fluid is obviously an exudate (thick, high protein, cloudy or purulent) it is worthwhile to try to isolate TB, particularly with the Gen-X technology. Ascites can be from a multitude of causes, but if the patient with ascites does not have cardiac failure and his screen for Hepatitis B and C are negative, TB should be considered, as either primary TB peritonitis or TB pericarditis may cause ascites. Some have suggested a limited laparotomy with examination of the internal surface of the visceral peritoneum for micronodules.<sup>[1]</sup>

### **TB of the spleen (4 cases seen)**

AM was a 50-year-old female with fever, splenomegaly (4 cm below the L costal margin), and anaemia (Hb 3.7 mg/dl). Ultrasound showed multiple cysts in the spleen. Aspiration of one of the cysts yielded blood-tinged fluid, but unfortunately the Gen X PCR was not carried out.

She was tried on RHZE and responded well with weight gain, reduction in the splenomegaly and in the cysts on ultrasound. Two months later she was asymptomatic.

**Comment:** Multiple ultrasound images suggestive of TB have been reported.<sup>[2]</sup> We have treated two children for TB on the basis of multiple micro-abscesses in the spleen, called “starry night pattern” (multiple micro-abscesses showing up white on a dark background) in the literature. The pattern of hypoechoic microcysts in the spleen is not unique to TB, but TB is one of the most common causes.<sup>[2]</sup>

### TB of the liver (5 cases seen)

RAA was a female who presented with a chronic cough and a large, hard liver reaching 13 cm below the xyphoid process. She also had spiking fever for three months, crackles and signs of consolidation on her chest exam. She had an elevated ESR. Her sputum was positive for *Mycobacterium tuberculosis*. She was negative for Hepatitis B (s ag) and C. Ultrasound showed diffuse infiltration of the liver that was initially diagnosed as liver cancer. The patient was placed on analgesics for the hepatic pain, and RHZE for pulmonary TB. Over the next ten days the liver shrank and became softer. She has continued to improve since discharge. Two months later, she was asymptomatic and had resolution of her hepatomegaly.

**Comment:** Multiple different ultrasound patterns have been reported.<sup>[3]</sup> This picture of diffuse infiltration is probably not unique to TB, but TB should be considered in the patient with hepatomegaly that is firm (hard) to palpation. The prognosis of liver cancer is dismal, particularly in South Sudan. Fever and an elevated ESR are helpful in suggesting TB. Liver cancer is less likely in the absence of Hepatitis B and C. We would suggest a trial of RHZE for those patients with suspected liver cancer, but without a discreet mass in the liver on ultrasound, particularly if the patient is negative for Hepatitis B and C. We have treated two. One did well, suggesting the liver disease was TB. The other died, suggesting the liver disease was hepatocellular carcinoma, though we have no confirmation of that disease.

### TB adenitis (8 cases seen)

IMM was a 28-year-old female who presented with high fever for two days and splenomegaly (3 cm below the LCM). On further examination, she had large, bilateral inguinal fluctuant lymph nodes extending above the inguinal ligament. The nodes on the right had been incised two months earlier and the incision had partially dehisced and had not closed completely. After treatment for malaria, she returned for aspiration of the nodes. Gen-X PCR for *Mycobacterium tuberculosis* was positive. The patient responded to RHZE with almost complete resolution of the lymphadenopathy.

**Comment:** TB adenitis typically shows large, confluent rubbery nodes. It is the second most frequent presentation but is more common in the cervical area. Staphylococcal adenitis is typically limited to one area and usually shows induration of the overlying skin. Incision of TB adenitis often results in poorly healing wounds, so patients with chronic adenopathy and fluctuance, particularly if present in more than one area, should be aspirated and examined for TB rather than going directly to incision and drainage.

### TB pericarditis (11 cases seen)

KJT was a 12-year-old female presenting with substernal pleuritic chest pain. Her weight was 21 kg. She had no cardiac murmur, but the cardiac apex beat (PMI—point of maximal impulse) was 5 cm lateral to the mid-clavicular line. Her ASO (anti-streptolysin antibodies) was <200, making Rheumatic carditis unlikely. Her liver was 8 cm below the right costal margin. Ultrasound showed a pericardial effusion and normal mitral valve. The left atrium (LA) measured 6.2 x 5.7 cm. The dilation of the LA is because of restricted filling of the L ventricle secondary to the pericardial effusion. After two months of treatment with RHZE (to treat the TB pericarditis), enalapril, and frusemide (to unload the heart) she had no chest pain or shortness of breath. Her weight was 24 kg. Her PMI was at the mid-clavicular line (normal). Her liver was 3 cm below the right costal margin. On ultrasound, there was minimal fluid within the pericardium, and the left atrium measured 5.8 x 4.5 cm, a 26% reduction in volume, but still minimally dilated.

**Comment:** TB is the most common cause of pericarditis worldwide, particularly in Africa.<sup>[4]</sup> Typically, it presents with substantial liver congestion, though unexplained ascites may also be a sign. Often there is chest pain that worsens with lying down. Steroids help the pain, though they have not been shown to improve survival. Occasionally, there are calcium deposits in the pericardium secondary to long-standing pericarditis that can result in constrictive of the pericardium and cardiac dysfunction.

## DISCUSSION

Pulmonary and EP TB are examples of the medical challenges in South Sudan. Sophisticated diagnostic techniques for TB are available in much of the first world, where TB is becoming increasingly less common. Where TB is common, the diagnostic technology is lacking. This report describes diagnostic techniques that are usually available in a regional hospital in South Sudan, though the most important diagnostic tools are available to all—a good history and physical exam. TB tends to be indolent in presentation—slow onset, with sub-acute or chronic symptoms rather than abrupt. This helps differentiate from *Pneumococcus*, the most common “bacterial” pneumonia. (Note: *Mycobacterium* TB is a bacterium,

but acts differently). Pneumococcus tends to be abrupt, with high fevers, prostration, often with more abdominal symptoms. Pneumococcus is almost always localized (in one area of the lungs), whereas TB can be localized or have findings in multiple areas of the lungs. We have had several patients with both acute and chronic symptoms and suspect that the Pneumococcus was a superinfection of the underlying TB. This paper is not designed to be a complete review of TB, but we strongly recommend that in patients with chronic symptoms, no matter where the problem, TB needs to be suspected. The foundation of any investigation begins with a good history and physical examination.

TB is more common in the lungs, but it is often encountered in other areas of the body. In our experience, approximately 25% of the patients had EP TB. A high index of suspicion is necessary to diagnose and treat these patients.

The association of TB and HIV is well known. In total, 43% of our TB patients had simultaneous infection with HIV; 33% of the EP TB patients had HIV; 64% of the children with TB were HIV positive. As the incidence of HIV increases, it is expected that the incidence of TB, in the lungs and elsewhere, will increase.

We suspect that the high incidence of EP TB may be related to the consumption of contaminated milk. The Dinkas (the primary indigenous population of the Lakes State) are pastoralists and commonly consume unpasteurized milk. There has been no consistent programme to eradicate TB in the bovine population of South Sudan. We think a dedicated effort to screen cows for TB and slaughter those that are positive, with some compensation to the owners, would be a worthwhile endeavour.

Gen-X PCR technology is increasingly available in South Sudan. It has substantially increased the number of "smear positive patients," as well as aiding in the diagnosis of patients with EP TB. It is the same technology used to test for HIV patients and Covid-19.

## CONCLUSION

Pulmonary and EP TB remain common diagnoses in this regional/county hospital in South Sudan; we strongly suspect that is true in the entire country. We encourage those clinicians dedicating themselves to improving the health of the people of South Sudan to keep a high index of suspicion for patients presenting with unusual features, particularly if the patient has chronic symptoms or HIV. Good clinical evaluation plus ultrasound and widely available laboratory studies can lead to the diagnosis of TB, resulting in a good clinical outcome rather than an ill, consumptive patient who continues to spread the disease prior to an untimely death.

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**Conflicts of interest:** none

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21 January 2022

## Severe Wasting in South Sudan

At least 1.5 million children are not receiving life-saving treatment for severe wasting in Eastern and Southern Africa, warned the United Nations Children's Fund (UNICEF) on Friday.

In South Sudan, an estimated 1.4 million children under five, are acutely malnourished, including over 310,000 children suffering from severe wasting.

Last year, UNICEF and partners treated more than 240,000 children, but the situation remains urgent, as floods have killed cattle, washed away food and fields, and blocked humanitarian access.

[https://news.un.org/en/story/2022/01/1110282?utm\\_source=UN+News+-+Newsletter&utm\\_campaign=c8c931541d-EMAIL\\_CAMPAIGN\\_2022\\_01\\_22\\_01\\_20&utm\\_medium=email&utm\\_term=0\\_fdbf1af606-c8c931541d-107573841](https://news.un.org/en/story/2022/01/1110282?utm_source=UN+News+-+Newsletter&utm_campaign=c8c931541d-EMAIL_CAMPAIGN_2022_01_22_01_20&utm_medium=email&utm_term=0_fdbf1af606-c8c931541d-107573841)

# Sanitation resources for disabled individuals in Uganda

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## ABSTRACT

The material presented in this paper was derived from research on sources of current literature that address global sanitation problems, especially in Uganda. Information gathered from interviews with Ugandans provided a vital component. The paper presents background information on the sanitation issues faced by Ugandan children in general and by individuals with physical disabilities in particular. It reviews the global progress being made to achieve international goals of sanitation and hygiene and compares them to the situation in Uganda. In particular, the paper sheds light on how, in the past two decades, Uganda has made meaningful strides with regard to equal rights and societal inclusion for individuals with disabilities, including access to improved sanitation facilities as well as regulations to ensure the cleanliness and hygiene of public facilities. However, these achievements do not include assistive technologies that can enable the physically disabled to use the many sanitation resources such as pit latrines in rural areas. Finally, the paper describes research that focuses on a marginalized group of disabled Ugandans who are excluded from the solution landscape.

**Keywords:** sanitation, latrine, disabled, technology, Uganda

## INTRODUCTION

There are programmes and policies in Uganda aimed at improving sanitation and hygiene.<sup>[1]</sup> The National Water Policy involves the construction of pit latrines in rural areas to offer an alternative to open defecation.<sup>[1]</sup> The Ugandan government and international NGOs recognize the need for vulnerable groups to have access to improved sanitation. However, typical, traditional pit latrines in Uganda do not improve the sanitation of individuals who experience physical limitations.<sup>[2]</sup> Likewise, since the sanitation solution architecture develops through regulatory changes as well as NGO intervention, programmes that address specifically the needs of the physically disabled are lacking. Moreover, sanitation solutions that only work for a part of the population further alienate marginalized groups, especially the physically disabled.<sup>[3]</sup>

Several of the federal and local government organizations that are responsible for providing sanitation services in Uganda do not have enough resources to operate efficiently, making it impossible to improve sanitation. Consequently, each year Uganda loses 389 billion Uganda Shillings, which is equivalent to approximately US \$177 million, due to lack of adequate sanitation.<sup>[4,5]</sup> On a microeconomic scale, people spend one-third of their professional time combating sanitation-related illnesses instead of working.<sup>[6]</sup>

It is estimated that over 4,500 children die from diarrhoea in Uganda each year.<sup>[7]</sup> Diarrhoeal related illnesses are the leading cause of children being unable to complete primary school.<sup>[8]</sup> This is mostly due to open defecation and poor sanitation, which expose people to debilitating diseases (e.g. roundworm, whipworm, guinea worm, and schistosomiasis).<sup>[9]</sup> Unfortunately, there is limited access to health or medical facilities for treatment, resulting in the death of 23,000 Ugandans per year due to diarrhoea.<sup>[4]</sup>



To date, there are no assistive devices that can be implemented easily and locally to enable disabled individuals to use available pit latrines independently. Human waste solutions that are available to people with disabilities in more advanced, technologically developed countries are too expensive to implement widely throughout Uganda and would hardly integrate with the country's current infrastructure. In areas of Uganda with limited economic resources, some disabled people have tried to remedy pit latrine usage by methods that are neither sanitary nor regularly maintained. These include chairs with holes and buckets to collect waste for disposal. This presents a technology shortcoming that is addressed in this paper.

## SANITATION IMPROVEMENT: EFFORTS AND RESULTS

The information in this section is derived from the relevant literature we studied in the research to gauge the extent to which efforts to improve sanitation in Uganda were achieved. Some of the methods used to improve sanitation are in concert with global recommendations from professional sources such as the United Nations (UN). However, the levels of success to achieve acceptable results are variable.

### Sanitation via Bellagio Principles<sup>[10]</sup>

In recent years, the issue of sanitation and hygiene across the globe has received more attention due to studies on how crucial sanitation is to the alleviation of health and poverty overall.<sup>[6]</sup> Consequently, more resources were directed towards global sanitation when the UN declared the year 2008 as the International Year of Sanitation. Subsequently, WaterAid published findings which concluded that poor sanitation is the leading cause of child mortality.<sup>[11]</sup> This generated much attention in sub-Saharan Africa, which includes Uganda. In addition to constructing pit latrines, many organizations in Uganda responded to the challenge by adopting the Bellagio Principles,<sup>[3]</sup> the strategies of which include: delivering and instilling the value and knowledge associated with sanitation infrastructure improvements, collectively called "sanitation software", a more decentralized delivery of services, and the need for a sector-wide approach. One such organization is the Uganda Village Project, located in Iganga, Uganda, which takes an economic approach when introducing sanitation software to the communities in which they work to implement sanitation solutions.<sup>[3]</sup> This achievement is a commendable result.

To that end, improvements within the sanitation sector are primarily focused on hygiene and behavioural changes to eliminate the pattern of poor sanitation. The research literature has information which indicates that previous implementations of sanitation and hygiene programmes

prove that community-based approaches for addressing sanitation are the most beneficial.<sup>[3,11,12]</sup>

### Construction of pit latrine facilities

The Uganda Water and Sanitation NGO Network (UWASNET) states in a report that, "[Initiatives in the promotion of sanitation and hygiene] include...addressing sanitation and hygiene among vulnerable groups, at public places and at institutions".<sup>[12]</sup> It is indicated in the same report that the construction and implementation activities involve building of traditional pit latrines. Moreover, the construction of pit latrines improves sanitation for those with the ability to use them.

In response, Uganda has successfully constructed pit latrine structures that enable individuals to relieve themselves in private, thus mitigating the problem of open defecation. However, while the Ugandan government and international NGOs recognize the need for vulnerable groups of people to have access to improved sanitation, the solutions introduced do not facilitate disabled individuals to take advantage of the improved sanitation. Overall, this is not a good result.

## DISCUSSION

Although the typical, traditional pit latrines constructed in Uganda are very useful to able-bodied individuals, they do not improve the sanitation of people with physical limitations. This disadvantage is highlighted among a group of marginalized, disabled individuals in Lira, Uganda.

### Shortcomings

Individuals who do not have full use of their lower extremities cannot use pit latrines. During interviews we conducted at the Lira District Union for Disabled Individuals, members of the organization revealed that people with disabilities often had family members hold them up while they relieved themselves, causing a great deal of embarrassment.<sup>[3,13]</sup> The pit latrines have adjacent hand-washing stations to promote clean hygiene practices. However, if disabled individuals cannot use the pit latrines, they are less likely to use the hand-washing stations.

This is a shortcoming example of how people with disabilities may be subjected to a perpetual cycle of poverty and poor health due to lack of sanitation improvements.

### Inhibiting factors

In Uganda, legislative acts, such as the Persons with Disabilities Act of 2006, call for total equality for those with disabilities in the realms of employment, education, and other opportunities, as well as increased representation of the disabled community in public and political forums. However, negative social stigmas regarding people

with disabilities persist and impede their inclusion in infrastructure solution development.

Institutionally, the Ministry of Gender, Labour and Social Development allocated 0.5% of their budget for the 2016/2017 fiscal year towards programmes helping the elderly and the disabled, while one in five Ugandans has some form of disability.<sup>[14]</sup>

According to the Basic Requirements and Minimum Standards set out by the Ugandan government, schools are required to address the needs of children with disabilities in facility designs.<sup>[15]</sup> Furthermore, The Public Health Act of Uganda calls for every building to have a latrine, and the Ugandan Constitution requires the government to ensure that every Ugandan has access to basic sanitation.<sup>[16]</sup> However, the responsibilities of the government exceed the resources available.

### CONCLUSION

Clearly, a new approach aimed at developing meaningful solutions to solve sanitation problems is required. Rather than attempting to solve sanitation issues by focusing on policy, a community-led approach should be taken.<sup>[8]</sup> Sustainable and lasting changes stem from promoting user ownership of technology and services as part of the sanitation software solution so that beneficiaries may take it upon themselves to improve sanitation and learn how to create the technology on their own or within their community.<sup>[8]</sup>

Community-Led Total Sanitation is recognized as the best approach for combating poor sanitation in rural communities because it empowers local people to own and invest in the correct technologies and maintain them for self-sustaining interests.<sup>[17,18]</sup> Additionally, further technological improvements and the promotion of research and development of affordable sanitation technologies is key to achieving improved sanitation.<sup>[1]</sup> Combining low-cost technology with education and marketing efforts to secure community participation will vastly improve sanitation in Uganda. Ensuring that marginalized groups of individuals are also included in the problem definition and solution landscape is essential for country-wide development. To that end, we are publishing another paper in this issue, "Hey et al. Portable pit latrine seats to increase sanitation for disabled individuals in Lira, Uganda. *South Sudan Medical Journal* 2022; 15(1)16-19."<sup>[19]</sup>

**Conflicts of interest:** The authors declare no conflicts of interest.

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KUAJOK - 8 OCT 2021 RADIO TAMAZUJ

## Snakebite cases on the rise as antivenom runs out in Warrap

Health authorities in different parts of Warrap State say an upsurge in snakebite cases has been recorded amid a shortage of antivenom medicines.

Warrap State health minister Abak Yel Madoot told Radio Tamazuj that about 150 cases have been recorded with two fatalities since June.

"I have stayed for long in Juba to engage other partners to help the gap which is not covered by the national ministry of health like antivenom injections. So, I came on Wednesday and I got that drugs are finished and the cases of snake bites are very high now. We have a child amputated in the leg in the hospital because of a snakebite which was delayed in the village," she said.

Although there are no antivenoms, the minister urges the communities to rush all snakebite patients to the nearby health facility.

"In Warrap, we have 148 cases of snakebites starting from June to October and other counties like Gogrial West didn't send some cases and we have two death cases in Tonj North. I realized this alarm when I visited Twic County last June. The health condition was bad that's why I went to Juba and talked to Health Pooled Fund- HPF Country Director and he donated some drugs for snakebites which have finished recently," Minister Yel said.

Dech Akot, Tonj North County health director said his county recorded 35 cases of snakebites with the latest case recorded on Wednesday this week.

"Cases of snakebites are very many, the floods have destroyed many health facilities like Faraqika, Pagakdit, and Abiembol. Abiembol health facility was facilitated by Islamic Relief it was equipped with the cold chain. Unfortunately, it collapsed at night and a lot of equipment was destroyed including solar panels," Akot said. "The cases of snakebites are 35 in which 2 people have died in Majak village, Abiembol Boma of Akop payam. We are really in need of antivenoms and the ministry of health is trying hard to find some." See <https://radiotamazuj.org/en/news/article/snakebite-cases-on-the-rise-as-antivenom-runs-out-in-warrap>

In November 2020 SSMJ published an article by MSF which gives a Snakebite Protocol algorithm for South Sudan based on WHO guidelines - see [http://www.southsudanmedicaljournal.com/assets/files/Journals/vol\\_13\\_iss\\_4\\_nov\\_20/Snakebite-Agok-Final.pdf](http://www.southsudanmedicaljournal.com/assets/files/Journals/vol_13_iss_4_nov_20/Snakebite-Agok-Final.pdf) Figure 4.

# Portable pit latrine seats to increase sanitation for disabled individuals in Lira, Uganda

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## ABSTRACT

This paper presents a viable solution that evolved over several years of research to mitigate the sanitation problems faced by individuals in rural areas of Uganda, particularly those with disabilities, addressed in our first paper (Schmachtenberger et al.). The solution is based on interviews and contacts with affected individuals in Lira, Northern Uganda, where the most commonly used sanitation facility is a pit latrine. To that end three types of design considerations and requirements for effective pit latrine assistive devices were adopted in the development of the technology discussed in this paper. Ultimately, three different designs were fabricated after synthesizing the requirements, preliminary user feedback, and engineering knowledge of mechanical design. The deliverables from these designs are three different assistive devices whose common feature is a portable seat that can be used safely in a pit latrine. The good results from several field tests engendered the development of more locally reproducible and cost-effective, assistive seat devices over a period of 3-5 years. Results from data collected over the years will be published in another manuscript, subsequently.

**Keywords:** sanitation, latrine, Uganda, disabled, technology

## INTRODUCTION

In 2014 a landmine victim from Lira, Northern Uganda, spent several months as a visiting scholar at the Institute of Peace and Justice (IPJ), University of San Diego (USD). She had struggled for years to find viable, safe sanitary assistive devices for her own personal use and for other disabled Ugandans whom she visited regularly in rural areas of Lira. She shared and discussed her problems in a conversation with USD members which led to the involvement of USD engineering students and professors to embark on solving her daunting problem.<sup>[1]</sup> Consequently, three different teams of students and professors made trips during the academic years 2016/2017, 2017/2018 and 2018/2019 to carry out interviews and field studies, and to collect data and pertinent, local information on the requirements and designs that were acceptable to the disabled individuals. The authors of this article all participated in the three field trips to Uganda.

The trips revealed many sanitation shortcomings. For an example, the main type of facility being implemented to improve sanitation in Lira and other rural parts of Uganda is a pit latrine. Moreover, there is no widely implemented device, facility, or other solution to enable those with disabilities to use the available pit latrines independently.<sup>[2,3]</sup> To solve this problem, we applied research to design three different variations and iterations of a pit latrine assistive device. User feedback was documented during each in-field research trip and then reviewed while designing the next set of prototypes. This resulted in three assistive devices, discussed below.

## METHODS USED IN THE DESIGN OF PIT LATRINE ASSISTIVE DEVICES

The methods used to collect data on design requirements for the assistive devices

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comprised recorded interviews, including conversations with disabled individuals. The interviews were conducted by our Ugandan partner, translating our questions to the local language, Luo, and keeping detailed notes. Thus, a local person conducting the interviews ensured genuine responses. Approximately 20 interviews were conducted at the Lira District Union for Disabled Individuals and through members of the Uganda Landmine Survivors' association. Photos documenting the users of the device and the pit latrines that we studied are also stored and referenced. Besides, we had fabrication manuals of the specific device designs that were presented to the beneficiaries, including notes of the local tools and materials. Subsequent papers will discuss user feedback on each device presented in this paper after a minimum of 30 days with the device.

### Requirements

One main design constraint is that the device must be portable. Since no one owns the latrines, it is often unclear whose responsibility it is to maintain the cleanliness of the pit latrines. The portability of the device encourages ownership and maintenance on the device itself. The portability of a personalized device is also important to avoid the negative social stigmas of sharing a toilet seat with others.

The social acceptability of the devices is a key design characteristic. If the device is not socially acceptable, then it will not be implemented by its users and the problem will persist. To satisfy this design requirement, it is pertinent that the development of the device involves the users directly to determine what is going to be socially accepted.

The solution needs to be accessible by deprived groups, so it must satisfy the requirement of being low-cost. For the purposes of designing early prototype devices, based on the average household earning in Uganda, the simplest version of a pit latrine assistive device should cost no more than \$12 USD.<sup>[4]</sup> Studies have shown that pricing aid technology and constructive services, even among low-income groups, shows a positive response in adoption because it associates value with the good or service.<sup>[5]</sup>

Also, to increase acceptability, sense of ownership, and accessibility, the design must be manufactured from locally available tools and materials. During our in-field research trips, data were gathered about what materials could be found in Kampala and what materials could be found in Lira. All three designs used readily available materials, consistent with the data from these studies.

### Engineering methodology

Stress analysis on a theoretical level was conducted for each design using basic principles of material mechanics

and mechanical design engineering. A distributed load approximation on the seat of each device was utilized to estimate the stress on the material and the margins of safety in the designs. Stresses and bending moments were calculated to ensure that the right materials and material thicknesses were used in the design, and longevity of the material based on these loads was also calculated. Lessons learned from previous prototyping and material selection also helped in the engineering design process.

### RESULTS

Figure 1 shows a simple, portable tripod toilet stool that can be made with hand tools for approximately \$8 USD. The design utilizes 0.75-inch-thick plywood seat and legs fabricated from two-by-fours (2-inch x 4-inch) lumber. Both materials are readily available in Lira. Devices are painted with a latex paint that fills porous woods and enables the device to be easily cleaned.

Figure 2 is a foldable latrine assistive device that costs approximately \$13 USD to fabricate in Uganda. The hand rails provide support while the user is getting onto the seat, and there are several contact points with the ground to make the device feel more stable. The design of this device requires use of plywood that is 9 cm thick and a total of 12 hinges, and it also uses a wood paint that ensures ease of maintenance. All of the material can be found in a local carpentry shop in any rural parts of Uganda.



Figure 1. Tripod Stool (Credit to: L. Utrecht and M. Hey)

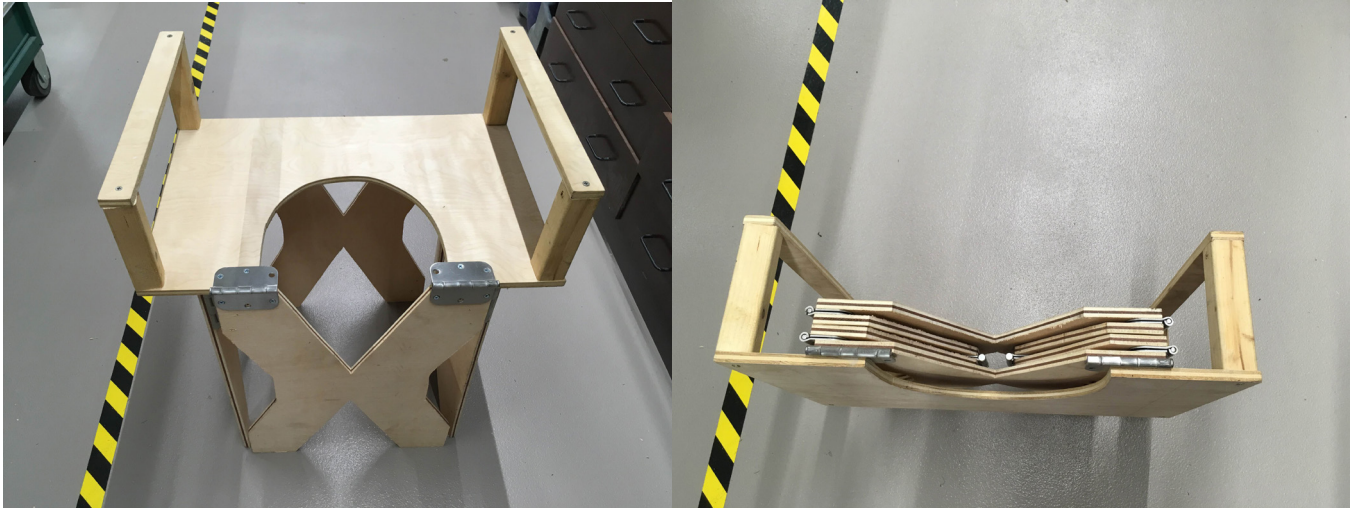


Figure 2. Portable Assistive Device (Credit: C. Avery and M. Hey)

Figure 3 shows a pit latrine assistive device that also serves as a dual-purpose mobility device. This is the design created by the 2017-2018 USD research team to meet all requirements and needs outlined by users. The device can be constructed for less than \$30 USD in Uganda, which is far cheaper than anything currently available. One disabled lady who has a business found this device ideal for carrying fabric and ornaments to sell, draped on the frame of the seat. She was able to test it successfully, walking without use of her prosthesis.

Figure 4 depicts three USD students instructing two disabled local students on how to construct a seat, with a fourth local student sitting on a newly constructed seat to test its robustness.

Figure 5 depicts USD team of students and a professor with four Ave Maria students and our Uganda contact.

## DISCUSSION

The design of each device was based on feedback from users and manufacturers on previous research trips. The preference on which device would best serve a user depended on the user's particular disability. Each device was designed to serve a portion of the disabled population and has features that cater to this portion. For example, the Tripod design was most favoured by individuals who used crutches, because they are able to hang the device off of their crutch and easily carry it to the latrine. Many of the individuals who used crutches had the strength and mobility to be able to squat low and then fold the device back up to carry home. The manufacturability of the tripod is easy, according to local carpenters.

The box seat in figure 2 was mainly designed for low-strength individuals who need the support of hand rails to lift themselves. This device received positive feedback unanimously from all users during in-field testing, and



Figure 3. Mobile PVC Walker (Credit: K. Forsythe, M. Kliegel, D. Giles and T. Bongiovanni)

many users expressed that it felt the most stable. Also, the shape of the device hides its intended use, so the social acceptability of this device was highest as well. Several of these devices have been constructed in Uganda by carpenters and carpentry students, who all confirm that the design is easy to manufacture.

During the device introduction trip, Ugandans expressed the problem of mobility assistive devices costing around \$300 USD, an amount that is unattainable for most Ugandan citizens. Surprisingly, they also revealed that it is cheaper to hire another person to carry the disabled individual from place to place, rather than purchase an assistive device. For those who also need mobility

assistance to the pit latrines, the walker in Figure 3 was the most preferred device, as it serves a dual purpose for the user to be able to get to the latrine in the first place. This device is the most complicated and expensive to manufacture.

**CONCLUSION**

It was clear from the feedback on the assistive devices that the foldable box (Figure 2) is the most widely accepted design, as it balances cost, portability, and manufacturability. Further, the foldable box was the most popular amongst children, and unanimously deemed the most appropriate for solving sanitation issues related to child illness.<sup>[6]</sup> On the other hand, the PVC Walker device (Figure 3) was the preferred design of the people who tested the devices, as it also serves as a mobility device. Although the PVC Walker is more time consuming and expensive to produce, manufacturers still believe that they would be able to make a profit on these devices. Both the foldable box and PVC Walker designs were regarded as easily manufacturable by Ugandans due to the simplicity of their component materials, a characteristic which eliminated other designs.

All designs incorporated a paint sealant that the manufacturers recommended in order to maintain cleanliness and enable the seats to repel liquid. The ease of maintaining the devices and their perceived cleanliness will be further evaluated once the devices are distributed to users and surveys are collected after a 30-day period of use. These results will be discussed further in a subsequent paper.

As far as future work is concerned, further technological improvements and the promotion of research and development of affordable sanitation technologies is key in achieving improved sanitation.<sup>[7]</sup> Therefore, our future work will include multiple distribution cycles of the fabricated pit latrine assistive devices presented in this paper. Surveys will be collected to gather data on the usability of the devices, along with feedback on any improvements that can be made. Future work also includes data collection on how current sanitation solutions affect the general population, compared with disabled individuals in particular.

**Conflicts of Interest:** None

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Figure 4. USD Students team and students with disabilities from Ave Maria Fabricating Devices



Figure 5. USD team with students with disabilities from Ave Maria and Margaret Orech

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# Double uterus in young women delivered by Caesarean Section: five cases from South Sudan and Ethiopia

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## ABSTRACT

Double uterus (uterus didelphys) is the second least common congenital anomaly of the female genital tract resulting from failure of fusion of the two Müllerian ducts during embryological development, leading to duplication of the uterus and the cervix. The condition may be associated with abnormalities of the Wolffian duct such as ipsilateral renal agenesis. Presence of a double uterus increases obstetric complications. We report five cases of young women with uterus didelphys who were delivered by Caesarean Section for obstetric indications.

**Key words:** uterus didelphys, double uterus, accessory breast, vaginal septum, case studies, South Sudan, Ethiopia

## INTRODUCTION

Double or didelphys uterus is a congenital anomaly of the female genital tract, arising from failure of fusion of the two Müllerian ducts during embryological development, leading to duplication of the reproductive organs. Although duplication may involve the uterus, cervix, vulva, bladder, urethra, vagina, and anus, it is generally confined to the uterus (uterus didelphys) and cervix (bicollis).<sup>[1]</sup>

Review of the prevalence of different types of uterine malformations revealed that uterus didelphys was the second least common (8.3%) of all Müllerian duct anomalies after complete agenesis (3%). Septate uterus was found to be the most common (35%).<sup>[2,3]</sup>

Because the Müllerian ducts develop often in association with Wolffian ducts, abnormalities of the kidneys may be found in conjunction with uterine abnormalities.<sup>[4,5]</sup> Ipsilateral renal agenesis where one kidney does not develop is associated with 15 to 20% of cases of double uterus. These anomalies are found on the right in 65% of patients.<sup>[1,6,7]</sup> Longitudinal vaginal septum and a blind hemivagina are found in up to 15 - 30% of patients with double uterus.<sup>[6]</sup>

Most women with uterus didelphys are asymptomatic.<sup>[8]</sup> However, in the presence of varying degrees of longitudinal vaginal septum, some patients may present with dyspareunia or dysmenorrhoea. A thick septum may hinder sexual intercourse or vaginal delivery.<sup>[9]</sup> Genital neoplasms, haematocolpos and haematometocolpos where menstrual blood collects behind an obstruction are rarely reported in association with uterus didelphys.<sup>[9]</sup> Despite some of these complications, there are many cases of women with a uterus didelphys who do not exhibit any reproductive or pregnancy related challenges.

## CASE DESCRIPTIONS

### Case 1.

A 24-year-old primigravida lady (Ethiopian national) whose gestational age (GA) was 34 weeks and 3 days from reliable dates supported by early second trimester



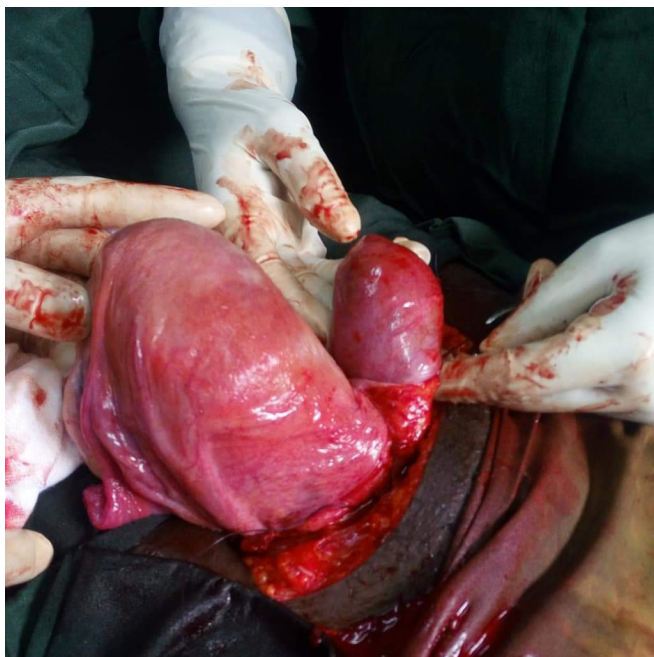


Figure 1. Case 1. Double uterus – anterior view

ultrasound. She had one antenatal clinic (ANC) visit at a nearby health centre where ultrasound scan was done. She was referred on February 8th 2019 to Ras Desta Damtew Memorial Hospital, Addis Ababa, Ethiopia following presentation to the health centre with “pushing down” pain and vaginal bleeding for two hours.

On arrival she was still bleeding. Her general condition was stable. BP 100/70 mm Hg, PR 112 bpm, RR 18 breath/minute. Fundal height was 32 weeks, longitudinal lie, cephalic presentation. She had two to three moderate contractions every 10 minutes. Pelvic examination was deferred. Ultrasound examination showed a single intrauterine pregnancy, cephalic presentation, placenta anterior covering the internal cervical os, average GA of 35 weeks and estimated fetal weight (EFW) of 2.6 kg and single deepest pocket (SDP) of 2.4 cm. Blood group was O+ve, haematocrit 34 %.

She was admitted as a case of placenta praevia with ongoing bleeding in labour. Caesarean Section was successfully done under aseptic conditions and general anaesthesia. A male child was delivered weighing 2.5 kg with Apgar scores of 7 and 9 in the 1st and 5th minutes respectively. No gross congenital anomaly was identified. There were two separate mirror image uteri each with a single ovary and Fallopian tube laterally and separate cervix opening into the vagina. The right uterus was the gravid one. Both kidneys were palpated in their normal positions. No other congenital anomaly was encountered. Postoperative course went smoothly with haematocrit 32%. She was discharged on the 3rd day (Figure1).



Figure 2. Case 2. Double uterus – anterior view

## Case 2

A 16-year-old primigravida lady (South Sudanese) whose GA was unknown but she claimed to have had eight months amenorrhoea. She had had no Anti-natal Care(ANC) contact but was referred on May 1st 2021 to Maban County Hospital , South Sudan from a Primary Health Care Centre (PHCC) following presentation with leakage of liquor for two days.

On arrival, her condition was stable. Vital signs were normal. Fundal height was 30 weeks, longitudinal lie, cephalic presentation. Positive fetal heart rate. No uterine contractions. Sterile speculum examination revealed a thick longitudinal vaginal septum. The cervix could not be visualized but there was continuous leakage of clear fluid. Ultrasound showed a single intrauterine pregnancy, cephalic presentation, fundal placenta, estimated GA of 32 weeks, EFW of 1.9 kg and amniotic fluid index (AFI) of 3.1 cm. She was admitted as a case of preterm pre-labour rupture of membranes (PPROM) and started on ampicillin, azithromycin and dexamethasone.

Four days later, she went into labour and Caesarean Section under general anaesthesia was undertaken because of the thick longitudinal vaginal septum. A male neonate weighing 2.1 kg was delivered with Apgar scores of 8 and 9 in the 1st and 5th minutes. Intra-operative findings were two separate, mirror image uteri each with a single ovary and Fallopian tube laterally and separate cervix opening into the vagina. The presence of two cervixes was confirmed through the uterine incision. Pregnancy was

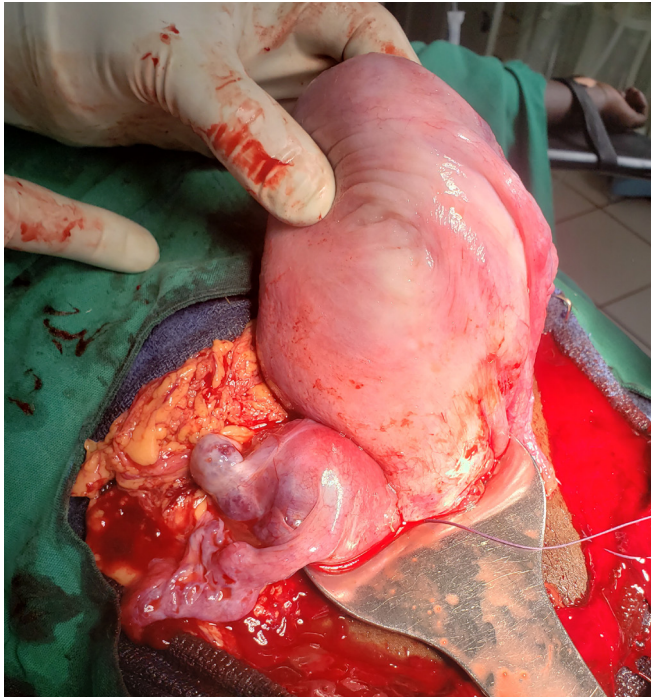


Figure 3. Case 3 – Double uteri – anterior view

in the right uterus. Both kidneys were palpated in their normal positions. No other congenital anomaly identified. She had a smooth postoperative course and discharged on the 3rd postoperative day with haemoglobin of 10.3 g/dl. (Figure 2).

**Case 3**

A 21-year-old primigravida (Sudanese refugee) whose last menstrual period (LMP) was unknown, but she reported amenorrhoea for nine months. She was referred to Maban County Hospital from a PHCC on August 9th 2021 with a diagnosis of breech presentation in labour.

Findings on arrival were a term size uterus, longitudinal lie, breech presentation. Fetal heart rate was 132 - 154 bpm. She had three strong contractions every 10 minutes. Cervix was 80% effaced, 3 cm dilated. Pelvis was clinically adequate. Ultrasound findings were a longitudinal lie of a single fetus in breech presentation. Placenta was fundal, no anomaly seen. EFW of 2.9 kg and GA of 36 weeks. Primary Caesarean Section was done under spinal anaesthesia because of prolonged latent first stage of labour plus breech presentation. A male neonate weighing 2.7 kg was delivered with 8 and 9 Apgar score in the 1st and 5th minute respectively.

Intraoperative findings were two separate uteri each with normal single ovary and Fallopian tube laterally and separate cervix. The left sided uterus was the one carrying pregnancy. Both kidneys were palpated in their normal positions. No other congenital anomaly observed. With smooth postoperative course, she was discharged on 4th postoperative day (Figure 3).

**Case 4**

A 28-year-old G6P5 mother (refugee from Sudan) whose LMP was unknown, but claimed to be nine months amenorrhoeic. Referred to Maban County Hospital from a PHCC on September 9th 2021 with diagnosis of breech presentation in labour. She stated to have had five vaginal deliveries of which two were breech presentation.

Findings on arrival were, term size fundal height, longitudinal lie and breech presentation. She had three contractions every 10 minutes. Fetal heart rate was 134 to 148 bpm. Cervix was fully effaced, and 5 cm dilated. Presentation was footling breech with intact membranes. There was another left lateral short cervix which was closed; no vaginal septum was encountered. There was right axillary accessory breast tissue (Figure 4a).

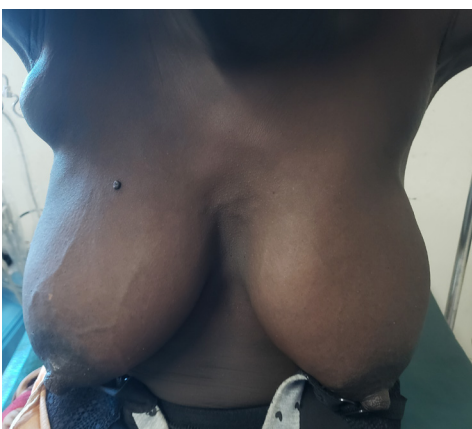


Figure 4a. Accessory breast.

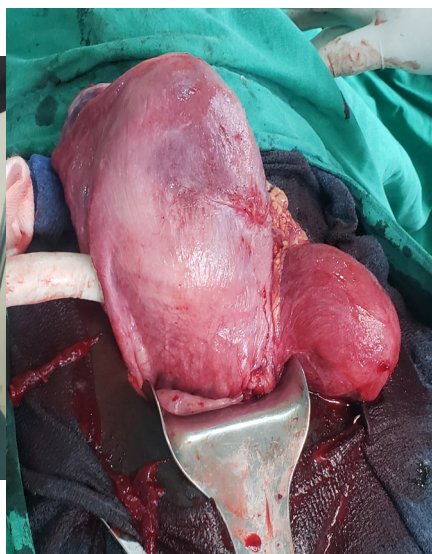


Figure 4b. Anterior view of two uteri.

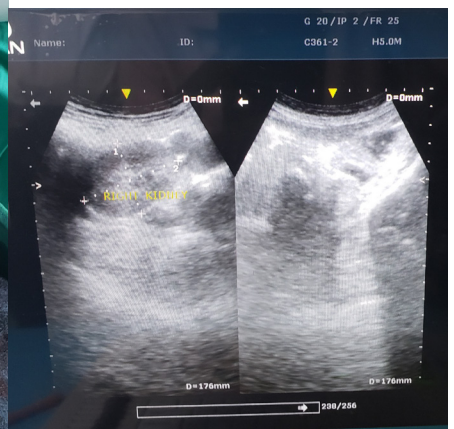


Figure 4c. Absent left kidney on U/S



Figure 5. Case 5. Double uterus – anterior view.

Ultrasound showed a single fetus, breech presentation with fundal placenta. No anomaly seen. Gestational age (GA) was 38 weeks and EFW of 3.8 kg. Primary Caesarean Section was undertaken because of the footling breech presentation.

A female neonate weighing 3.7 kg was delivered with Apgar scores of 8 and 9 in the 1st and 5th minute. Intraoperative findings were two separate mirror images uteri (Figure 4b) each with healthy single ovary and Fallopian tube laterally and a separate cervix. The right uterus was the gravid one. Right kidney was palpable in its normal position. The left kidney was absent on palpation (this was confirmed by ultrasound postoperatively- see Figure 4c). No other congenital anomaly was encountered. Postoperative course was uneventful and so was discharged on the 3rd day.

### Case 5

A 25-year-old G2P1 mother (Ethiopian national) whose GA was 38 weeks + 6 days from reliable LMP. She was referred on the 16th of May 2017 from a nearby health facility to Mekelle Hospital, Northern Ethiopia with the diagnosis of transverse lie at term. She had a history of preterm vaginal breech delivery. She was first seen at the regular Out-patient Department on arrival.

Physical examination revealed normal vital signs. Abdomen was 34 weeks size fundal height, transverse lie and FHR 126 to 152 bpm. No uterine contractions. Pelvic examination was deferred. Ultrasound showed a single intrauterine pregnancy at 37 weeks + 3 days, transverse lie (back down) and EFW of 3 kg. The placenta was 1.3

cm away from the internal cervical os. No fetal anomaly detected.

With the diagnosis of low-lying placenta and transverse lie at term, she was admitted to the Maternity suite for elective Caesarean Section. A day later, after informed written consent, Caesarean Section was done under aseptic technique and spinal anaesthesia, through Pfannenstiel and lower uterine segment transverse incisions. A male neonate weighing 2.8 kg was delivered with Apgar scores of 8 & 9 in the 1st and 5th minutes. Intraoperative findings were two uteri with pregnancy in the left uterus. Both kidneys were palpated and found to be in their normal positions with no malformations. After abdominal closure, vaginal examination was done and she was found to have two cervixes. Postoperative course was smooth and she was counselled on the diagnosis, possible abnormal lies or presentation in her subsequent pregnancies and discharged on day three (Figure: 5).

### DISCUSSION

Didelphic or double uterus as one of the rare congenital anomalies of the female genital tract<sup>[2,3]</sup> is associated with some Wolffian duct malformations<sup>[4,5]</sup> and therefore should be suspected and investigated in young patients who present with primary amenorrhoea secondary to menstrual outflow obstruction or in a patient diagnosed with vaginal septum, unilateral renal agenesis or in a patient for which two cervixes visualized on speculum examination. Investigations include pelvic ultrasonography, hysteroscopy and MRI.<sup>[10]</sup>

Although infertility and poor pregnancy outcomes have been reported in association with double uterus,<sup>[5,9,11,12]</sup> many cases have been reported to have successful pregnancy outcomes with no history of fertility impairment.<sup>[4,8]</sup> A long term retrospective follow-up of 49 women with uterus didelphys found no impairment with fertility and decreased rate of spontaneous abortion; however the rate of prematurity was increased in comparison to other studies on septate and bicornuate uteri.<sup>[4]</sup> All of our five cases in this series denied any fertility concern, although each had obstetric complications, but with favourable outcomes.

Cases of simultaneous twin pregnancies with each fetus in separate uterine horns have been reported.<sup>[13,14]</sup> Except for patients who have history of infertility, cyclic pelvic pain or obstetric complications such as recurrent pregnancy loss and preterm deliveries, surgical corrections (metroplasty) are not indicated in patients diagnosed with uterine didelphys.<sup>[15,16]</sup>

Unless indicated, uterus didelphys by itself is not an indication for Caesarean delivery, although its presence increases rates of Caesarean Section.<sup>[5,10]</sup> All five cases

we report underwent Caesarean Section as indicated by obstetric complications (placenta praevia for the 1st case and malpresentation associated with labour dystocia and with footling breech in the 3rd and 4th cases respectively), transverse lie associated with low lying placenta in the 5th case and presence of thick inelastic vaginal septum for the 2nd case.

### CONCLUSION

The presence of uterus didelphys does not commonly affect fertility rate. However, it does increase pregnancy complications such as preterm delivery, fetal malpresentation and placenta praevia, which in turn increase rates of Caesarean Section delivery. Furthermore, pregnancy occurs in either uterus. While double uterus is associated with ipsilateral renal agenesis and longitudinal vaginal septum, we have not found a previous report of an association with accessory breast (polymastia). However, it is quite common and so may not be directly related.

The purpose of this case series is to share lessons learned in clinical practice, as these lessons may help clinicians in designing antenatal care and labour follow-up policy for patients diagnosed with double uterus.

**Conflict of Interests:** None

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# Giant ossifying fibroma of the mandible

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## ABSTRACT

Ossifying fibroma is classified as a benign bone tumour. It is often considered to be a type of fibro-osseous lesion. It can affect both the mandible and the maxilla, particularly the mandible. This bone tumour consists of highly cellular, fibrous tissue that contains varied amounts of bone or cementum resembling calcified tissue. This case report is of an unusual peripheral ossifying fibroma involving the left side of mandible in a 22-year-old female patient, who presented to the dental department with a painless hard swelling which impaired proper breathing and mastication. The lesion was treated by surgical resection.

**Keywords:** ossifying fibroma, fibro-osseous lesion

## INTRODUCTION

Ossifying fibroma, a benign bone tumour often considered to be type of fibro-osseous lesion, can affect both the mandible and maxilla, but is more frequently seen in the mandible with an incidence of 70-90% of the cases.<sup>[1]</sup> Clinically this tumour appears as a slowly growing intrabony mass which is often asymptomatic and rarely large enough to cause facial deformity or functional problems.<sup>[2]</sup> It is commonly seen in the third and fourth decades of life. Radiographically, the lesion is often unilocular and well defined with varying degrees of mineralization. This bone tumour consists of highly cellular, fibrous tissue that contains varying amounts of calcified tissue resembling bone, cementum or both.<sup>[3]</sup> Treatment consists of enucleation and curettage or surgical resection for larger lesions. The



Figure 1. Giant ossifying fibroma of the mandible: massive size, involvement of the mandible, floor of the mouth, cheek, covering the tongue.

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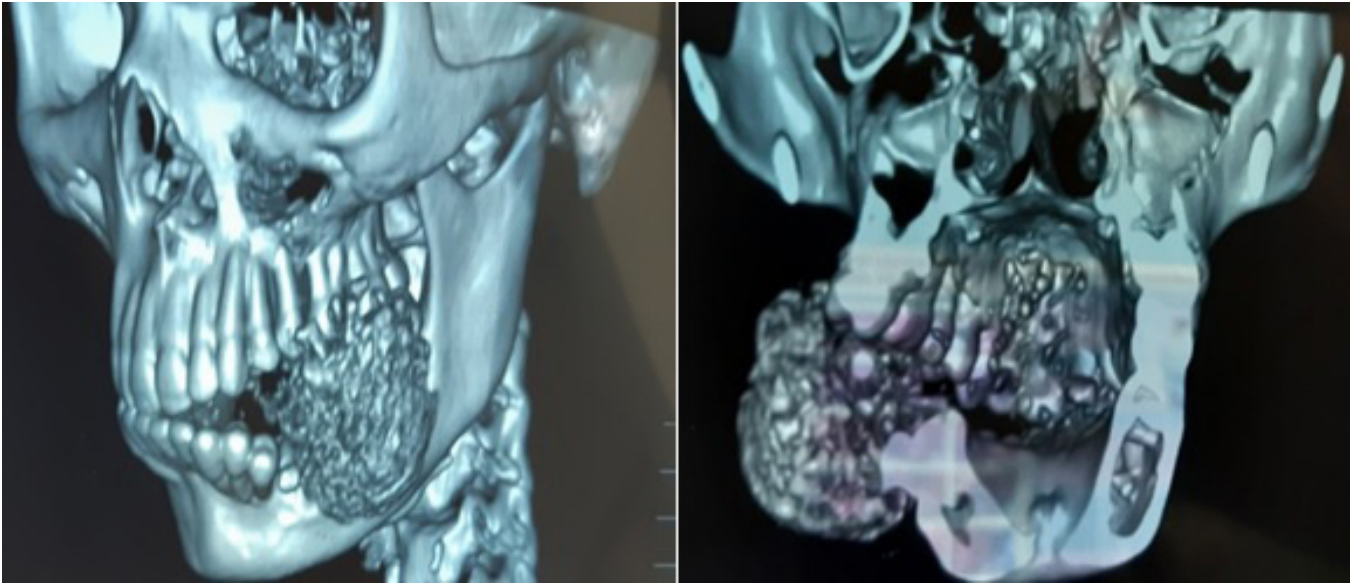


Figure 2. High dense mass of the mandible, measuring 22×9.5×12 cm, affecting alveolar bone and extending like a pedicle to the floor of the mouth, cheek and tongue.

rate of recurrence is usually low.<sup>[4]</sup> Although cases of have been reported in the literature, massive expansive lesions, as in this case are unusual.

### CASE REPORT

A female patient aged 22 years reported to our department complaining of a painless swelling in the lower left side of the face. Her history revealed that swelling started spontaneously three years ago slowly progressing in size to its current status. Extra oral examination revealed a hard swelling with diffuse borders in the lower left side of the face, approximately 22cm X 11cm in size. The swelling extended from the anterior border of the mandible ramus to the symphysis region, covering the tongue on its posterior part, occupying the floor of the mouth. The swelling was non-tender, hard to palpation, impairing normal speech, mastication and also breathing (Figure 1).

On computed tomography (CT) scan, it was a large, very well defined, single, expansive lesion, 22×9.5×12 cm, involving the body of the lower jaw, floor of the mouth, cheek and tongue. The matrix was calcified, and part of the alveolar bone was involved. The mandible bone was mostly intact (Figure 2).

Incisional biopsy was done and histology showed dense connective tissue stroma with areas of immature bone suggestive of a fibro-osseous lesion. After obtaining informed consent from both the patient and her relatives, resection of the tumour and reconstruction was planned under general anaesthetic.

As the patient could not be intubated and there was no facility at the hospital for fiberoptic intubation, the surgery started with tracheostomy under local anaesthesia. After

the airway was secure, the anaesthesiologist started her procedure. Gastrostomy was also performed to guarantee a way to feed the patient as oral feeding had to be avoided for four weeks. The patient was not able to tolerate a nasogastric tube.

A modified Risdon approach to the midline was used to access the tumour. Resection was carried out using a scalpel blade, electrocautery and a driller. A surgical burr was employed to remove the tumour, which was attached to the alveolar bone occupying the floor of the mouth, cheek and lateral pharyngeal wall. (Figure 3)

Homeostasis was achieved with diathermy, ligations of bleeding vessels and the wound was closed in layers up to the midline, leaving in a vacuum drain. Suturing was performed using vicryl 3-0 and nylon 3.0. (Figure 4). A specimen was taken for histopathological study.

Post-operative healing was satisfactory and the patient was followed up regularly every month for one year (Figure 5a and b).

Histopathology report: microscopic examination of Haematoxylin and Eosin-stained sections showed highly cellular connective tissue composed of interlacing fascicles of plump and proliferating spindle shaped fibroblasts with delicate collagen fibres. Areas of multiple and varying sized dystrophic calcifications were evident.

### DISCUSSION

Ossifying fibroma is classically a slowly growing benign tumour that replaces the normal bone as it enlarges. The precise pathogenesis is unknown. Some authors suggest the role of trauma induced stimulation. The origin of this neoplasm lies in the multipotent, undifferentiated,

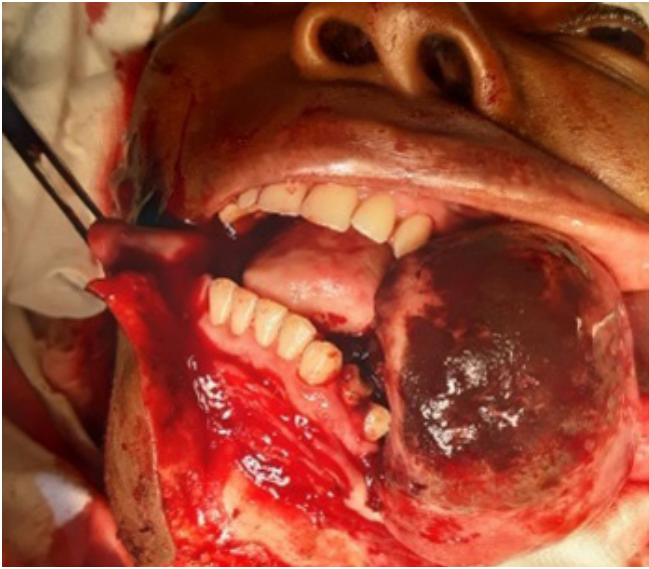


Figure 3. Exposure of tumour through Modified Risdon approach, opening midline.

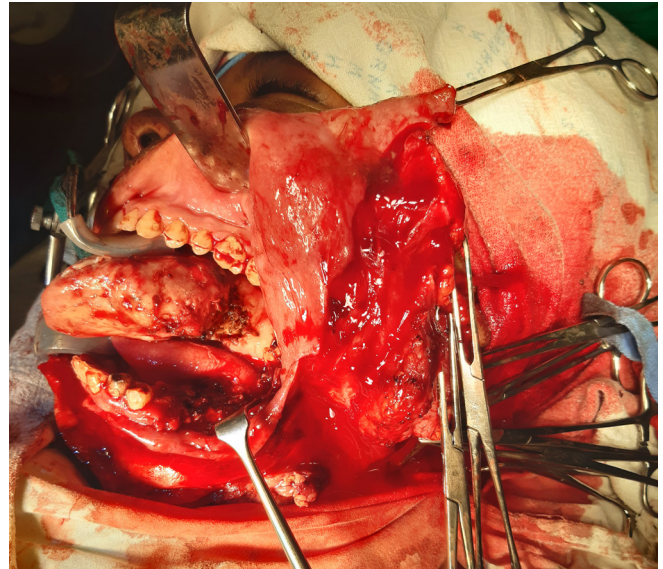


Figure 4. Surgical defect after surgery.



Figure 5a and b. Follow up after 3 weeks and 3 months.

mesenchymal cells of the periodontal ligament tissues capable of forming both bone and cementum. Based on the microscopic similarity with fibrous dysplasia, some investigators consider it to be a localized dysplastic process in which bone metabolism has been altered. The neoplastic aetiology is supported by its persistent, locally aggressive growth characteristics and the occasional reports of local recurrences.<sup>[5]</sup>

Most of these tumours are asymptomatic at the time of initial presentation. The most common site of origin is the teeth bearing portion of the jaws; the mandible being more commonly involved. Most affected patients are in the third or the fourth decade of life. Females are more commonly affected than males.<sup>[5]</sup> The well-defined border between the tumour and the surrounding uninvolved bone tissue differentiates it from fibrous dysplasia.

On radiography, the early tumours are radiolucent but become radiopaque when the tumours become old. The teeth are gradually displaced to the periphery of the mass or, rarely, the roots may be resorbed. There is no evidence for a potential for malignant transformation. Complete surgical excision followed by reconstruction is the standard management. Recurrences are rare and should be managed surgically.<sup>[6-8]</sup>

The basic principle behind this surgery was the successful excision of the whole tumour mass with the affected alveolar bone, followed by the reconstruction of the mandible and soft tissues of the face. The extra-oral approach used carries the advantages of avoiding difficulties accessing the site involved, providing a satisfactory field of view of the tumour, as well as the surrounding structures involved. However, it leads to an external wound defect

and risk of facial nerve damage. Nevertheless, all depends on the skills of the surgeon. In the present case it was impossible to use an intraoral approach because of the size of the tumour and its extension to the lateral pharyngeal wall, and obvious risk of bleeding. After full recovery the patient should be able to lead a good social life with minimum restrictions.<sup>[9-11]</sup>

All images were taken, with the patient's permission, by the author.

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## Over prescription of antibiotics

Over prescription of antibiotics is high in sub-Saharan Africa, due partly to perverse financial incentives for prescribers and partly to their ready availability making self-medication easy. Another important factor is the lack of robust clinical guidelines.

This new paper in the WHO Bulletin concludes that African countries 'lack antimicrobial treatment guidelines that meet internationally accepted methods'.

See <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8722630/>



# Back-to-basics: Fever is a syndrome and not just pyrexia

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## ABSTRACT

Fever is a common presenting complaint in sub-Saharan Africa. Although it has many causes, the symptoms of fever, with or without an elevated body temperature, should always make the clinician suspect infection. The other presentations associated with fever often help identify its likely cause. However, the features of fever that make it life-threatening continue to bedevil physicians.

**Key words:** fever, pyrexia, sepsis, assessment, monitoring

## INTRODUCTION

“Fever” is a common presenting complaint, especially in sub-Saharan Africa. Equating “fever” with pyrexia (raised body temperature) is of questionable value. In some African languages the word “fever” is used to describe malaria, or indeed any acute illness. Symptoms reported by patients as “fever” vary and include anorexia, headache, fatigue, rigors, or chills with shivering, feeling hot and then cold, and anxiety.<sup>[1]</sup>

During exercise heat production increases the body core temperature above the thermoregulatory reference temperature, which results in vasodilatation and sweating. In illnesses this reference temperature may be re-set to a higher level<sup>[2]</sup> so that heat loss is inhibited by skin vasoconstriction accompanied by chills, shivering and rigors and the patient feeling cold. If the ‘set-point’ falls, heat is lost by skin vasodilatation, and the patient feels hot and sweaty. The febrile response may also be accompanied by anorexia, headache, malaise, and other cognitive symptoms caused by pyrogenic cytokines.<sup>[3]</sup>

There are many causes of a raised and prolonged body temperature, which include:

- Infective and inflammatory conditions:
  - o Pneumonia and pneumonitis,
  - o Urinary tract infections including pyelonephritis,
  - o Dysentery,
  - o Venous thromboembolic disease / phlebitis,
  - o Pancreatitis,
  - o Ulcerative colitis and Crohn’s disease,
  - o Sarcoidosis.
- Connective tissue disorders.
- Meningeal and cerebral haemorrhages.
- Skin conditions: pemphigus, bullous pemphigoid, exfoliative dermatitis.

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## SUMMARY

- Primary and secondary malignancies.
- Allergic conditions.
- Drug reactions e.g., malignant hyperthermia.
- Fictitious fever in mentally disturbed patients.

The clinical value of the symptoms of “fever”, with or without an elevated body temperature, is that they should always make the clinician suspect infection.<sup>[4,5]</sup> In addition to the symptoms of fever several other features also suggest infection, which include:

- Skin or soft tissue changes: hyperaemia and oedema, or chronic ulcerations,
- Airway symptoms: sore throat, rhinorrhoea, cough, sputum, or respiration dependent chest pain,
- Gastrointestinal symptoms: diarrhoea or abdominal pain,
- Genitourinary symptoms: dysuria, frequent or abnormal urination, low back pain,
- Feeling faint.<sup>[5]</sup>
- Myalgia is a common symptom with viral infections (especially SAR-Cov2), influenza and dengue fever and is also seen in many other infections (Lyme disease, malaria, and pneumonia).

Most “fevers” arise acutely and are often upper respiratory tract viral infections, which are recovered from within a week. However, this is not always so. There are no bedside findings that reliably distinguish between viral and bacterial infections. Bacteria are always present in the healthy body, and a bacterial infection only occurs when bacteria are in areas of the body in which they are not normally present. Usually, the body will confine these infections to a painful local area of inflammation, but the development of “fever” symptoms and/or a pyrexia suggests that the infection has become systemic. In contrast, there should be no viruses anywhere in the body, so all viral infections are likely to have systemic manifestations even if rapidly contained within their area of entry to the body (i.e., usually the respiratory or gastro-intestinal tract). The interval between the early nonspecific symptoms and the development of specific symptoms and signs may be minutes in meningococcal sepsis, and hours or even days in other conditions. Therefore, every patient presenting with fever needs an immediate careful bedside assessment, which considers the likely infectious agent, anticipates the likely course of the illness and the monitoring required to follow its clinical progress.

### CLINICAL ASSESSMENT

#### Associated symptoms and signs

The presentation of a patient with suspected infection

often indicates the likely cause, and the immediate actions needed. These are key examples:

1. Breathlessness: pneumonia, which requires prompt antibiotic therapy in all age groups.
2. Cough: consider pneumonia, chronic obstructive airway disease, tuberculosis.
3. Night sweats: tuberculosis
4. Dysuria with or without loin pain: pyelonephritis.
5. Swollen tender joint: pyogenic arthritis - an emergency!
6. Tender bone: osteomyelitis (NB in diabetic feet)
7. Lymphadenopathy: lymphoma, HIV, glandular fever, early hepatitis
8. Headache: influenza, consider meningitis or sub-arachnoid haemorrhage. Bacterial meningitis usually kills within minutes or hours, while viral meningitis usually presents to hospital with a three-day history and then improve.
9. Muscle aches: influenza, but could be dengue, leptospirosis, poliomyelitis, leukaemia, polymyositis, malignant hyperthermia.
10. Diarrhoea: always consider salmonella. Do not treat diarrhoea with antibiotics. Salmonella and Shigella are often resistant, and cultures must be obtained off antibiotics. If you give antibiotics the chances are that all you will do is prevent a resistant organism from being cultured and we will remain in the dark for weeks.
11. Rash: If haemorrhagic consider Ebola or similar fevers. If like sunburn early toxic shock possible. Petechia or erythema suggest meningococcal infection.
12. Abdominal pain: gall stones, appendicitis, hernia, pancreatitis.
13. Sore Throat: streptococcal tonsillitis or infectious mononucleosis.
14. “Fever” or temperature only: If raised white cell count consider pyogenic infection, leptospirosis, or liver abscess. If no elevation of white cell count, consider viral infection, salmonella, early sepsis, pancytopenia, bacterial endocarditis, TB, auto-immune disease, and neoplasia.

#### Patterns of pyrexia

Many physicians have abandoned the use of the classical “fever patterns” associated with different diseases described by Wunderlich, because they are greatly influenced by antibiotic therapy and diagnostic bacteriology, if available, is a more dependable.<sup>[6]</sup> Nevertheless, fever patterns may

still be useful in low-resource settings to guide empiric treatment.

Elevated temperatures can be arbitrarily classified into:

- Acute: lasts less than seven days and is characteristic of malaria and viral upper respiratory tract infection.
- Subacute: lasts approximately two weeks, such as occurs in typhoid fever and intra-abdominal abscess.
- Chronic or persistent pyrexia lasts longer than two weeks and is seen in chronic bacterial infections e.g., tuberculosis, HIV, cancers, and connective tissue diseases.

There are three common temperature patterns:<sup>[3]</sup>

- Continuous: the temperature does not fluctuate more than 1°C during any 24-hour period but is never normal as with lobar and gram-negative pneumonia, typhoid, acute bacterial meningitis, malaria, and urinary tract infection. A slow stepwise temperature rise, and a high plateau are classical of typhoid fever. However, this pattern is often lost if anti-pyretics and antibiotics are given.
- Remittent fever is a variation with daily fluctuations exceeding 2°C but never returning to normal.
- Intermittent: a normal / low temperature in the morning and peaking in the evening often with chills occurs with localised pyogenic infections, in malaria (with spikes daily, every third or fourth day), and acute brucellosis (usually with marked sweating). Salmonellosis, miliary TB, gonococcal and meningococcal endocarditis may display two daily peaks.
- Other patterns include:
  - \* Saddle-back (biphasic): dengue, yellow fever, relapsing fever (*Borrelia* genus) and occasionally with influenza, poliomyelitis and lymphocytic choriomeningitis.
  - \* Pel-Ebstein: weekly or longer periods of pyrexia with intervals of normal temperature: Hodgkin's disease, brucellosis and occasionally tuberculosis
  - \* Reversed diurnal pattern (higher in the morning and lower temperature in the evening) may be seen in miliary TB, salmonellosis, liver abscess, bacterial endocarditis.
  - \* Jarisch-Herxheimer: sharp increase in temperature after penicillin treatment can occur in syphilis, leptospirosis, relapsing fever.

### Relative bradycardia

The pulse increases by approximately eight beats per

minute for each degree Celsius rise. However, there are exceptions, such as yellow fever and typhoid fever, where such an increase in pulse rate does not occur i.e., there is "relative bradycardia". The latter also occurs in some viral infections (e.g., sandfly and dengue fever) and in psittacosis, Q fever, typhus, malaria, leptospirosis, and viral haemorrhagic fevers.<sup>[7]</sup> More commonly relative bradycardia occurs in infected patients taking beta-blockers. It is also a common feature of all fevers caused by drugs, lymphomas, and central nervous system disorders such as intracranial bleeds and tumours.

### What makes a fever dangerous?

Identifying the features of "fever", with or without a temperature, that make it life-threatening continue to bedevil physicians. Fever and pyrexia are not the same thing. Less than 5% of patients admitted to a low-resource hospital in Uganda had a temperature >38 °C on admission, whereas 11% had a temperature ≤36 °C and more than 15% complained of fever; only 11% of patients complaining of "fever" on admission had a temperature >38°C, and 9% had a temperature ≤38 °C. Unless they had rigors, patients complaining of "fever" were no more likely to have an increased temperature on presentation than patients not complaining of "fever". Patients complaining of "fever" were younger, had shorter lengths of hospital stay, lower blood pressure and respiratory rates and higher oxygen saturations on admission than patients not complaining of fever, and did not have an increased risk of in-hospital death.<sup>[1]</sup>

Patients complaining of fever should be touched to determine if they feel hot and sweaty, or cold and clammy. Those who are cold and clammy were more likely to die.<sup>[1]</sup> Although rigors are strongly associated with bacteraemia,<sup>[4]</sup> an elevated temperature alone is a weak predictor of mortality and indeed in infected patients has been associated with a survival benefit, whereas a low temperature is associated with an increased mortality.<sup>[8]</sup>

Acute sickness may be associated with an "unhealthy" body odour,<sup>[9]</sup> altered gait patterns,<sup>[10]</sup> and the response to overt sickness behaviours, such as coughing. Conversely, supine emergency room patients with crossed ankles, crossed hands behind the neck, or folded hands over the upper abdomen have been reported to be highly unlikely to have any acute critical condition.<sup>[11]</sup> Facial cues such as paler lips and skin, a more swollen face, droopier corners of the mouth, hanging eyelids, redder eyes, less glossy and patchy skin, and appearing tired, can aid in the detection of acutely sick and potentially contagious people. Ill patients have less variability in their facial expression in response to emotional cues;<sup>[12]</sup> they may appear anxious and flushed with bright eyes, or the eyes may be congested and the facial expression dull. The alae nasi of patients with pneumonia may dilate with each inspiration and

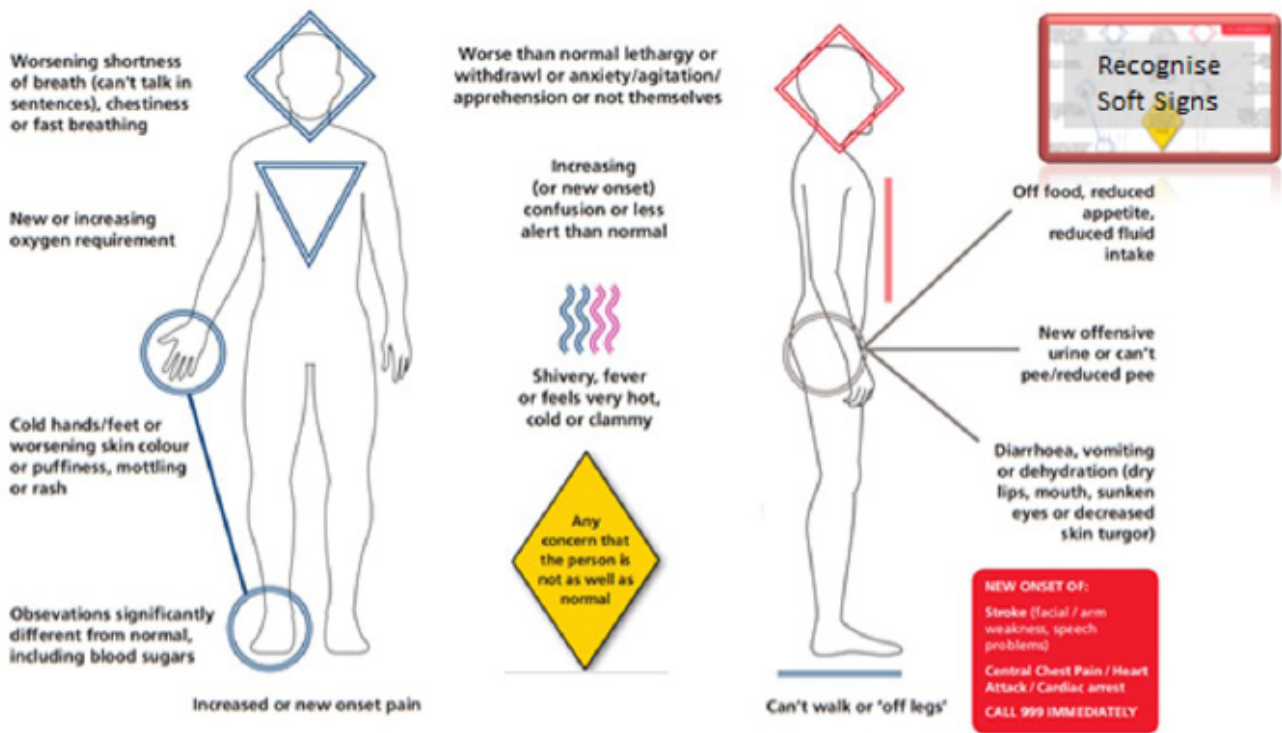


Figure 1. Soft signs to identify early indications of infection and sepsis (reproduced with permission from the Wessex Academic Health Science Network).

commonly have Herpes labialis.<sup>[13]</sup>

In a low resource hospital in sub-Saharan Africa the intuition of inexperienced clinicians accurately discriminated between patients who were likely to survive and those who were likely to die.<sup>[14]</sup> Most of these concerning patient characteristics selected by intuition are included in the Dutch Early Nurse Worry Indicator Score (DENWIS)<sup>[15]</sup> and have been adopted as “soft” vital signs of infection by Wessex Patient Safety Collaborative in the UK<sup>[16]</sup> to be used as triggers for further clinical assessment, even before there are significant vital sign changes (Figure 1).

**Recognition of Sepsis**

Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection. All deaths, including those caused by infection, are caused by hypoxia and hypoperfusion that causes multi-organ failure. Increasing oxygen and perfusion demand, therefore, produce many of the common symptoms and signs of acute illness (see Figure 1) which force the patient to rest so that perfusion and oxygen demands can again be met. As peripheral perfusion and oxygenation declines the patient may appear pale and his or her periphery becomes cold and cyanotic. Interventions that successfully increase oxygenation and cardiac output will usually improve the patient’s condition. However, this improvement will only

continue if the underlying causes of hypoperfusion and/or hypoxemia are identified and overcome.

The latest definition of sepsis defines organ dysfunction as an increase in the Sequential Organ Failure Assessment (SOFA) score of 2 points or more. This requires laboratory tests that are unlikely to be available in low resource settings. The “quick” SOFA score is a useful alternative which indicates that sepsis is likely if two or more of the following are present:

- Alteration in mental status,
- Systolic blood pressure <100mmHg,
- Respiratory rate >22 breaths per minute.<sup>[17]</sup>

All the classic vital signs of respiratory rate, temperature, pulse rate and blood pressure are indicators of tissue perfusion and oxygen delivery. Pulse oximetry, which measures oxygenation more explicitly has become widely adopted as the fifth vital sign. Capillary refill time (CRT) and urine output are also measures of tissue perfusion. CRT monitors the perfusion of peripheral tissues: skin and muscles are the first to be affected by impaired blood flow in pre-shock states (whether caused by infection or injury) and the last to be re-perfused after resuscitation. Hypoperfusion and poor oxygenation cause fatigue, so that eventually the patient is forced to take to their bed and in severe illness becomes prostrate and often

confused. Therefore, changes in mobility<sup>[18]</sup> and mental function<sup>[19]</sup> should also be considered vital signs.

The four classic vital signs reflect the continuous physiological adjustments required to maintain homeostasis, which ensures the body is alert to danger with enough mobility to avoid or confront it. The brain is the priority organ. Therefore, in any acute illness there is balance between vital sign changes, mobility, and mental alertness, which reflect the body's capacity to adjust and adapt its available resources appropriately.<sup>[20]</sup> Any patients who must be "looked after" in hospital for an acute illness has started to exceed their physiological capacity to adapt and they are far more likely to die than members of the general population of the same age.<sup>[21]</sup> The time it takes for the body to return to normal depends on the severity of the illness and their body's resilience. Until patients "get better" their vital signs, mobility and mental status may fluctuate. Therefore, their clinical course will remain unpredictable and they will require constant monitoring.

### MONITORING THE COURSE OF FEVER

A high temperature in acute falciparum malaria, shigella infections and dengue fever indicates a poor prognosis but other vital sign changes are even more predictive of outcome.<sup>[3]</sup> The normal pulse to respiratory rate ratio is about 4.0 but classically falls with pneumonia and other respiratory conditions.<sup>[13]</sup> Breathlessness, respiratory distress, cyanosis, vital sign changes and altered consciousness indicate hypoxia. The oximeter is widely available, is easily used and rapidly measures oxygen saturation and pulse rate. The response of both oxygen saturation and pulse rate to exercise and change in posture can be quickly assessed. A rise in heart rate of more than 30 beats per minute on standing indicates the presence of hypovolemia, while a fall in oxygen saturation with exercise indicates a likelihood of serious lung or heart disease.<sup>[22]</sup> The ratio of oxygen saturation to respiratory rate identifies patients on supplemental oxygen who need intubation and ventilation.<sup>[23]</sup>

An increased resting heart rate is a risk factor for cardiovascular mortality and hypotension is associated with a high mortality. Once the heart rate exceeds the systolic blood pressure it is likely that the patient has a low intravascular volume or a severely depressed cardiac output. This can be distinguished by a careful fluid challenge of intravenous fluid. The ratio between pulse rate and systolic blood pressure (Shock Index) is normally 0.5 to 0.7 in adults. Persistent elevation of the Shock Index over 1.0 for several hours following trauma or acute circulatory failure has been related to a poor outcome.<sup>[24]</sup> A pulse rate below 100 beats per minute with a systolic blood pressure over 110 mmHg and a respiratory rate of 16 breaths per minute indicates a blood loss of less than 750 ml. A pulse rate over 140 beats per minute with a

systolic blood pressure below 90 mmHg and a respiratory rate over 26 breaths per minute indicates severe shock (Class IV) or a blood loss of over 2000 ml.<sup>[25]</sup>

### CONCLUSION

The syndrome of fever, with or without an abnormal body temperature, is common and indicates the likely presence of infection. Although identifying the infective agent causing fever can require expensive technology, which may be unavailable in low-resource settings, much can be learned from a careful history and bedside examination and then monitoring the course of the patient. Although worldwide most fevers come on acutely, are usually upper respiratory tract viral infections and patients recover within a week, this is not always the case. Temperature measurements alone are of little prognostic value. However, in combination with other vital signs the pattern of temperature recordings can provide important diagnostic clues. The severity of infection is determined by the perfusion and oxygenation of vital organs, which are best assessed by a full examination of the patient to determine and promptly correct underlying pathophysiology by the judicious use of oxygen, fluids, and appropriate antibiotics.

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## Appeal to support the Al Sabah Children's Hospital Resource Centre, Juba, South Sudan



Dr Justin Tongun, Consultant Paediatrician and Senior Lecturer in Paediatrics at the University of Juba Medical School would like to make an appeal for assistance, preferably in kind, to furnish the Al Sabah Resource Centre. It needs desktop computers, wide screens to beam lectures from abroad and paediatric reference books.

Al Sabah Children's Hospital is the only tertiary referral children's hospital in South Sudan and serves a population of ten million. It is under-resourced but run by five dedicated South Sudanese paediatricians who not only treat ill children but teach newly qualified doctors, nurses and technicians.

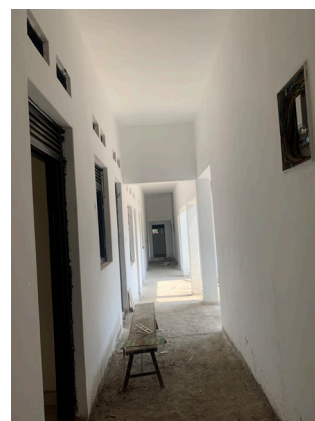
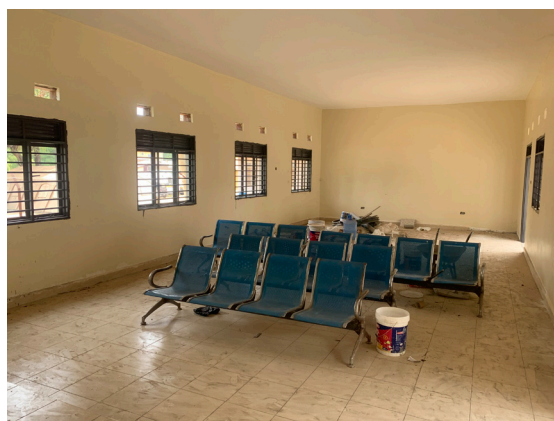
The Resource Centre will house a library, a lecture theatre, tutorial rooms and a computer room to which lectures may be beamed from overseas centres of excellence. The Centre is scheduled to open in March 2022.

For further details please contact Dr Justin Tongun at [tongunmafi@gmail.com](mailto:tongunmafi@gmail.com)

We are grateful for your support for this new Resource Centre

**Dr Justin Tongun**, MB. Ch.B, M.Med(Paeds), Ph.D((Bergen)

Consultant Paediatrician and Head of Department



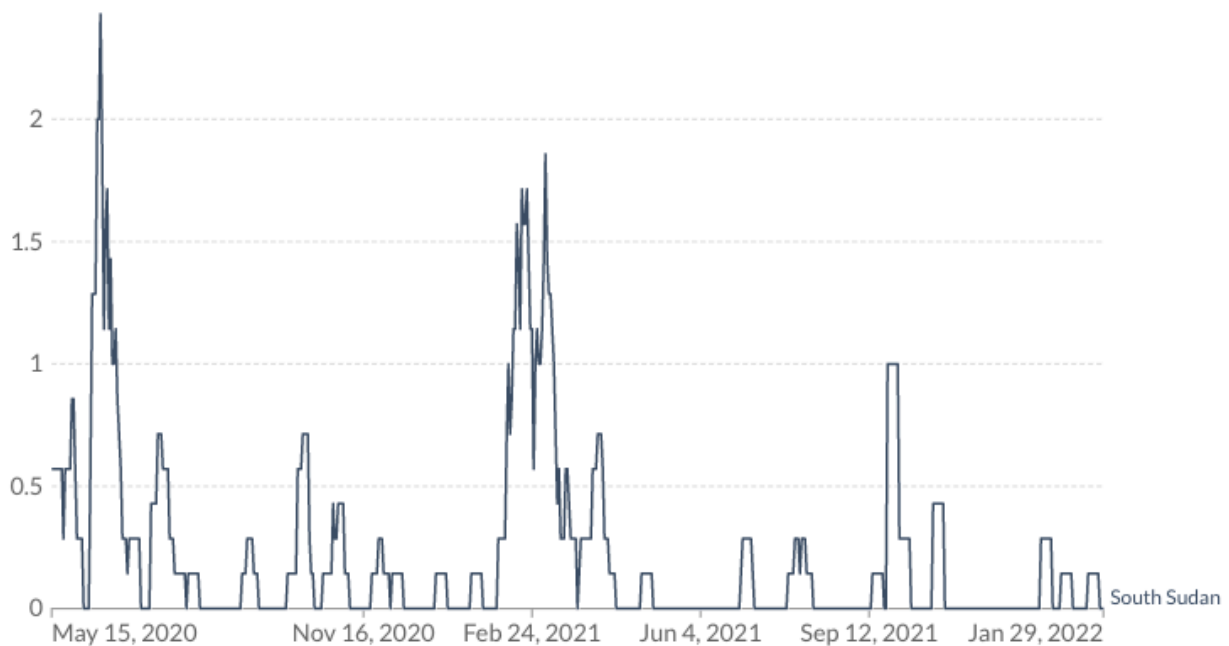
The graphs show South Sudan daily confirmed and cumulative COVID-19 deaths. See [here](#)

## Daily new confirmed COVID-19 deaths

For some countries the number of confirmed deaths is much lower than the true number of deaths. This is because of limited testing and challenges in the attribution of the cause of death.

Our World  
in Data

**LINEAR** LOG **+ Add country**



Source: Johns Hopkins University CSSE COVID-19 Data

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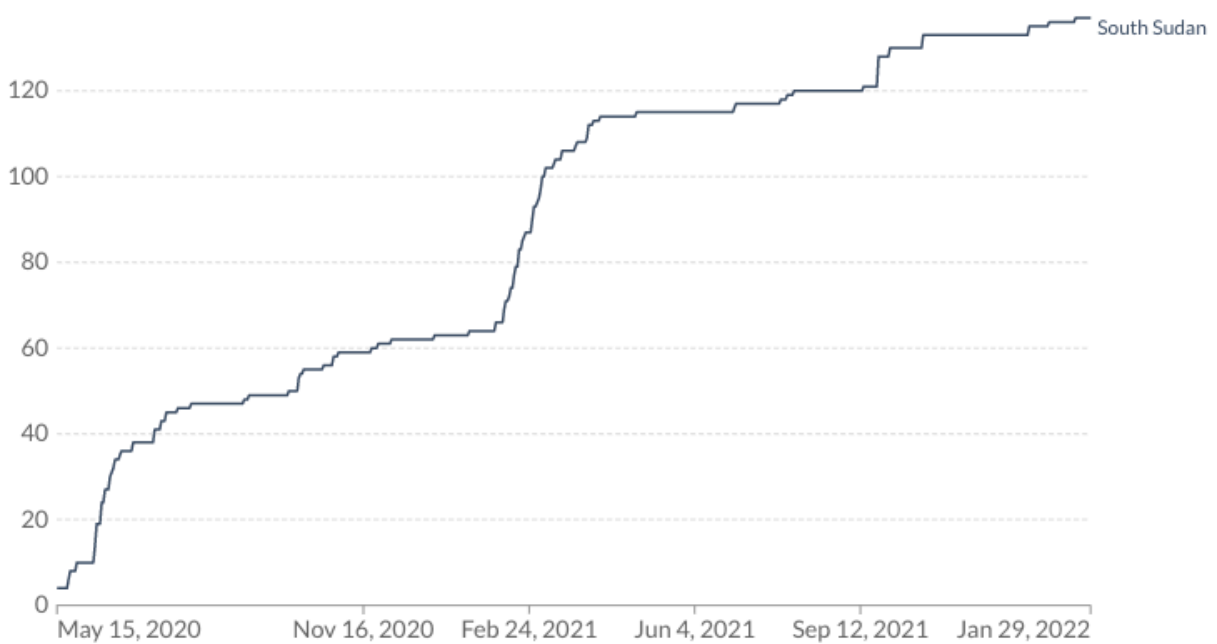
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## Cumulative confirmed COVID-19 deaths

For some countries the number of confirmed deaths is much lower than the true number of deaths. This is because of limited testing and challenges in the attribution of the cause of death.

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