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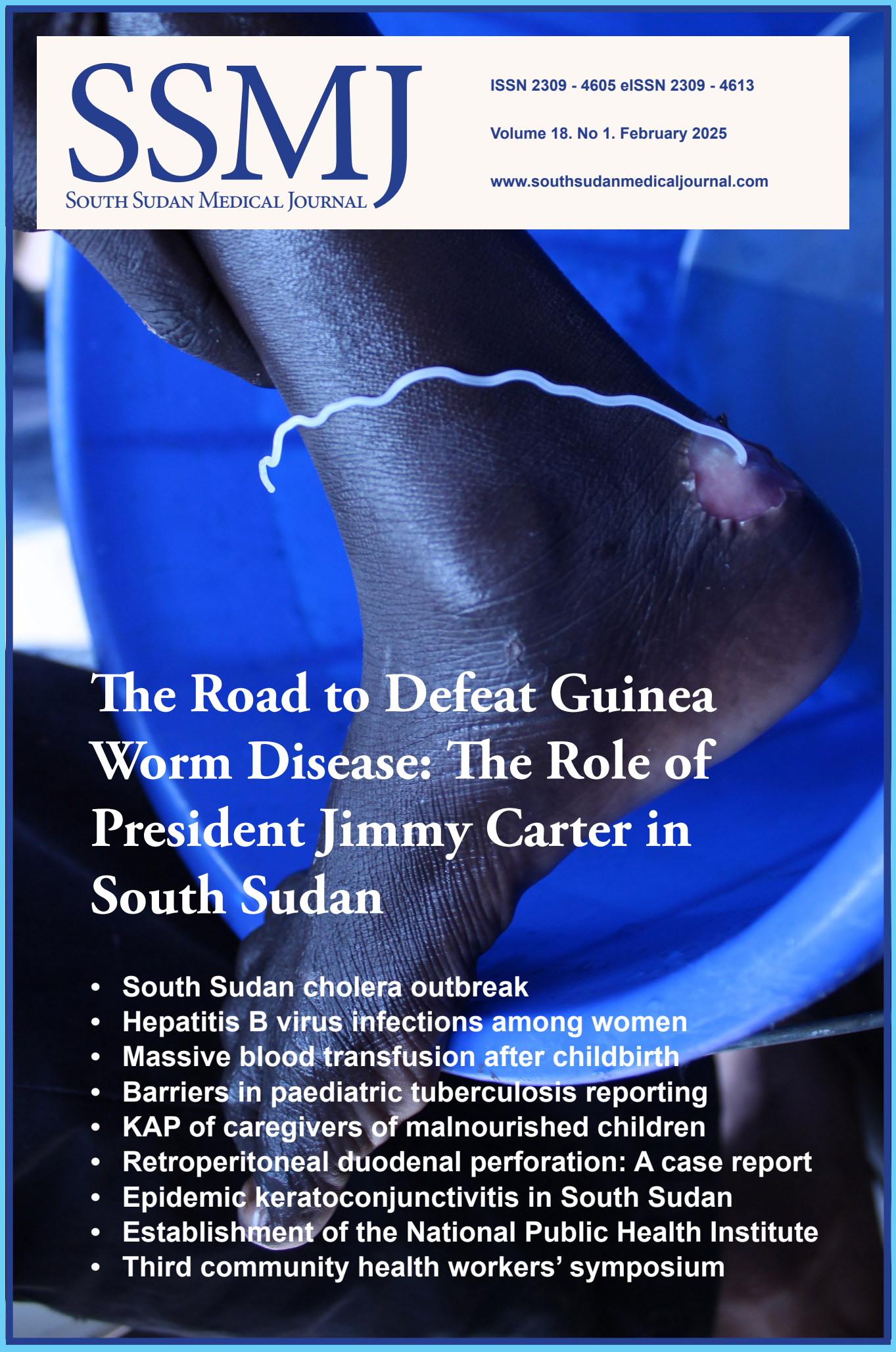

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Index and Copyright Information

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South Sudan cholera outbreak: A call to improve sanitation

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South Sudan has been in a cycle of conflicts since the 1950s with underdeveloped health infrastructures and a critical gap in human resources for health. However, in the past two decades, after the signing of the Comprehensive Peace Agreement (CPA) in 2005 which culminated in independence in 2011, a significant advancement in access and services delivery has been achieved.

Despite the advancements, the health sector continues to face challenges from human resources, drugs availability to multiple outbreaks of infectious diseases.

The Ministry of Health declared a cholera outbreak on the 28th October 2024 from the town of Renk in the northern border with Sudan. The index case was imported from Sudan which has been experiencing cholera outbreaks since 2023. Because of poor sanitation and congestion of refugees and returnees from the Sudan at the reception facilities in the outskirts of Renk, and because they had free movement, the outbreak extended to the whole town and other parts of the Upper Nile state.

Since then, the outbreak has extended to involve almost the whole country with about 13,000 cholera cases reported by the last week of December 2024, of which about 50% are from Rubkona county of Unity State mostly from the UN Protection of Civilians (PoC) sites. The other two most affected towns are Malakal and the capital city, Juba, accounting for 20% and 15% of cases respectively.

With this cycle of outbreaks, which usually occur annually, critical questions need to be asked about the reasons behind them. It is obvious from this outbreak and other outbreaks that the sanitation, especially where Internally Displaced Persons (IDPs) and refugees are hosted, is the main culprit. Also, lack of awareness among communities is a key component; it is only by reporting any suspected cases to the surveillance team that measures can be put in place to contain any suspected outbreak.

From my personal visits to Renk in August 2023, in the early days of conflict in Sudan, I witnessed the situation at the reception site which was designated for the returnees and refugees at the University of Upper Nile premises; the minimal standards of sanitation were lacking, as well as safe and clean water. The same thing is seen in the Malakal, Juba and Bentiu PoCs from where most cases are reported.

The health authorities, together with partners, have taken several measures to curb the spread of cholera outbreaks:

1. Strengthening surveillance and reporting systems.
2. Establishing coordination meetings at different levels to make sure that communication is maintained between different actors.
3. Improving sanitation, provision of clean water and infection control measures to about 730,000 people in the areas of population movement and weak health systems.

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4. Establishing Cholera Treatment Centres (CTCs) across the country to handle severe cases.
5. Introducing the cholera vaccine to the high-risk population on 9th December 2024, when about 300,000 doses were available.

To avoid future outbreaks, especially those related to conflicts, I recommend the following:

1. Robust health promotion on Infection Prevention and Control (IPC) measures to the affected populations.
2. Strict measures on setting up sanitary facilities at the reception sites.
3. Control population movement during the time of outbreak.
4. The government to address the living conditions within the UN Protection of Civilians (PoCs) sites. Also, it takes these necessary actions to ensure that IDPs are transported to their original states or are provided with housing plans within the host communities.

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Research Article

Prevalence and associated risk factors of hepatitis B virus infections among women of reproductive age in Juba, South Sudan

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ABSTRACT

Introduction: Hepatitis B virus (HBV) is a partially double-stranded, enveloped virus with a circular DNA genome. This virus increasingly infects the population. Information on HBV infections in South Sudan is limited. This study aimed to examine the prevalence and major risk factors of HBV infections among women of reproductive age in Juba City, South Sudan.

Method: This study adapted a quantitative cross-sectional research design to assess prevalence and risk factors of HBV infections among these women. The study sites were seven health facilities in Juba. A validated semi-structured questionnaire was used to collect data from the 1808 randomly selected women. The study used EpiData software v4.7 to control data entry and Stata v15 for analysis. Chi squared tests and regression model were performed to determine association and likelihood respectively.

Results: Among the 1808 women, the burden of HBV infections was 11.2% and nearly half were unaware of their HBV status. The HBV infections were significantly associated with blood transfusion ($p < 0.001$), surgical operations ($p < 0.001$), and close contact with a case of HBV ($p < 0.001$). The women who had close contact with a case of HBV infections were 2.5 times more likely to be infected (OR: 2.487, 95% CI: 1.549 - 3.995). Women who had a history of surgical operations were more likely to be positive for HBV by 12.6% compared to those who had had no surgery (OR: 1.126, 95% CI: 0.614 - 2.067). The women who receive blood transfusions were more likely to be infected HBV (OR: 1.134, 95% CI 0.594 - 2.166).

Conclusion: The prevalence of HBV infections among these women was high and nearly half of them were unaware of their HBV status. It is associated with blood transfusion, surgical operations, and close contact with cases of HBV. The study recommends the improvement of tailored health promotion, antenatal HBV screening, birth dose vaccines.

Keywords: prevalence, associated risk factors, hepatitis B virus infections, women of reproductive age, Juba, South Sudan

Introduction

Hepatitis B virus (HBV) is a partially double-stranded, enveloped virus with a circular DNA genome. It belongs to Hepadnaviridae family of viruses. A first infection with HBV is considered as an acute infection. An infection lasting more than six months is defined as chronic infection. The transmission of HBV from mother to child during birth is known as vertical transmission. Horizontal transmission refers to the passage from one host to another (e.g. sexual contact with an infected person, blood transfusion).[1]

Globally, this virus infects 1.5 million people every year, accounts for 296 million chronic infections (3.8%), and 6 million children younger than five (0.9%) and 820,000 deaths. In Africa, the new cases of HBV infections are 990,000, the burden of HBV infections is 7.5% among the general population (82,300,000), among children younger than five years is 2.5% and deaths related HBV infections are 80,000.[2]

The magnitude of HBV endemicity in South Sudan has become a major public health problem. The burden of the infection among the South Sudanese general population is 22.4%.[3] Seropositivity of HBV among blood donors at the Blood Bank of Juba Teaching Hospital (JTH) is 18% and at the National Blood Bank is 8.2%.[4,5] The prevalence of HBV infections among pregnant women accessing health services at JTH stands ranges 6.3% to 11%.[6,7]

Conflicts have weakened the health system and the people's health status, particularly among women and children.[8,9] Fragmented social structures exacerbate the transmission of HBV as do cultural patterns, e.g. inadequately sterilised tools used in ear piercing and tribal markings and eating together from common utensils.[7] Although many studies have been conducted on HBV prevalence and risk factors globally, few of them were conducted in South Sudan. This study was designed to examine prevalence and major risk factors of HBV infections among women of reproductive age in Juba City and to inform the relevant plans for policies, strategies, and practices.

Method

This study adapted a quantitative cross-sectional research design to assess prevalence and associated risk factors of HBV infections among these women at seven health facilities in Juba of South Sudan. These health facilities were Gumbo Primary Health Care Centre (PHCC), Gurei PHCC, Juba Military Referral Hospital (JMRH), Juba Teaching Hospital (JTH), Kator PHCC, Munuki PHCC, Nyakuron PHCC. The Cochran's formula was adapted at 95% confidence level, 5% degree of accuracy, 15% non-response rate, design effect of 4, and variance of 50%. A sample size of 1808 women was calculated and was proportionally allocated to each health facility.

Women aged between 18 and 49 years and who accessed healthcare services were included and those who declined to participate in this study were excluded. A validated semi-structured questionnaire was used in collection of data.

The EpiData software version 4.7 was used to control data entry. Afterwards, the data were exported to Stata version 15 for analysis. Chi squared tests and regression model were performed to determine association and likelihood respectively.

Ethical approval was obtained from University of Juba Graduate College and the Ministry of Health Research Ethics Review Board. Participants consented to be included after being assured of confidentiality and privacy.

Results

A total of the 1808 women were interviewed of whom 925 (51.2%) had accessed HBV tests and 883 (48.8%) did not. The burden of HBV infections was 104 (11.2%) among these women.

The burden of this infection at the various sites is shown in Table 1. JMRH had the highest burden of HBV. Among the regions of South Sudan, Greater Bahr El Gazal region had the highest burden of HBV infections. Regarding the subnational levels, this burden was 14.5% in Eastern Equatoria, 25% in Abyei, 25% in Pibor, 33.3% in Northern Bahr El Ghazal. of Juba City Council Blocks, the burden was 5.8% in Munuki City Block, 13.3% in Juba City Block, 17.4% in Kator City Block (Table 1).

The women aged ≥ 45 years had the highest HBV infections (14.3%). Women who had attended formal education had a lower rate of infections compared to those who had not, that is, 10.3% and 16% respectively. Unemployed women had a higher burden of HBV infections than those who were employed. Whereas the unmarried women had 16.2% burden of HBV infections, the married ones had 10.7% burden of HBV infections (Table 1).

To determine the major risk factors associated with HBV infections among these women, the analyses by Chi-square test and of logistic regression were performed.

Table 1. The factors related to HBV infections among women of reproductive age

Variable	HBV test results		Total	Chi-square test (p-value)
	Negative n (%)	Positive n (%)		
Name of health facility				13.106 (0.410)
JTH	219 (91.6)	20 (8.4)	239	
JMRH	122 (83)	25 (17)	147	
Gurei PHCC	123 (92.5)	10 (7.5)	133	
Nyakuron PHCC	122 (91)	12 (9)	134	
Gumbo PHCC	113 (84.3)	21 (15.7)	134	
Munuki PHCC	62 (91.2)	6 (8.8)	68	
Kator PHCC	60 (85.7)	10 (14.3)	70	
Age group				0.070 (0.792)
< 32 years	646 (88.6)	83 (11.4)	729	
≥ 32 years	175 (89.3)	21 (10.7)	196	
Age group				0.768 (0.857)
18 - 24 years	293 (89.9)	33 (10.1)	326	
25 - 34 years	417 (88.3)	55 (11.7)	472	
35 - 44 years	99 (87.6)	14 (12.4)	113	
≥ 45 years	12 (85.7)	2 (14.3)	14	
Residential area in Juba				15.322 (0.002)
Juba	52 (86.7)	8 (13.3)	60	
Kator	142 (82.6)	30 (17.4)	172	
Munuki	260 (94.2)	16 (5.8)	276	
Others	367 (88)	50 (12	417	
Residence				13.402 (0.515)
Rural	367 (88)	50 (12)	417	
Urban	454 (89.4)	54 (10.6)	508	
Region of origin				1.496 (0.473)
GER	650 (88.6)	84 (11.4)	734	
GBR	62 (86.1)	10 (13.9)	72	
GUR	109 (91.6)	10 (8.4)	119	
State of origin				18.139 (0.112)
Central Equatoria	464 (88.2)	62 (11.8)	526	
Eastern Equatoria	94 (85.5)	16 (14.5)	110	
Western Equatoria	92 (93.9)	6 (6.1	98	
Jonglei	73 (91.3)	7 (8.8)	80	
Lakes	36 (90)	4 (10	40	
Unity	18 (94.7)	1 (5.3)	19	

Upper Nile	14 (93.3)	1 (6.7)	15	
Northern Bahr El Ghazal	6 (55.6)	3 (44.4)	9	
Warrap	10 (90.9)	1 (9.1)	11	
Western Bahr El Ghazal	8 (100)	0 (0)	8	
Pibor	3 (75)	1 (25)	4	
Abyei	3 (75)	1 (25)	4	
Ruweng	1 (100)	0 (0)	1	
Religion				3.090 (0.213)
Christianity	724 (88.9)	90 (11.1)	814	
Islam	96 (88.1)	13 (11.9)	109	
Traditional Beliefs	1 (50)	1 (50)	2	
Formal education				4.301 (0.038)
No	131 (84)	25 (16)	156	
Yes	690 (89.7)	79 (10.3)	769	
Main occupation				1.007 (0.316)
Housewife	552 (88)	75 (12)	627	
Others	269 (90.3)	29 (9.7)	298	
Employment status				0.206 (0.650)
Unemployed	399 (88.3)	53 (11.7)	452	
Employed	422 (89.2)	51 (10.8)	473	
Marital status				2.869 (0.650)
Unmarried	83 (83.8)	16 (16.2)	99	
Married	642 (89.2)	78 (10.8)	720	
Separated/widow	96 (90.6)	10 (9.4)	106	
Type of marriage				0.160 (0.690)
Monogamy	444 (89.7)	51 (10.3)	495	
Polygamy	294 (88.8)	37 (11.2	331	
Parity				2.036 (0.154)
≤ 3	517 (89.9)	58 (10.1)	575	
> 3	304 (86.9)	46 (13.1)	350	
Monthly family income				5.577 (0.233)
≥ USD50	72 (94.7)	4 (5.3)	76	
≥ USD100	210 (90.1)	23 (9.9)	233	
≥ USD150	147 (88)	20 (12)	167	
≥ USD200	230 (88.8)	29 (11.2	259	
≤ USD201	162 (85.3)	28 (14.7)	190	
Use of mani-pedicure instrument				0.002 (0.962)
Own instruments	452 (88.8)	57 (11.2)	509	
Common instruments	369 (88.7)	47 (11.3)	416	

Scarification or tribal marks				1.724 (0.189)
No	675 (89.4)	80 (10.6)	755	
Yes	146 (85.9)	24 (14.1)	170	
Dental procedure				0.054 (0.189)
No	632 (88.9)	79 (11.1)	711	
Yes	189 (88.3)	25 (11.7)	214	
Blood transfusion				5.946 (0.015)
No	706 (89.8)	80 (10.2)	786	
Yes	115 (82.7)	24 (17.3)	139	
Surgical operation				6.074 (0.014)
No	694 (89.9)	78 (10.1)	772	
Yes	127 (83)	26 (17)	153	
Close contact with hepatitis B case				25.854 (<0.001)
No	667 (91.5)	62 (8.5)	729	
Yes	154 (78.6)	42 (21.4)	196	
Smoking shishia (tobacco)				12.805 (<0.001)
Yes	135 (80.8)	32 (19.2)	167	
No	686 (90.5)	72 (9.5)	758	
Drinking alcohol				4.952 (0.026)
Yes	160 (84.2)	30 (15.8)	190	
No	661 (89.9)	74 (10.1)	735	
Overall burden of HBV infections	821 (88.8)	104 (11.2)	925	

The Chi-square X^2 identified that, of the sociodemographic characteristics, HBV infection was significantly associated with residential area (p =0.002), and formal education (p = 0.038) (Table 1). Furthermore, of the health behaviours, HBV infection was statistically associated with blood transfusion (p <0.001), surgical operations (p <0.001), close contact with a case of HBV (p < 0.001), smoking of shishia (p < 0.001) and drinking of alcohol (p < 0.001) (Table 1).

The statistically significant factors (independent variables) and HBV test results (dependent variable) were entered into logistic regression model. This was to determine the likelihood of the association. A preliminary analysis entailed that the statistical multicollinearity was realised with overall tolerance = 0.984. A review of standardized residual values highlighted that there were outliers which were kept in the dataset. Thus, the model was statistically significant, [X^2 (9=925)=42.269, p <0.001], indicating that the model could differentiate study participants who had HBV positive test result from those who had a negative result. Subsequently, the model explained between 4.5% (Cox & Snell R^2) and 8.8% (Nagelkerke R^2) of the variance and correctly predicted 88.8% of the test results. As shown in Table 2, Juba residential area and use of tobacco had significantly contributed to the model.

Table 2 presents odds ratios (OR) analyses of HBV infections among the women. The women who had close contact with a case of HBV infections were 2.5 times more likely to be infected (OR: 2.487, 95% CI: 1.549 - 3.995). For every increase in odds of the women who smoke shishia, there is 31.3% likelihood of these women to be HBV infected (OR: 1.313, 95% CI: 0.714 - 2.414). Those who attend formal education were 1.5 times more likely to have negative HBV results than those who did not attend formal education (OR: 1.479, 95% CI: 0.892 - 2.454). Women who had a history a surgical operation were more likely to be positive for HBV at 12.6%.

Table 2. Predictors of HBV infections among women of reproductive age: Multivariable Analyses

Predictor	B	SE	Wald	df	p-value	OR (95% CI LL, UL)
Residential area in Juba						
Juba*						
Kator	0.177	0.423	0.176	1	0.675	1.194 (0.522, 2.734)
Munuki	0.353	0.259	1.862	1	0.172	1.423 (0.857, 2.363)
Others	-0.726	0.305	5.645	1	0.018	0.484 (0.266, 0.881)
Formal education						
No*						
Yes	0.392	0.258	2.298	1	0.13	1.479 (0.892, 2.454)
Ever blood transfused						
No*						
Yes	0.126	0.33	0.146	1	0.703	1.134 (0.594, 2.166)
Surgically operated						
No*						
Yes	0.119	0.31	0.148	1	0.701	1.126 (0.614, 2.067)
Contact with case of HBV						
No*						
Yes	0.911	0.242	14.206	1	<0.001	2.487 (1.549, 3.995)
Ever used tobacco						
No*						
Yes	0.272	0.311	0.766	1	0.382	1.313 (0.714, 2.414)
Ever taken alcohol						
No*						
Yes	0.055	0.298	0.035	1	0.853	1.057 (0.59, 1.894)
Constant	-2.454	0.191	165.089	1	<0.001	0.086

* Reference category

Discussion

This study found that the overall burden of HBV infections was 11.2% among women of reproductive age. This burden is higher than the regional estimate (East Africa 6%) and also higher than other in-country studies (Juba Teaching Hospital, 11%; Bor State Referral Hospital, 8.6%.[6,10,11]) The study also identified that nearly half of these women were unaware of their HBV status. This might be due to the test of HBV infection being optional. Promoting the importance of antenatal hepatitis B testing is continuing. It is likely that this burden is a consequence of weak health systems.[8,9] Furthermore, fragmented social structures and cultural patterns may play a part in exacerbating the transmission of HBV.[7]

This study identified that HBV infection is associated with residential area, level of education and history of blood transfusion, surgical operations, close contact with other HBV infected persons, smoking of shishia and alcohol consumption. Our findings are consistent with previous studies: HBV infections in Ethiopia are associated with blood transfusion and with level of education in a Nigerian Study.[12,13]

Conclusion

The prevalence of HBV infections among women of reproductive age was high and nearly half of these women were not aware of their HBV status. It is significantly associated with, level of education, blood transfusion,

surgical operations, close contact with HBV infected persons, smoking of shishia and alcohol consumption. Concerted efforts should be made to improve the provision of healthcare services incorporating tailored health promotion, antenatal HBV screening, birth dose vaccines, and continuing professional development for healthcare providers.

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Management and outcome of women requiring massive blood transfusion after childbirth: A cross-sectional study at Muhimbili National Hospital, Tanzania

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ABSTRACT

Introduction: Massive Obstetric Haemorrhage is the leading cause of maternal morbidity and mortality in sub-Saharan Africa. The management of obstetric haemorrhage requires a systematic and standardized approach to have a favourable maternal outcome. We describe the prevalence, aetiology, current management and outcomes of women with obstetric haemorrhage at Muhimbili National Hospital (MNH).

Method: A two-year retrospective review of cases with a diagnosis of obstetric haemorrhage whose gestation age was ≥ 24 weeks and blood loss ≥ 2L or required a blood transfusion of ≥ 4L. Data were analysed using SPSS version 23 and summarized into proportions as well as measures of central tendencies (mean and median) where appropriate. The case fatality rate was calculated using the number of deaths of women with obstetric haemorrhage to the total number of women who were diagnosed to have obstetric haemorrhage.

Results: The prevalence of women who had obstetric haemorrhage was 1%. Triggering of massive blood transfusion protocols by informing physician, blood bank, theatre team, pre-transfusion laboratory test and administration of intravenous fluid was performed in more than 98%. About 2.3% of patients received a proper ratio of blood and blood products during management. The percentage of patients with acute kidney injury (AKI), disseminated intravascular coagulopathy (DIC) and heart failure were 13.6%,7.0% and 4.3% respectively. Calcium gluconate was not administered to patients who had obstetric haemorrhage. During the study period the case fatality rate was 4.7%.

Conclusion: Management of patients with obstetric haemorrhage was deficient resulting in high rates of maternal mortality and morbidity. Standardised practice by adopting and use of massive transfusion protocol should reduce the adverse maternal outcomes.

Keywords: massive obstetric haemorrhage, maternal outcomes, Tanzania

Introduction

Massive Obstetric Haemorrhage is blood loss of ≥ 2L or a rate of blood loss of >150ml/min. It is also defined as any blood loss that is associated with significant maternal morbidity. Maternal obstetric haemorrhage remains the leading cause of maternal morbidity worldwide and associated with substandard care.[1,2,3] The main types of obstetric haemorrhage are antepartum haemorrhage, postpartum haemorrhage and uterine rupture.[3,4,5]

Management of obstetric haemorrhage involves a multidisciplinary approach where Obstetrician, Midwives, Haematologist and Anaesthesiologist[1-5] are involved. Management involves massive blood transfusion arbitrarily defined as transfusion of blood volume to patient equivalent to their total blood volume (7% - 8% of the body weight) in less than 24 hours.[6,7,8]

Assessment of near-misses consistently identifies severe haemorrhage as a major cause of maternal morbidity. These includes AKI, acute decompensated heart failure, DIC, pulmonary embolism (PE), admission to Intensive Care Unit (ICU) and emergency hysterectomy.[2,9,10] Optimal use of available guidelines and protocols is essential in providing appropriate care in women presenting with massive obstetric haemorrhage.

This study aimed to assess the current practice in the management of obstetric haemorrhage in our hospital and address gaps by developing standard operating procedures and protocols from existing National or International guidelines.

Method

All files of pregnant women who delivered at MNH from 1st January 2017 to 31st December 2019 and who had obstetric haemorrhage were traced from the labour ward and theatre register book. A desk review of patients' medical records to be included was done manually using clinical and operation notes, laboratory investigation results, recorded estimated blood loss, Intensive Care Unit (ICU) maternal obstetric monitor charts, blood and blood products request forms, blood transfusion notes and discharge summaries. Data were entered into a pretested proforma developed from the management described as part of the massive transfusion protocol for obstetric haemorrhage according to National Clinical Guideline for appropriate use of blood and blood products.[8] Analysis was done using chi-squared and Fisher's exact test where appropriate to calculate the p-value which was significant at $p \leq 0.05$ using SPSS version 23. The case fatality rate was calculated using the number of deaths of women with obstetric haemorrhage to the total number of women who were diagnosed to have obstetric haemorrhage.

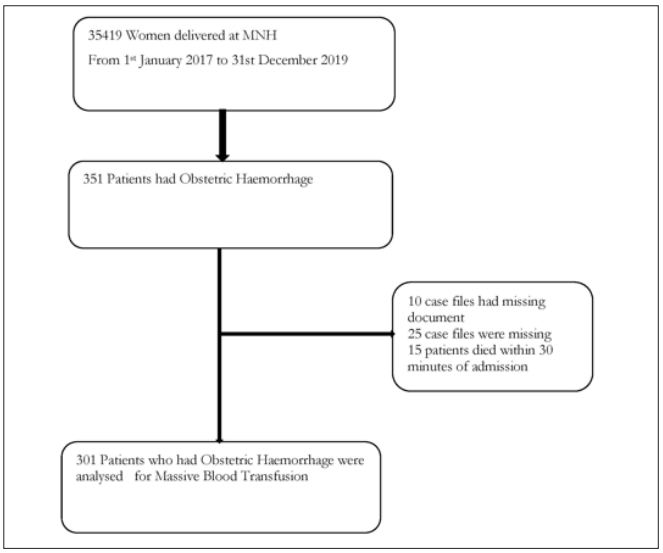

Figure 1. Patient flow chart

Ethical approval was granted by Senate Research and Publication Committee (SRPC), Muhimbili University of Health and Allied Sciences (MUHAS).

Results

During the study period 35,419 women delivered at MNH, 351 were recruited for the study after meeting inclusion criteria for obstetric haemorrhage (Figure 1). Out of these 49.2% lost ≥2L of blood, 35.2% had peripartum hysterectomy, 6% required ≥ 4 units of whole blood/packed red blood cell during acute transfusion and 12.6% had a drop of more than 4g/dl in haemoglobin from baseline. Majority of the study participants delivered by Caesarean Section and reported to have severe PPH. It was also noted that majority of study participant in this aged above 30 years (Table 1). Most patients had no morbidity after massive blood transfusion (64.8%) while 16.9% had ≥ 2 morbidities. The case fatality rate due to massive obstetric haemorrhage was 4.7%. Abruption placenta, uterine atony, perineal tear and uterine rupture were leading causes of obstetric haemorrhage (Table 2) The management of patients with massive obstetric haemorrhage is shown in table 3. Triggering of protocol, pre-transfusion laboratory testing and giving intravenous fluids were performed accurately in women who needed massive blood transfusion (Table 4).

Table 1. Demographic and Obstetric Characteristics of women with obstetric haemorrhage (N=301)

Characteristics		n (%)
Age group (years)	≤19 years	5(1.7)
	20 to 29 years	130(43.2)
	30 to 39 years	157(52.2)
	≥ 40 years	9(3.0)
Gestational age	24 to 27 weeks	1(0.3)
	28 to 36 weeks	119(39.5)
	≥37 weeks	181(60.1)
Mode of delivery	Vaginal delivery	108(35.9)
	Caesarean Section	193(64.1)
Estimated blood loss	500 to 999ml	24 (8.0)
	1000 to 1999ml	129(42.9)
	≥2000ml	148(49.2)
Diagnosis of Post-Partum Haemorrhage (PPH)	500 to 999ml PPH	23(7.6)
	≥1000ml SEVERE PPH	278(92.4)

Discussion

The prevalence of massive obstetric haemorrhage in this study was 1%. About half of these patients had an estimated blood loss of ≤ 2 litres. More than one third underwent emergency peripartum hysterectomy as a means of combating haemorrhage. Abruption placenta, uterine atony and perineal/cervical tear and uterine rupture were the major causes of massive obstetric haemorrhage. Triggering of the protocol for Massive Blood Transfusion was performed appropriately in > 98% in women who had massive obstetrics haemorrhage. A very low proportion of patients received the prescribed ratio of blood and blood products during transfusion. The major source of blood and blood products at MNH is from the blood bank where family members of the patients and free donors contribute. There is a low availability of blood and blood products at MNH as in other developing. Calcium gluconate was not prescribed to any of the patients despite of meeting criteria after receiving ≥ 4 unit of blood. The highest morbidity was AKI, acute decompensated heart failure. The overall fatality rate was 4.7%.

Table 2. Distribution of the causes and morbidities associated with Massive Blood Transfusion (n=301)

Variable	Mode of delivery		Total	p-value
	Vaginal delivery n (%)	Caesarean Section n (%)		
Abruptio placenta	27(26.7)	74(73.3)	101	0.019
Placenta Praevia	2(8.0)	23(92)	25	0.002
Placenta accreta*	4(30.8)	9(69.2)	13	0.776
Perineal tear	49(96.1)	2(3.9)	51	
Retained tissue	9(64.3)	5(35.7)	14	0.023
Uterine atony	24(45.3)	29(54.7)	53	0.116
Thrombin*	2(40.0)	3(60.0)	5	>0.999
Uterine rupture	4(11.8)	30(88.2)	34	0.002
Haemoperitoneum Post-caesarean section	0(0)	32(100)	32	<0.001
Morbidity associated with Obstetrics Haemorrhage				
Acute kidney injury	12(29.3)	29(70.7)	41	0.342
Heart failure*	1(7.7)	12(92.3)	13	0.037
Disseminated intravascular coagulation*	3(14.3)	18(85.7)	21	0.034
Pulmonary embolism*	2(40)	3(60)	5	>0.999
ICU admission	32(31.7)	69(68.3)	101	0.281

* Fisher's exact test was used instead of chi-squared

Table 3. Management of patients with Massive Obstetric Haemorrhage N=301

Variable		Mode of Delivery		Total	p-value
		Vaginal delivery n (%)	Caesarean Section n (%)		
Triggering of protocol (call for help, attending physician informed, blood bank and theatre team involved)		105(35.4)	192(64.6)	297	0.134
Laboratory testing of blood samples pre- transfusion for FBP*, PT$^{\alpha}$, aPTT$^{¥}$, and ABO$^{\beta}$		106(35.8)	190(64.2)	296	>0.999
IV fluid resuscitation with crystalloid and/or colloid infusion		107(35.8)	192(64.2)	299	>0.999
Request and administer in parallel a 1:1:1 ratio of 6 Units of RBCs$^{\gamma}$, 6 Units of FFP‡ and 6 Units of Platelets over 6 hours*		4(57.9)	3(42.9)	7	0.255
Peripartum hysterectomy		17(16.0)	89(84.0)	106	0.001
Use of tranexamic acid 10mg/kg Intravenous followed by 1g over 8 hours for patients presenting with intractable bleeding		15(51.7)	14(48.3)	29	0.061
No correction of hypocalcaemia if ≥ 4 units of whole blood is given by infusion used by injection calcium chloride or calcium gluconate		62(41.1)	89(58.9)	151	0.060
Control FBC*, PT$^{\alpha}$ and aPTT$^{¥}$ every 4hrs after blood transfusion		74(35.7)	133(64.3)	207	0.944
Women with some morbidities after massive obstetric haemorrhage		34(31.2)	75(68.8)	109	0.201
Maternal status	Alive on discharge	105(36.6)	182(63.4)	287	0.248
	Death	3(21.4)	11(78.6)	14	
Provision of packed red blood cells	Not given	65(31.9)	139(68.1)	204	0.108
	Given of ≥ 4 unit	19(44.2)	24(55.8)	43	
	Given <4 unit	24(44.4)	30(55.6)	54	
Provision of whole blood	Not given	39(41.1)	56(58.9)	95	0.106
	Given of ≥ 4 unit	40(39.2)	62(60.8)	102	
	Given <4 unit	29(27.9)	75(72.1)	104	
Provision of fresh frozen plasma	Not given	39(30.5)	89(69.5)	128	0.019
	Given of ≥ 4 unit	15(60.0)	10(40.0)	25	
	Given <4 unit	54(36.5)	94(63.5)	148	
Provision of platelet concentrate	Not given	104(36.0)	185(64.0)	289	0.319
	Given of ≥ 4 unit	2(66.7)	1(33.3)	3	
	Given <4 unit	2(22.2)	7(77.8)	9	

*Full blood Picture; α Prothrombin time; ¥ Partial Prothrombin time; β . blood grouping for A, B and O; γ, Red blood cell concentrate; ‡ Fresh Frozen Plasma

Table 4. Management of patients with Massive Blood Transfusion (n=301)

Steps in management of Massive Obstetrics Haemorrhage	n (%)
Informed attending physician and blood bank	297(98.7)
Pre-transfusion laboratory testing	296(98.3)
Resuscitation with Intravenous fluids	299(99.3)
Request and administration of appropriate blood and blood products.	7(2.3)
Use of tranexamic acid.	29(9.6)
Correction of hypocalcaemia if ≥4 units of whole blood are used.	0(0)
Repeat laboratory tests after blood transfusion.	150(49.8)

The leading cause of massive obstetric haemorrhage in this study was at odds with a study done in developed countries where uterine atony was the main cause.[6] There is higher percentage of relaparotomies after delivery by Caesarean Section compared to vaginal delivery.[10,11] The proportion of those with massive obstetric haemorrhage in this study was lower than that reported by Gutierrez et al.[2] Although the proportion of massive obstetrics haemorrhage at MNH falls within the sub-Saharan region's prevalence of 0.06%-3.05% it was significantly lower than the prevalence reported in Ghana.[12,13]

The commonest aetiologies for massive obstetric haemorrhage in this study were abruption placenta, uterine atony, perineal /cervical tear, uterine rupture and haemoperitoneum after abdominal delivery. Initial described practices (Table 4) in the management of women with massive obstetrics haemorrhage at MNH were performed well when compared to the study done in Karachi, Pakistan.[14] More than 97% of our cases did not receive the recommended ratio of blood and blood products. We found that the highest morbidity after massive blood transfusion was AKI (13.6%) a finding similar to a study conducted in Pakistan where AKI was the leading complication among women who received massive blood transfusion.[13,14]

The case fatality rate in sub-Saharan Africa due to obstetric haemorrhage ranges between 2.8%- 27.3%, indicating a deficiency in the management of obstetric haemorrhage. Studies in Ghana and Rwanda reported case fatality rates between 5.9% and 22% which are greater compared to our finding.[13-15] This clearly implies that there is a need to review and improve our practice in the management of massive obstetric haemorrhage .

Our study highlights where we are in terms of good clinical practice based on existing guidelines. It emphasises areas where focus is needed.

This study was done in a tertiary facility where most cases are referred and thus any extrapolation to other populations must be cautious. Underestimation of blood loss was one of the limitations in this study; efforts were made to use a combination of criteria to extract women who had obstetric haemorrhage. Documentation of blood loss on the way to operating rooms or waiting room prior to operation was not noted. Being a retrospective case review it was not possible to capture factors that affect current practice when administering massive blood transfusion. Further studies on this important topic are needed.

Conclusion

Massive blood transfusion was associated with high rate of maternal morbidity and mortality. Adoption of a protocol for massive transfusion from the national guideline for use in the maternity unit at MNH should reduce maternal morbidities significantly. Informed attending physician and blood bank, pre transfusion laboratory testing and resuscitation with intravenous fluids were among the three steps in the management of obstetric haemorrhage which were effectively performed.

Management of obstetric haemorrhage requires the adherence to an accepted transfusion protocol in every labour and delivery unit and obstetric theatre. Training of health workers on massive transfusion protocol in the maternity unit is essential to reduce maternal morbidity and mortality.

Conflicts of interest: None

Authors' contributions: SEL, PJW and MER: Participated in study design, data collection, analysis and manuscript preparation and review.

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Addressing barriers in paediatric tuberculosis reporting: A qualitative study of private healthcare providers' perspectives

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ABSTRACT

Introduction: Tuberculosis (TB) in children poses a global health challenge, contributing to high morbidity and mortality rates. In 2020, approximately 208,000 TB-related deaths occurred in children under 15 years, many due to under-reporting, particularly in the private healthcare sector. Barriers to TB notification include hesitancy and misconceptions, lack of awareness and training, technological challenges, stigma, and regulatory issues.

Method: This qualitative study examined primary care physicians' perspectives on the under-reporting of TB cases through in-depth semi-structured interviews with 15 physicians from private practices and clinics in Indonesia. Data collection was between May and July 2024. Thematic analysis, supported by NVivo 12 software, was used to identify key themes, and findings were reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ).

Results: The analysis revealed two primary themes: Barriers to Tuberculosis Notification and Social and Policy Impacts on Tuberculosis Notification. Under the first theme, five sub-themes were identified: Hesitancy and Misconceptions, Lack of Awareness and Training, Technological and Logistical Barriers, Stigma and Confidentiality Concerns, and Regulatory and Enforcement Issues. These findings highlight the complex factors influencing TB notification practices in the private sector.

Conclusion: Addressing these barriers through targeted interventions is essential for improving paediatric TB notification rates. This study underscores the need for enhanced training, better regulatory frameworks, and improved collaboration between private practitioners and public health authorities to ensure timely diagnosis and treatment of paediatric TB.

Keywords: tuberculosis; paediatric; reporting; barriers; private healthcare providers, Indonesia

Introduction

Paediatric tuberculosis (TB) remains a major global health issue, contributing to high morbidity and mortality among children. In 2020, an estimated 1.3 million deaths were attributed to TB, with 208,000 of these fatalities occurring in children under 15 years, and more than 80% among those under five years. This emphasises the critical role of early diagnosis and timely intervention in preventing paediatric TB deaths. Treatment, once started, reduces the mortality rate to below 1%.[1,2]

The unique nature of paediatric TB presents particular challenges, especially among young children who are susceptible to severe, often extra-pulmonary, forms of the disease. Such presentations are frequently harder to diagnose due to their nonspecific symptoms, especially in resource-limited settings.[3,4] Unfortunately, TB in children has historically received far less attention than adult TB, despite its disproportionate impact. The World Health Organization (WHO) estimates that approximately 54% of paediatric TB cases globally go unreported, creating a substantial gap in disease control efforts.[2]

In many countries, the private healthcare sector—comprising independent practitioners, clinics, and private hospitals—serves as a primary point of contact for families seeking care. Although valued for its perceived higher quality, shorter waiting times, and patient confidentiality, the private sector often operates outside formal public health reporting systems. This disconnect has led to significant under-reporting, particularly in paediatric TB cases, where the private sector's role in TB management is often under-prioritized.[2,5,6,7]

This study aimed to explore the factors influencing the under-reporting of paediatric TB in the private healthcare sector in Semarang, which has one of the highest incidences of TB in Indonesia.[8] By identifying and understanding these barriers, we propose targeted interventions to improve reporting rates, ensure timely diagnosis and treatment for at-risk children, and contribute to more effective TB control efforts.

Method

This qualitative study employed in-depth interviews to explore primary healthcare providers' perspectives on the under-reporting of paediatric TB cases. Fifteen physicians practicing in private clinics and independent practices were selected based on their willingness to participate and their direct involvement in diagnosing and managing TB cases.

A semi-structured interview guide allowed for in-depth exploration of key issues while maintaining consistency across interviews. Each session lasted 45 to 60 minutes and was conducted either in person or via virtual platforms, depending on participant preference. The interview guidelines probed challenges, facilitators, and experiences related to TB reporting practices.

Data collection was carried out from May to July 2024. With participants' consent, all interviews were recorded verbatim. To ensure confidentiality, identifying information was not linked to the data. Both the research assistant and the principal investigator reviewed the transcripts alongside the recordings to ensure accuracy.

Thematic analysis was used for data analysis, incorporating both inductive and deductive coding. Codes were documented in a codebook, grouped into subthemes, and further consolidated into main themes. This iterative process involved two research team members who reviewed the codebook and themes for consistency. Discrepancies were resolved during team discussions. NVivo 12 software facilitated the qualitative analysis, and this study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ).

Results

Fifteen healthcare providers from ten facilities were invited to participate in the interviews but two were unavailable from one facility. The facilities served a total of approximately 300 paediatric TB cases annually.

Factors related to under-reporting of paediatric tuberculosis in the private sector

The interview data revealed two main themes capturing healthcare providers' views on factors related to the under-reporting of paediatric TB. A summary of these themes and their subthemes is presented in Table 1.

Barriers to Tuberculosis Notification

Interviews with general practitioners and paediatricians in the private sector revealed several critical barriers to notifying paediatric TB cases. These barriers were grouped into three subthemes: hesitancy and misconceptions, lack of awareness and training, and technological and logistical obstacles.

- **Hesitancy and Misconceptions:** Twelve of 15 physicians expressed uncertainty and misconceptions regarding the notification requirements for paediatric TB. Practitioners were

Table 1. Themes and subthemes emerging from interviews with private healthcare practitioners

Themes	Subthemes
Barriers to Tuberculosis Notification	Hesitancy and Misconceptions
	Lack of Awareness and Training
	Technological and Logistical Barriers
Social and Policy Impacts	Stigma and Confidentiality Concerns
	Regulatory and Enforcement Issues

often hesitant to report cases due to concerns about losing patients to the public sector

- **Lack of Awareness and Training:** Fourteen of 15 private practitioners were not fully informed about paediatric TB notification mandatory requirements, and they expressed a need for more targeted training, particularly on using digital systems like the Wi-Fi TB App. This lack of awareness contributed to confusion about notification procedures.
- **Technological and Logistical Obstacles:** Technical and logistical challenges, such as limited Internet access and outdated systems, further hindered TB case notification. Twelve of 15 practitioners reported that the notification system was not user-friendly, especially in clinics with high patient volumes.

Social and Policy Impacts on Tuberculosis Notification

- Interviews highlighted two social and policy-related barriers significantly impacting TB notification: stigma and confidentiality concerns, and regulatory and enforcement issues.
- **Stigma and Confidentiality Concerns:** Eleven of 15 practitioners expressed concerns about the stigma associated with TB, particularly in paediatric cases. Providers feared that notifying authorities might breach patient confidentiality, which is highly valued in close-knit communities.
- **Regulatory and Enforcement Issues:** Eleven of 15 physicians noted a lack of strict regulatory enforcement and the absence of penalties for non-compliance in TB notification. Without strong enforcement mechanisms, notification was often viewed as optional rather than obligatory.

Discussion

This study highlights significant barriers to paediatric TB notification by private practitioners, posing substantial obstacles to effective TB control. The primary barriers identified can be grouped into three categories: hesitancy and misconceptions, lack of awareness and training, and technological and logistical obstacles.

Hesitancy and Misconceptions. A pervasive finding in this study was the widespread uncertainty and misconceptions among healthcare providers regarding notification requirements for paediatric TB cases. Many practitioners expressed reluctance to report cases due to concerns about patient retention if referrals to government facilities were required. This hesitancy underscores the need for building trust between private healthcare providers and public health systems to ensure continuity of care. [7,9,10]

Lack of Awareness and Training. Lack of awareness and training about mandatory notification procedures emerged as another significant barrier. Comprehensive training on digital notification platforms and the notification process itself is crucial. Previous studies confirm that targeted, ongoing training correlates positively with compliance in reporting protocols among healthcare providers.[12-17]

Technological and Logistical Obstacles. Limited connectivity, outdated notification platforms, and time constraints due to high patient loads emerged as practical barriers in paediatric TB reporting. Addressing these challenges requires investing in robust technology infrastructure and providing technical support to streamline the reporting process.[14-17]

Social and Policy Impacts on Tuberculosis Notification

Stigma and Confidentiality Concerns. Social issues like stigma and confidentiality concerns further contribute to under-reporting. Campaigns aimed at reducing TB stigma and fostering trust between providers and the community are essential to mitigating these concerns.

Regulatory and Enforcement Issues. Weak enforcement of notification policies compounds the challenge of under-

reporting. Implementing clearer regulatory guidelines, regular audits, and enforcing penalties for non-compliance may help improve notification practices in the private sector.

Discussion

This study identifies key social and policy-related barriers hindering the private practitioners' notification of paediatric TB cases by private practitioners. Addressing these barriers requires a multifaceted approach, including reducing stigma, strengthening regulatory frameworks, and ensuring privacy while reinforcing the importance of mandatory notification. Comprehensive training and robust technological infrastructure are also essential to support private practitioners in fulfilling their reporting obligations effectively.

By enhancing collaboration between the private and public sectors and creating an environment that encourages accurate reporting, significant progress can be made in paediatric TB control efforts. Future research should evaluate the effectiveness of targeted interventions and promote partnerships between private practitioners and public health authorities to optimize TB case reporting and safeguard child health.

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Conflicts of Interest: None

Informed Consent Statement: Informed consent was obtained from all study participants.

Institutional Review Board Statement: Approved by the Ethics Committee of University Dian Nuswantoro, approval number 3394/UDINUS/XI/2023.

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South Sudan begins mass inoculation campaign with cholera vaccines

Juba, South Sudan — 3 Jan 2025

More than 1.1 million doses of an oral cholera vaccine have arrived in South Sudan, as the government launched a program to inoculate more than 80 percent of the population. But the mass vaccination exercise faces numerous challenges, including a lack of access to the areas dealing with the worst cholera outbreaks.

Medics in South Sudan will attempt to vaccinate at least 9 million people against cholera, an exercise that targets mostly children and mothers.

More than 1.1 million doses of oral cholera vaccine arrived in the capital, Juba, and will be dispatched next week to hot spots areas like the town of Bentiu.

The country's Ministry of Health reported last week that 199 people have died of cholera, with 13,000 more diagnosed so far with the bacteria.

Dr. Gabriel Boum Tap is an immunization officer at UNICEF in South Sudan.

https://www.voanews.com/a/south-sudan-begins-mass-inoculation-campaign-with-cholera-vaccines-/7923116.html

Research Article

Knowledge, attitudes, and practices of caregivers of malnourished children at the Al Sabbah Children's Hospital, Juba, South Sudan

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ABSTRACT

Introduction: Malnutrition results from insufficient, excessive, or imbalanced intake of nutrients. The contributory factors include poverty, lack of access to food and family knowledge, inadequate healthcare, and recurring illnesses. This study aimed to gather data on the nutrition-related knowledge, attitudes, and practices of the caregivers of young, malnourished children at the Al-Sabbah Children's Hospital, Juba, South Sudan

Method: This cross-sectional study was conducted in April 2024. A pretested questionnaire was used to collect information from the calculated sample size of 50 caregivers. The data were analysed using Statistical Packages for Social Sciences (SPSS).

Results: Data taken from the hospital registers showed that, at the time of the survey, the mid-upper-arm circumference of the children indicated that 35 were not malnourished and 15 were still moderately malnourished. Most caregivers had heard about malnutrition and said they had got this information from their husbands; most had previously used malnutrition services at health facilities having been encouraged by their families although transport was expensive, and many paid for the service. More than half felt family and traditional perceptions of malnutrition had a negative impact on the condition.

Conclusion: The information provided by caregivers of children attending hospital malnutrition services indicate that, although they have some knowledge of malnutrition and malnutrition services, there is need for improvement.

Keywords: caregiver knowledge, malnutrition, children under-five years, Al Sabbah Children's Hospital.

Introduction

Malnutrition is caused by insufficient, excessive, or imbalanced intake of nutrients.[1] In children it can lead to stunted growth, weakened immune system, and increased susceptibility to diseases.[2] Underlying causes may be a lack of access to food, inadequate healthcare, and recurring illnesses, and these vary across

different regions and countries. In South Sudan, conflicts, economic instability, and poor infrastructure contribute to food insecurity, limited access to clean water and sanitation, and inadequate healthcare services leading to a high prevalence of young child malnutrition.[3] Cultural practices such as early marriage increase the risk of teenage girls having low-birthweight babies.[4] The underlying causes of malnutrition should be addressed through a multi-sectoral approach involving governments, local communities, and international organizations.[5] As well as investments in agriculture, healthcare, and clean water, there needs to be improved education and promotion of gender equality and empowerment of women and girls.[5]

In South Sudan, many communities lack access to healthcare facilities, and those that do often face shortages of medical supplies and trained healthcare workers.

This paper, part of a student dissertation, summarises what caregivers of young children attending Al Sabbah Children's Hospital reported they knew about young child malnutrition and malnutrition services.

Method

A cross-sectional study was conducted in April, 2024 amongst the caregivers of young children using the malnutrition services at Al Sabbah Children's Hospital, the referral hospital for the whole of South Sudan.

The sample size, calculated for cross-sectional design with a 0.01 margin of error, was 50 respondents.

A structured pretested questionnaire with open- and closed-ended questions, (translated from English into 'Juba Arabic' which is widely spoken locally) was used to collect information from the caregivers. Literate caregivers completed the questionnaire themselves, for the others the data were collected in face-to-face interviews. The researcher translated the responses into English. The data were analysed using Statistical Packages for Social Sciences (SPSS).

The study was approved by the Upper Nile University (UNU), Faculty of Public and Environmental Health and Al Sabbah Children's Hospital administration. Its purpose and importance were explained to each participant. Confidentiality was always maintained.

Results

Data taken from the hospital registers for the 50 caregivers' children showed that, at the time of the survey, the mid upper arm circumference (MUAC) of the children indicated that 35 (70%) were not malnourished and 15 (30%) were still moderately malnourished.

Table 1. Caregiver characteristics (N = 50)

Variable	n (%)
Age (years)	
15 – 25	10 (20.0)
26 – 35	28 (54.0)
36 - 49	12 (24.0)
Education	
Primary	14 (28.0)
Secondary	27 (54.0)
University and above	9 (18.0)
Family income (SS pounds)	
Less than 5,000	23 (46.0)
5,000 and above	27 (54.0)

5,000 SS pounds = about 40 US$

Table 1 shows that, of the 50 caregivers (mainly mothers), about half were aged 26-35 years and 36 had been to Secondary school.

Table 2 shows that 46 of the caregivers 'heard about malnutrition in their daily routine'; 40 got this information from their husbands and 10 from a health professional.

When asked if they had used malnutrition services at health facilities before this visit 38 said they had and 30 said they had been encouraged to use them by their family; 32 said that transport to the health facility was expensive and 30 said they paid for the service in some facilities.

When asked about malnutrition among young children in their communities, 29 said there were cases, and that parents', and traditional, perceptions of malnutrition had a negative impact on the condition.

Discussion

The data from mothers and other caregivers attending the malnutrition services at Al-Sabbah Children's Hospital show that most had heard of malnutrition and that husbands were an important source of information. The majority had previously attended malnutrition services in a health facility although many said that transport was expensive and some facilities charged for services.

Table 2. Caregivers' responses about malnutrition and malnutrition services (N=50)

Variable	n (%)
Have you ever heard about malnutrition?	
Yes	46 (92.0)
No	4 (8.0)
From what source do you get malnutrition information?	
Husband	40 (80.0)
Health professional: midwife, nurse, doctor	10 (20.0)
Have you ever used malnutrition services before this visit?	
Yes	38 (76.0)
No	12 (24.0)
Who encouraged you to use malnutrition services?	
Myself	20 (40.0)
My family	12 (24.0)
Husband	18 (36.0)
How affordable is the transportation cost to the health facility for you?	
Expensive	32 (64.0)
Not expensive	18 (36.0)
Do you pay for malnutrition services in any of the health facilities?	
Yes	30 (60.0)
No	20 (40.0)
Do you have malnutrition cases in your community especially of children aged under five years?	
Yes	29 (58.0)
No	21 (42.0)
Do parents' perceptions have a negative impact on solving malnutrition in children aged under five years?	
Yes	40 (87.0%)
No	10 (13.0%)
Do traditional perceptions towards malnutrition among children aged under five years negatively impact children's health and growth?	
Yes	33 (66.0)
No	17 (34.0)

So, despite some knowledge about young child malnutrition, and because many felt that traditional perceptions had a negative impact, there is a need to improve the communication about malnutrition so caregivers and their families know how to feed and care for their young children.

Conclusion

The information provided by caregivers of children attending hospital malnutrition services indicate that, although they have some knowledge of malnutrition and malnutrition services, there is need for improvement.

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South Sudan: Malaria Vaccine in South Sudan - Now It's Time for Life-Saving Pneumonia and Rotavirus Vaccines

2 December 2024

By Dr Emmily Koiti and Dr. Anne Pita Lomole

In 2019, South Sudan experienced significant child mortality from preventable diseases. Pneumonia and diarrhea were particularly deadly, accounting for 19% and 10% of under-5 mortality, respectively. Rotavirus is especially impactful, causing 24.4% of diarrheal disease deaths in low- and middle-income countries.

Vaccination emerges as a crucial public health strategy, preventing an estimated 3.5 to 5 million deaths from vaccine-preventable diseases. Given the substantial burden of these illnesses, prioritizing comprehensive vaccination programs is essential for reducing child mortality and improving overall health outcomes.

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Evaluation and surgical repair of retroperitoneal duodenal perforation following blunt trauma: A case report

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ABSTRACT

Isolated horizontal duodenal injuries resulting from blunt abdominal trauma are exceedingly rare, primarily due to the retroperitoneal location of the duodenum. This anatomical characteristic often leads to delayed diagnoses. A 61-year-old man presented to the emergency room following an assault by a bull. He complained of severe abdominal pain, vomiting, and fever. Imaging revealed a perforation on the anterior wall of the third part of the duodenum. However, during the laparotomy after Kocherisation (a way of exposing the duodenum to get better access), an additional posterior wall perforation at the same duodenal site was identified. Tension-free transverse primary repair was performed for the anterior and posterior wall perforations, with duodenal decompression procedures. Drains were placed accordingly. The patient recovered well, with gradual resumption of feeding and subsequent removal of drains. He was discharged after 15 days, demonstrating successful recovery without complications.

Keywords: horizontal duodenal perforation, surgical repair, bull attack, India

Introduction

Isolated horizontal duodenal injuries resulting from blunt abdominal trauma are exceedingly rare, primarily due to the retroperitoneal location of the duodenum. This anatomical characteristic often leads to delayed diagnoses.

We present a case report on the surgical repair of retroperitoneal duodenal perforation following blunt trauma.

Case Presentation

A 61-year-old male, having been attacked by a bull, presented four days later to our emergency department. Following the incident, he developed sudden and progressively worsening abdominal pain radiating to his back. He also had multiple episodes of bilious vomiting for two days followed by intermittent feverishness without chills or rigors.

On general examination, the patient appeared sick with the heart rate of 98 beats/min, blood pressure 108/75 mm of Hg, temperature 37.6ºC, and respiratory

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rate 14 breaths/min, were normal. There was abdominal distension and generalized tenderness and guarding, particularly in the right iliac fossa. Bowel sounds were absent on auscultation. A FAST (Focused Assessment with Sonography in Trauma) examination revealed the presence of free fluid collection in the right iliac fossa and dilated small bowel loops. The working provisional diagnosis was a haemoperitoneum.

Blood investigations were normal and showed the following: Hb: 11.8gm/dL, WBC: 6.74 x 103/µl. Serum amylase: 66 IU/L, serum lipase: 40.1 IU/L). A chest x-ray was normal. An erect abdominal x-ray revealed dilated small bowel loops without air under the diaphragm. Since the patient was haemodynamically stable, a contrast-enhanced CT (CECT) scan of the abdomen and pelvis was planned. This showed a 12mm perforation on the anterior wall of the third segment of the duodenum, with a peripherally enhancing air mixed collection measuring 7.6 x 7.2 cm causing compression of the right upper ureter. These findings indicated a post-traumatic retroperitoneal duodenal perforation. An emergency laparotomy was arranged. At operation, around 750 ml of bilious fluid was present in the peritoneal cavity and a perforation of size 2cm on the anterior wall of the third segment of the duodenum (Figure 1).

After surgical Kocherisation, a posterior wall perforation of size 1.5cm of the third portion of the duodenum was also discovered (Figure 2). The remaining parts of the intestine and visceral organs were normal. Tension-free transverse primary repair of both the anterior and posterior wall perforations was done in a double-layered fashion (Figure 3), followed by tube duodenostomy, which was placed proximal to the repaired site in a retrograde manner, and side by side gastrojejunostomy and feeding jejunostomy 15-20 cm distal to the gastrojejunostomy (Figure 4).

Two drains were placed in the subhepatic space and in the pelvis, respectively. A nasogastric tube was placed for gastric decompression. (Tube duodenostomy is to divert bile from the duodenum for better healing of the primary duodenorraphy and anastomosis site. Side by side gastrojejunostomy is to bypass the duodenum from gastric contents. Feeding jejunostomy is for early initiation of enteral healing (ERAS Protocol) for better healing of the primary repair and anastomosis. Drains in the subhepatic space and pelvis were to identify any intraperitoneal haemorrhage/leak from the anastomosis.)

On postoperative day (POD) 2, feeding through the feeding jejunostomy tube was started and changed to orally on POD 7. The pelvic drain was removed on POD 8, and the subhepatic drain was removed on POD 12. There was no evidence of any leak or collection and the patient was discharged on POD 15. Feeding jejunostomy and retrograde duodenostomy tubes were removed after two weeks post-discharge. The rest of the postoperative course was uneventful.

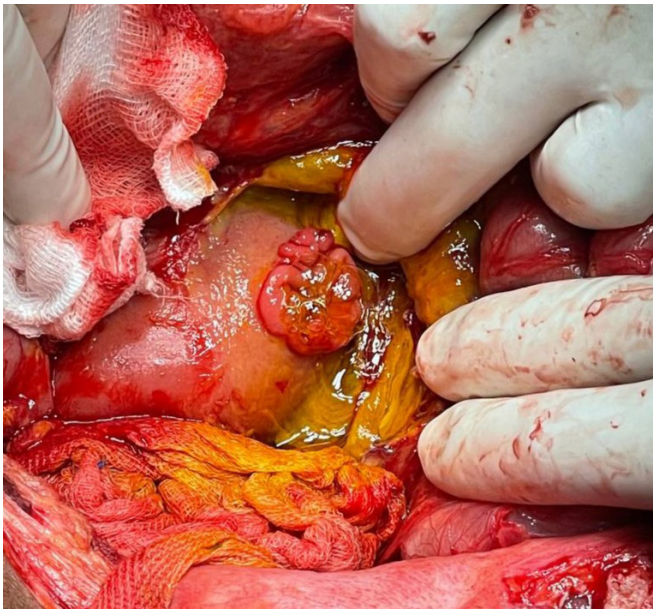

Figure 1. Anterior wall perforation

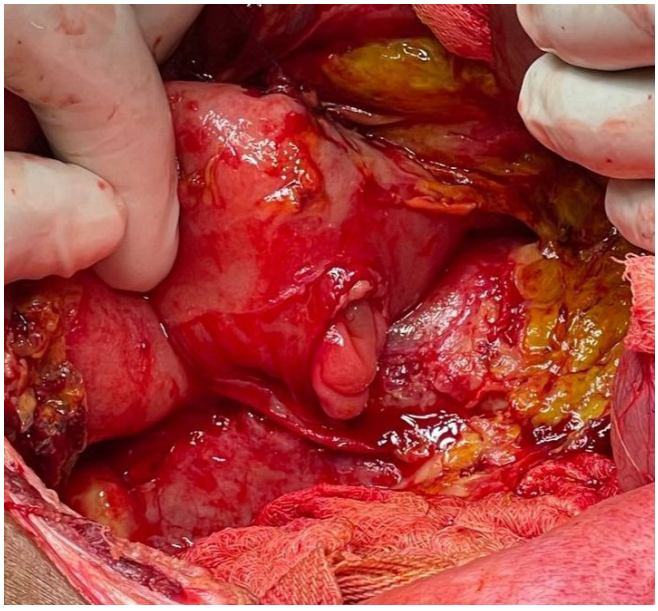

Figure 2. Posterior wall perforation of third segment of the duodenum

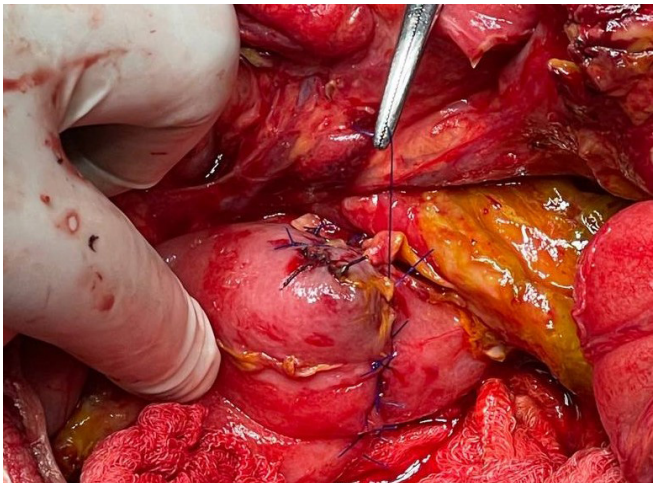

Figure 3. Primary closure of the perforation

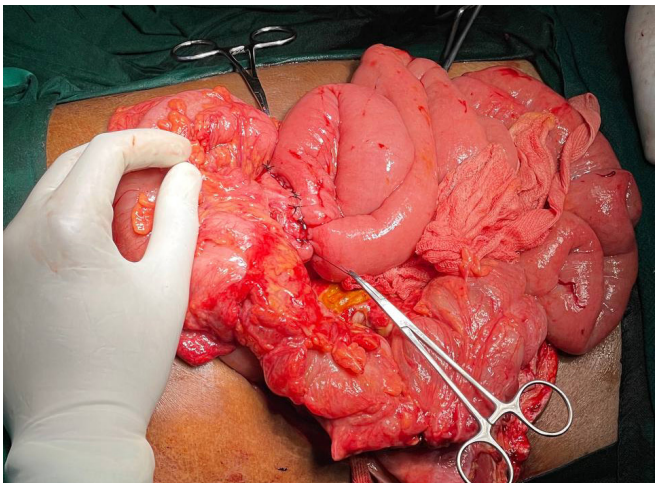

Figure 4. Gastrojejunostomy

Discussion

Injuries to the duodenum are uncommon after abdominal injury, representing 2-3% of all abdominal injuries. Blunt injury constitutes 22% of all duodenal injuries.[1] Perforations in the second and third parts of the duodenum are mainly involved during blunt injuries.[1] Blunt injury can directly compress the duodenum against the thoracic vertebrae or sudden closure of the pylorus and duodeno-jejunal flexure, simultaneously making it a closed bowel loop, sharply increasing pressure within it, leading to perforation.[2] The duodenum is closely related to the pancreas, major blood vessels, and other visceral organs all of which may be injured at the same time. Isolated duodenal injuries are uncommon, accounting for less than 30%.[3] Duodenal injury may not cause noticeable symptoms, especially in blunt trauma cases, making the diagnosis difficult.[4] However, intra-abdominal injuries may be suggested by abdominal tenderness and other signs of peritoneal irritation, although these signs are not exclusive to duodenal injury.[4]

FAST (Focused Assessment with Sonography in Trauma), Abdominal erect abdominal, and chest X-ray may help with diagnosis. A CT scan with both IV and oral contrast media is the most useful approach. Patients with haemodynamic instability and suspected internal injuries require immediate laparotomy, while a patient who is haemodynamically stable may undergo CT imaging.[3] The CT imaging of our patient showed a perforation on the anterior wall of the third segment of the duodenum with a surrounding fluid collection. At operation a separate posterior wall perforation was found.

The American Association for the Surgery of Trauma (AAST) has graded duodenal injuries to standardize local and regional disruptions, which aids in characterizing the damage and management strategy (Table 1).[3] According to AAST grading our patient belongs to Grade 2 (Involving less than 50% of circumference).

A variety of techniques are used for the management of duodenal injuries, including primary repair with or without tube duodenostomy, resection, and anastomosis, duodenal diverticulization, gastrojejunostomy with or without pyloric exclusion and pancreatico-duodenectomy. These management techniques are planned according to the degree of duodenal injury and associated injuries. Our patient had perforations of the anterior and posterior walls of the third segment of the duodenum and underwent double-layered primary closure and retrograde tube duodenostomy placed proximal to the duodenorraphy, and gastrojejunostomy. There were no postoperative complications.

It is essential to be aware of the potential complications: leakage from the repaired or anastomosis site, intraperitoneal abscess formation, duodenal fistula formation, and bowel obstruction. The risk of duodenal leak varies depending on the severity of the injury and the segment of the duodenum affected. For example, the American Association for the Surgery of Trauma classification (AAST) Grade I wounds have a low risk of leakage at approximately 0%, AAST Grade II injuries have a chance of 1.6%, and AAST Grade III injuries have

Table 1. AAST Grading for duodenal injuries

Grades	Injury description
1	Haematoma: involving one part of the duodenum Laceration: partial thickness, no perforation.
2	Haematoma involving more than one part of the duodenum Laceration: <50% circumference disruption
3	Laceration: 50-75% circumference of D2 and/or 50-100% circumference of D1, D3, D4
4	Laceration >75% circumference of D2 Involvement of the ampulla or distal common bile duct
5	Laceration: complete rupture of the pancreatico-duodenal complex Blood vessels: decreased blood supply to the duodenum (devascularization)

a significantly higher risk of 66.7%. Furthermore, the risk of duodenal leak varies across different segments of the duodenum, with "First segment of duodenum (D1) having a chance of 32%, second segment (D2) at 12.5%, third segment (D3) at 38.5%, and fourth segment (D4) at 16%".[4]

A report by Nepal et al. described three cases of horizontal duodenal perforation due to various causes.[5] These cases were managed variously with duodenojejunostomy, tube duodenostomy, tube gastrostomy, and feeding jejunostomy. However, two cases had anastomosis site leaks, one with pelvic abscess formation.

According to the Pan American Trauma Society, primary closure was considered the preferred management approach for duodenal injuries, regardless of the grade.[4] Additionally, combining suppression of bile and pancreatic secretions, with a nasogastric tube or tube duodenoscopy, has been shown to improve outcomes by reducing the risk of leakage.[4] Alternative surgical approaches may be needed, depending on the condition of the injured bowel and any associated injuries. Although CT scans are the preferred diagnostic tool, they can sometimes be inconclusive or miss specific pathologies, as demonstrated in our case. It is crucial to thoroughly expose the duodenum and examine other organs to ensure that associated pathologies are not overlooked. This comprehensive approach facilitates the adoption of optimal management strategies, ultimately reducing morbidity and mortality rates.

Conclusion

Duodenal injuries are infrequent and pose diagnostic challenges due to the absence of specific clinical manifestations. Comprehensive intraoperative assessment, encompassing meticulous duodenal exposure, is imperative for identifying concomitant pathologies that may elude detection via imaging modalities in isolation. The management of duodenal injuries, employing primary closure augmented by decompression techniques and other interventions, has exhibited favourable outcomes, accompanied by a diminished incidence of postoperative complications. These findings underscore the criticality of a thorough clinical and investigative approach, ensuring optimal management and minimizing untoward sequelae in individuals with duodenal injuries.

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Figure 1. Using pillows or some rolled-up cloth under the baby (Credit: Hesperian Health Guides)

Epidemic keratoconjunctivitis (Pink Eye) in South Sudan: A review

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ABSTRACT

Epidemic keratoconjunctivitis is an adenoviral infection that is highly contagious occurring in overcrowded settings where hygiene conditions are poor. Common symptoms include a gritty sensation, tearing, membranous conjunctivitis, and subconjunctival haemorrhage. It is a self-limiting disease but its spread can be limited by observing hygiene, avoidance of overcrowded spaces and not sharing formites. Health education and isolation of the infected individual is recommended.

Key words: epidemic keratoconjunctivitis, hygiene, adenoviral infection, South Sudan

Introduction

There have been recent incidents in South Sudan of severe inflamed eyes accompanied by discomfort, tearing, burning sensation and bleeding on the conjunctiva observed in both children attending schools and adults, including hospital personnel. Identical conditions have been observed in travellers from Uganda and newspaper reports from Mozambique suggest a similar outbreak is underway. Medical evaluations confirm that the individuals are affected by Epidemic keratoconjunctivitis (EKC), also referred to as "Pink Eye".

EKC is primarily an infection of the conjunctiva caused by an adenovirus,[1] although it can be caused by other viruses including rubella, measles, *Herpes simplex*, and bacteria.

Clinical manifestation

Initial symptoms often resemble those of an upper respiratory tract illness, such as coughing, a sore throat, and general fatigue. These are shortly followed by ocular symptoms including eye redness, discomfort, a gritty feeling, burning, excessive tearing, fluid discharge from the eye, swelling of the eyelids, and sometimes a thick discharge indicative of a secondary bacterial infection - see Figure 1A. Subconjunctival haemorrhage and keratitis may also occur - see Figure 1B. Symptoms typically begin in one eye, but the other eye may become affected due to the transfer of the virus from the infected eye.

EKC is infectious, spreading from one individual to another through contaminated hands, objects, and close contact with an infected person. The condition tends to resolve on its own within one to two weeks. However, it is highly contagious and

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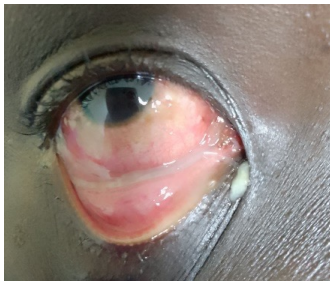

Figure 1A. Discharge (All Credit: Wani Mena)

Figure 1B. Subconjunctival haemorrhage

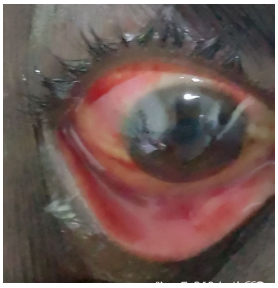

Figure 2. Pseudomembrane in the lower formice

can disseminate quickly, especially in crowded settings such as camps, educational institutions, lodging facilities, and amongst health workers, and those overseeing border crossings. Potential complications include the development of a pseudo-membrane (see Figure 2), and epithelial keratopathy, which can lead to reduced vision if the cornea is significantly affected.

Diagnosis

Diagnosis is usually clinical and is based on the distinctive presentation that starts in one eye with symptoms of redness, excessive tearing, bleeding on the conjunctiva, membrane formation, and swelling around the eye. Adenoviral infections can be confirmed with serological tests using devices such as Adenoplus, where available, which offers high sensitivity (88%) and specificity (91%).

Prevention

As an infectious disease, transmission occurs through contact with contaminated hands and objects bearing ocular secretions. Regular hand washing, refraining from shaking hands, not sharing personal items like towels and handkerchiefs, and cleaning surfaces and instruments with alcohol-based cleaners can help mitigate transmission. Avoiding crowded locations and having schools exclude or isolate infected children helps to prevent the infection spreading.

Treatment

Although "Pink Eye" generally resolves on its own, lubricating ophthalmic solutions can be applied to alleviate discomfort and antibiotics may be used if a concomitant bacterial infection, indicated by a pus-like discharge, is suspected. Ocular cleaning with 2% povidone-iodine solution should be done after anaesthetizing the area to minimize discomfort.[2,3] However, antiviral creams are not recommended as they do not shorten the duration of the infection. Steroids should not be used as they can encourage viral growth and extend the contagious period. Providing health education about the likelihood of transmitting the infection, especially during the first ten days, is also crucial.

Conclusion

"Pink Eye" is a frequently seen adenoviral infection that has self-limiting characteristics but is highly contagious and prone to quick spread in densely populated areas with insufficient sanitation. The infection causes significant eye discomfort and morbidity, leading to requests for extended leave from work and a loss in productivity. Prevention measures to control the spread and prevent an epidemic are important, along with public health education. Clinicians should aim for swift diagnosis, immediate isolation and treatment while practicing good hygiene until patients are no longer contagious.

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The Establishment of the National Public Health Institute (NPHI) in South Sudan

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Introduction

Following the establishment of the Africa Centres for Disease Control and Prevention (Africa CDC) within the African Union in 2016, it was mandated to support the creation of National Public Health Institutes (NPHIs) in African Union (AU) member states. In 2018, the Africa CDC published a framework for the development of NPHIs. That same year, a high-level meeting was held at the National Public Health Laboratory (NPHL) involving the Ministry of Health (MOH), the US CDC, and the World Health Organization (WHO), which affirmed the commitment to establishing an NPHI for South Sudan.

Country profile

South Sudan is located in the eastern African region between latitudes 3° and 13°N, and longitudes 24° and 36°E. It is bordered by the Sudan to the north, Central African Republic and Democratic Republic of the Congo to the west, Ethiopia to the east, and Uganda and Kenya to the south. The country has a surface area of about 619,745 square kilometres comprising tropical forest, swamps and grassland. The White Nile flows through the country, passing the capital, Juba. Administratively, the country is divided into 10 States and 3 Administrative Areas, each with several Counties subdivided into Payams, within three major administrative regions of Equatoria, Bahar El Ghazal, and Upper Nile. South Sudan joined the East African Community (EAC) of partner states in March 2016.

NPHI establishment

The NPHI in South Sudan was established on February 11, 2019, through Ministerial Order Number 004/2019, as an autonomous entity with perpetual succession and legal personnel. As provided for in the South Sudan National Public Health Act 2023, the NPHI's primary objectives include enhancing disease surveillance and response systems, fostering a sustainable public health workforce, and collaborating with stakeholders to improve environmental and occupational health. Its structure comprises two main directorates: the Technical Directorate, which encompasses departments focused on surveillance, emergency preparedness, public health research, and laboratory systems, and the Directorate of Administration & Finance, which manages human resources, finance, procurement, and ICT.

The Institute was envisioned to serve as a centre of excellence in the following thematic areas:

- Thematic Area 1: Surveillance and Disease Intelligence

- Thematic Area 2: Emergency Preparedness and Response and EOCs
- Thematic Area 3: Laboratory Services and Public Health Diagnostics
- Thematic Area 4: Public Health Workforce Development
- Thematic Area 5: Non-Communicable Disease and Injuries
- Thematic Area 6: Public Health Research and Ethics

The development of health research is part of the mandate of the NPHI. Research activities will ensure that health research agendas and research resources focus on priority health problems in the country.

NPHI scope

The scope of the NPHI extends to generating knowledge for better health outcomes, understanding the determinants of health, and innovating interventions that address the health challenges faced by the South Sudanese population. It focuses on:

- Generating knowledge to enhance health outcomes and promote individual, community and population health
- Understanding health determinants by analysing how biological, social, cultural, and environmental factors interact to influence population welfare.
- Creating health innovations by developing interventions needed to improve health outcomes for the population of South Sudan.

Through these functions, the NPHI is pivotal in strengthening the Nation's public health infrastructure and addressing critical health issues.

Progress and milestones accomplished

The establishment of the NPHI was significantly advanced by a ministerial order that facilitated the formation of a steering committee tasked with providing oversight, high-level guidance, and advocacy among stakeholders. To ensure technical oversight during the institute's creation, a 15-member Technical Working Group (TWG) was established. In October 2019, the Minister of Health appointed an Interim Director to coordinate stakeholder engagement and manage the establishment process effectively.

With funding from the US CDC, a benchmarking visit to Ethiopia was conducted in late September and early October 2019, involving nine members from the steering committee and TWG. This visit aimed to gather insights and best practices for the development of the NPHI.

In November 2019, with support from Africa CDC, US CDC, WHO, and Intra-Health International, the legal framework for the NPHI was developed. Subsequently, in October 2021, the Ministry of Justice and Constitutional Affairs presented the NPHI to the Governance Cluster, which passed it with amendments. This passage transformed the legal framework into a Bill, which was tabled before the Council of Ministers and unanimously passed in September 2022.

The NPHI Bill was then passed by the National Parliament in June 2023 and received Presidential assent on the 7th of July, 2023. It was officially printed and disseminated as the NPHI Act, 2023, in August 2024. Following this significant legislative milestone, an Acting Executive Director and an Acting Deputy Executive Director were appointed in July 2024, marking a new phase in the operationalization of the NPHI.

Achievements

In October 2021, with support from Africa CDC, the NPHI conducted two high-level advocacy meetings targeting senior leadership from the Ministry of Health and leaders from various line ministries, including the Ministries of Water, Environment, and Livestock, as well as Members of Parliament in the Health Committee and representatives from the Universities of Juba and Upper Nile.

During the same month, the NPHI developed a strategic plan for the years 2022-2026. The Institute also identified budget priorities for the fiscal year 2024-2025, successfully incorporated these priorities into the health sector budget, and secured funding from the Ministry of Finance and Planning for the NPHI Directorate of Administration & Finance for FY 2024-2025.

With assistance from Intra-Health International, US CDC, Africa CDC, the African Field Epidemiology Network (AFENET), WHO, and the University of Juba, the NPHI designed and established several fellowship programs, including:

1. Data Management (DM)
2. Leadership Management and Governance (LMG)
3. Field Epidemiology Training Programmes (FETP)

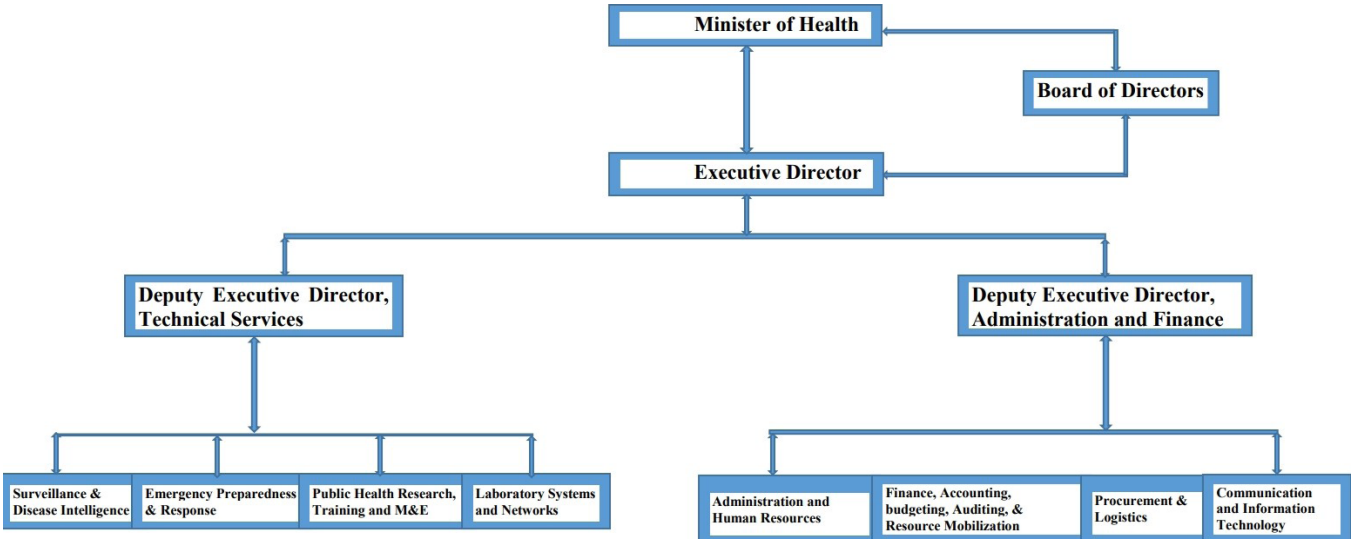

Figure 1. Governance Structures: NPHI Organogram

On the 3rd June, 2022, 42 health workers graduated from the DM and LMG programmes (20 from DM and 22 from LMG). Additionally, eight cohorts of the Frontline FETP (F-FETP) were trained, resulting in the graduation of 66 frontline field epidemiologists. Supported by the Global Fund through UNDP, an Intermediate-FETP (I-FETP) cohort has commenced in January 2025.

Furthermore, the NPHI launched its official website at https://phi.gov.ss, which is linked to the Ministry of Health website https://moh.gov.ss enhancing its online presence and accessibility.

Next Steps

The following priorities have been identified for the NPHI:

- Appointment of the Board of Directors: Establishing a governing body to provide oversight and strategic direction. See Figure 1.
- Change Management: Facilitating a smooth transition of departments and units from the Ministry of Health (MOH) to the NPHI.
- Operationalization of the Directorate of Technical Services: Ensuring that this key directorate is fully functional and integrated into the institute's operations.
- Review and Update of the Strategic Plan 2022-2026: Assessing and refining the existing strategic plan to ensure its relevance and effectiveness in guiding the NPHI's activities.
- Development of Infrastructure: Building and enhancing the physical and organizational infrastructure necessary for the NPHI to operate effectively.

Summary

The establishment and operationalization of the NPHI in South Sudan involved a series of strategic steps aimed at enhancing public health capabilities:

- A dedicated 15-member TWG was established to provide technical oversight during the creation of the NPHI.
- The TWG conducted assessments to identify public health needs and gaps, clarifying how the NPHI would contribute to improving health outcomes in the country.
- A comprehensive plan was developed to guide the establishment of the NPHI, ensuring alignment with national health priorities.
- The core functions of the NPHI were outlined to focus on key public health areas.
- A review was conducted to determine which current functions from the MOH would transition to the NPHI while identifying major gaps that needed to be addressed.
- The NPHI developed a strategic plan for 2022-2026, which included identifying budget priorities

for 2024-2025, successfully integrating these into the health sector budget.

- Resources were identified to support the operationalization of the NPHI, including funding allocations from the Ministry of Finance and Planning.
- Two high-level advocacy meetings were held with senior leadership from the MOH and other line ministries, as well as universities, to foster collaboration and support.
- With support from various partners, including Africa CDC and WHO, the legal framework for the NPHI was developed and subsequently passed into law as the NPHI Act, 2023.
- A structured change management process is currently being implemented to facilitate the smooth transition of departments and units from the MOH to the NPHI.
- The institute was officially inaugurated, marking a significant milestone in public health governance.

The NPHI is now actively engaged in the change management phase, as specified in Article 39 of the NPHI Act, 2023, which outlines transitional provisions. Ongoing dialogue and advocacy within the health sector are crucial to ensure a seamless transition. The NPHI is set to absorb the existing workforce from various departments and units earmarked for transfer, thereby strengthening its operational capacity to address public health challenges effectively.

List of key WHO-recommended maternal and newborn health commodities

Overview

This document provides a list of key WHO-recommended maternal and newborn health commodities and aims to accelerate progress towards the SDGs. It consolidates the key and enabling commodities from existing WHO guidelines on maternal and newborn health.

The commodities included in the list are either critical for reducing maternal, fetal, and/or newborn deaths, or are essential for providing high-quality care. Consumables and training materials are excluded.

The list was produced by WHO's Department of Maternal, Newborn, Child and Adolescent Health and Ageing (MCA), in collaboration with WHO technical departments and the WHO Strategic and Technical Advisory Group of Experts for Maternal, Newborn, Child and Adolescent Health and Nutrition (STAGE).

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The third community health workers' symposium, Liberia, 2023: What are the implications for South Sudan's Boma Health Initiative?

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ABSTRACT

Community health workers (CHWs) are defined by the International Labour Organization (ILO) as healthcare workers who 'provide health education, referral and follow-up, case management, basic preventive health care and home visiting services to specific communities. This paper is a synthesis report on the third CHWs' symposium held in Monrovia, Liberia in March 2023 and its implications for the South Sudan version, the Boma Health Workers (BHWs). It documents the notes on the conference deliberations supplemented by literature on the Boma Health Initiative in particular and CHWs in general. The key thematic areas were institutionalization and integration of CHW programmes into the health system, human resource recruitment, training and retention, CHWs in conflict and complex emergencies, effect of gender, and measuring performance. The Symposium was a platform for sharing information on best practices and challenges facing CHW programmes across nations. In the Monrovia Call to Action, the Symposium urged stakeholders to invest in country-led strategies, professionalize and integrate CHWs into the national human resources and health sector plans, galvanise political support and track progress.

Key words: community health, workers, boma, Monrovia, South Sudan

Introduction

Community health workers (CHWs) are defined by the International Labour Organization (ILO) as healthcare workers who 'provide health education, referral and follow-up, case management, basic preventive health care and home visiting services to specific communities. They provide support and assistance to individuals and families in navigating the health and social services system'.[1] They are also described as service extenders, social change agents and cultural brokers.[2] Community health programmes are recognized as important strategies for accelerating progress towards universal health coverage and achieving global goals such as the Sustainable Development Goals (SDGs), and CHWs are becoming increasingly critical in responding to current and emerging pandemics.[3] For

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instance, they have been credited for robust response to the Ebola epidemic in West Africa and the COVID-19 Pandemic around the world.[4]

The community health variant in South Sudan, is known as the Boma Health Initiative (BHI), a homegrown innovation guided by the BHI policy launched by the national Ministry of Health (MOH) in 2017.[5] BHI aims to offer basic health services to 56% of South Sudanese living at more than 5 kilometres from a health facility.[5]

This paper is a synopsis of the reflections during the 3rd International CHWs' Symposium held in Monrovia, Liberia, in March 2023 and discusses its implications for South Sudan's BHI programme using a comparative lens to the global practice.

Setting

The 5-day symposium was held from 20th to 24th of March 2023 under the theme "Advancing community health workers programmes to build resilient and equitable health system that accelerates primary health care for universal coverage." The event provided an opportunity for magnifying CHW voices and CHW led advocacy among more than 700 delegates from over forty entities including countries, organizations, researchers and UN Agencies. The workshop took stock of bold policy reforms and renewed commitment to develop a professionalized community health workforce capable of driving health outcomes and realizing the 'health for all' agenda.

Two days of the pre-symposium period focused on funding mechanisms for Global Fund, country level reflections, interaction with countries to foster experience sharing and learning between countries. Following the opening ceremony, a series of corresponding sessions of presentations, panel discussions, and plenaries as well as marketplaces for poster presentations, institutional engagement, sponsorship, and sales by accredited local vendors, were unveiled.

Symposium deliberations

During the Symposium, focus was drawn to five issues thought to be critical for CHW programmes and services across countries. Through a series of plenaries and break up groups, the following thematic areas were covered:

Institutionalization and integration of CHW into national health systems

Delegates compared notes on the foundational role played on primary health care (PHC) by established community-level health care but noted that it continues to struggle to be prioritized within the PHC systems because governments focus mainly on facility-based care. In some countries the results of lack of prioritization manifest in:

1. Under funding and inadequate support to CHWs, supply chain, and information systems;
2. Poor institutionalization and integration of CHW programmes;
3. Inadequate political will to provide an enabling policy environment for CHW progress;
4. Relegation of CHW programmes to partners, instead of government, in most countries (Table1).

Despite these observations, in countries such as Liberia, Rwanda, Uganda, Kenya and Ghana, where strong CHW programmes are established, it was reported that:

1. Government leads priority-setting and this is backed by strong alignment within the MOH, key non-governmental partners, and donors;
2. Strong linkage between health facilities and community health programmes exist;
3. Policies, strategies, and programmes with focus on improving the delivery of integrated, comprehensive, and quality community health services were developed and operationalized;
4. Data management and information sharing were prioritized and were seen as critical for success and
5. Bold mechanisms for resource mobilization and management were devised.

Human resource recruitment, training, and retention

Further deliberations captured information on best practices and the modus operandi regarding CHW recruitment, training and retention. Country reports indicated that all CHWs are selected from within the community according to written terms of reference and each country presented tailored curriculum for training CHWs. Such curricula showed varying training durations from as short as 2 weeks in South Sudan to as long as 3 years in Ghana. Across all the countries, a mix of practical and in-class learning models were used during training. In Ghana for instance, there is a clear career development pathway for the CHWs. Some CHWs can advance to medical or paramedical courses. As an example, a former Ghanaian CHW was at the conference as a PhD scholar

Table 1. Thematic areas of discussion during the Symposium, challenges and success steps

Thematic area	Challenges across countries	Success steps in some countries
Institutionalization and integration of CHW into national health systems	• Under funding and inadequate support to CHWs, supply chain, and information systems • Poor institutionalization and integration of CHW programme • Inadequate political will to provide an enabling policy environment for CHW progress; • Relegation of CHW programmes to partners, instead of government	• Government leads priority-setting backed by strong alignment within the MOH and partners • Strong linkage between health facilities and community health programmes • Policies, strategies, and programmes focus on improving delivery of integrated, comprehensive, and quality community health services • Bold mechanisms for resource mobilization and management
Human resource recruitment, training, & retention	• Financial insecurity and unfairness in fund use • High attrition rates attributed to low payments • Lack of recognition • Unclear career pathway	• Improved supportive supervision • Payment of incentives to complement government pay • Recruitment into the public service and clear career ladder
Impact and influence of gender	• Chronic gender underrepresentation • Cultural taboos such as barring women from riding bicycles • Domestic responsibilities • Education disparities between boys and girls	• Gender sensitive recruitment • Deliberate preference for female CHWs to provide women related community health services • Addressing wider gender gaps
CHW programmes in conflict and complex humanitarian context	• Insecurity • Access constraints	• Use of mobile phones for reporting • Negotiation skills to ensure access to supplies • Use of women to transport and preposition supplies since they are less targeted by conflicting parties
Measuring performance for community health programmes	• Inadequate use of standard matrices for measuring CHW performance • Inadequate supportive supervision and appraisal of CHW work • Insufficient capacity of CHW to use data for decision making and poor records of recruitment and training • Parallel recruitment by some CSOs doing vertical programmes	• Improved supportive supervision • Use of mobile phone reporting • Data management and information sharing are prioritized and were seen as critical for success • Integration of CHW programmes into the health system

from Johns Hopkins University to attest to this. He was a very special inspiration for the CHW fraternity as his presence was a litmus test for the future of the career. Remuneration also varied remarkably from as little as 45 US dollars in South Sudan to 150 US dollars in Ghana. The mode of payment included performance-based approaches, although this was marred with irregularities such as financial insecurity and unfairness in using the funds. High attrition rates attributed to low payment, lack of recognition, unclear career pathways were raised as

bottlenecks to CHW programmes across countries.

Impact and influence of gender

As a cross-cutting issue of global concern, a gender lens was applied to CHW programmes and delegates reported key milestones such as gender sensitive recruitment and deliberate preference for female CHWs to provide women related community health services to curb chronic under representation of women in the CHW workforce. Given that female CHWs have strong commitment to remain in their jobs longer than their male counterparts, delegates agreed to pay attention to issues that discourage women participation such as barring women from riding bicycles which undermines their mobility, and social responsibilities which curtail career advancement among females.

CHW programmes in conflict and complex humanitarian context

Given the prevailing conflict environment in many less developed countries, delegates shared experiences and adjustments made to ensure continuity of essential community based PHC services in such contexts. In the face of conflict and complex emergencies, CHWs are usually the main service providers and this ensures continuity of services such as community-based treatment of cases, vaccinations, hygiene promotion and distribution of essential high impact health commodities. Maintenance of the supply chain for health commodities was reported as one of the key areas where CHWs supported essential services. It was reported that CHWs use mobile phones reporting, negotiation skills to ensure access to supplies, and women to transport supplies and preposition buffer stock because they are less targets of conflicting parties.

In many countries it was reported that CHWs are critical during emergencies as they are the key cadres who provide critical risk communication messages to the community, promote hygiene during disease outbreak and carry out patient centred services such as screening, dispensing and referral.

Measuring performance for community health programmes

Institutionalization and integration of effective and sustainable community health systems is currently being challenged by inadequate use of standard matrices for measuring CHW performance and the systems they work within. Strategies such as developing robust measurement techniques for tracking the performance of CHWs, appraisal of CHWs and recruitment were examined. Delegates also identified gaps in supportive supervision and appraisal of CHW work, insufficient capacity of most CHWs and their communities to use data generated for decision making, poor records of recruitment, training of CHWs and parallel recruitment and training by some CSOs doing parallel programmes.

Discussion

This report highlights key issues relevant to the development and progression of CHW programmes across countries which dominated discussions during the Symposium. It also reveals how variable CHW programmes are in different settings and countries. This variability oscillates around four main themes identified as selection criteria, roles or tasks, training and remuneration.[6] These issues resonated through the symposium's major topics which were; institutionalization and integration into the health system, recruitment, training and retention, impact and influence of gender, CHW in conflict and complex emergencies and measuring performance. In line with this thinking, South Sudan's BHI programme aims at institutionalizing BHWs through formal recruitment into the public service at the entry grade 17.[5] They are nominated by the communities, based on community membership, minimum education level, personal character, age between 21 – 45 years, readiness to work for at least one year, numeric skills for reporting, knowledge of the local language and gender considerations, for a competitive recruitment into the public service.[5] Except for age requirements in BHI, these recruitment criteria align with WHO recommendations which list community membership, minimum education levels appropriate to the tasks to be performed, membership of and acceptance by the local community, promotion of gender equity, personal attributes and capacity of the candidates as key requirements for selection of a CHW.[7]

With regards to training, BHWs are trained for a period of two weeks, a wide variation from the three years' training period for Community Health Extension Workers in Nigeria.[8] Training may be as short as a few days in some settings depending on the intention of the cadres.[8] To address these variations, the Symposium recommends professionalization of CHWs with a clear career path. Scholars have suggested that training of CHWs should aim at professionalizing, monitoring performance and scaling up as this workforce takes shape with several tiers of the workforce having varying training levels necessary for placement and progression at different grades in the

public service scales.[8]

The role of CHWs in conflict and complex humanitarian emergencies such as the Ebola Outbreak in West Africa, COVID-19 and several disasters such as flooding, wars and famine cannot be overemphasized. The BHI mid-term evaluation report noted that they played crucial roles providing preventive messages on COVID-19 vaccination, distribution of IEC materials, and health education to local authorities, religious leaders, and the management committees of healthcare facilities.[9] They are equally engaged in detection and management of HIV and tuberculosis, management of chronic diseases and palliative care.[10] Their community embeddedness is their strength because it enhances their acceptability and effectiveness.[2] Evidence also shows that tasks such as community mobilization, health promotion, preventive services, offering selected clinical services, epidemiological surveillance and record keeping as well as referral to health facilities have traditionally been carried out by CHWs.[4]

The gender gap continues to bite the CHW programme. Despite obvious advantages of women performing key roles in their communities, and deliberate efforts by countries to preferentially recruit women, their numbers were still wanting across countries. Evidence from the BHI mid-term evaluation report also showed that the programme lags behind on gender representation; 83% of BHWs and 90% of BHW supervisors were males.[9] This is surely an area that requires special efforts to close the gap.

Measuring performance and tracking the progress of CHW programmes is a critical area that requires the attention of countries. BHI could benefit from innovative platforms such as the open data kit and incorporation of the indicators into DHIS 2 reporting system. It is critical to measure the performance of the individual CHWs, the community outcomes and processes in order to track progress.[11] The mid-term evaluation of BHI conducted in 2022 is a right step in the right direction; it highlights activities such as monitoring and supervision visits conducted by the BHI partners using MOH National BHI Supportive Supervision Checklist, assessment of quality of care, alignment to MoH treatment guidelines and protocols, supply chain, training, implementation and data reporting; analysis of monthly community data submitted by the implementing partners, use of visual dashboards for monitoring progress of counties, and progress on community health information management system (CHIMS) indicators tracked, as uploaded on DHIS-2 every month by county health authorities. Moreover, donors have also noted regular audits and data quality assessments for funds management, submission of quarterly reports by the implementing partners to the fund managers and use of third-party monitoring mechanisms.[9]

Conclusion

The 3rd International Community Health Workers' Symposium held in Monrovia, Liberia in March 2023 provides an invaluable learning experience among countries in general and South Sudan in particular. Key lessons were learnt and the gathering responded with a resounding 'yes' to the development, support and institutionalization of CHWs by all partners in order to accelerate the delivery of essential PHC services across countries. South Sudan's Boma Health Initiative is bound to benefit from the key lessons learnt from the gathering especially addressing local shortcomings identified during the event.

This report therefore recommends several actions to strengthen the implementation of BHI. First, there is a need for more advocacy to galvanize strong political will for BHI. There also needs to be improved resource allocation for BHI, led by domestic resource mobilization and supplemented by partners (UN agencies, CSOs and donors) to ensure ownership and sustainability. Coordination mechanisms should be strengthened at all levels of BHI implementation with involvement of BHW representatives in the coordination of activities. Additionally, the digitalization of CHIMS in South Sudan, such as use of open data kits for data collection and storage, should be prioritised.

To enhance motivation and retention, remuneration, including salaries and incentives, need to be improved. Human resources for BHI should also be strengthened, through supporting recruitment, training and retention of BHWs. This includes adopting at least a six months training curriculum with hands on job training and collaborating with the education sector to provide evening classes to improve BHWs' skills. Ultimately, this should lead to clear career pathways for BHWs being developed, as enshrined in the Monrovia Call to Action.[12]

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2024 Snapshot on HIV and AIDS in children and adolescents

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South Sudan's journey to defeat Guinea Worm Disease: The role of President Jimmy Carter and the Carter Center

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Introduction

Guinea Worm Disease (GWD), caused by the parasitic worm *Dracunculus medinensis*, is a debilitating condition characterized by painful skin ulcers. This waterborne disease, transmitted by ingesting contaminated drinking water infected with the larvae poses a significant public health challenge, primarily affecting rural communities with limited access to safe drinking water and proper sanitation facilities. Since 1986, The Carter Center has led the international campaign to eradicate Guinea worm disease, working closely with ministries of health and local communities, the U.S. Centers for Disease Control and Prevention, the World Health Organization, UNICEF, and many others. South Sudan is one of the last remaining endemic countries in the world, along with Angola, Chad, Ethiopia, and Mali.

How President Jimmy Carter joined the fight against GWD

The global campaign for Guinea worm eradication was first championed as a major indicator to measure the success of the United Nations International Water and Sanitation Decade campaign (1981-1990). This conceptualized GWD as an indicator of the isolation of poor rural residents from national development programmes such as water supply, education, and health care.[1,2]

However, getting GWD eradication into the Water Decade would not have been an easy task were it not for the persistent and determination of Dr Donald Hopkins, then at the U.S. Centers for Disease Control and Prevention (CDC), a veteran of the smallpox eradication and the first to lead the global GWD campaign at the Carter Center. Dr Hopkins was surprised to see no reference to GWD in that month's Special Issue of WHO's World Health magazine that was devoted to the Water and Sanitation Decade, while attending a conference in Geneva in October 1980., the year in which the Water Decade campaign was supposed to begin. Dr Hopkins then took the initiative about how to address the disease, including adding its eradication to the Water Decade agenda. Dr Ernesto Ruiz, the second Director for the Guinea worm eradication programme at the Carter Center, explained some of the reasons for lack of enthusiasm: GWD was mostly unknown in the developed world, there was no vaccine or cure, and its one-year incubation period meant progress would be slow.[3] The efforts of Dr Hopkins while working at the Center for Disease Control and Prevention (CDC), as the Assistant Director for International Health, materialized when the first national conference on GWD in 1985 was held in Nigeria. In the following year (1986), WHO's governing body passed the first resolution calling for the eradication of GWD.[2] and the First African Regional Conference on Dracunculiasis Eradication was convened at Niamey, Niger in July.

However, it became clear to Dr Hopkins and colleagues at the CDC that getting the necessary funding for the global eradication campaign was not forthcoming and diplomacy on a grand scale was essential. There was a need for a global champion and President Jimmy Carter was approached. President Carter wasted no time in committing himself, his family, and his NGO (The Carter Center) to lead a global drive for the eradication of GWD.

The impact of the Carter Center

President Carter brokered a nearly six-month long ceasefire in Sudan's civil war in 1995. This Guinea worm ceasefire enabled countrywide active case searches and implementation of Guinea worm eradication interventions, vaccination of children against measles and polio and the treatment of populations in endemic areas against onchocerciasis (river blindness). It also provided corridors for other humanitarian interventions to areas affected by conflict. Dr Donald Hopkins and Craig Withers wrote about the ceasefire: *"In our opinion, at this stage of the Sudan GWEP, temporary cease-fires or days of tranquillity are only useful to the extent that they are confidence-building steps toward the main goal, which is ending the war altogether."*[4]

With financial, technical and management support, mainly from the Carter Center as well as WHO, UNICEF, and NGOS working in southern Sudan, two guinea worm programmes operated (one through the Federal Ministry of Health and one through Operation Lifeline Sudan supported NGOs) from 1995 to 2005. After the Comprehensive Peace Agreement, the Carter Center continued to date with support for the programme in South Sudan. In 2006, Southern Sudan reported 20,851 cases of GWD accounting for 98% of cases reported worldwide. As of 2024, South Sudan has reduced cases by 99.99% compared to the cases reported in 2006.

Reduction in the cases of GWD

The civil war in Sudan (1983-2005), meant that the health infrastructures were destroyed, with humanitarian, health and social services being provided mainly by a consortium of non-governmental organizations. Therefore, the South Sudan Guinea Worm Eradication Programme (SSGWEP) was established in 2006 with the daunting task of establishing a community-based surveillance system from scratch capable of:

1. Detecting all Guinea worm cases in endemic and at-risk villages. Figure 1
2. Establishing an effective intervention delivery system to break guinea worm transmission. Figure 2.
3. Establishing a village-based surveillance system covering thousands of villages that became the model for a community healthcare system across the country.[5]

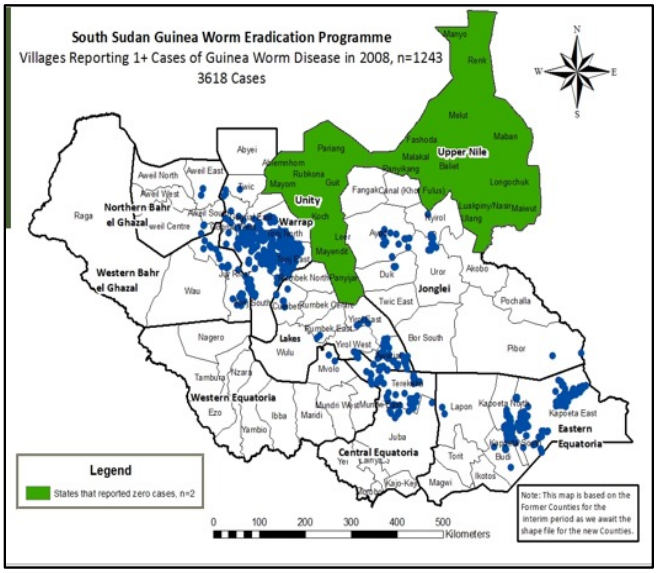

Figure 1. South Sudan Guinea worm eradiation progamme 2008. (Source: SSGWEP)

Figure 2. Filters for drinking water in Guinea worm areas (Southern Sudan Guinea Worm Mid-year 2006 report)

Challenges in eradicating GWD

The persistence of GWD in South Sudan is compounded by ongoing socio-political challenges, including civil unrest, population displacement, and limited access to clean drinking water. Additionally, the recognition of Guinea worm infections in animals, particularly among domestic dogs and wild cats, raises new challenges for interrupting transmission.

Recommendations

The South Sudan Guinea Worm Eradication Programme (SSGWEP) greatly contributed to strengthening the national health system through the Boma Health Initiative. The programme has consistently advocated and supported the management capacities especially at the county and payam levels as an integral part of strengthening the existing health systems. In view of the apparent donor fatigue, it is important that the gains of the eradication efforts must be sustained in addressing the challenges of the last-mile.

Conclusion

From 2023 - 2024 the SSGWEP implemented a new strategy based on effective engagement of communities in endemic areas, utilizing their knowledge of home-ranges for domesticated and wild animals and applying all interventions in bomas with villages that reported one or more cases or animal infections from 2018-2024. The strategy has not only resulted in increased identification and treatment of water sources, that pose risks to both host human population and animals, it has also resulted in the surge of screening animals for GWD contributing to heightened surveillance. This gives the momentum that interruption of transmission is still possible, and South Sudan has turned the corner to achieve the much-anticipated attainment of guinea worm elimination targets.

President Jimmy Carter died on 29 December 20024 at the age of 100. The South Sudan National Minister of Health, Ms Yolanda Awel, commented on his passing: *"[President] Jimmy Carter's life was dedicated to saving millions of lives in the World through [the] initiative of the Carter Center Organization. His legacy shall continue to inspire us to serve humanity, provide peaceful [re]solution of conflicts and advancement of democracy in the developing countries including South Sudan."*

His wish was to outlive the Guinea worm and make the world a better place for all. Now we will only have his legacy.

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South Sudan: Urgent Response Needed to Stop Cholera Outbreak in Upper Nile State South Sudan

6 December 2024

Medecins Sans Frontieres (Geneva)

Press release

Médecins Sans Frontières (MSF) is deeply concerned about the rapidly escalating cholera outbreak in Malakal, in South Sudan's Upper Nile state. Since the first suspected case was reported on 5 November, the number of people affected has risen significantly, placing an immense strain on the limited response to date. By 3 December, a total of 737 cholera cases were reported in Malakal, with MSF treating 646 patients - more than 87 per cent of all cases.

"The situation in Malakal remains critical, and we are concerned that the outbreak is spreading to neighbouring areas such as Tonga and Kodok," says Zakaria Mwatia, MSF head of mission in South Sudan. "MSF urgently set up the 100-bed cholera treatment centre in Assosa and continues to provide critical medical care; however, significant gaps remain, especially in the number of functioning oral rehydration points and water and sanitation. We have been stretched thin in our response as we have had to expand our efforts to address critical gaps in the ongoing response."

The outbreak, initially declared in Renk, Upper Nile state, on 28 October 2024, has spread to Malakal, Bentiu in Unity state, Aweil in Northern Bahr-el Ghazal state, and even South Sudan's capital, Juba. Renk is a major entry point for refugees and returnees from Sudan, and the inadequate living and hygiene conditions have contributed to cholera's spread.

https://allafrica.com/stories/202412060296.html?utm_campaign=daily-headlines&utm_medium=email&utm_source=newsletter&utm_content=aans-view-link

President Jimmy Carter deserves a special recognition for his work to eradicate Guinea worm in South Sudan

Victor Vuni Joseph

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Dear Editor,

President Jimmy Carter (also called James Earl Carter), the 39th President of the United States of America from 1977 to 1981,[1] died on 29 December 2024 at the age of 100 years. He was an extraordinary humanitarian worker who dedicated part of his post-presidency life and the Carter Center to the eradication of the Guinea worm globally, especially in South Sudan.

The Carter Center deserves special recognition and appreciation from the people of South Sudan. It could have chosen to invest its efforts and resources elsewhere, including in the US or other parts of the world, but instead, it chose South Sudan.

Guinea worm disease is an infection caused by the nematode roundworm parasite Dracunculus medinensis. It is a serious disease that incapacitates patients, making them unable to undertake activities of daily living, work, or attend school.[2]

Based on concerted efforts of global and national partners, including The Carter Center, Guinea worm is on the verge of elimination. The incidence of the disease has been reduced by 99.99% from 3.5 million cases in 1986 to seven cases in 2024 (three were reported in South Sudan between January and November 2024).[2,3]

We greatly appreciate the efforts of public health professional colleagues in eradicating Guinea worm in South Sudan.[4] They have shown a strong focus on controlling the disease by establishing a community-based surveillance system in the country.

The real lessons and implications of The Carter Center for the people of South Sudan are not only to finish the mission of eradicating the Guinea worm in South Sudan but also to continue working towards the elimination of other water-borne diseases.

Together with international partners, the people of South Sudan need to build a country where its people have access to safe drinking water, can avoid contaminated water, are educated about the risks involved, or are protected if they have to come into contact with contaminated water. If we do this, we would have indeed honoured the legacy of former President Jimmy Carter and the work of The Carter Center.

Guinea worm emerging from the foot of a patient in South Sudan (Credit: Makoy S. Yibi)

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Simulation-based education amid conflict: The Sudanese American Medical Association experience in Sudan

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Dear Editor,

We extend our best wishes for a happy and prosperous New Year 2025. In this communication, we aim to reflect upon, and update you on, an innovative learning initiative undertaken in Sudan by the Sudanese American Medical Association in 2024. The conflict in Sudan, which commenced on 15 April 2023, has posed considerable challenges to medical and clinical education. The significant displacement of senior medical professionals, the destruction of hospitals and educational facilities, and the limited access to training materials and the Internet have severely hindered the training opportunities available to junior doctors.[1] These circumstances have necessitated the prompt development of innovative solutions to address the challenges imposed by the ongoing conflict.

The Sudanese American Medical Association[2] (SAMA) is a non-profit organisation with offices established in the United States in 2008 and in Sudan in 2017. It has now become operational in South Sudan since 2024. This organisation has been actively involved in humanitarian, medical, and educational relief initiatives before the conflict. The mission of SAMA is to enhance the health and well-being of Sudanese communities through providing services, capacity building, educational and research programmes. In 2024, SAMA integrated all its knowledge, training, and research functions into a single entity, the SAMA Institute of Health (SAMA-IH).[3] This institute focuses on training local healthcare professionals in Sudan, South Sudan, and Sub-Saharan Africa while promoting innovation to address challenges in conflict and resource-limited regions. SAMA-IH operates two centres, one in Port Sudan, Sudan, and another in Juba, South Sudan.

In August 2024, the SAMA-IH, in collaboration with Shabaka,[4] a diaspora-led organization dedicated to strengthening the capacity of communities affected by conflict and displacement, introduced a simulation-based education course in Port Sudan, Sudan. This course employs the Full Code platform,[5] which is an immersive, 3D medical simulation tool that enables learners to engage with over 200 cases that reflect real-world medical scenarios across a range of clinical specialties, including emergency medicine, internal medicine, paediatrics, obstetrics, and gynaecology. The platform guides learners through each case, allowing them to make decisions regarding diagnosis investigations and management, supplemented by AI-powered prompts. After each case, the platform offers insights and additional reading resources to enhance the learning experience.

The course comprised 20 junior doctors, predominantly female (13, 65%). Among the participants, the majority were medical officers (12, 60%), while the remaining were house officers (8, 40%). They were employed across various departments, including internal medicine (8, 40%), surgery (8, 40%), and critical care (4, 20%) at Port Sudan Teaching Hospital (12, 60%) and Osman Digna Hospital (8, 40%).

SAMA recruited learners through a web form disseminated within local doctors' WhatsApp groups. Selected individuals registered on the Full Code platform and received training on its functionalities. The course was conducted from 21 August to 15 October 2024. During this period, learners were required to complete weekly assignments consisting of five cases each. By the end of the course, each participant had completed an average of 84 cases, dedicating an average of 12 hours to the platform.

SAMA distributed an end-of-course feedback form to gather learners' input on their course experience. Sixteen learners (80% of the total participants) completed the form. The feedback covered various aspects, including ratings for the overall experience, the Full Code platform, and the perceived improvement in knowledge and skills. All questions utilised a Likert scale ranging from 1 (poor) to 5 (excellent).

SAMA distributed an end-of-course feedback form to gather learners' input on their course experience. Sixteen learners 80% of the total participants) completed the form. The feedback covered various aspects, including ratings for the overall experience, the Full Code platform, and the perceived improvement in knowledge and skills. Among the respondents, 87.5% rated their overall experience as excellent, 81.2% rated the Full Code platform as excellent, and 62.5% indicated that their knowledge and skills had significantly improved.

In conclusion, simulation-based education has the potential to address some of the challenges faced by healthcare professionals in conflict regions. By leveraging the Fullcode platform, the junior doctors in Sudan could engage with diverse, simulated clinical scenarios, improving their knowledge and decision-making skills despite the disruption of medical education. This highlighted the importance of the adaptability of the learning methods, ensuring the continuity of education during the crisis.

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Major Dr Santino Kuot Maluil

Major Dr Santino Kuot Maluil Nyang was born on 17 July 1979 at Marial Baai village, Jur River County, Western Bahr El Ghazal State, to Maluil Nyang Maluil Kuot and Mama Achok Uchiir Machit. Dr Santino hailed from Warrap State, Gogrial East County, Pathuon West Payam, Luonyaker Boma, Amolbany Nyang Maluil village.

Dr Santino had his basic education in Aweil, Northern Bahr El Ghazal from 1990 – 1995 at Comboni Primary School. He attended primary 6 to 8 at the John Paul II Intermediate School in Wau, Western Bahr el Ghazal State, from 1996 – 1999. From 2000 – 2003, he attended St. Augustine Secondary School in Khartoum, Sudan, and was at the University of Bahr El Ghazal, School of Medicine, from 2004 – 2010, graduating with a Bachelor of Medicine and Surgery (MBBS). He did his internship training at Juba Teaching Hospital from 2012 – 2013.

He was pursuing and about to complete a Master of Science degree in Paediatrics and Child Health from Ain Shams University in Cairo, Egypt, at the time of his passsing.

Dr Santino served as an officer in the National Security Services. He attended the Nyanchigak Military College from 2010 to 2011, graduating as a Captain. In 2012 he also attended basic intelligence training in Uganda. He was promoted to the rank of Major in January 2018.

His colleagues described him a friendly and social person, who loved the medical profession and his military job. One of his classmates Dr Jacob Mach remembered him as a leader in the student movement of the African National Front (ANF) at the School of Medicine, University of Bahr el Ghazal. Dr Jacob described him fondly as a calm person, who loved people from all walks of life and did not interfere in the private matters of others.

Dr Santino died in Cairo, Arab Republic of Egypt, on 1 December 2024.

He is survived by his wife Dr Adau Monytuil of Abyei. The late has two daughters, Ayak and Adior Santino Kuot Maluil Nyang.

May his soul rest in peace.

Dr Benjamin Peter Oduk

Dr Benjamin Peter Oduk was born on 18 January 1986 in Omdurman, Sudan, to father Peter Oduk Elli from Upper Nile State, Makal County, Ugod Payaam, Ashok village, and mother Rebecca Paul Akuch of Upper Nile State, Panyikang Payaam, Nyar village.

Dr Benjamin attended Good Shepherd Basic School until 2000. He completed his secondary school education in 2003 at Comboni College Khartoum in Khartoum, Sudan. He attended the University of Bahr el Ghazal, Faculty of Medicine and Health Sciences, and obtained a Bachelor of Medicine and Surgery (MBBS) in 2010.

After graduation, Dr Benjamin worked in several Sudan and South Sudan hospitals. In 2010, he worked as a Teaching Assistant at the University of Bahr el Ghazal, Faculty of Medicine in Wau, Western Bahr el Ghazal State, as a General Practitioner at the Friendship Hospital in Omdurman, and in the Department of Home Economics at Omdurman Hospital.

In 2011, Dr Benjamin worked as a General Practitioner in the Paediatric Department at Omdurman Children's Hospital, Sudan. In Juba, he worked in the Department of Obstetrics and Gynecology and the Department of Surgery at Juba Teaching Hospital in Juba, South Sudan.

From 2012 to 2013, he worked as a medical doctor for Al-Najumi Pharmaceutical Company. Until his untimely death, Dr Benjamin worked for the Dar Petroleum Operations Company in the oil fields in Paloch, Upper Nile State.

Dr Benjamin attended several courses and workshops, including, but not limited to, Design and Management (2010), Evaluation and Assessment (2010), Advanced Techniques of Industrial Hygiene and Occupational Health Training (2014 in Dubai), and NEBOSH Certificate in Occupational Safety and Health (2014).

His colleagues remembered him for his kindness, dedication, and unwavering commitment to his family and community. They said his legacy will continue through the countless lives he touched.

Dr Benjamin had a heart attack and died on Saturday, 30 November 2024, at his workplace in Paloch. He is survived by his three wives and children: Lurit Andrea Quirino (has three daughters and a son); Viola John (has two sons); and Hanan Abbas Fadallah (has a daughter).

May his soul rest in peace.

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