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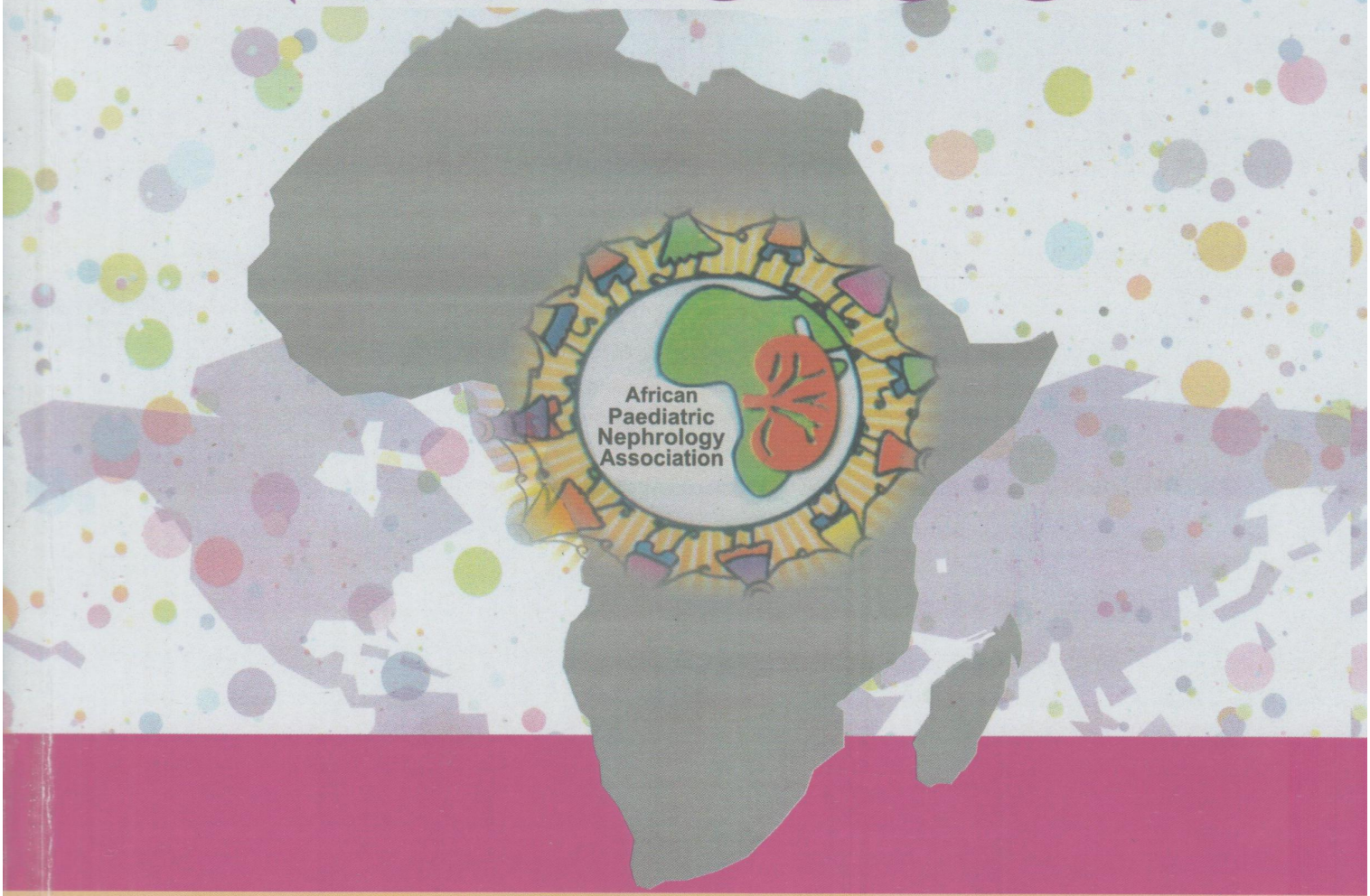

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Original Article

Neonatal Urinary Tract Infection in the University of Uyo Teaching Hospital, Uyo, Nigeria.

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Abstract

Background: Neonatal infections including urinary tract infections (UTI) constitute a significant proportion of neonatal deaths globally with about ninety-eight percent occurring in the resource poor countries like Nigeria. UTI is a common cause of childhood morbidity with a potential for long-term sequelae if it is not diagnosed early and appropriate treatment instituted. The Prevalence of neonatal urinary tract infection varies in the experience of many authors, possibly as a result of variations in the clinical characteristics of the neonates at presentation ranging from asymptomatic cases to those with severe illness. Sometimes differing cut-off criteria for microbiological diagnosis also affect the incidence. Limited studies are available on the prevalence of neonatal UTI in Nigeria, hence this study set out to determine this prevalence in the University of Uyo Teaching Hospital, Uyo, Akwa-Ibom State of Nigeria.

Methods: A prospective study of all neonates admitted with risk factors or clinical features suggestive of sepsis between 13th December 2013 to 30th April 2014 was done. Urine specimens were collected by clean catch urine collection method for microscopy, culture and antimicrobial sensitivity.

Results: 108 neonates were recruited, (65 males, 43 females , commonest clinical symptom was fever. UTI was found in 5(4.6%) of the neonates who underwent urine culture. They were 3 males and 2 females.

Conclusions: The prevalence of UTI in the study was 4.6%. Fever was the commonest clinical feature among those with positive urine cultures.

Key words: neonate, UTI, prevalence, fever, Nigeria

Introduction

Urinary tract infection (UTI) is common in children and has the potential of causing both acute and long term morbidities which can be life threatening if not promptly diagnosed and managed.[1,2] Despite the substantial progress in reduction of child mortality since 1990, there has not been a significant and proportionate reduction in neonatal mortality. This in part is due to neonatal infections and complications.[3] Neonatal infections (including UTI) account for 36% of the 3.6 million neonatal deaths globally and ninety eight percent of these occur in developing countries including Nigeria.[4] Prompt diagnosis of a first UTI especially in the neonatal period nonetheless provide ample opportunity for adequate management and prevention of its acute and possible long term morbidities of hypertension, failure to thrive and chronic renal diseases.[1-2]

The prevalence of neonatal UTI varies in the experience of many authors, possibly as a result of variations in the clinical characteristics of the neonates at presentation ranging from asymptomatic cases to those of severe illness.[5-10] There are no adequate data on prevalence among asymptomatic term neonates. In term neonates with fever, a prevalence of 7-15% was documented,[5-7] while amidst neonates with unexplained jaundice, some

reports revealed a prevalence of 12.5-21.1%.[11,12] These studies also suggest jaundice as an early diagnostic sign of UTI in afebrile newborns. A male predominance is noted in most of these studies with a striking increase among uncircumcised males.[7]

Limited studies are available in preterms, however, a prevalence of 8 to 25.3% was found with an increasing trend as gestational age decreases.[13,14]

There are very few studies on the prevalence of neonatal UTI in Nigeria. A range of 1.4 to 7.6% was reported in some studies.[15-17] The clinical characteristics of the neonates varied as in most other studies from a relatively asymptomatic group, born by caesarean sections and only on routine observation in the Special Care Baby Unit,[17] to very ill ones requiring intensive care.[15,16]

Difficulties in urine sample collection in the newborn is a major drawback as most available methods are invasive and not generally acceptable, especially in otherwise stable and asymptomatic patients who are only at risk for sepsis. Knowledge of the prevalence of UTI furnishes the clinician with a tool of assessment of the burden and the need for diagnostic testing in the newborn with suspected sepsis. It also provides statistical data needed for adequate planning for healthcare both locally and internationally. There are no studies on neonatal UTI in Uyo and the entire South-South geopolitical zone of Nigeria. This study is an attempt to provide data on prevalence of neonatal UTI to bridge the aforementioned gap. The study in addition, is the first in Nigeria to the best of authors' knowledge to explore a relatively more acceptable method of urine sample collection for culture: the clean catch method. It is fast, non-invasive and more generally acceptable than the suprapubic aspiration and urethral catheterization methods in earlier use. It is hoped that a more frequent use of this method will promote increased routine collection of urine for neonatal sepsis evaluations.

Methods

This study was carried out at the neonatal unit of the University of Uyo Teaching Hospital (UUTH). U.U.T.H is the only tertiary health facility in Akwa - Ibom state and it provides comprehensive neonatal care to residents from both within and outside the state. The hospital is situated in the outskirts, about 6km from the centre of Uyo the capital of Akwa - Ibom State in the South-South region of Nigeria. Uyo lies between latitudes 4'33 and 5'33 North and longitude 7'35 and 8'35 East.

The neonatal unit of the hospital is a 41 bedded unit where babies requiring regular and intensive neonatal care are admitted. It consists of two separate wards which are the Special Care Baby Unit (SCBU) and the Sick Baby Unit (SBU). In-born neonates of mothers who had received antenatal care are offered care in the SCBU while the SBU takes care of out-born neonates and those born to mothers who had not received antenatal care. Consecutively presenting neonates aged 1-28 days with clinical features or risk factors for sepsis seen at the neonatal units of the University of Uyo Teaching Hospital(UUTH) Uyo, between December 2013 and October 2014 were studied. Information on the pregnancy, labour and delivery history were obtained from mothers or caregivers of neonates that fulfilled the criteria for inclusion in the study and presence or absence of risk factors or clinical features for sepsis were noted. This was followed by a physical examination. Urine for microscopy, culture and sensitivity was obtained by clean catch method as described by Fernandez et al.[18,19] The procedure was carried out about 20 - 30 minutes after a feed. The Investigator after wearing a pair of sterile surgical gloves, washed the genitalia of the subjects with soap and water, and dried them with sterile gauze. The neonate was then carried by the underarms by a trained assistant with the legs dangling freely in air; the suprapubic area was percussed several times by the Investigator at a frequency of about 100 taps per minute for about 30 seconds. This was usually followed by voiding in a majority of cases in both sexes. All subjects were uncircumcised. A sterile universal bottle was then placed in the flowing stream of urine (after having allowed a few mls to drop) to collect some of the flowing urine. The paravertebral area was also sometimes massaged to help stimulate the voiding process when there was a delay in voiding. The

procedure was successful in most of the babies though it had to be repeated in some who failed to void after a first trial. Preterm neonates who could not be subjected to these maneuvers, majority of who were males voided successfully in the supine position inside their incubators. The sample collected was sent to the Medical Microbiology Laboratory of the U.U.T.H. within 1 hour of collection for inoculation by Medical Microbiologists. Urine microscopy was also done. Dipstick urinalysis was not included in the study. Exclusion criteria included some critically ill neonates, in whom the maneuvers necessary for the approved method of clean catch urine sample collection could not be carried out, those with acute renal failure or those who failed to void after repeated attempts at urine collection, those already on antibiotics before admission and those whose parents refused consent.

Microscopy: Each urine sample was first inoculated on petri dishes for culture, subsequent to which microscopy was done. Two to ten millilitres of urine was centrifuged at 1500 rpm for 5 minutes, the supernatant was discarded and a wet preparation made from the sediment and examined under a 10X and 40X objective of a microscope for pus cells and bacteria. [20,21]

Urine Culture: Each urine sample was mixed very well and subsequently inoculated into Cysteine Lactose Electrolyte Deficient(CLED) agar plates using the filter paper method of Leigh and Williams[22] and incubated at 37°C for 24 hours. More than 25 colonies on the plate was considered equivalent to ≥ 10^5 colony forming units (CFU)/ ml of urine. This is the cut off criteria for diagnosis for voided urine in the centre of study.

Identification of the isolates:
Characterisation and identification of the isolates was carried out according to Gowan and Steels.[23] The bacterial tests carried out were Gram staining, coagulase, citrate utilisation motility, indole oxidase, urease and sugar fermentation. Triple iron sugar agar was inoculated to test for gas production, hydrogen sulphide, acid and alkaline production.

Antimicrobial sensitivity:
Antibiotic sensitivity was performed on significant isolates as recommended by the Clinical and Laboratory standards institute 2014,by the disc diffusion method of Stokes using Oxoids multidiscs (Oxoid Ltd, Basing Stoke, Hampshire, England) with the following antimicrobials: gentamicin (10mcg), ceftazidime (30 mcg), cefuroxime (30 mcg), ceftriaxone Sensitivity testing was done using Mueller Hinton Agar (BIOTEC Lab, Ipswich, Suffolk, IP57RG, United Kingdom) at a pH of 7.2-7.6.[25] *Escherichia coli* NCTC 10481 and *Staphylococcus Aureus* Oxford strain NCTC 6571 were employed as the control strains in the antibiotic sensitivity testing. After incubation at 37°C for 24 hours, zones of inhibition around individual discs in test and control strains were measured and compared with a standard chart and recorded as sensitive or resistant in relation to the susceptibility of the control strain. When there was no zone of inhibition or the zone radius measures 2mm or less, the organism was reported as being resistant to the antimicrobial.

The data obtained was analysed using the Statistical Package for Social Sciences (SPSS) version 20. The prevalence of UTI was determined from number of samples with≥ 10^5 colony forming units (CFU)/ ml of urine. The results were reported in texts, tables and graphs. Categorical data was reported as frequencies and percentages while continuous variables were reported as means(+/-standard deviation) in normally distributed population or as median (inter-quartile range) when not normally distributed.

Results
One hundred and eight (108) patients were recruited into the study. Patient's age at presentation ranged from 1 hour(0.02 days) to 21 days with a mean age of 3.04 ± 4.74 days. Gestational age in weeks ranged from 28 to 42weeks with a mean of 37.81 ± 3.53 weeks. The weight (in Kg) of the infants ranged from 1.0-4.7 with a mean of 2.90 ± 0.89Kg. There were 65 males and 43 females giving a male: female of 1.51:1. Table 1 shows the baseline socio-demographic characteristics of the study population.

Significant bacteriuria was found in 5 (3males, 2 females) of the 108 subjects giving a prevalence of 4.6% as shown in figure 1.Most of the patients recruited presented in their first week of life and all the patients who had UTI were less than 7 days old as shown in table 2. Prevalence of UTI was 60.0% in the male and 40.0% in the females as shown in Figure 2. Prevalence of UTI was about the same in term and preterm neonates as shown in table 3.

Analysis of the clinical signs and symptoms seen in the neonates show that fever was the commonest symptom with a prevalence of 45.4% as shown in table 1.Statistical tests of association between selected risk factors and UTI show no statistically significant associations between the selected risk factors and UTI as seen in table 1.

Table 1: Baseline characteristics of the subjects

Characteristics	Frequency	Percent
Sex		
Males	65	60.2
Females	43	39.8
Total	108	100.0
Gestational age in weeks		
Less than 37	24	22.2
37-39	42	38.9
40-42	42	38.9
Total	108	100.0
Ward		
SCBU(Inborn)	77	71.0
SBU(Outborn)	31	29.0
Total	108	100.0
Low Birth Weight Babies		
Less than 1 Kg	1	3.9
1- 1.49	9	34.6
1.5- 2.49	16	61.5
TOTAL	26	100.0

Table 2: Clinical features of the subjects

Clinical features	Neonates With Clinical Features Suggestive Of Sepsis		Total	Statistical Tests And Values
	UTI Present No. (%)	UTI Absent No. (%)		
Fever				$X^2 = 0.453$
Yes	3 (6.1)	46 (93.9)	49(100.0)	DF = 1
No	2 (3.4)	57 (96.6)	57(100.0)	P = 0.675
Vomiting				$X^2 = 0.202$
Yes	0(0.0)	0(0.0)	4(100.0)	DF = 1
No	5(4.8)	5(4.8)	104(100.0)	P = 1.000
Abdominal Distension				$X^2 = 0.150$
Yes	0(0.0)	4(100.0)	3(100.0)	DF = 1
No	5(4.8)	99(95.2)	105(100.0)	P = 1.000
Respiratory Distress				$X^2 = 0.150$
Yes	0(0.0)	3(100.0)	3(100.0)	DF = 1
No	5(4.8)	100(95.2)	105(100.0)	P = 1.000
Lethargy				$X^2 = 0.150$
Yes	0(0.0)	2(100.0)	2(100.0)	DF = 1
No	5(4.7)	101(95.3)	106(100.0)	P = 1.000
Jaundice				$X^2 = 1.049$
Yes	0(0.0)	1(100.0)	18(100.0)	DF = 1
No	5(5.6)	85(94.4)	90(100.0)	P = 0.587
Inadequate weight gain				$X^2 = 0.049$
Yes	0(0.0)	1(100.0)	1(100.0)	DF = 1
No	5(4.7)	102(95.3)	107(100.0)	P = 1.000
Poor feeding				$X^2 = 0.477$
Yes	0(0.0)	9(100.0)	9(100.0)	DF = 1
No	5(5.1)	94(94.9)	99(100.0)	P = 1.000

P= fishers exact P

Table 3: Prevalence of neonatal UTI by age of subjects

Age	ALL NEONATES RECRUITED FOR THE STUDY		Total	Statistical tests and values
	Number with UTI n (%)	Number without UTI n (%)		
0 to 6 days	5 (5.2)	91(94.8)	96(100.0)	X^2 0.655 P=0.999 DF 1
7-28 days	0 (0.0)	12 (100.0)	12(100.0)	
Total	5	103	108	

Table 4: Comparison of prevalence among term and preterm neonates

Status	Total	Number with UTI	Prevalence%
Term	84	4	4.8
Preterm	24	1	4.2

Table 5: Association between selected maternal risk factors and occurrence of UTI.

RISK FACTORS	Risk Factors and occurrence of UTI		Total	Statistical tests and Values
	UTI Present	UTI Absent		
Delivery Mode				
Emergency CS	3 (60.0)	43 (41.7)	46	X^2= 1.024
Elective CS	1 (20.0)	16 (15.5)	17	DF 2
Vaginal Delivery/vacuum	1 (20.0)	44 (42.7)	45	p=0.577
Total	5	103	108	
History of PROM	0 (0.0)	27 (26.2)	27	X^2= 1.748
Yes	5 (100.0)	76 (73.5)	81	DF 1
No				p=0.328
Total	5	103	108	
Maternal Pyrexia				
Yes	0 (0.0)	15 (14.6)	15	X^2= 0.846
No	5 (100.0)	88 (85.4)	93	DF 1
				p=1.000
Total	5	103	108	
Foul smelling liquor				
Yes	0 (0.0)	4 (3.9)	4	X^2= 0.202
No	5 (100.0)	99 (96.1)	104	DF 1
				p=1.000
Total	5	103	108	
Prolonged labour				
Yes				X^2=0.552
No	1(20.0)	10(9.7)	11	DF1
	4(80.0	93(90.3)	97	*p=0.422
Total	5	103	108	

*P- Fishers exact

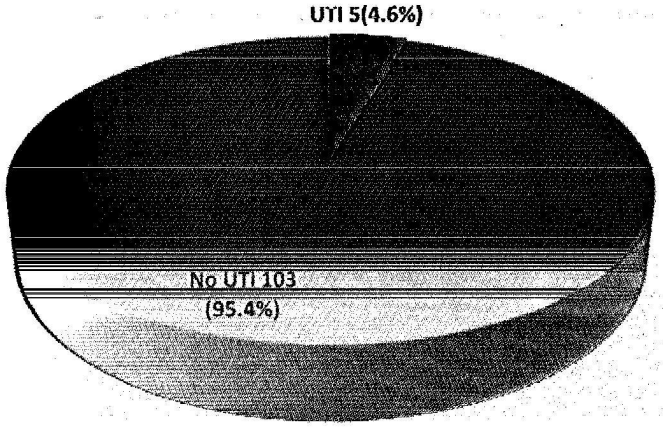

Figure 1. Proportion of Neonates with Urinary Tract Infection among study subjects

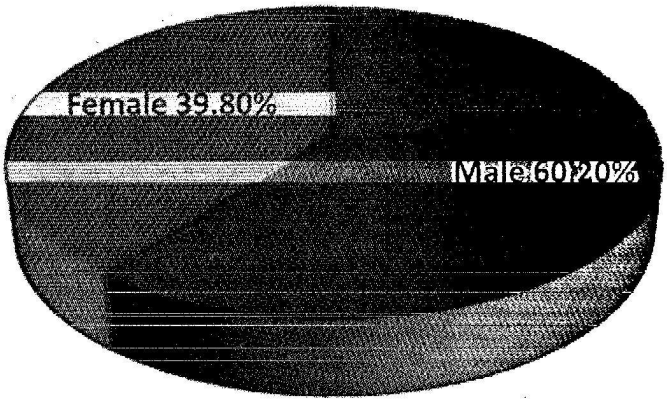

Figure 2: Gender prevalence of UTI

Discussion

The prevalence of Urinary tract infection ((UTI) obtained in this study was 4.6%. This was in a study background of a regular neonatal unit and utilization of the clean catch method of urine collection. It is therefore expected that the prevalence may differ from those obtained in other units who offer highly intensive neonatal care. The prevalence rate of 4.6% recorded in this study may not represent the true rate of bacteriuria in our centre because some critically ill neonates (in whom the maneuvers necessary for the approved method of clean catch urine sample collection could not be carried out) were excluded. Others with acute renal failure or those who failed to void after repeated attempts at urine collection and those already on antibiotics before admission were also excluded.

The prevalence is comparable to that of Jos (3%)[25] perhaps because both studies looked at neonates with risk factors and clinical features suggestive of sepsis. It is lower than the 6.3% reported in Benin,[16] and the 15.4% in New York.[5] This is probably because some of the neonates in the present study had only risk factors and not obvious clinical symptoms suggestive of sepsis whereas all neonates in the New York study had obvious clinical features of infection such as fever with temperature ≥38^{0}c. The prevalence on the other hand was higher than the 1.1% found in the West Indies[26] because the present study excluded patients whose reason for admission was not related to infection as against the West Indies study where all patients on admission were studied.[26]

The prevalence of UTI was not significantly associated with gestational age in this study as seen in other studies.[13,14] It was 4.8% among term neonates and 4.2% among preterms. This may have also resulted from the fact that very few preterms had positive urine cultures in the study.

There were more males with UTI in this study comparable to reports both within and outside Nigeria.[13-15] It is however contrary to the report by Olusanya et al [17] who obtained an equal gender prevalence. This difference, though not statistically significant could be clinically significant due to the fact that there is increased risk of congenital anomalies in the urinary tract in males making them stand a higher risk of UTI than females in the first months of life.[1-3]

Fever though not significant was the commonest clinical feature among those with positive urine cultures. This may be an inflammatory response reaction to the presence of a microorganism.[24] This study has shown no significant associations with the risk factors for sepsis. This concurs with studies by Airede[15] and Olusanya *et al*,[17] though Falcao *et al*[27] demonstrated these associations. In the Falcao *et al* study,[27] the risks were much higher since they included patients with indwelling catheters, renal and urinary tract malformations.

The study highlights the need for routine screening of neonates at risk or with clinical features suggestive of sepsis for UTI and also brings to the fore the practicability of the non invasive clean catch urine collection method especially where the invasive suprapubic method is undesirable i.e. in screening of otherwise well neonates with only risk factors for sepsis.

Conclusions

The prevalence of urinary tract infection among neonates at risk of sepsis or with clinical features suggestive of sepsis at the University of Uyo Teaching hospital was 4.6%. History of fever in the neonate was more commonly associated with UTI though not significant. It is therefore recommended that urine culture should compulsorily be part of screening for neonates at risk or with clinical features suggestive of sepsis and that periodic evaluation of epidemiology of neonatal UTI is crucial for paediatricians for accurate knowledge of the burden which is needed for effective planning for health both locally and internationally.

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Conflict of interest: None

Authors' Contributions

Ikpeme EE conceived the study and supervised the work while Adesina SB carried out the work and wrote the manuscript. Nyong EE also supervised the work and critically read through the manuscript.

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