BACTERIOLOGICAL PROFILE AND RESISTANCE PATTERN OF BLOOD CULTURE ISOLATES IN A TERTIARY HOSPITAL IN PORT-HARCOURT, NIGERIA

ABSTRACT

Blood stream infection can result in life threatened condition with high morbidity and mortality, hence prompt diagnosis and antimicrobial treatment is required. The gold standard of making a diagnosis of septicaemia is the isolation of the offending pathogen from a blood culture. A knowledge of the bacteriological profile and susceptibility patterns of organisms isolated from blood culture will help guide the choice of empirical antibiotic administration in that institution

The study aim to determine the bacteria profile of blood stream infections and the antibiotics susceptibility pattern Bacteria strains isolated from 623 blood cultures from various wards of the University of Port Harcourt Teaching Hospital, Nigeria, over a period of 24 months were retrospectively analyzed for frequency of isolation, susceptibility profile, age and gender distributions

Overall prevalence yield from blood culture was 22.5% and gram negative bacilli accounted for 81.6% of the total yield with K. pneumoniae being the most frequently isolated organism. K pneumoniae was mostly resistant to gentamicin and ceftriaxone (95.8%) while S. aureus showed the highest resistance to cefuroxime (91.7%) followed by ceftazidime (87.5%). Majority of the samples and isolates were from neonates representing 49.1% and 75.89% respectively and this was statistically significant P<0.05 while ages between 1-18months and adult accounted for 18.44% and 5.67% of the total isolates respectively.

The exhibition of multidrug resistance to the commonly used antibiotics buttresses the need for a review of the empirical antibiotic regimen used in sepsis. It also emphasizes the importance of the use of more sensitive and rapid methods of bacterial detection from blood culture.

KEY WORDS: *blood culture, septicaemia, antibiotic resistance, Nigeria.*

INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to bloodstream infection[1]. In sepsis, there's active multiplication of bacteria with release of toxins into the bloodstream which triggers the release of cytokines, causing fever, chills, malaise and lethargy, as well as difficulty with breathing especially in children[2]. It is common in health institutions worldwide with resultant significant morbidity and mortality[3]. In the United States alone, blood stream infections account for 10% of nosocomial infections with mortality rate of 4-5%[2,3]. Though careful clinical assessment may provide a clue for making provisional diagnosis, the gold standard for the diagnosis of sepsis remains the isolation of the offending pathogen from a blood culture[3,4]. Moreover, the isolated bacterial pathogen is tested against an array of antimicrobial agents to help select the most appropriate for patient management[2,3,5]. Both gram negative and positive bacteria have been isolated from blood culture, and predominance of one type over the other and their susceptibility pattern vary

from place to place and even in the same place over time[4,6,7].

The ideal sample for a blood culture is best collected by venipuncture[8]. The collection from intravascular devices is discouraged and only interpreted if paired with another sample from a venipuncture. It is an aseptic procedure so, false positive results are mostly due to contamination from skin flora[9]. Therefore emphasis on adequate skin disinfection is an important pre-analytical measure that will determine the accuracy of the blood culture result. Skin disinfection can be accomplished by the use of either of or a combination of: chlorhexidine, tincture of iodine, povidone iodine also known as iodopovidone and alcohol-based products[10]. Some studies have compared their various efficacies judging by the contamination rates of blood cultures[11,12]. Over all, most authorities recommended that skin preparation be performed using an alcohol swab followed by tincture of iodine or chlorhexidine and allow the disinfectants to dry completely on the skin before proceeding with venipuncture[13]. In addition, the culture bottles should also be prepared by swabbing the rubber septae with alcohol prior to inoculation[9].

In septicaemia, relatively few bacteria or fungi are present in blood, therefore, to improve the yield of these pathogens, the volume of blood to be cultured should be quite significant[13]. *Li et al*, in their study, reported increasing microbial yield with larger volumes of blood cultured[14]. For adults, authorities recommend that 10-20ml of blood per bottle be cultured, whilst 1-3ml per bottle is accepted for children under 3 years[10]. However, blood volumes greater than 30ml are not recommended because there is a greater likelihood of clot formation when it is inoculated into the bottle[15]. On the number of cultures, most authorities agree to the use of two or more sets of blood cultures (a set consists of one aerobic bottle and one anaerobic bottle). It has been reported that most septicaemia will be detected by at least two sets of culture[15]. Furthermore, a single set would be difficult to interpret especially if coagulase negative *Staphylococci* (which are common contaminants from the skin, but can also be a cause of serious infections) were to be isolated. The Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC) recommend that 3 sets of blood be used to confirm the diagnosis of infective endocarditis[16]. They also concluded that it was unnecessary for time collection of samples to coincide with the fever peaks. Similarly, authorities advocate for blood culture sets to be collected simultaneously from different venipuncture sites rather than serially[14,17].

Blood culture systems have evolved over the years from manual systems, to semi-automated

and eventually fully automated systems for bacterial identification and antimicrobial susceptibility testing. The manual systems, however, have remained the main stay for resource-limited settings due to their relative cheap costs of operation and procurement of consumables. A set, consisting of an aerobic and an anaerobic bottle containing their respective broth are inoculated with blood. The appropriate blood to broth ratio is between 1:5 and 1:10, dilutions greater or less than this range results in reduced microbial yield[15]. After the first overnight incubation, an aliquot of each broth is gram stained and sub-cultured unto appropriate agar plates. Following this, the bottles are examined daily for signs of microbial growth (turbidity, haemolysis, gas or visible growth on the surface of the broth)[17]. Blind or terminal subcultures are performed at the end of the incubation period. Manual systems are quite labour-intensive which is a major drawback especially in large hospitals with numerous samples for processing. The Septi-Chek and Opticult blood culture systems (Becton Dickinson) are improvements of the manual system that limit contact with the blood samples during sub-culturing.

Extensive discussion on the automated blood culture systems like BACTEC system (Becton Dickinson Microbiology Systems),Bio Argos System(Sanofi Diagnostics Pasteur, Marnes-la-Coquette, France), BacT/Alert (OrganonTeknika Corp.) and ESP (Difco Laboratories) are beyond the scope of this paper. The earlier versions of these systems detected the growth of microorganisms by measuring carbon dioxide production. This was done daily or twice daily by either the use of 14C-labeled CO_2 or infrared spectrophotometry. These gave way for the continuous-monitoring blood culture systems (CMBCS) which are able to detect carbon dioxide production in as little as 10-minute intervals as well as changes in pH, pressure and several other gases like oxygen, nitrogen and hydrogen. Thus microbial growth is detected much earlier and action taken.

The microbial spectra usually isolated from blood cultures include *Staphylococcus aureus, Escherichia coli* and other Enterobacteriaceae, *P. aeruginosa, S. pneumoniae,* and *Candida albicans*[13,18]. *Klebsiella pneumoniae* and *Staphylococcus aureus* were the two most common isolates amongst neonatal blood culture specimens in a previous study in the University of Port Harcourt Teaching Hospital[19]. Similarly, another study in Calabar reported *Staphylococcus aureus* as the most common organism isolated from blood cultures of children[20]. In yet another Nigerian study in Kano, *Escherichia coli* and *Staphylococcus aureus* were ranked amongst the most common isolates from blood[21]. Most of the *E. coli* isolates were susceptible to Ceftriaxone, Ciprofloxacin, Gentamycin and Co-amoxiclav;

while *S. aureus* showed comparable susceptibility to Cefuroxime, Ceftriaxone, Clindamycin and Co-amoxiclav[19–21].

Despite the benefits of blood culture in the specific management of sepsis, the result may take 3-7 days to be available - a time span that may not be available for the desperately sick patient. Surviving Sepsis Campaign recommends that blood cultures should be obtained before instituting appropriate empirical antimicrobial agents which should be commenced within the first hour of recognizing severe sepsis[2,22,23]. This is because, early administration of drugs to patients with sepsis drastically reduces mortality[23].

It is apparent that the early use of the most appropriate empirical antimicrobial agents is critical to the survival of sepsis patients. However, this is complicated by the changing pattern of the etiologic pathogens and their antimicrobial susceptibility over time even in a particular region. Hence, there is need for constant surveillance of this changing pattern periodically to guide empirical treatment.

This study is aimed at determining the current microbial profile of sepsis and their antimicrobial susceptibility pattern in University of Port Harcourt Teaching Hospital in the southern part of Nigeria. The result of this study is expected to guide empirical therapy and also influence infection control practices and rational antibiotics use thus mitigating against the emergence of antimicrobial resistance among common pathogens.

MATERIALS AND METHODS

This is a retrospective cross-sectional study. We reviewed the results of a total of 623 blood cultures collected from patients of various ages groups admitted in different wards in University of Port Harcourt Teaching Hospital over a period of two years, between January 2016 and December 2017. The University of Port Harcourt teaching hospital is one of the two tertiary health institutions in Rivers state and serves a large proportion of people living in the south- south geo-political zone of Nigeria.

The indications for blood cultures were clinical features adjudged by the attending clinicians to be indicative of sepsis. Blood culture samples were aseptically collected by the doctors into blood culture bottles containing trypticase soy broth and thioglycolate broth and immediately transported to the Microbiology laboratory for microscopy, culture and sensitivity. These were incubated aerobically and anaerobically at 35^0C- 37°C and monitored for evidences of growth (haemolysis, turbidity, clot formation, gas production and cotton ball

effect). Bottles showing evidence of growth were promptly sub-cultured on blood, chocolate and MacConkey agar media and incubated in appropriate temperature and atmospheric pressures according to established methods[13,18]. Isolates were identified through standard microscopic and biochemical procedures. Antimicrobial susceptibility tests were carried out by modified Kirby Bauer method in accordance with CLSI criteria and similarly interpreted[24]. *Escherichia coli* ATTC 25922, *Staphylococcus aureus* ATTC 25923, *Pseudomonas aeruginosa* ATTC 27853, *Enterococcus faecalis* ATTC 2921 and *Streptococcus pneumoniae* ATTC 49619 were used as control strains.

Data Analyses

Data obtained from this study was analyzed using the statistical package for social sciences (SPSS) version 20. The level of significance set at 0.05. Chi square test was used to estimate the possible association between blood culture isolates (dependent variable) and age, gender and, antibiotics resistance pattern (independents variables)

RESULTS

A total of 623 blood culture requests were received and processed in the Department of Medical Microbiology during the study period. Majority of this came from the neonatal age group with 306 blood samples (49.1%) followed by children 245(39.9%) and then adults 72 (11.6%) as shown in Table 1. Also, there was a slight male preponderance in the patients with 361 males and 262 females giving a sex distribution of 1.38:1.

The bacterial isolation rate from all the patients in this study was 22.5% with the highest rate recorded among neonates with 34.6% having culture positivity as shown in Table 2. Bacterial isolation was more in the females 28.2% than in males 18%, table 3.

141 bacterial organisms were isolated from 140 patients including *K. pneumoniae* (72), *E. coli* (37), *S. aureus* (24), *P. aeruginosa* (5), *S. pyogenes* (2), *S. marcescens* (1) in decreasing order of number isolated as shown ***Table 2***. There was a case of mixed growth of 2 organisms from a neonatal patient. The isolated organisms were predominantly gram negatives (81.6%).

The isolated bacteria were tested against ampicillin, gentamicin, ofloxacin, cefuroxime, ceftazidime, ciprofloxacin, amoxicillin clavulanic acid, ceftriaxone and meropenem with their resistance pattern shown in ***Table 3***. Most of the isolates exhibited multidrug resistance, the most isolated organism was *Klebsiella pneumoniae* which showed the highest resistance to

both gentamicin and ceftriaxone (95.8%) followed by amoxicillin clavulanic acid (94.4%) and ceftazidime (91.7%) while the least resistance was to ofloxacin (18.1%). *Staphylococcus aureus* showed the highest resistance to cefuroxime (91.7%) followed by ceftazidime (87.5%) with least resistance to ampicillin (41.7%). *Pseudomonas aeruginosa* showed total resistance to 4 out of the 6 tested antimicrobial agents.

Table 1: Age groups and gender distribution of patients

Age groups	Male (%)	Female (%)	Total (%)	Chi-square (p-value)
Neonates (0-28 days)	195 (63.7)	111 (36.3)	306 (49.1)	8.24 (0.004)*
Children (1month – 18 years)	138 (56.3)	107 (43.7)	245 (39.3)	0.43 (0.659)**
Adults (>18 years)	28 (38.9)	44 (61.1)	72 (11.6)	3.48 (0.001)*
	361 (58)	**262 (42)**	**623**	

*Statistically significant P<0.05

** not statistically significant P<0.05

Figure 1: Distribution of blood culture positive cases by age group

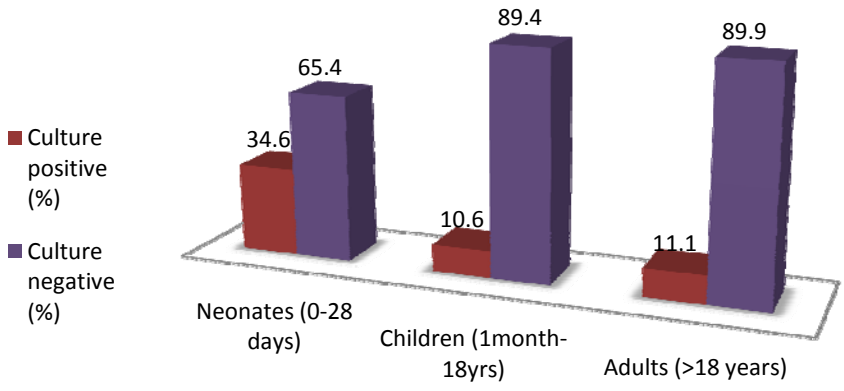

Fig.1..: Distribution of blood culture positive cases by age group

Table 2: Distribution of isolates among the different age groups

Isolates	Neonates	Children	Adults	Total	Chi-square (P-value)
K. pneumoniae	60 (56.1)	8 (30.8)	4 (50.0)	72 (51.1)	5.36 (0.068)**
E. coli	24 (22.4)	9 (34.6)	4 (50.0)	37 (26.2)	4.07 (0.130)**
S. aureus	18 (16.8)	6 (23.1)	0 (0.0)	24 (17.0)	2.89 (0.088)**
P. aeruginosa	4 (3.7)	1 (3.8)	0 (0.0)	5 (3.5)	0.01 (0.979)**
S. pyogenes	0 (0.0)	2 (7.7)	0 (0.0)	2 (1.4)	8.36 (0.003)*
S. marcescens	1 (0.9)	0 (0.0)	0 (0.0)	1 (0.7)	4.33 (0.037)*
TOTAL	**107 (100.0)**	**26 (100.0)**	**8 (100.0)**	**141 (100.0)**	

*Statistically signficant P<0.05

** Not statistically significant P<0.05

Figure 2: Distribution of blood culture positive cases by gender

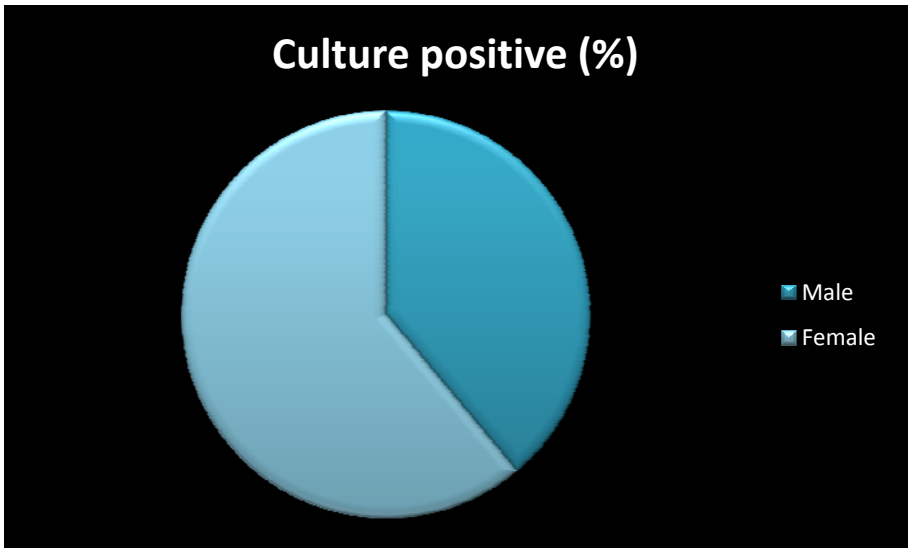

Table 3: Antibiotic resistance pattern of the isolates

Antibiotics	*K. pneumoniae* (n=72)	*E. coli* (n= 37)	*S. aureus* (n= 24)	*P. aeruginosa* (n=5)	*S. pyogenes* (n=2)	*S. marcescens* (n=1)
Ampicillin	NT	NT	10 (41.7)	NT	NT	NT
Gentamicin	69 (95.8)	30 (81.1)	18 (75)	5 (100)	2 (100)	0 (0)
Ofloxacin	13 (18.1)	10 (27.0)	12 (50)	3 (60)	NT	0 (0)
Cefuroxime	65 (90.3)	31 (83.7)	22 (91.7)	NT	1 (50)	1 (100)
Ceftazidime	66 (91.7)	32(86.5)	21 (87.5)	5 (100)	1 (50)	0 (0)
Ciprofloxaxin	39 (54.2)	15 (40.5)	19 (79.2)	2 (40)		0 (0)
Amoxicillin-clavulanic acid	68 (94.4)	37 (100)	20 (83.3)	5 (100)	1 (50)	1 (100)
Ceftriaxone	69 (95.8)	33 (89.2)	21 (87.5)	NT	NT	0 (0)

DISCUSSIONS

The findings of this study revealed that septicemia still remains very prevalent in Nigeria affecting all age groups but with a higher prevalence in neonates. The isolation rate of

bacteria from blood culture in this study was 22.5% which agrees with a rate of 23.4% from a study in Uyo[3], but is lower than 31.4% reported in Ile-Ife[25] both in Nigeria. This is also compliant with 20.5% rate reported in India [6]. Neonates were more affected with an isolation rate of 34.6% which agrees with an earlier study done in this center 10 years ago among neonates which had an isolation rate of 33.1%[19] and also corroborates with other studies in Nigeria[7,20,25,26]. This higher prevalence of septicemia in neonates is generally attributed to their immature immune system, obstetric practices, bottle feeding (in some cases) and poor hygiene. Also, in this study, females had more positive blood culture. This may be attributed to genetic factors. However, other studies both within and outside Nigeria have shown conflicting results in this regard[2–6,20–22,25–29].

There were more gram negative bacteria isolated than gram positive. This observation was also made in some studies in Nigeria[19,21], India[6] and Iran[30]. However, this contrasts with other studies where gram positive organisms are predominant[2–5,7,20,22,31]. The most common isolate from this study was *Klebsiella pneumoniae* (51%), followed by *Escherichia coli* (26%) and *Staphylococcus aureus* (17%). This is comparable to an earlier study done in this center[19]. However, some other studies within and outside Nigeria showed *Staphylococcus aureus* as the predominant organism isolated[3,4,20,27].

This study confirms reports that multidrug resistant isolates (resistant to at least 3 drugs) from blood culture are on the rise. Resistance to gentamicin and the cephalosporins were high across all the isolates whereas resistance was least to ofloxacin across board for the isolates. Similar pattern of resistance have been reported in some studies in Nigeria[3,19]. However, this pattern contrasts with other studies done within and outside Nigeria[2,5,7,20–22,26]. This attests to the fact that antimicrobial resistance pattern varies with geography and time and underscores the need for constant surveillance. The high level of resistance to gentamicin and cephalosporins is expected since these have been used over the years as the first line for empirical treatment of septicemia and other bacterial infections in the study population. Also the ease with which prescription drugs are obtained over the counter in the country may also contribute to this. Thus there is need to review the antimicrobial agents currently used for empirical treatment of sepsis in the study population. Also efforts should be made to regulate access to prescription medicines including antibiotics. The principles of antimicrobial stewardship should be promoted as part of the efforts to mitigate the emergence of drug resistance. Most of the isolates which are multidrug resistant are acquired primarily from the hospital. Hence, infection control practices will go a long way in reducing the incidence of

sepsis.

CONCLUSION

This study has shown the microbial and resistance profile of blood culture isolates in Port-Harcourt, Nigeria in the last two years. Most of the isolates exhibited multidrug resistance to commonly used antibiotics, hence the need for urgent review of antibiotics used for empirical treatment. Results from this study will provide the much needed information to guide such review. Periodic studies are recommended in order to make necessary changes in the future. We also recommend that tertiary health institutions such as ours should acquire better and rapid testing technologies for blood culture testing in other to improve upon the yield and turnaround time of blood cultures.

REFERENCES

1. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D,Bauer M et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315(8):801. doi:10.1001/jama.2016.0287

2. Ayobola ED, Sochi O. Study of prevalence and antimicrobial susceptibility of blood culture bacterial isolates. 2011;7(September 2009):78-82.

3. Chiedozie Kingsley O, Onwuezobe Ifeanyi A, Emmanuel Edet A, Chukwuemeka Smart O. Bacteriologic profile and antibiotics susceptibility pattern of suspected septicaemic patients in Uyo, Nigeria. *Res J Med Sci*. 2013;7(2):35-39. doi:10.3923/rjmsci.2013.35.39

4. Iregbu KC, Elegba OY, Babaniyi IB. Bacteriological profile of neonatal septicemia in a tertiary hospital in Nigeria. *Afr Heal Sci*. 2006;6:151-154.

5. Ako-Nai AK, Adejuyigbe EA, Ajayi FM, Onipede AO. The bacteriology of neonatal septicaemia in Ile-Ife, Nigeria. *J Trop Pediatr*. 1999;45(3):146-151. doi:10.1093/tropej/45.3.146

6. Garg A, Anupurba S, Garg J, Goyal RK. ORIGINAL ARTICLE Bacteriological Profile and Antimicrobial Resistance of Blood Culture Isolates from a University Hospital. 2007;8(2):139-143.

7. Adejuyigbe, E. A., Ako-Nai A.K. AB. Bacterial Isolates in the Sick Young Infant in Ile-Ife, Nigeria. *J Trop Pediatr*. 2004;50(6):323-327. doi:10.1093/tropej/50.6.323

8. Kirn TJ, Weinstein MP. Update on blood cultures: how to obtain, process, report, and interpret. *Clin Microbiol Infect*. 2013;19(6):513-520. doi:10.1111/1469-0691.12180

9. Hall KK, Lyman JA. Updated Review of Blood Culture Contamination. *Clin Microbiol Rev*. 2006;19(4):788-802. doi:10.1128/CMR.00062-05

10. Wilson ML WM and RL. *Manual of Clinical Microbiology, 11th Edition*. 11th ed. (Pfaller MA, Richter SS, Funke G, et al., eds.). American Society of Microbiology;

2015. doi:10.1128/9781555817381

11. Mimoz O, Karim A, Mercat A, Cosseron M et al. Chlorhexidine Compared with Povidone-Iodine as Skin Preparation before Blood Culture A Randomized Controlled Trial. *Ann Intern Med*. 1999.

12. Calfee DP, Farr BM. Comparison of Four Antiseptic Preparations for Skin in the Prevention of Contamination of Percutaneously Drawn Blood Cultures: a Randomized Trial. *J Clin Microbiol*. 2002;40(5):1660-1665. doi:10.1128/JCM.40.5.1660-1665.2002

13. John E. Bennett RD, Blaser MJ. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 8th ed. Elsevier Saunders; 2015.

14. Li J, Plorde JJ, Carlson LG. Effects of volume and periodicity on blood cultures. *J Clin Microbiol*. 1994;32(11):2829-2831. http://www.ncbi.nlm.nih.gov/pubmed/7852579.

15. Weinstein MP. Current blood culture methods and systems: clinical concepts, technology, and interpretation of results. *Clin Infect Dis*. 1996;23(1):40-46. http://www.ncbi.nlm.nih.gov/pubmed/8816127.

16. Habib G, Hoen B, Tornos P, et al. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): The Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). *Eur Heart J*. 2009;30(19):2369-2413. doi:10.1093/eurheartj/ehp285

17. Reimer LG, Wilson ML, Weinstein MP. Update on detection of bacteremia and fungemia. *Clin Microbiol Rev*. 1997;10(3):444-465. http://www.ncbi.nlm.nih.gov/pubmed/9227861.

18. Pfaller MA, Richter SS, Funke G, et al., eds. *Manual of Clinical Microbiology, 11th Edition*. American Society of Microbiology; 2015. doi:10.1128/9781555817381

19. West BA, Tabansi PN. Prevalence of neonatal septicaemia in the University of Port Harcourt Teaching Hospital, Nigeria. *Niger J Paed*. 2014;41(1):33-37. doi:http://dx.doi.org/10.4314/njp.v41i1,6

20. Meremikwu MM, Nwachukwu CE, Asuquo AE, Okebe JU, Utsalo SJ. Bacterial isolates from blood cultures of children with suspected septicaemia in Calabar, Nigeria. *BMC Infect Dis*. 2005;5(1):110. doi:10.1186/1471-2334-5-110

21. Nwadioha SI, Nwokedi EOP, Kashibu E, Odimayo MS, Okwori EE. A review of bacterial isolates in blood cultures of children with suspected septicemia in a Nigerian tertiary hospital. *African J Microbiol Res*. 2010;4(4):222-225. http://academicjournals.org/journal/AJMR/article-abstract/60F6EF311690.

22. Peterside O, Pondei K, Adeyemi OO. Bacteriological profile of childhood sepsis at a tertiary health centre in southern Nigeria . 2017;4(2):11-15.

23. Dellinger RP, Levy MM, Opal SM, et al. Surviving Sepsis Campaign : International Guidelines for Management of Severe Sepsis and Septic Shock , 2012. 2013:165-228. doi:10.1007/s00134-012-2769-8

24. Testing S. *M100-S24 Performance Standards for Antimicrobial*.; 2014.

25. Komolafe AO, Adegoke AA. Incidence of bacterial Septicaemia in Ile-Ife Metropolis , Nigeria. *Malays J Microbiol*. 2008;4(2):51-61.

26. Babatunde. O. Motayo, P . Akinduti, Joseph.I. Ogiogwa, Olusola.A. Akingbade, Bukola. W. Aboderin OA and JAA. Nature and Science. *Change*. 2011;2011(44):1-68. doi:10.1111/j.1365-2486.2011.02248.x

27. Arora U, Devi P. Bacterial profile of blood stream infections and antibiotic resistance pattern of isolates. *JK Sci*. 2007;9(4):186-190.

28. Asghar AH. Frequency and antimicrobial susceptibility patterns of bacterial pathogens isolated from septicemic patients in Makkah hospitals. *Saudi Med J*. 2006;27(3):361-367. doi:20050931' [pii]

29. Kumalo A, Kassa T, Mariam ZS, Daka D. iMedPub Journals Bacterial Profile of Adult Sepsis and their Antimicrobial Susceptibility Pattern at Jimma University Specialized Hospital , South West Ethiopia. 2016:1-8.

30. Mehdinejad M ADK and AM. Study of Prevalence of Antimicrobial Susceptibility Pattern of Bacteria Isolated from Blood Cultures. *J Biol Sci*. 2009;9(3):249-253.

31. Muley V, Ghadage D, Bhore A. Bacteriological profile of neonatal septicemia in a tertiary care hospital from Western India. *J Glob Infect Dis*. 2015;7(2):75-77. doi:10.4103/0974-777X.154444