

Implementing Antimicrobial Stewardship Program in Pediatrics Across Six Hospitals in Six States in Nigeria: Needs Assessment

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Abstract: Antimicrobial resistance (AMR) is the ability of microorganisms to withstand treatment with antimicrobial agents. Antimicrobial use in children tends to be higher than in adults, especially in developing countries such as Nigeria. In 2017, the percentage of antibiotics prescribed per patient encounter ranged from 26.8% to 71.1 with the highest proportion reported among children under five years of age, underscoring the need for AMS in pediatrics in Nigeria. A review of the literature on AMS in pediatrics across Nigeria show scanty studies. In view of this, the Centre for Initiative and Development (CFID) in collaboration with Nigeria Centre for Disease Control (NCDC) through a grant from Pfizer conducted needs assessment in six healthcare facilities in six States of Nigeria. This was a hospital based cross sectional study conducted using well-structured questionnaire. The structured tools were administered to key hospital management in pediatrics department and data was analyzed using simple percentages. The study recorded low pediatrics AMS structures across all the six hospitals in six states. Results show that all the six hospitals do not produce antibiogram, Five hospitals 5(83.3%) do not have formal organizational structure for antimicrobial stewardship in pediatrics, most hospitals do not have formulary. Results also show that most hospitals do not have specific clinical guidelines for management of common infectious diseases in pediatrics. This reflects that pediatrics AMS practice is still in its infancy across hospitals in Nigeria. Findings from this study identifies useful drivers that will help to effectively implement pediatrics AMS in Nigeria. This study therefore, calls for urgent need of implementing antimicrobial stewardship in pediatrics across Nigeria which will be instrumental in spurring behavioral change towards rational dispensing and use of antibiotics in pediatrics and ultimately contribute towards reducing the risk of antimicrobial resistance development and spread of resistant bugs, improve pediatrics patient health outcomes and preserve the effectiveness of antibiotic therapy in pediatrics age groups.

Keywords: Antimicrobial Resistance, Pediatrics Antimicrobial Stewardship, Antibiogram

I. INTRODUCTION

The World Health Organization [WHO],(2017) defined Antimicrobial Resistance as a situation when

microorganisms such as bacteria, viruses, fungi and parasites change in ways that render the medications used to cure the infections they cause ineffective and such condition is usually referred to as multi- and pan-resistant bacteria (superbugs). The WHO further stated that though Antimicrobial resistance occurs naturally, however, it is facilitated by inappropriate use of Antimicrobials such as antibiotics of which most of it are commonly prescribed in pediatrics (Vander et al., 2001, Gerber et al., 2010, Donà et al. 2020).

In sub-Saharan Africa, over 50% of the infants newly diagnosed with HIV carry a virus that is resistant to non-nucleoside reverse-transcriptase inhibitors (NNRTIs). Informed by these findings, latest WHO ARV guidelines now recommend the adoption of a new drug, dolutegravir, as the preferred first-line treatment for adults and children (WHO, 2021).

Nigeria out of 12 countries, has one of the highest average number of prescriptions and highest percentage of Antimicrobial prescription including antibiotics (Omole et al., 2022). In 2017, the percentage of antibiotics prescribed per patient encounter ranged from 26.8% to 71.1, with the highest proportion reported among children under five years of age, underscoring the need for AMS in paediatrics in Nigeria.

In view of this, Centre for Initiative and Development (CFID) Taraba in collaboration with Nigeria Centre For Disease Control (NCDC) conducted a needs assessment in order to ascertain baseline indicators across 6 semi-urban and rural states in Nigeria, with very poor access to quality health care but high population density of over 25 million people with plans to reach Doctors/Dentists/Nurses/Pharmacists working in pediatrics/children wards or units in each

Aim and Objectives of the Study

The aim of the study is to conduct needs assessment across six States and six hospitals in Nigeria namely; Abuja FCT - Limi Children's Hospital, Wuse FCT, Benue State - Federal Medical Center (FMC) Makurdi, Nasarawa State - Dalhatu

Araf Specialist Hospital (DASH) Lafiya, Plateau - Plateau State Specialist Hospital (PSSH) Jos, Taraba- Federal Medical Center (FMC) Jalingo, Taraba State and Sokoto - Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto.

The objectives were to;

- i. Conduct a hospital based needs assessment across target facilities
- ii. Identify missing but priority gaps that will guide in the implementation of AMS in pediatrics across all the target facilities

II. METHODOLOGY

Design: This was a hospital based cross sectional that was conducted using well-structured questionnaire across six states and six hospitals across Nigeria. Interviews were administered to hospital management staff such as Clinical Microbiologist/Medical Laboratory, Infectious disease physicians, Paediatricians, Pharmacy, infectious diseases nurses, Infection Prevention and Control, Pharmacy department, Infection Prevention and Control and ICT/Record officer by well-trained and qualified CFID/NCDC assessors.

Scope of the Study

The assessment was conducted in six States (Taraba, Benue, Nasarawa, Abuja FCT, Plateau and Sokoto) across six hospitals, structured questionnaire were used to obtain primary data from the hospitals.

Data Collection Instruments

The study was conducted using structured standardized questionnaires for the collection of quantitative data at the health facility level. The instruments for the needs assessment were designed by CFID's MEARL unit with inputs from NCDC. It was further reviewed by CFID and NCDC technical program team to ascertain the comprehensiveness of the tool before training of assessors and deployment to the field for data collection. During the training of assessors, the instrument was reviewed by the trained Assessors to test run the tool.

Data Analysis

Data was analysed using Statistical Package for Social science (SPSS version 26). For the purpose of needs assessment survey, descriptive statistics such as charts and simple percentages were calculated using crosstabulations. A quality check was ensured and a cut off mark of 0.05 was set as statistically significant.

Data Availability Statement: The data presented in this study are available on request from the authors.

III. RESULTS

Frequency Distribution of Responses from Six Hospitals Across Six States in Nigeria

Key Questions	Response	
	Yes	No
Does the facility have a drugs and therapeutics committee?	1(16.7%)	5(83.3%)
Does your facility have a committee on pharmacovigilance?	3(50%)	3(50%)
Does the facility have an infection prevent & control committee?	4(66.7%)	2(33.3%)
Does your facility have an infectious disease physician available for consults 24/7?	3(50%)	3(50%)
Does your facility meet to discuss the effectiveness of AMS program on pediatrics?	4(66.7%)	2(33.3%)
Does the facility have a formal organizational structure for antimicrobial stewardship in pediatrics?	1(16.7%)	5(83.3%)
Is an antimicrobial stewardship team in pediatrics available at the facility?	1(16.7%)	5(83.3%)
Does the facility have an antimicrobial stewardship committee in pediatrics?	0(0%)	6(100%)
Does your antimicrobial stewardship committee in pediatrics include patient representative?	0(0%)	6(100%)
Is there a physician or pediatrician identified as the leader for antimicrobial stewardship in the facility?	0(0%)	6(100%)
Do pediatrician work with the stewardship leaders to improve antibiotic use?	3(50%)	3(50%)
Do microbiology work with the stewardship leaders to improve antibiotic use?	3(50%)	3(50%)
Do information technology work with the stewardship leaders to improve antibiotic use?	3(50%)	3(50%)
Do nursing work with the stewardship leaders to improve antibiotic use?	3(50%)	3(50%)
Does the facility provide any support for pediatrics antimicrobial stewardship activities?	1(16.7%)	5(83.3%)
Does the facility have the information technology (IT) capability to support antimicrobial stewardship activities?	5(83.3%)	1(16.7%)
Do nurses, physicians, pediatricians and pharmacists offer antibiotic stewardship education in your facility?	2(33.3%)	4(66.7%)
Is there a pharmacist(member of the antimicrobial stewardship team) monitoring appropriate antibiotic use?	2(33.3%)	4(66.7%)
Does your facility have a physician or pharmacist review of therapy for specified antibiotic agents?	3(50%)	3(50%)
Does your facility have specific antibiotic agents that need to be approved by a pediatrician/physician or pharmacist prior to dispensing?	2(33.3%)	4(66.7%)
Does your facility monitor antibiotic use at the unit and/or facility wide level by counts of antibiotic(s) administered to patients per day?	1(16.7%)	5(83.3%)
Does your facility monitor antibiotic use at the unit and/or facility wide level by number of grams/mg of antibiotic use?	3(75%)	3(75%)
Does your facility monitor antibiotic use at the unit and/or facility wide level by direct expenditure for antibiotics?	0(0%)	6(100%)
Does your facility track antibiotic use on paper or electronically?	3(50%)	3(50%)
Is dose adjustments in cases of organ	0(0%)	6(100%)

dysfunction on antimicrobial use implemented in your facility?		
Is dose optimization based on organism's susceptibility on antimicrobial use implemented in your facility?	0(0%)	6(100%)
Is automatic alerts in situations where therapy might be unnecessarily duplicative on antimicrobial use implemented in your facility?	1(16.7%)	5(83.3%)
Does the facility have an outpatient parental antibiotic therapy(OPAT) unit?	2(33.3%)	4(66.7%)
Does your facility produce an antibiogram(cumulative antibiotic susceptibility report)?	0(0%)	6(100%)
Has annual report focused on antimicrobial stewardship been produced for your facility in the past year?	0(0%)	6(100%)
Does the facility have an antibiotic formulary for pediatrics?	2(33.3%)	4(66.7%)
Does the facility have an antibiotic guideline?	2(33.3%)	4(66.7%)
Are the antibiotic guidelines based on local antibiotic susceptibility	2(33.3%)	4(66.7%)
Does your hospital have specific clinical guidelines for management of common infectious diseases in pediatrics?	3(50%)	3(50%)
Does the facility have written policy that requires prescribers to document an indication in the pediatrics medical records or antibiotic prescription forms?	2(33.3%)	4(66.7%)
Is there a formal procedure to review the appropriateness of an antibiotic at or after 48 hours from the initial order?	1(16.7%)	5(83.3%)
Does your facility monitor pediatrics antibiotic use?	2(33.3%)	4(66.7%)
Does your facility monitor whether the indication is captured in the medical record for all antibiotic prescriptions?	2(33.3%)	4(66.7%)
Does your facility audit or review surgical antibiotic prophylaxis choice and duration?	2(33.3%)	4(66.7%)
Does your facility monitor antibiotic use by grams of antibiotic(s) by patient per	3(50%)	3(50%)
Is monitored antibiotic use reported by hospital activity denominator?	1(16.5%)	5(83.3%)
Has your facility produced a cumulative antibiotic susceptibility report in the past year?	0(0%)	6(100%)
Is your facility participating in the national antibiotic resistance surveillance programme?	1(16.5%)	5(83.3%)
Does the microbiology laboratory that performs cultures for your facility have an established system for alerting infection prevention staff in a timely manner (i.e within 24 hours) whenever a case is identified?	2(33.3%)	4(66.7%)
Is a UV technology system used as part of terminal cleaning of patient care areas?	0(0%)	6(100%)
Are environmental service personnel monitored to ensure adherence to appropriate terminal cleaning procedures?	3(50%)	3(50%)

Description of Results

In all, 6 facilities participated in the survey. Results from the analysis shows that 5 hospitals representing 83.3% had no drugs and therapeutics committee, 3 (50%) facilities did not have committee on pharmacovigilance, 3 (50%) hospitals had no infectious disease physician who is available for consults 24/7, and 2 hospitals do not meet to discuss the effectiveness of AMS program in pediatrics (33.3%). It was also observed that 5 (83.3%) hospitals do not have a formal organizational

structure for antimicrobial stewardship and AMS team in pediatrics, none had antimicrobial stewardship committee/team in pediatrics or patient representative as part of this team/committee as the result. Only one hospital provides support for pediatrics antimicrobial stewardship activities, the remaining 5 do not (83.3%), most hospitals 5(83.3%) have information technology (IT) capability to support antimicrobial stewardship activities however, this is not practically applied.

Four hospitals do not give provision for nurses, physicians, pediatricians and pharmacists to offer antibiotic stewardship education or monitor antibiotic use 4(66.7%). Four hospitals do not have specific antibiotic agents that need to be approved by a pediatrician/physician or pharmacist prior to dispensing and this represents 4(66.7%). Five (83.3%) do not monitor antibiotic use at the unit and/or facility wide level by counts of antibiotic(s) administered to patients per day while none of the hospitals uses by direct expenditure for antibiotic. 50% of the hospitals track antibiotic use on paper while the remaining 50% tracks electronically, all the hospitals do not use dose adjustments in cases of organ dysfunction on antimicrobial use also, dose optimization is not based on organism's susceptibility of antimicrobial use 6(100%), four hospitals do not have OPAT unit while 5(83.3%) hospitals do not use automatic alerts in situations where therapy might be unnecessarily duplicative on antimicrobial use, all the hospitals 100% do not produce antibiogram (cumulative antibiotic susceptibility report) or had annual report that focused on antimicrobial stewardship, only four hospitals had formulary for pediatrics and antibiotic guideline this represent 4(66.7%). 66.7% of hospitals that had antibiotic guidelines were based on local antibiotic susceptibility, 50% of the hospitals have specific clinical guidelines for management of common infectious diseases in pediatrics 3(50%), four hospitals do not have written policies that requires prescribers to document in the pediatrics medical records or antibiotic prescription forms and this represents 4(66.7%), five hospitals do not have formal procedure to review the appropriateness of an antibiotic at or after 48 hours from the initial order 5(83.3%), four hospitals 66.7% do not monitor pediatrics antibiotic use 4(66.7%). Five hospitals do not report antibiotic use by hospital activity denominator this represents 83.3%.

None of the hospitals had produced a cumulative antibiotic susceptibility report in the past, and five hospitals had never participated in national AMR surveillance programme 5(83.3%), four of the hospitals that had microbiology laboratories where cultures for your facility have an established system for alerting infection prevention staff in a timely manner (i.e within 24 hours) whenever a case is identified 66.7%. None of the hospitals use UV technology system as part of terminal cleaning of patient care areas 6(100%). Three hospitals had environmental service personnel who monitor to ensure adherence to appropriate terminal cleaning procedures this represent 50%.

Discussions of the Results

The healthcare system in Nigeria can be categorized into three different levels namely; primary, secondary and tertiary healthcare system. This structure also reflects the three tiers of government in Nigeria, namely Local, State and Federal government (Asuzu MC 2004, Kombe G 2009, ADF 2002). This study assessed the facility-specific needs of six healthcare facilities in Six states of Nigeria using a well-structured questionnaire. This study recorded low pediatrics ASP implementation. Similar results have also been reported in Health care facilities in Lagos (Emelda et al., 2021), other parts of Nigeria (Fadare et al., 2019) and elsewhere in upper and lower middle-income countries (Herawati et al., 2020). This could be attributed to the fact that Pediatrics AMS is still in its infancy in Nigeria.

Leadership support

A lack of necessary resources is commonly cited as the top barrier to success in implementing paediatrics Antimicrobial stewardship programs. Generally, this study reported limited paediatrics Antimicrobial Stewardship programs going on in all the six intervention states and hospitals, with none of the facilities having a formal Pediatrics Antimicrobial stewardship committee/teams. This lack of a formal structure across hospitals were pronounced in both governments own hospitals and private health-care hospitals and could be largely attributed to poor awareness, human and infrastructural deficit. Regrettably, even the tertiary hospitals which are believed to be more robust had no formal Paediatrics Antimicrobial Stewardship Programs, only few of the hospitals had in place general Antimicrobial stewardship committee/team supporting their hospitals. Our findings were similar to a previous study that reported lack of ASPs (Emelda et al., 2021) in Lagos, a substantive proportion of tertiary hospitals in Nigeria with only 35% of sampled healthcare facilities having a formal organizational structures such as AMS committees/teams that are responsible for AMS (Emelda et al., 2021, Fadare et al., 2019).

The ability of hospital management and leadership to support and provide enabling environment to institutionalize Paediatrics Antimicrobial Stewardship practices is key and crucial to the success of any Antimicrobial stewardship Program [CDC, 2022]. Hospital leadership can play a pivotal role in helping the Pediatrics AMS to obtain the resources needed to accomplish its ultimate goals. A low proportion of the health facilities 16.7% in our study hardly support pediatrics AMS activities. This study suggests urgent need for hospitals to secure hospital leadership buy-in so as to ensure management support in the provision of infrastructure and dedicated time for co-ordinated stewardship activities in Pediatrics.

The availability of information technology capability to support and fast track AMS activities in hospitals can be seen as a strength to be leveraged upon especially in private and tertiary hospitals. In this study, a reasonable percentage 83.3%

of the hospitals had IT capability that can potentially support AMS activities but this is not in practice since there is absence of AMS structures.

The availability of laboratories for carrying out culture and sensitivity test in hospitals are key to planning and implementing a facility-specific Pediatrics AMS program. Although the majority of the hospitals had laboratories, unfortunately only few of these hospitals had reasonable number of culture produced in their facilities all the labs do not produce antibiogram. This could be attributed to absence of Multidisciplinary Pediatrics antimicrobial stewardship structures in most of the hospitals that led to poor education on antibiogram use. Also worthy of note is that all the hospitals do not have patient representatives as part of their general or Pediatrics AMS team/Committee however, most hospitals were willing to buy such innovations. Therefore, financing and human capacity constraints especially in many of these hospitals need to be urgently addressed to facilitate the acceleration and implementation of AMS.

Accountability

This study shows that none of the hospitals had pediatrics AMS team/Committee nor had dedicated medical doctor and/or pharmacist as AMS team lead. Based on hospitals' resources available, it is recommended for hospitals to establish a multidisciplinary pediatrics antimicrobial stewardship team (consisting of nursing managers; pharmacists; infection prevention practitioners; doctors; clinical microbiologists and patient representatives) so as to improve children patient safety and health outcomes. A designated pediatrician/physician leader or Microbiology clinician co-leaders who will be accountable for programme management and outcomes is key (CDC, 2019). However,

Implementation of interventions to improve antibiotic use

Although this study sampled different cadres of healthcare facilities, our findings showed that only two hospitals had antibiotic formulary for pediatrics and antibiotic guidelines which are based on local antibiotic susceptibility (33.3%) this agrees with a study by Emelda et al., 2021 and other previous studies on tertiary healthcare facilities in Nigeria (24%) (Fadare et al., 2019). This could be attributed to poor Pediatrics AMS structures across hospitals.

There are several implementation strategies recommended for ASP interventions. Published evidence has demonstrated that prospective audit and feedback and pre-authorisation are the two most effective AMS interventions in hospitals (Barlam et al., 2016). Unfortunately, only two facilities performed prospective audit and feed-back or review surgical antibiotic prophylaxis choice and duration this represents 33.3%, while only 2 hospitals had specific antibiotic agents that need to be approved before dispensing this also represents 33.3% of the hospitals. Prospective audit and feedback involves an external review of antibiotic therapy by an expert in antibiotic use,

accompanied by suggestions to optimise use, at some point after the agent has been prescribed (Barlam et al., 2016).

Tracking antibiotic use and outcomes

In ASP, measurement is critical to identify opportunities for improvement and necessary adjustments. It also helps to assess the impact of interventions in hospitals. In this study, it was observed that only one hospital representing 16.5% monitors antibiotic use by activity denominator. This pose a serious gap across hospitals. There was an overall poor tracking of antibiotic use and outcomes and this was irrespective of the healthcare cadre. Most hospitals still track antibiotic use on paper rather than electronic, despite the IT capability reported from hospitals in this study. This study showed limited use of AMS pediatrics guidelines which is comparable with some previous studies in South East Nigeria. Based on the findings, none of the hospitals track AMR by submitting data to the NCDC AMR surveillance system which suggests minimal AMS activities across hospitals.

Reporting antibiotic use and outcomes

Pediatrics AMS are expected to provide regular updates to pediatricians, prescribers, pharmacists, nurses and leadership on process and outcome measures that address both national and local issues. Unfortunately, only one hospitals report antibiotic use. Reporting of outcomes of antibiotic use was poor among the facilities assessed and this was evident in the very low percentage (0%) of facilities with a cumulative antimicrobial susceptibility report. Our findings agree with a previous report by Emelda et al., 2021 and Fadare et al. 2019 where a cumulative antimicrobial susceptibility report for the previous year was available in only two (12%) of the tertiary healthcare facilities in Nigeria. There is every possible evidence and urgent need to see and ensure that effort on implementing pediatrics AMS in Nigeria is realized as this will ensure adequate health facilities integration into national health policy.

Education

In AMS education is considered as one of the important component of improving prudent antibiotic use. It has been established that education is most effective when paired with interventions and measurement of outcomes such as prospective audit with feedback and pre- authorisation, especially when feedback is done (CDC, 2019, Emelda et al., 2021). This study revealed that fewer number of facilities 2(33.3%) engaged nurses, physicians, pediatricians and pharmacists in antibiotic stewardship education and this can be compared with a study by Emelda et al., 2021 whose study only provided prescriber education (32%) compared with patient education (64%) and the majority of the facilities that provide patient education undertook verbal counselling regarding prudent use of antibiotics and AMR during consultation.

IV. CONCLUSION

AMR is still a budding public health challenge across the globe, and especially in low-income settings. AMS practice is still in infancy in these settings. We demonstrate how expertise from developed and advanced settings can be leveraged to move Pediatrics AMS practice forward. The findings from this study identifies drivers of effective PAMS intervention across hospitals which will be useful in carrying out AMS interventions in Nigeria. It also shows that continuous AMR training for healthcare professionals can increase knowledge and awareness, spur behavioural change to improve practice and build momentum for sustainable AMS programmes.

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Conflicts of interest: All authors – none to declare.

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