In-silico multi-omic characterisation of viral versus bacterial paediatric pneumonia: a machine-learning–based approach

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Background: Childhood pneumonia remains a leading infectious cause of morbidity and mortality. Multi-omic approaches through in-silico machine learning can identify biomarkers for viral-bacterial differentiation.

Objectives: The study aims to identify biomarkers that differentiate viral from bacterial pediatric pneumonia through bioinformatics.

Methods: We curated transcriptomic, proteomic and metabolomic datasets from children with confirmed pneumonia applying standard preprocessing steps. Differential expression analysis identified omic features associated with viral or bacterial infection while supervised machine learning algorithms generated classification models. We used multi-omic integration to identify cross-layer molecular modules and conducted biological interpretation using pathway enrichment analysis from established databases.

Results: Transcriptomics revealed that viral pneumonia was strongly associated with upregulation of IFIT1, MX1, ISG15, OAS1, and RSAD2 reflecting canonical interferon-driven antiviral pathways. Bacterial pneumonia, on the other hand, showed higher expression of LCN2, MMP8, CEACAM8, S100A8/A9, and IL1B consistent with neutrophil activation and acute inflammatory responses. Proteomics highlighted elevated myeloperoxidase (MPO), calprotectin and complement C3 fragments in bacterial cases, whereas viral cases showed increases in interferon-inducible proteins such as IFI16 and STAT1-associated signaling proteins. Metabolomics revealed that viral pneumonia demonstrated increased levels of kynurenine and nicotinamide metabolites, while bacterial pneumonia exhibited higher concentrations of lactate, succinate and amino acid–derived inflammatory metabolites. Integrated machine-learning models achieved consistent separation of viral and bacterial infections across datasets.

Conclusion: In silico multi-omic approach revealed biologically meaningful biomarkers with viral-bacterial differentiation in paediatric pneumonia. This offers opportunity for developing precision diagnostics and improving antimicrobial stewardship.

Keywords: Paediatric pneumonia, in silico, multi-omics, viral–bacterial differentiation, machine learning.

ANTIBIOTIC USE IN HOSPITALISED CHILDREN AT THE UNIVERSITY COLLEGE HOSPITAL, IBADAN: APPROPRIATENESS AND ASSOCIATED FACTORS

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Background

The abuse and misuse of antibiotics have contributed to the emergence and spread of antimicrobial resistance. Evaluating antibiotic use is a crucial step for antimicrobial stewardship interventions.

Aims

The study sought to determine the prevalence and pattern of antibiotic use in hospitalised children at the University College Hospital in Ibadan, as well as the appropriateness of these antibiotics.

Methodology

It was a descriptive longitudinal study of 418 children aged 0-15 years, hospitalised and commenced on antibiotic. Patients were followed up until discharge and Day 28 post-discharge. The review for appropriateness in accordance with the existing antibiotic handbook in the department was done by the investigator and verified by a paediatric infectious disease specialist.

Antibiotics used were classified using the WHO AWaRe classification 2021 into Access, Watch or Reserve groups.

Results

The prevalence of antibiotic use was 95.9 %, with ceftriaxone being the most prescribed while cefuroxime plus gentamicin were the most common combination. Pneumonia was the most common indication for antibiotics. Only 49.2% of the prescribed antibiotics were from the Access group while 50.0% were from the Watch group and 0.8% were the Reserve group antibiotics. Only 5.7% of the patients had targeted therapy. Adherence to antibiotic treatment guidelines was 40.7%, with most antibiotics prescribed empirically. Factors associated with inappropriate antibiotic use were a diagnosis of presumed early onset neonatal sepsis (aOR: 10.42, 95% CI: 2.08–52.31, p=0.004), acute diarrhoeal disease (aOR: 5.72, 95% CI: 1.43–22.93, p=0.014), prescriptions involving "Watch only" (aOR: 29.78, 95% CI: 4.99–177.72, p<0.001) and "Access + Watch" (aOR: 14.00, 95% CI: 3.29–59.56, p<0.001) category antibiotics. Low socioeconomic class was however associated with less risk of inappropriate antibiotic use.

Conclusion

The prevalence of antibiotic use was high with a high usage of broad spectrum “Watch” group antibiotics. Widespread implementation of antimicrobial stewardship programme is recommended.

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Combating paediatric antimicrobial resistance through microbiome modulation: emerging bioinformatic and biotechnological approaches.

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Background: Antimicrobial resistance is a significant public health challenge especially in Sub-Saharan Africa with huge childhood morbidity and mortality. Traditional antimicrobial therapies often disrupt the host microbiome with consequences such as multi- and pan-drug resistance. Emerging evidences suggest that the host microbiome through bioinformatics and biotechnology offers a promising target for innovative interventions to managing antimicrobial resistance.

Objectives: This study aims to explore current knowledge on paediatric microbiome-based interventions targeting antimicrobial resistance, highlighting bioinformatic and biotechnological innovations, associated challenges and recommendations.

Methods: We conducted a narrative review of peer-reviewed articles from 2015 to 2025 in PubMed, Scopus, Google scholar and Web of Science using keywords and MeSH terms such as "Paediatric microbiome", "antimicrobial resistance", "bioinformatics", and "biotechnology". We analysed relevant studies thematically and contextually.

Results: This review identified multiple microbiome-based strategies against antimicrobial resistance which include probiotics, prebiotics, synbiotics, engineered antimicrobial peptides, nanoparticles, bacteriophage therapy, CRISPR-based approaches and fecal microbiota transplantation. Integrative metagenomics, metatranscriptomics and metabolomics through computational bioinformatics and machine learning algorithms allow for high-resolution mapping of antimicrobial genes, predictive analytics, personalized therapeutics, drug repositioning, resistome profiling and surveillance. Challenges found were inter-individual microbial heterogeneity, poor tolerability in children, poor biotechnological infrastructure, poor health-data literacy among healthcare workers and regulatory constraints on health data ethics. Identified recommendations included human capacity building, research funding, improved health-data infrastructure, and ethical data governance.

Conclusion: Microbiome-based bioinformatics and biotechnology is the next frontier to combating antimicrobial resistance. There is the urgent need for capacity building and trans-disciplinary research especially in Sub-Saharan Africa.

Keywords: Paediatric microbiome, antimicrobial resistance, bioinformatics, biotechnology.

Predictors of outcomes of paediatric diphtheria in Sub-Saharan Africa: a systematic review and meta-analysis

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Background: Diphtheria is a disease of public health significance with disproportionate childhood morbidity and mortality. We systematically reviewed the literatures on predictors of outcomes of paediatric diphtheria in Sub-Saharan Africa.

Methods: We conducted a systematic search of PubMed, Embase, Scopus, Web of Science, Google scholars and grey literature, from January 1990–October 2025. Eligible studies included children ≤15 years with laboratory-confirmed or clinical or epidemiologic diphtheria reporting outcome data. Two reviewers independently screened articles, extracted data, and assessed study quality using a modified Newcastle–Ottawa Scale. We pooled data using random-effects meta-analysis where two studies reported comparable outcome and assessed heterogeneity with I^2 statistics.

Results: Of the 1,732 records screened, 23 studies from 12 Sub-Saharan countries (n = 5,480 paediatric cases) met the inclusion criteria. Reported Case Fatality Rates (CFR) ranged from **4.9% to 24.3%** with pooled CFR of **14.7% (95% CI 11.3–18.7%; I^2 = 56%).** Meta-analysis synthesis showed the predictors of poor outcome to include delayed presentation (>72hours) **(Pooled OR 2.89, 95% CI 1.95–4.29, I^2 = 38%),** delayed or absent diphtheria antitoxin **(Pooled OR 4.12, 95% CI 2.45–6.93, I^2 = 29%),** lack of vaccination **(Pooled OR 2.73, 95% CI 1.84–4.06, I^2 = 24%),** and severe airway obstruction **(Pooled OR 3.47, 95% CI 2.16–5.57, I^2 = 33%).**

Conclusions: Diphtheria remains a major cause of mortality in Sub-Saharan Africa. Lack of diphtheria antitoxin and vaccination are predictors of adverse outcomes in children. There is the need to strengthen vaccine coverage.

Keywords: Diphtheria, Paediatric, Predictors, outcome, Sub-Saharan Africa,

Hepatic Hydatidosis with Pyogenic Liver Abscess in a Child: A Case Report from Federal Teaching Hospital Gombe, Northeast Nigeria.

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Background: Hydatid disease caused by *Echinococcus* species is a neglected tropical disease of public health relevance. It primarily affects the liver with attendant complications such as secondary infection and abscess formation.

Objective: To highlight the clinical presentation and multidisciplinary management of paediatric hepatic hydatidosis in a resource-limited setting.

Case Report: AA**,** 9-year-old male presented with recurrent high-grade fever of 1/12; dull abdominal pain and poor appetite of 3/52; weight loss of 3/52 and bilateral leg swelling of a 1/52. He has a significant contact with sheep and is from a low socioeconomic background. Examination revealed a wasted child with palor, bilateral pitting oedema and hepatomegaly. Laboratory investigations showed PCV 24%, WBC 8.0×10^9/L, platelets 560×10^9/L, elevated ALP, hypoalbuminemia, and ESR 125mm/hr. Serological test for hydatid disease was however unavailable. Abdominal ultrasound revealed multiple thick-walled hepatic cystic masses with septations, largest 8.0×6.8cm. Abdominal CT confirmed large multiseptated hepatic masses with contrast-enhancing septations. Stool microscopy was unremarkable. Diagnosis was Hepatic hydatidosis with pyogenic liver abscess. He received oral albendazole, intravenous ceftriaxone,

metronidazole, hydrocortisone, and nutritional support. He was transfused with packed cell and had exploratory laparotomy resulting in drainage of eight abscess pockets totaling ~800ml; largest cyst contained about 400ml of chocolate-brown collection, with a daughter-cyst superiorly. Aspirate culture yielded no growth and cytology showed lymphocytic infiltrates. He recovered well and was discharged eight days post-operation.

DISCUSSION/CONCLUSION

Hydatid disease may progress to secondary bacterial abscesses. Early imaging, prompt antiparasitic therapy and timely multidisciplinary management are essential to reduce morbidity and ensure favorable outcomes..

Keywords: Hepatic hydatidosis; Pyogenic liver abscess; *Echinococcus Spp*; Neglected Tropical Diseases; Child

BURDEN OF BACTERIAL ANTIMICROBIAL RESISTANCE AMONG HOSPITALISED CHILDREN AT THE UNIVERSITY COLLEGE HOSPITAL, IBADAN

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Background

Antimicrobial resistance (AMR) is a rapidly emerging global health crisis, disproportionately affects children, and thus a pressing threat to childhood survival**.** Assessing the burden of AMR is essential to determine the magnitude of this problem, to set priority, and guide policy interventions

Aim

The study sought to evaluate the burden of bacterial antimicrobial resistance among hospitalised children at the University College Hospital, Ibadan.

Methodology

It was a descriptive longitudinal study of children with suspected infections aged 0-15 years, hospitalized between February 2024 to June 2024 and commenced on antibiotic. Blood cultures and other clinical samples were tested using standard microbiological processes. Patients were followed up daily until discharge and Day 28 post-discharge. Data was analysed using summary and inferential statistics with level of significance set at α of 0.05.

Results

Over a 5-month period of 436 children admitted across twelve paediatric units, 418 children were enrolled, with mean (SD) age of 3.9 (1.9) years and 284 males. The commonest infection was community

acquired pneumonia 103/418 (24.6%) followed by sepsis 68/418 (16.4%). The commonest empiric antibiotics used were ceftriaxone 203 (20.5%) and gentamicin 197 (19.9%). There were 97 isolates from 331 blood cultures, with 49 (50.5%) Gram positive organisms and 48 (49.5%) Gram negative organisms. The commonest isolates were *Staphylococcus aureus* 29 (29.9%), *Klebsiella pneumoniae* 11 (11.3%), *Escherichia coli* 9 (9.3%), *Pseudomonas aeruginosa* 8 (8.2%), *Acinetobacter baumanii* 7 (7.2%) and *Salmonella typhi* 4 (4.1%). Among the *Staphylococcus aureus* isolates, 35%; were *MRSA.* Furthermore, 66.7% of the *Klebsiella pneumoniae* were extended spectrum Beta-Lactamase producers while 28.6% were carbapenem resistant. In all, 86.4% of patients were discharged, 10.3% died, 3.3% left against medical advice and 4.5% were re-admitted after discharge.

Conclusion

There was a high local burden of antimicrobial resistance. The need to improve infection, prevention and control practices, antibiotic stewardship, sustain AMR surveillance, and update of evidence-based treatment guidelines should be encouraged.

Antibiotic Stewardship in a Paediatric Practice: Experience from a Secondary-Level Facility – The Oni Memorial Children's Hospital, Ibadan.

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Background: Antimicrobial resistance (AMR) disproportionately affects children, especially in low- and middle-income countries. The Oni Memorial Children's Hospital (OMCH), Ibadan, established an Antibiotic Stewardship (AMS) programme in 2025 to improve rational antibiotic use and align with the Nigeria AMR National Action Plan 2.0.

Objective: To improve rational antibiotic use and align with Nigeria AMR National Action Plan 2.0.

Methods: Using a hub-and-spoke model, the CwPAMS Ibadan–Sheffield AMS Partnership supported assessments at OMCH. Global Point Prevalence Surveys (GPPS) in July and December 2025 informed and evaluated interventions, including a "Culture-First" policy, mandatory stop/review documentation, and WATCH antibiotic restrictions.

Results: Baseline data (July 2025) showed 32.1% Access and 67.9% Watch antibiotic use among inpatients, with 0% culture rates and 0% stop/review documentation. Following AMS interventions, December 2025 results showed significant improvement: Inpatient Access group use rose to 70.6%, while Watch group use fell to 29.4%. Under the "Culture-First" policy, laboratory cultures sent for inpatients increased from 0% to 97.1%. Notably, stop/review date documentation reached 100% compliance. For outpatients, Access antibiotic use increased from 50% to 84.6%, and guideline compliance reached 92.3% from 40%. While sepsis remained the primary inpatient indication (68.2%), reliance on broad-spectrum empiric therapy was replaced by targeted, diagnostic-led prescribing and scheduled reviews.

Conclusion: Data-driven AMS interventions can be successfully implemented in secondary-level paediatric hospitals, resulting in 100% documentation compliance and universal culture rates. OMCH successfully surpassed the WHO 60% Access group target, supporting national AMR objectives.

Keywords: Antimicrobial stewardship, Global-PPS, paediatrics, AWaRe, antimicrobial resistance, secondary-level hospital.

TITLE : PATIENT EDUCATION AND BEHAVIORAL CHANGE IN ANTIMICROBIAL STEWARDSHIP; A NARRATIVE REVIEW OF GAPS, CHALLENGES AND OPPORTUNITIES.

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Background and Objective

Antimicrobial resistance (AMR) is a rapidly escalating global public health threat driven largely by inappropriate antibiotic use, including misuse, overuse, self medication

and poor adherence. In Nigeria, inappropriate antibiotic use is estimated at 20 – 50%, with low public understanding of antimicrobial resistance despite widespread awareness of antibiotics. Antimicrobial stewardship (AMS) programmes aim to optimize antibiotic use and reduce resistance; however, patient education and behavioural change remain underutilized components. This narrative review explores gaps, challenges and opportunities in patient centred education and behavioural interventions within antimicrobial stewardship.

Methods

A narrative literature review was conducted using PubMed, Scopus, ,Web of Science, Cochrane Library databases. English language articles published between 2010 and 2025 were searched using keywords including antimicrobial stewardship, patient education, behaviour change, antibiotic use, and antimicrobial resistance. Peer reviewed studies, guidelines and landmark reports were prioritized.

Results

Evidence indicates significant gaps in patient knowledge, high rates of self medication, misconceptions about antibiotic use, and poor adherence to prescribed regimens, particularly in low and middle income countries like Nigeria . Patient education interventions were associated with improved antibiotic knowledge, reduced inappropriate demand, enhanced adherence and decreased self medication. Behavioural strategies such as shared decision making, counselling and community engagement strengthened stewardship outcomes.

Conclusion

Integrating patient education and behavioural change strategies into antimicrobial stewardship programmes is essential for combating AMR. Patient centred, culturally appropriate and multidisciplinary approaches present key opportunities for strengthening stewardship efforts in Nigeria and similar settings.

Keywords: Antimicrobial stewardship; patient education; behavioural change; antibiotic use; antimicrobial resistance.

ABSTRACT:

META-ANALYSIS REVIEW OF CASES OF NOMA (CANCRUM ORIS) IN CHILDREN

By

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Background: Noma (Cancrum Oris) is a rapidly progressive, gangrenous infection of the orofacial tissues that predominantly affects impoverished children living in low-resource settings. It mainly affects children aged 2–16 years, with the highest incidence among those aged 1–4 years—a period marked by high vulnerability to malnutrition and infectious diseases. The Sub-Saharan Africa, particularly the region extending from Senegal through Nigeria to Ethiopia (the "Noma belt"), accounts for most of the estimated 140,000 global cases annually. Although mortality has decreased from 70–90% in untreated cases to about 8–10% with improved access to antibiotics, surgery, and nutritional rehabilitation, survivors frequently suffer from severe lifelong facial deformities and psychosocial problems. Risk factors including extreme poverty, chronic malnutrition, poor oral hygiene, measles, and inadequate sanitation remain widespread, despite evidence of preventability demonstrated by the elimination of Noma in Europe and North America. Northwestern Nigeria carries the country's highest disease burden, with an estimated incidence of 6.4 per 1,000 children.

Objectives: This meta-analysis aimed to synthesize existing evidence on the epidemiology, risk factors, clinical outcomes, and preventive strategies related to Noma in children.

Methods: A systematic search of published literature on Noma in children was conducted across major electronic databases. Eligible studies reporting epidemiological patterns, associated risk factors, treatment outcomes, and preventive interventions were included. Extracted data were pooled and analyzed using standard meta-analytic methods to estimate prevalence, mortality trends, and the strength of associations between recognized risk factors and Noma occurrence.

Results: The pooled analysis confirms a disproportionately high burden of Noma among children in Sub-Saharan Africa, with Nigeria—particularly the northwest—showing significantly higher incidence than national estimates. Chronic malnutrition, extreme poverty, measles infection, poor oral hygiene, and inadequate sanitation were consistently identified as major risk factors. Mortality rates have improved considerably with early antibiotic therapy, nutritional rehabilitation, and reconstructive surgery. However, survivors frequently experience long-term facial disfigurement and psychological trauma, including depression and social stigmatization.

Conclusions: Noma remains a major yet preventable childhood disease in resource-poor settings. Despite declining mortality, the condition continues to cause significant morbidity and psychosocial impairment. Strengthening preventive measures—especially nutritional support, vaccination programs, improved sanitation, and oral hygiene practices—alongside early detection and timely treatment is essential for reducing the burden. Focused public health strategies are urgently needed in high-risk regions such as north-western Nigeria.

Keywords: Noma, Cancrum Oris, Meta-analysis, Children, Epidemiology

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