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ADVANCING THE LABORATORY PROFESSION AND NETWORKS IN AFRICA

ANTIMICROBIAL RESISTANCE (AMR) COMMUNITY OF PRACTICE (CoP)

Alarming levels of Multidrug Resistance in aerobic gram-negative bacilli isolated from the nasopharynx of healthy under-five children in Accra, Ghana

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External Quality Assessment for AMR Testing

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Overview

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Introduction

- Nasopharyngeal bacterial pathogens include both Gram-positive bacteria and Gram-negative bacteria (Zar and Ferkol, 2014).

- And in children, this may lead to the development of lower respiratory tract infections including pneumonia and bronchiolitis later in life (Vissing *et al*., 2013.

- Children with nasopharyngeal carriage serve as reservoirs and transmitters of pathogens including antimicrobial resistant producing genes (Simell *et al*., 2014).

Introduction Cont'd

- Previous studies from Brazil, Indonesia, Angola and the Netherlands report a Gram negative bacilli (GNB) carriage prevalence varying from 5% to 57% in healthy children (*Lima et al*., 2010; Vissing *et al*., 2013; Farida *et al*., 2013; Wolf *et al*., 2001 and Wolf *et al*., 1999 .

- There is no published evidence on nasopharyngeal carriage of aerobic GNB from Ghana.

- The information is crucial to help in understanding the common aerobic GNB prevalent in Ghana and also serve as a baseline for the monitoring of future trends.

Study Objectives

- This study was among healthy under-five children attending selected day-care centres in the Accra metropolis of the Greater Accra region of Ghana from September to December 2016, to…

  (i) determine the prevalence of nasopharyngeal colonization of GNB and

  (ii) describe the common organisms isolated and their antimicrobial resistance patterns including multidrug resistance (MDR), Extended-Spectrum Beta Lactamase (ESBL)-, AmpC- and Carbapenemase-producing bacilli.

Materials and Method

- Retrospective cross-section study involving frozen samples at -80°C in STGG collected as part of previous study conducted in 2016.

- Random sampling was made from seven day-care centres from four districts in the Accra metropolis.

Inclusion criteria: Pneumococcal vaccination

Exclusion criteria: No approved consent

Children who declined

Children with active upper respiratory tract infection

Antibiotic use

MATERIALS AND METHOD CONT'D

Achieved swabs in STGG → Plated on sterile MacConkey. Incubated for 18-24 hrs at 35 ±2 °C → GNB identification using MALDI-TOF after BTS passes → 0.5 MacFarland using Phoenix nephelometer after calibrating with a standard

Inoculated on Mueller Hinton to obtain confluent growth → All antibiotics were controlled using ATCC *E. coli* 25922 control strain → AST
1. ESBL
2. AmpC
3. Carbapenemase

→ Antibiotic zones of inhibition were interpreted using CLSI 2021 version → Data analysis using STATA version 14.1

Materials and Method Cont'd

- Antibiotics selected for the research was based on
  - Ghana National Drugs Programme (GNDP) Standard Treatment Guidelines Republic of Ghana Ministry of Health.
  - WHO AWaRE Antibiotics 2021 AWaRe Classification.

Republic of Ghana

Ministry of Health
Ghana National Drugs Programme
(GNDP)

Standard Treatment Guidelines

Ministry of Health
Seventh Edition (7th), 2017

Results

- The nasopharyngeal carriage prevalence of aerobic GNB was 14%, n = 57/410% (95% CI: 10.8%-17.6%).

species	Prevalence
Enterobacterales	
E.coli	(26.3%, n = 15/57);
Klebsiella pneumoniae	(24.5%, n= 14/57);
Enterobacter cloacae	(17.7%, n = 10/57)
Serratia marcescens	1.8%, 1/57)
Acinetobacter baumannii	8.9%, n = 5/57
Pseudomonas aeruginosa	7.0%, n = 4/57

Results Cont'd

- Resistance was most frequently observed for cefuroxime (73.7%) followed by ampicillin (64.9%) and amoxicillin/clavulanic acid (59.6%).
- The organisms were least resistant to gentamicin (7.0%), amikacin and meropenem (both at 8.8%).
- Overall, MDR was observed in 66.7% (95% CI: 53.3%-77.8%) of isolates.
- MDR was relatively higher in *Acinetobacter baumannii* (100%), *E. cloacae* (90%) and *E. coli* (80.0%).

Results Cont'd

Species	AmpC	ESBL	Carbapenemase
Enterobacterales			
E.coli	26.7%	33.3%	10.5%
K. Pneumoniae	28.8%	21.4%	20.0%
A. baumannii	100%	20%	20.0%
P. aeruginosa	-	-	-

Discussions

- This is the first study from Ghana reporting on the prevalence of nasopharyngeal carriage of aerobic GNB and their resistance patterns in healthy under-five children.

- Many studies globally on nasopharyngeal carriage were on Gram-positive bacteria and anaerobic Gram-negative bacteria, however evidence on aerobic GNB is limited.

- Consequently, this study also contributes to the limited global evidence on this issue.

Discussions

- One in seven children were carriers of aerobic GNB. Prevalence of aerobic GNB carriage was 14% in our study.

- *E.coli*, *K. pneumoniae* and *E. cloacae* were the commonest organisms and accounted for two-thirds of all organisms isolated.

- Resistance levels were high and two-thirds of the organisms exhibited MDR.

Conclusions

- In this first-ever study from Ghana calls for a nationwide surveillance system with data collected periodically;
    - to help in generating a national representative information which can be used to inform the choice of antibiotics in empiric treatment of infections caused by GNB.
- The evidence also calls for better infection prevention and control at the day-care centres in Ghana to prevent further transmission.

Limitations

- Overall, with the prevalence of GNB carriage in the healthy under-five children, the sample size was not sufficient to estimate the resistance levels in individual bacteria.

- The study was conducted in one of the areas of Accra and, thus, we feel that the findings are not generalizable nationwide.

Recommendations

- The study used samples collected in 2016, this reflects the situation six years ago;
  - This warrants a follow-up study to assess the current rates of nasopharyngeal carriage and resistance levels.

- A single study from one city may not be representative of the situation in Ghana;
  - This calls for either a nationwide study or strengthening surveillance systems to routinely capture the GNB carriage rates in healthy children.

Recommendations Cont'd

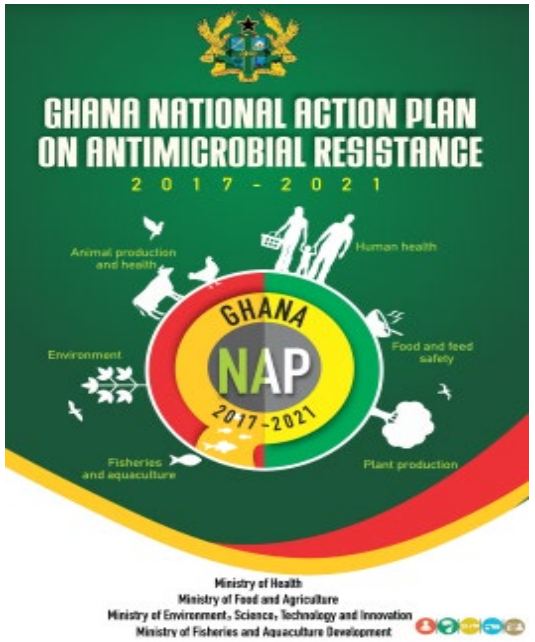
- Setting up sentinel sites for collection of nasopharyngeal samples on a periodic basis and analysed using molecular technology to know the circulating genes responsible for antimicrobial resistance.

- Setting up prospective follow-up studies to find out the factors associated with progression from carriage to infection.

- The high levels of GNB carriage and MDR call for improved infection prevention and control in day-care centres to prevent any further transmission.

Way Forward in AMR Fight

- The study is in line with strategic plan objectives of the Ghana National Action Plan on AMR;
  - To develop and implement infection prevention and control (IPC) policies and interventions in all relevant sectors nationwide.
  - To set research agenda into AMR in affected sectors.
  - To establish a surveillance system for antimicrobial resistance.
  - Increase national awareness of AMR.



Way Forward in AMR Fight

- The WHO Structured Operational Research and Training IniTiative (SORT IT) through this research will help to formulate IPC policy ;
    - Specifically to target day-care centres or early child development centres.

World Health Organization

SORT IT
Structured Operational Research and Training Initiative

AMR

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THANK YOU

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DEPARTMENT OF MEDICAL MICROBIOLOGY, UGMS

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