Presentation to ASLM-AMR-CoP

Overall AMR Performance in Laboratory Human Health-NHLDS.

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Presentation Lay out
Intro, Objectives & AMR Global Pic

AMR- National Microbiology Sentinel Surv. Design

AMR Surveillance, Data Analysis & Facility Burden or Resistance, AMS/U Diagnostic Stewardship

Challenges, Recommendations
AMR Governance Mechanisms @ National Level

One Health Platform

Uganda National Antimicrobial Resistance Committee (UNAMRC)

Public Awareness, Training and Education (PATE) TWG
Infection Prevention and Control (IPC) TWG
Antimicrobial Stewardship Optimal Access and Use (ASO) TWG
Surveillance (SURV) TWG
Research and Innovation (RI) TWG

NAP Strategic objective 4: “Antimicrobial Resistance surveillance for evidence-based public policy and practices”
Objective 1: To establish Robust system for supporting and coordinating AMR Activities in Laboratories under the guidance of TWCs and National AMR-Sub committee.

Objective 2: A well-functioning MoH AMR/AMU surveillance system with established ToRs for governance structure to provide technical support on Antimicrobial Resistance Surveillance.

Objective 3: Establish a MOH-led system of collecting, analysing, reporting and disseminating AMR and AMU data at national and sub national level to support policy formulation on antibiotic use.
Current Strength at NMRL and the Low Hanging Fruits Ideal for AMR Surv.

Current Strength.

• AMR-Governance Structure exists, and over 9 key surveillances documents developed and approved.
• In a phased manner, all RRHs are enrolled as Sentinel Surveillance Sites. Mulago NRH and Entebbe GB is yet to be enrolled.
• The National Microbiology Ref. Lab is strengthened in terms of Technical experts-CAP Accredited to support the Lower sites.
• We have trained a National Pool of mentors Microbiology TOT at national Level, a team of 20 Microbiologists to mentor lower sites. Capacity Building activities, Microbiology EQA.
• Six Country Fellows trained in AMR/C Surveillance by FF-CG1 and another Cohort of Fellowship is on.
• 80 % of the Sentinel Sites are enrolled on to the National Microbiology EQA program.
• Micro-B basic data capture tools- lab Registers developed for HMIS reporting. But not yet printed.
• We conducted a national Microbiology Supplies and Consumables quantification.
  • Developed key Indicators for AMR/U surveillance and linked to country NAP strategy.
• Clinical, epidemiological and microbiology AST data collected from sentinel sites for initial site level data validation, analysis for local use and submission to national level.
• Sites like Jinja, Mbarara, Fortportal, Kiruddu, Kabale have activated Medicines & Therapeutic Committees-MTC to promote Diagnostic Stewardship and Local Data utilization.
• Established a functional AMR-NCC @ NHLDS for coordination of AMR Surv.

AMR National Key Partner Collaboations
• GHSA-CDC AMR funding through the IDI-GHSA and
• Baylor Uganda GHSA-CDC AMR funding for Fortportal RRH, Hoima (Laboratory based AMR Surveillance) and
• Implementation of AMS/U in two GHs
• Fleming Fund Project-National CG2 implementer-ID for 9 RRHs
• Fleming Regional Grant Support for capacity building in Fellowships (Surveillance and Policy) and ASLM-QWARs
The Global Burden of AMR

- The recent Global Research on Antimicrobial Resistance (GRAM) indicates that:
- That in 2019, there were 1.27 million deaths globally attributable to AMR - higher than HIV/AIDS or malaria.
  - In 2019 255,000 deaths in Sub-Saharan Africa were due to AMR. More than half of this were children under 5 years
  - 51,000 deaths were in Western Europe
  - 97,000 deaths were in Southern Asia
  - 389,000 death were in South Asia & 84,000 were children under 5 years…etc
- Resistance particularly high for multiple classes of essential agents, including beta-lactams and fluoroquinolones

- Full report here: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02724-0/fulltext#seccestitle10

- 1.2 M deaths in 2019 Globally attributable to AMR. Compared to Malaria, HIV, TB etc
The data used is from the isolates obtained from patient samples at AMR sentinel sites in Uganda.

These isolates are re-analyzed at the National Microbiology Reference Laboratory in Butabika.

Over 5000

Isolates from sterile samples 864

This data analysis focused on the 6 commonest pathogenic organisms from sterile sites like blood, cerebral spinal fluid, peritoneal and pleural fluid.
**Sentinel Surveillance-Isolates Referral**  
National Microbiology Ref. Lab Capacity-NMRL @NHLDS

- **Capacity @ National Ref. Lab and the Sentinel sites referral of samples**
- **Isolates ref. Capacity**
- **Performance of Isolates ref. Per RRH and Central Biorepository.**

**ISOLATES RECEIVED FROM REGIONAL REFERRAL HOSPITAL @ NMRL**

**AVERAGE % AGREEMENT WITH NMRL FOR ISOLATES CONFIRMATION**

- Sites with zero scores did not send in isolates because there were not performing culture and sensitivity routinely by then.
Detection of Antimicrobial Resistance - IDI-FF GC Support

**Priority samples cultured**

- Up to **7,665** priority microbiology samples were cultured at 12 human sites during Oct 2020 to Jun 2022

**Microbiology samples cultured during Oct 2020 to Jun 2022**

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Priorities</th>
<th>Achieved</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>309</td>
<td>1,311</td>
<td>1,600</td>
</tr>
<tr>
<td>Uro-genital</td>
<td>180</td>
<td>863</td>
<td>1,000</td>
</tr>
<tr>
<td>Stool</td>
<td>310</td>
<td>917</td>
<td>1,000</td>
</tr>
<tr>
<td>Urine</td>
<td>410</td>
<td>904</td>
<td>1,000</td>
</tr>
<tr>
<td>Blood</td>
<td>238</td>
<td>1,145</td>
<td>1,500</td>
</tr>
<tr>
<td>Uro-genital</td>
<td>726</td>
<td>772</td>
<td>1,000</td>
</tr>
<tr>
<td>Stool</td>
<td>95</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

**Pathogens recovery**

- Recovery of priority pathogens generally improved at 18 months (March 2022) vs baseline (Oct 2020)
- Improvement in the quality of sample collection on the clinical side and processing in

**Pathogen recovery by sample type**

- Blood: Baseline (Oct 2020) = 16%, Achieved (Mar 2022) = 36%, Target = 40%
- Stool: Baseline (Oct 2020) = 17%, Achieved (Mar 2022) = 46%, Target = 50%
- Urine: Baseline (Oct 2020) = 25%, Achieved (Mar 2022) = 47%, Target = 50%
- Uro-genital: Baseline (Oct 2020) = 10%, Achieved (Mar 2022) = 40%, Target = 40%

**Microbiology samples cultured during Oct 2020 to Jun 2022**

- Priority samples cultured: Oct 2020 to Jun 2022

<table>
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<tr>
<th>Sample Type</th>
<th>Priorities</th>
<th>Achieved</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>2,821</td>
<td>3,047</td>
<td>3,300</td>
</tr>
<tr>
<td>Uro-genital</td>
<td>467</td>
<td>558</td>
<td>600</td>
</tr>
<tr>
<td>Stool</td>
<td>772</td>
<td>772</td>
<td>800</td>
</tr>
<tr>
<td>Urine</td>
<td>3,047</td>
<td>3,047</td>
<td>3,500</td>
</tr>
</tbody>
</table>
Resistance profile for sterile samples isolates to Access antibiotics

- **Ampicillin**: High level resistance to Amp, Amoxclav, septrine and gentamycin
- **Amoxclav**: High level resistance to Amp, Amoxclav, septrine and gentamycin
- **SXT**: High level resistance to Amp, Amoxclav, septrine and gentamycin
- **Genta**: High level resistance to Amp, Amoxclav, septrine and gentamycin

**Bacterial Species**:
- Acinetobacter spp
- Enterobacter spp
- Escherichia coli
- Klebsiella pneumoniae
- Pseudomonas aeruginosa
- Enterococcus spp
- Staphylococcus aureus
- Grand Total

**Antibiotics**:
- Ampicillin
- Amoxclav
- SXT
- Genta

**Resistance Levels**
- Acinetobacter spp: 100%
- Enterobacter spp: 100%
- Escherichia coli: 88%
- Klebsiella pneumoniae: 97.1%
- Pseudomonas aeruginosa: 100%
- Enterococcus spp: 70%
- Staphylococcus aureus: 70%
- Grand Total: 84.9%
Higher resistance rates to Watch antibiotics like Ceftriaxone
Last resort Reserve antibiotics are not spared

Percentage resistance

- Acinetobacter spp: 27.3 (11)
- Enterobacter spp: 25 (8)
- Escherichia coli: 55.6 (9)
- Klebsiella pneumoniae: 15.6 (32)
- Pseudomonas aeruginosa: 10.3 (39)
- Enterococcus spp: 20 (5)
- Staphylococcus aureus: 11.3 (60)

Legend:
- Blue: Meropenem
- Orange: Vancomycin
Some isolates from the ICU show ‘Pan Resistance

<table>
<thead>
<tr>
<th>Organism Isolated</th>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter spp</td>
<td>Amikacin</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Ceftazidime</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Colistin</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Gentamicin</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Imipenem</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Meropenem</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Peperacillintazobactam</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Piperacillin</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>Tetracycline</td>
<td>R</td>
</tr>
</tbody>
</table>

Comment: Final Report

Result Guide: S - Sensitive | R - Resistant | I - Intermediate
More of Capacity Building in Sample Collection

Organisms (from sterile samples) by HF

- 2018
- 2019
- 2020
- 2021

Arua RRH  Fortportal  GMH  Hoima RRH  IDI  Jinja RRH  Kabale RRH  Kiruddu NRH  Mbale RRH  Mbarara RRH  Soroti RRH

1 3 3 12 5 9 1 1 2 2 13 5 2 7 6 1 2 2 2 1 22 64 50
RIS Distribution Across Age groups 2020 & 2021

Organism distribution by age category

- AMR: R (Red), S (Green), I (Blue)
- Gram positive
- Gram negative

Age of patients

- Neonates
- 1mo-5yrs
- 6-18yrs
- 19-45yrs
- 46-65yrs
- Above 65yrs
PROFICIENCY TEST RESULTS OF SITES PARTICIPATING IN THE FULL MICROBIOLOGY PANEL

Jan – March 2022
Test Ordering Practices are still lacking

- Completeness: 22%
- Right patient: 41%
- Right test: 64%
- Correct timing: 17%

- Identification
- Age
- Sex
- Dietetary Intake
- Treatment
- Physiological changes

- Type of sample
- Type of tube additive
- Hemolysis
- Contamination

- Storage
- Timing
- Transportation
- Preparation
- Centrifugation
- Stability
- Temperature
WHO classification of Antibiotics

Access
This indicates the antibiotic of choice for each of the 25 most common infections. These antibiotics should be available at all times, affordable and quality-assured.

Watch
This includes most of the ‘highest priority critically important antimicrobials’ for human medicine and veterinary use. These antibiotics are recommended only for specific, limited indications.

Reserve
These antibiotics should only be used as a last resort when all other antibiotics have failed.
Antimicrobial use and consumption surveillance

Quarterly surveillance of antibiotic use and consumption

- 5/9 targeted point prevalence surveys (PPS) were conducted at 9 RRHs
- Ceftriaxone and metronidazole infusion were the most prescribed
- Half of the prescriptions were based on AWaRe classification;

Key PPS results

- On average, 1.9/2.0 antibiotics were prescribed per patient
- Of patients were prescribed an antibiotic at every encounter
- Of prescriptions were in accordance with treatment guidelines/protocols
- Of antibiotic prescriptions were based on appropriate diagnosis
- Of prescriptions were based on culture and sensitivity results

Annual antibiotic use survey (July 2020 – June 2021)

- Average expenditure on antibiotics at the 9 RRHs was 41%
- With over 60% of this expenditure being spent to procure amoxicillin caps, ceftriaxone and metronidazole infusion
National Level Data - ATC (Anatomical Therapeutic Chemical) class consumption

National Level Overall AMC by ATC Class (% share)

- Penicillins with extended spectrum - most frequently consumed ATC class
- Top four ATC classes accounted for >88% of all AMC and top 5 consistent for all 3-years

Data Source: Fleming Fund Regional Grant_MAARPs Uganda_16 Sites_GoU and PNFPS

**Percentage represents percentage share of national-level data from DDD per 1000 inhabitant days**

- Independent FF-MAARPS Study singles out over use of penicillin's similar to available data for 2017 and 2018-Retrospective data review.
Traditional wisdom for solving complex problems: the ‘waterfall’
Whole of Society Engagement

Whole-of-society engagement (One Health approach)

Prevention first

Access

Sustainability

Incremental targets for implementation
Our Overall Theory of Change for AMR Approach: Comprehensive capacity development

1. Tools
2. Skills
3. Staff & Infrastructure
4. Structures, Roles & Systems
5. Cognisance of local context: Cultural & Religious values, Local Politics, Policies, Strategies, Partnerships, relationships)
Conclusions and Way forward data.

- Continuous building of Microbiology Capacity & data management skills at facility and national level and collaboration with laboratorians to analyse and improve data quality for local use
- Link AMR testing laboratories to ALIS LIMS to provide near real time AMR information to the national reference lab and NCC-National AMR Dashboard for AMR/U. Conduct further epidemiological analysis.
- Increase microbiology testing at all NRHs, RRH, and district hospitals
- Provide the required microbiology supplies and reagents.
- Gov’t Recruit clinical microbiologists at NRH, RRHs
- Provide capacity building in microbiology skills as well demand creation for microbiology services
- Leverage the e-LIMS laboratory information system to strengthen real time AMR surveillance-AMR dash Board

One-Health. Embrace a holistic implementation approach of One Health, Sector Specific Levels and One Health