

Capacity of laboratories as surveillance sites for *Neisseria gonorrhoeae* culture and antimicrobial resistance or susceptibility testing in public hospitals within Kisumu County, Kenya

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Public health and clinical importance of *Neisseria gonorrhoeae* infection

Frequency

Infection: ~82.4 million new cases worldwide annually; 11.4 million in developing countries (Wi, 2017; Natch, 2019; WHO, 2021)

Morbidity

- Affects quality of life (Global Burden of Disease Study, 2013)
- Associated with adverse medical conditions (Frieden, 2015)
- May lead to reproductive health complications (Franjić, 2019)
- Facilitate the risk of HIV & other STI transmission and acquisition (Ward, 2010)

Curable & Preventable

- Syndromic management of NG currently practiced in lower and middle income countries, including Kenya
- Employs dual antimicrobial treatment using Cephalosporins (cefixime or ceftriaxone) plus Macrolides (azithromycin) (Unemo, 2015)
- These drugs are threatened by emergence of multi drug resistant (MDR) NG strains showing increased resistance to both the antimicrobial classes (Unemo, 2016; Suay-García, 2018; White, 2019; Chokshi, 2019)



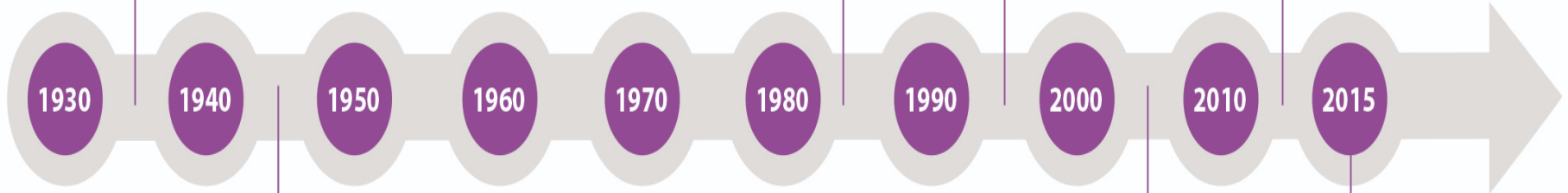
Historical background of Antimicrobial Resistance to *Neisseria gonorrhoeae*:

1930s: Introduction of sulfanomide antimicrobials to treat GC

1980s: Due to increasing resistance, penicillin and tetracycline no longer recommended to treat GC

1990s: Fluoroquinolones become predominant treatment

2012: Cefixime no longer recommended as first-line regimen, leaving ceftriaxone-based dual treatment as last recommended treatment



1940s: Due to increasing resistance, sulfanomides no longer recommended for GC treatment; penicillin becomes treatment of choice

2007: Fluoroquinolones no longer recommended; cephalosporins (incl. injectable ceftriaxone and oral cefixime) become backbone of GC treatment

2015: Ceftriaxone plus azithromycin is the only recommended treatment for treating GC

<https://www.cdc.gov/nchstp/newsroom/2016/data-on-antibiotic-resistant-gonorrhea.html>

- Research shows that continued rise in AMR could lead to 10 million deaths every year and a 3% reduction in GDP by 2050 (CDC, 2018)



New interventions to prevent community spread of MDR NG strains

- Surveillance is proposed as one of the intervention strategies to prevent community spread (Lee, 2013; WHO, 2014; CDC, 2018; Bett, 2019)
- Objective of the study was therefore to assess surveillance capacity for AMR NG strains in public hospitals within Kisumu County, Kenya

HOWEVER

- Capacity of laboratories as surveillance sites for NG testing is not well known in Kenya



Materials and methods

- Cross-sectional data from public hospitals in Kisumu County
- Hospitals classified as **Kenya Essential Package for Health (KEPH)** levels IV and above.
- 25 facilities qualified (Kisumu County Health Reports, 2018)
- 12 (48%) randomly selected facilities after being assessed for availability of:
 - STI related services
 - Laboratories that can perform basic microbiology
 - Data management system
- Data was collected using:
 - Questionnaires
 - Laboratory report forms
 - Direct observations
 - Check lists and
 - Desk review forms



Results

Table 1: Equipment for Diagnosing *Neisseria gonorrhoeae* within KEPH, Kisumu County

Equipment	Lumumba	Migosi	JOOTRH	Nyahera	Kombewa	Nyakach	Chulaimbo	Ahero	Gita	KCH	Miranga	Nyangoma
Incubator	0	1	1	1	0	0	0	0	0	1	0	1
Autoclave	0	0	1	0	0	0	1	0	0	0	0	0
Microscope	1	1	1	1	1	1	1	1	1	1	1	1
Weighing balance	1	1	1	0	0	1	1	1	0	1	0	0
Refrigerator	1	1	1	1	1	1	1	1	1	1	1	1
Magnetic stirrer	0	0	0	1	0	0	0	0	0	0	0	0
Vortex	0	0	1	0	1	1	1	1	0	0	0	0
Burner	1	1	1	0	0	0	1	0	0	1	0	0
Biological wireloop	0	0	1	0	0	0	0	0	0	0	0	0
Computer to input results	1	0	1	1	1	1	1	1	0	1	0	1
Ultralow freezer	0	0	1	1	0	1	1	1	1	0	0	0
Total (n)	5	5	10	6	4	6	8	6	3	6	2	4

50% of the facilities had <6 essential equipment for diagnosing NG (n=11)

91.7% of the facilities lacked biological wire loop & magnetic stirrer (n=12)

Table 2: Equipment for diagnosing *Neisseria gonorrhoeae* available in urban & rural public hospitals within Kisumu County

Equipment	Urban public hospitals (Lumumba, Migosi, JOOTRH, KCH)	Rural public hospitals (Nyahera, Kombewa, Nyakach, Chulaimbo, Ahero, Gita, Miranga, Nyangoma)
Incubator	3 (75.0%)	2 (25.0%)
Autoclave	1 (25.0%)	1 (12.5%)
Microscope	4 (100.0%)	8 (100.0%)
Weighing balance	4 (100.0%)	3 (37.5%)
Refrigerator	4 (100.0%)	8 (100.0%)
Magnetic stirrer	0 (0.0%)	1 (12.5%)
Vortex	1 (25.0%)	4 (50.0%)
Burner	4 (100.0%)	1 (12.5%)
Biological wireloop	1 (25.0%)	0 (0.0%)
Computer to input results	3 (75.0%)	6 (75.0%)
Ultralow freezer	1 (25.0%)	5 (62.5%)

Urban hospitals had 36.4% of the essential equipment compared to 18.2% in rural hospitals (n=11)



Results (contd)

Table 3: Consumables for diagnosing *N. gonorrhoeae* available in public hospitals within Kisumu County

Consumables	Lumumba	Migosi	JOOTRH	Nyahera	Kombewa	Nyakach	Chulaimbo	Ahero	Gita	KCH	Miranga	Nyangoma	Total (n)
GC Agar	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemoglobin Bovin Powder	0	0	0	0	0	0	0	0	0	0	0	0	0
Blood Agar Base	0	0	1	0	0	0	0	0	0	0	0	0	1
Defibrinated Horse Blood	0	0	0	0	0	0	0	0	0	0	0	0	0
Iso Vitalex Enrichment	0	0	0	0	0	0	0	0	0	0	0	0	0
VCNT Inhibitor	0	0	0	0	0	0	0	0	0	0	0	0	0
Petri Dishes	0	0	1	0	0	0	0	0	0	1	0	0	2
Drug Sensitivity Discs	0	0	1	0	0	0	0	0	0	0	0	0	1
Gram's Stain Reagents	1	0	1	0	0	0	0	0	0	1	0	0	3
Normal Saline	1	1	1	1	1	0	1	1	1	1	1	1	11
Phosphate Buffer Saline (PBS) or Both	0	0	0	0	0	0	0	0	0	0	0	0	0
Oxidase Discs	0	0	0	0	0	0	0	0	0	0	0	0	0
Autoclave Tape	0	0	1	0	0	0	0	0	0	0	0	0	1
Autoclave Biological Indicator	0	0	0	0	0	0	0	0	0	0	0	0	0
Trypticase Soy Broth/Freezing Media	0	0	0	0	0	0	0	0	0	0	0	0	0
Microscope Glass Slides (clean)	1	1	1	1	1	1	1	1	1	1	1	1	12
Total (n)	3	2	7	2	2	1	2	2	2	4	2	2	

All the study sites lacked 56.3% of consumables essential for diagnosing NG (n=16)

Tests for diagnosing *Neisseria gonorrhoeae* conducted in public hospitals within Kisumu County

Tests	Lumumba	Migosi	JOOTRH	Nyahera	Kombewa	Nyakach	Chulaimbo	Ahero	Gita	KCH	Miranga	Nyangoma
Microscopy	1	1	1	1	1	1	1	1	1	1	1	1
Gram's Stain	1	0	1	0	0	1	1	1	0	1	0	0
Culture	0	0	1	0	0	0	0	0	0	0	0	0
Antimicrobial Sensitivity (Resistance) Testing	0	0	1	0	0	0	0	0	0	0	0	0
Media Preparation	0	0	1	0	0	0	0	0	0	0	0	0
Sterilization	0	0	1	0	0	0	0	0	0	0	0	0
Total (n)	2	1	6	1	1	2	2	2	1	2	1	1

91.7% of the study sites lacked capacity to perform NG culture and susceptibility testing (n=12)



Discussions & Conclusions

Discussions:

- All the 12 (100%) hospitals reported having qualified laboratory staff
- Only KEPH Level V hospital laboratory showed some capacity to perform bacterial culture and AMS testing (phenotyping), but not AMR testing (genotyping).
- However, the hospital could not isolate NG due to lack of some essential equipment and consumables.

Conclusions:

- These results should enable the government to identify hospitals whose capacities can be built faster, with less capital for initiation of antimicrobial resistance surveillance, in order to help reduce emergence and community transmission of multi-drug resistant NG strains for effective drug choices in Kenya.



Recommendations

- Qualified laboratory staff should undergo mandatory continuous professional development (CPD) for efficient surveillance studies
- At least one KEPH level V public hospital should be well equipped, in every county, to act as dedicated sentinel surveillance site in Kenya
- Sentinel surveillance can be facilitated by selection of KEPH level IV hospitals meeting minimum requirements for sample flow
- Ongoing surveillance is required to reveal community transmission patterns of MDR organisms



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References:

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