MINISTRY OF HEALTH UGANDA

UNIPH

PUBLIC HEALTH Bulletin

Volume 9| Issue 4| Oct - Dec, 2024

UGANDA PUBLIC HEALTH BULLETIN

October–December, 2024

Dear Reader,

We take great pleasure in welcoming you to Issue 4 Volume 9 of the Uganda Public Health Bulletin.

We aim to inform the district, national, and global stakeholders on disease outbreak investigations, public health surveillance, and interventions undertaken in detecting, preventing, and responding to public health threats in Uganda.

In this issue, we present a variety of articles including: Mobile Laboratory Deployment during COVID-19, Laboratory Test Menu Fulfillment, HIV Viral Load Suppression Trends, Vibrio cholerae Trends and Distribution, HIV Testing Kits Inventory Management, Laboratory Response to Acute Conjunctivitis Outbreak, Conjunctivitis Spatial and Temporal Trends, Increasing Malaria Cases in Kampala, Bottlenecks and Enablers for Measles Outbreak Response, Measles Outbreak at Uganda's Porous Borders, Anemia in Pregnancy Trends and Prevention Uptake.

Should you have any questions or require additional information related to articles in this bulletin please contact us on: jklubega@uniph.go.ug, emmamfitundinda@uniph.go.ug, trutogire@uniph.go.ug, jnalwanga@uniph.go.ug, lbulage@uniph.go.ug

We hope you find this information valuable and we shall appreciate any feedback from you.

Thank you

Inside this issue:

Continued from page 1

Effect of a mobile laboratory deployment during the COVID-19 pandemic response, Adjumani District, Uganda, 2020-2021

Ritah Namusoosa[1,2*], Samuel Gidudu[1], Godfrey Pimundu[2], Martha Pedun[3], Benedict Kanamwanji[2], Tonny Muyigi[2], Morgan Otita[5], Michael Rogers Eilu[5], Gerald Aluma[5], Rebecca Nakidde[2], Ibrahim Mugerwa[2], Grace Najjuka[2], William Ambayo[4], Rebecca Nalwanga[2], Isaac Ssewanyana[2], Atek Kagirita[2], Susan Nabadda[2], Alex Riolexus Ario[1].

Institutional affiliations: [1]Uganda National Institute of Public Health, Ministry of Health Kampala, Uganda, [2]National Health Laboratory and Diagnostics Services, Ministry of Health, Kampala, Uganda, [3]African Society for Laboratory Medicine; Kampala, Uganda, [4]Adjumani District Local Government, Adjumani, Uganda and [5]Infectious Diseases Institute, Kampala, Uganda.

Correspondence*: Tel: +256785842878, Email: rnamusoosa@uniph.go.ug

Summary

Background: COVID-19 is a highly contagious and rapidly spreading disease, declared as a pandemic by World Health Organization (WHO) in 2019, was first reported in Uganda on March 21, 2020. At the start of the pandemic, COVID-19 testing in Uganda was centralized leading to long turnaround time. The rapid spread of the pandemic necessitated innovative strategies for effective testing and containment. The urgency to deploy mobile laboratories arose from the need to address challenges in turnaround time, test coverage in high-risk settings such as points of entry, crowded areas, and border regions. Adjumani District, a district centrally located in the Northern and West Nile regions of Uganda was one of the locations where a mobile laboratory for COVID-19 testing was deployed. The laboratory conducted real-time reverse transcription polymerase chain reaction (RT-PCR) testing, a standard molecular method for diagnosis of COVID-19 and served 32 districts in the Northern and West Nile regions of Uganda. We assessed the effect of a mobile laboratory on the test coverage, distribution, and average results turnaround time in the Northern and West Nile regions of Uganda, 2020-2021.

Method: In this retrospective study, we analyzed data abstracted from the Results Dispatch System (RDS) for COVID-19 tests conducted in Northern and West Nile regions of Uganda between March 2020 to March 2021. This period covers before and after the deployment of the mobile laboratory. We used the Chi-square test of independence to assess the association between the test coverage and distribution and the mobile lab introduction in Adjumani; and the two-sample t-test to compare the mean turnaround time of results, before and after the mobile laboratory deployment.

Results: The Average turnaround time reduced from 40.27 hours to 21.93 hours, a reduction of 18.33 hours ((95% CI −19.16934, −17.49866) with results returned within 24 hours increasing from 11% to 88.9%, and those taking over 96 hours dropping from 100% to 0%. The overall proportion of suspected samples tested in the regions increased from 14.2% (852/6000) to 16.9% (972/6000) (p-value = <0.001) with testing coverage increasing in home-based care from 123/644 (19.1%) to 520/644 (80.9%), in prisons from 10/123 (8.1%) to 110/123 (91.9%), in refugee camps from 41/372 (11.0%) to 330/372 (89.0%), and in quarantine centers from 32/538 (43.1%) to 306/538 (56.9%) (p-value = <0.001) .

Conclusion: The mobile laboratory significantly improved the results turnaround time and coverage of COVID-19 testing in Northern and West Nile regions. The improved turnaround time facilitated quicker diagnosis.

Background

COVID-19 also referred to as SARS-CoV-2 is highly contagious, spreads rapidly and continuously evolves in the human population (1). Uganda reported her first COVID-19 case on March 21st 2020, a Ugandan traveler returning from Dubai (2).

At the start of the pandemic, all samples for COVID-19 testing were centrally analyzed at Uganda Virus Research Institute (UVRI) in Entebbe and later on decentralized to Central Public Health Laboratories (CPHL) at the National Health Laboratory and Diagnostic Services (NHLDS) at Butabika and Makerere University College of Health Sciences Laboratory at Mulago. Despite the decentralization, turnaround time for COVID 19 test was approximately ≥72 hours(3), thus contributing to delay in patient management and public health intervention. Two negative Real Time- PCR results on sequential samples taken 24 hours apart and clinical recovery were required for patients to meet the criteria for discharge from a healthcare facility or isolation center at the time(4).

Continued from page 2

In order to address long turnaround time, Ministry of Health deployed mobile laboratories in designated areas such as points of entry targeting trucker drivers as a core group and districts with high number of cases(5). Mobile laboratories were deployed at Tororo General Hospital (serving Malaba and Busia POE in the Eastern part of Uganda) and Adjumani General Hospital which was serving 32 districts in the Northern and West Nile regions of Uganda including Elegu POE. These laboratories conducted real-time reverse transcription polymerase chain reaction (RT-PCR) testing, a standard molecular method for diagnosis of COVID-19(6). Before deployment, samples from Northern and West Nile regions were tested at the Central Public Health Laboratories and Uganda Virus Research Institute. After deployment, testing of these samples was fully at the mobile laboratory in Adjumani District starting September 2020.

We assessed the effect of a mobile laboratory on the test coverage, distribution, and average results turnaround time in the Northern and West Nile regions of Uganda, 2020-2021.

Methods

We conducted a retrospective study using COVID-19 testing data abstracted from the Results Dispatch System (RDS), (March to August 2020) before the Adjumani Mobile laboratory deployment and (September, 2020 to March 2021) after the deployment was analyzed.

We abstracted data regarding patient information such as age, gender, nationality, date of sample collection, sampling site, result, result date and sample type while the dependent variable was the proportion of suspected samples tested before and after the mobile laboratory deployment. All data was extracted from the National COVID-19 Results Dispatch System (RDS) into excel sheets for the study period (March 2020 to 31st March 2021).

We checked for significance differences between test coverage before and after mobile laboratory deployment using the Chi-square test of independence. To compare the mean turnaround time of test results (time from specimen collection to results release) the independent t- test was used to compare the mean turnaround time before and after the deployment of the mobile laboratory.

Data was extracted from the National COVID-19 Results Dispatch System (RDS) and no personal identifiers included. Permission was sought from the National Health Laboratory and Diagnostic Services, Ministry of Health (NHLDS- MoH) to access and use the data.

Results

Test coverage and distribution before and after mobile laboratory deployment, Northern and West Nile regions, Uganda, March 2020-March 2021

There were significant differences in the numbers tested from the different sampling sites with more samples having been tested at the different sites after the mobile laboratory deployment ($p<0.001$) (Table 1).

Most of the results were released with medium turnaround time 2,922 (48.7%) (24-48 hours) followed by shortest turnaround time 2,545 (42.4%) (>24-hours) with the minority of the results being released beyond 96 hours 19 (0.3%). Furthermore, majority of the test results in the mobile laboratory were released in less than 24 hours 2,262 (88.9%) and no result released beyond 96 hours compared to before the mobile laboratory deployment where majority of the results were released between 24 hours and 48 hours 2,224 (76.1%) ($p <0.001$) (Table 1).

Continued from page 3

Table 1: Test coverage and distribution before and after mobile laboratory deployment in Northern and West Nile regions, Uganda, March 2020-March 2021

Characteristic	Total N = 6000	Before Mobile lab, N= 3000 (%)	Mobile Lab, N= 3000 (%)	P-value
Gender				
Female	1,212 (20.2)	336 (27.7)	876 (72.3)	<0.001
Male	4,788 (79.8)	2,664 (55.6)	2,124 (44.4)	
Age group				
0-18 (Children)	667 (11.1)	348 (52.2)	319 (47.8)	
19-35 (Youth)	2,735 (45.6)	1,368 (50.1)	1,367 (49.9)	<0.001
36-64(Middle-age adults)	2,507 (41.8)	1,259 (50.2)	1,248 (49.8)	
≥65(Elderly)	91 (1.5)	25 (27.5)	66 (72.5)	
Result				
Positive	564 (9.4)	325 (57.6)	239 (42.4)	<0.001
Negative	5,436 (90.6)	2,675 (49.2)	2,761 (50.8)	
Sampling sites				
Health facility	1,214 (20.2)	713 (58.7)	501 (41.3)	
Home based care	644 (10.7)	123 (19.1)	521 (80.9)	<0.001
Point of Entry	3,109 (51.8)	1,881 (60.5)	1,228 (39.5)	
Prisons	123 (2.1)	10 (8.1)	113 (91.9)	
Quarantine centers	538 (9.0)	232 (43.1)	306 (56.9)	
Refugee camps	372 (6.2)	41 (11.0)	331 (89.0)	
Nationality				
Ugandan	3,575 (59.6)	1,308 (36.6)	2,267 (63.4)	
South Sudanese	436 (7.3)	31 (7.1)	405 (92.9)	<0.001
Kenyan	311 (5.2)	209 (67.2)	102 (32.8)	
Other EAC country	28 (0.5)	18 (64.3)	10 (35.7)	
Others	1,650 (27.5)	1,434 (86.9)	216 (13.1)	
Turn Around Time (Hours)				
< 24 (Shortest)	2,545 (42.4)	283 (11.1)	2,262 (88.9)	
24 – 48 (Medium)	2,922 (48.7)	2,224 (76.1)	698 (23.9)	<0.001
49- 96 (Long)	514 (8.6)	474 (92.2)	40 (7.8)	
>96 (Longest)	19 (0.3)	19 (100.0)	0	

Continues to page 4

Continued from page 4

Average turnaround time of COVID-19 test results before and after mobile laboratory deployment, Northern and West Nile regions, Uganda, March 2020-March 2021

The mean turnaround time before Adjumani mobile laboratory was 40.269 hours and 21.935 hours after deployment of Adjumani mobile laboratory. The difference in the mean turnaround time was 18.334 hours and this was statistically significant (95% CI =−19.2, −17.5) (Table 2).

Table 2: Turnaround time before and after mobile laboratory deployment, Northern and West Nile regions, Uganda, March 2020-March 2021

Group	Observations (Obs)	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Combined	6,000	31.102	0.243709	18.87761	30.6, 31.6
Before Mobile lab	3,000	40.269	0.393685	21.56302	39.5, 41.0
After Mobile lab	3,000	21.935	0.163054	8.93081	21.6, 22.3
Difference		18.334	0.426115		-19.2, -17.5

Discussion

The deployment of the mobile laboratory resulted in a substantial reduction in turnaround time for test results. Prior to deployment, most test results were released within 24 to 48 hours, whereas post-deployment, most of the results were available within 24 hours, with none exceeding 96 hours. This was crucial for timely decision-making like quicker isolation and treatment of positive cases, thereby minimizing transmission risk. There was also improved test coverage and distribution of tests across various sampling sites. There was a substantial increase in the number of tests conducted in prisons, refugee camps, home-based care settings, and quarantine centers. The mobile laboratory deployment enabled COVID-19 testing in underserved and high-risk populations, ensuring that more individuals are tested, facilitating early detection and isolation of positive cases to curb the spread of the virus.

Before deployment of Adjumani Mobile laboratory, COVID-19 samples collected from Northern, West- Nile regions and points of entry were transported to UVRI for PCR testing resulting in significant delay in turn-around-time. After deployment of Adjumani mobile lab, there was a statistically significant reduction in turn-around-time and this led to improved management of COVID-19 patients in the region (7). Quick diagnosis is key in disease containment, improves the effectiveness of treatment and helps to avoid long-term complications for the infected patients. This was evident in South Korea where the rapid of test capacity with a turnaround time of 6 to 24 hours in core and risk populations meant that cases were identified early, isolated and case-based contact tracing quickly initiated across large clusters of cases contributed to the containment of the epidemic in the country (8).

Since it is recognized that nearly half of the COVID-19 infections are transmitted by asymptomatic cases it was important to test as many people as possible especially contacts, people in quarantine centers, refugee camps and prisons (9). Testing of large population for COVID-19 including asymptomatic cases helped to prevent the spread of COVID-19 by identifying people who needed care in a timely fashion. A positive test in the early course of the disease enabled individuals to isolate thus reducing the chances of infecting others and also to access treatment early, reducing the likelihood of disease severity and the risk of long-term disability or even death.

Study limitations

The key limitations of the study were its retrospective design, which relied on potentially incomplete or inaccurate historical data, and inconsistencies in the National COVID-19 Results Dispatch System that could compromise the accuracy of test coverage and turnaround times.

Continues to page 5

Continued from page 5

Conclusion

The Adjumani mobile laboratory significantly improved the results turnaround time and coverage of COVID-19 testing in Northern and West Nile regions. The improved turnaround time facilitated quicker diagnosis.

Recommendations

Integration of mobile laboratories into the national health laboratory systems would greatly improve outbreak response with reduced result turnaround time which is crucial for public health interventions.

Conflict of interest

The authors declare no conflict of interest.

Authors contribution

RN: participated in the conception, design, analysis, interpretation of the study and wrote the draft bulletin; SG, PG, MP, KB, MT, MO, MRE, GA, RN, IM, GN, AW, NR, IS, AK and SN reviewed the report, reviewed the drafts of the bulletin for intellectual content and made multiple edits to the draft bulletin; RN, SG, and ARA reviewed the final bulletin to ensure intellectual content and scientific integrity. All authors read and approved the final bulletin.

Acknowledgements

We thank the Ministry of Health for permitting us to respond to this outbreak. We thank the East African Community Mobile Laboratory Project and Bernhard-Nocht-Institute for Tropical Medicine for the donation of the mobile laboratories.

References

1. Alqassieh RS, Bsisu IK, Al-Sabbagh MQ, El-Hammuri NM, Yousef MA, El Jarbeh MA, et al. Clinical characteristics and predictors of the duration of hospital stay in COVID-19 patients in Jordan. F1000Research. 2020;9:1439.
2. Ministry of Health, Uganda 2020. Uganda confirms 1st cases of omicron coronavirus variant [Internet]. Available from: https://www.aa.com.tr/en/latest-on-coronavirus-outbreak/uganda-confirms-1st-cases-of-omicron-coronavirus-variant/2441050. 2021;17(1):1–5.
3. Gehre F, Lagu H, Achol E, Katende M, May J, Affara M. Commentary: mobile laboratories for SARS-CoV-2 diagnostics: what Europe could learn from the East African Community to assure trade in times of border closures. Global Health
4. World Health Organization. Criteria for releasing COVID-19 patients from isolation [Internet]. Scientific brief. 2020. Available from: https://www.who.int/publications/i/item/criteria-for-releasing-covid-19-patients-from-isolation
5. Bajunirwe F, Izudi J, Asiimwe S. Long-distance truck drivers and the increasing risk of COVID-19 spread in Uganda. Int J Infect Dis [Internet]. 2020;98:191–3. Available from: https://doi.org/10.1016/j.ijid.2020.06.085
6. Rao SN, Manissero D, Steele VR, Pareja J. A Narrative Systematic Review of the Clinical Utility of Cycle Threshold Values in the Context of COVID-19. Infect Dis Ther [Internet]. 2020;9(3):573–86. Available from: https://doi.org/10.1007/s40121-020-00324-3
7. Federica M, Pattnaik A, Jordanwood T, Nakyanzi A, Byakika S. Uganda's Emergency Response to the COVID -19 Pandemic : A Case Study. ThinkWell Minist Heal Uganda. 2020;Washington (September).
8. Dighe A, Cattarino L, Cuomo-Dannenburg G, Skarp J, Imai N, Bhatia S, et al. Response to COVID-19 in South Korea and implications for lifting stringent interventions. BMC Med. 2020;18(1):1–12.
9. Johansson MA, Quandelacy TM, Kada S, Prasad PV, Steele M, Brooks JT, et al. SARS-CoV-2 Transmission from People without COVID-19 Symptoms. JAMA Netw Open. 2021;4(1):1–8.

Continued from page 6

A 31.9% Laboratory Test Menu Fulfillment Rate in District Health Information System Version 2 (DHIS-2), July 2022-June 2023, Uganda

Authors: Shem Mwebaza*[1,2], Samuel Gidudu[1], Bannet Muwanguzi[2], Lilian Bulage[1], William Lali[3], Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]Mildmay Uganda, Kampala, Uganda, [3]World Health Organisation, Kampala, Uganda
Correspondence*: Tel: +256702987664, Email: smwebaza@uniph.go.ug

Summary

Background: In 2011, the Uganda Ministry of Health (MoH) and National Health Laboratory and Diagnostic Services (NHLDS) launched the national test menu guidelines to standardize the number of testing techniques conducted by medical laboratories at each tier of the health system. Since the launch of the said guidelines, the percentage of laboratory tests or procedures on a laboratory's menu that are actually performed (test menu fulfillment rate) has not been evaluated. We evaluated the laboratory test menu fulfillment rate at the various health center levels in Uganda, July 2022-June 2023.
Method: We abstracted and analyzed laboratory testing data (July 2022 to June 2023) reported in District Health Information System-2 (DHIS2) by 2,278 health facilities. Test menu fulfillment rate was calculated by dividing reported number of test techniques with that expected per the national test menu at each health facility level. We assessed ability to enter specific tests in DHIS-2 by screening and comparing various test nomenclatures in laboratory diagnostics reference materials (A total of 146 testes should be provided at RRH level and below in Uganda). **Results:** A total of 28,190 out of 88,234 test techniques were reported to have been conducted by the health facilities, resulting in a national laboratory test menu fulfillment of 31.9%. Regional Referral Hospitals had the highest test menu Fulfillment rate of 35.7 % (834/2336) followed by GHs with a rate of 35.3% (5374/15215), HCIIIs at 30.2% (17298/57288) and HCIVs at 29.6% (3966/13395). A total of 68 of the specific 146 tests (46.5%) had No Specific area for Entry (NSE) into DHIS2.
Conclusion: A sub-optimal national laboratory test menu fulfillment rate for the period July 2022 to June 2023 was noted.

Background

The Ministry of Health (MoH) strategic plan 2020/21 - 2024/25 (1) and Health Sector Strategic and Investment Plan (HSSIP) 2015/16-2019/20 (1) identify laboratory services as a key driver for effective delivery of the Uganda National Minimum Health Care Package (UNMHCP) (2); and as a critical component for effective disease control and prevention . Uganda health laboratory services are designed to support UNMHCP at various levels of healthcare, with the complexity of tests performed rising in accordance with the level of healthcare. Strategic objective III of the National Health Laboratory Services Strategic Plan III (2021-2025) (2) sets out ensure provision of quality and equitable laboratory services at all levels to support clinical care, public health services, and research.
An efficient laboratory system strategically identifies laboratory diagnostic tests and procedures that could be conducted at various health care levels and those that need to be outsourced. This results in cost savings without negatively impacting patient care. Using data analytics, monthly or annual test volume can be evaluated to inform such decisions with careful consideration being given to the downstream impact on patient care as well as overall healthcare expenditures to identify opportunities for cost savings without compromising clinical efficacy. Ministry of Health through National Health Laboratory and Diagnostic services (NHLDS) formerly referred to as Central Public Health Laboratory (CPHL) developed the first set of national laboratory test menus, test techniques, supplies, and laboratory equipment for each type of test and each level in the health system in 2011. This was in line with the 2008 Maputo Declaration on Strengthening of Laboratory Systems (3). These were later revised in 2013 and in 2017 to reflect the changes in technologies and treatment guidelines. The Uganda National standard test menu, techniques, and supplies list for laboratories (4) specifies the range of laboratory services provided at the various levels ranging from basic services at health center III (HCIII) laboratory, through health center IV (HCIV) laboratory increasing in complexity in General Hospital (GH) laboratory, Regional Referral Hospital (RRH) laboratory, and to highly specialized testing at national referral laboratory.

Continues to page 8

Continued from page 7

A total of 146 testes should be provided at RRH level and below in Uganda. The MOH with support of her partners has equipped these laboratories with required commodities, functioning equipment, trained personnel, information systems, and infrastructure coupled with regular technical support supervision using a regionalized approach.

Despite efforts to standardize the Uganda National laboratory test menu, techniques and supplies there has not been an evaluation of the fulfillment rate of the standard. The evaluation findings are critical in providing an insight on access and utilization of laboratory services in the country and hence inform programming for equitable access to laboratory services. We evaluated the fulfillment rate for the Uganda National standard test menu, and techniques in the period July 2022 to June 2023 to inform programming.

Method

We conducted a descriptive study using surveillance data on laboratory test types conducted by health center facilities at health center level III, IV, general hospital, and regional referral hospital that report to MOH through the District Health Information System-2 (DHIS-2) in Uganda.

We abstracted data on laboratory test types from DHIS-2 for the period July 2022 to June 2023; disaggregated into test category and health facility level. We obtained information on required test types to be conducted by each health facility level from the Uganda National standard test menu, techniques and supplies list (4).

We assessed ability to enter specific tests in DHIS-2 by screening and comparing the test nomenclature of the expected 146 testes at RRH level and below in laboratory diagnostics reference materials with what is indicated in DHIS2.
We defined test menu fulfillment rate as the percentage of laboratory tests or procedures on a laboratory's menu that are performed. The fulfillment rate was calculated by dividing the number of test types reported in DHIS2 over the number of expected test types as stated in the national laboratory test menu. Table 1 below details the health facilities (16 regional referral hospitals, 179 general hospitals, 235 health center IVs and 1,848 health center IIIs) considered for the study and the total expected test counts for the different facility levels.

Table 1: Study facilities by level and expected tests

Health facility level	N (2,278)	Tests on Menu	Total expected test counts (88,234)
Regional referral hospital	16	146	2,336
General hospital	179	85	15,215
Health centre IV	235	57	13,395
Health center III	1,848	31	57,288

The test type was considered based on the following assumptions; health facility conducted all the tests on the national menu at least once in the review period (none reporting and a total of 0 tests done in the review period indicated test type not done), a reported value of 1 and above indicated specific test type as being conducted, test types not expected at the health facility level excluded from the study, combined tests were split up and each counted separately. We also reviewed laboratory parameters reported in DHIS-2 comparing them with the national test menu to identify areas of improvement in the laboratory report section.

This study was reviewed by the US CDC and was conducted consistent with applicable federal law and the US CDC policy. We obtained administrative clearance from the Ministry of health. Since the study didn't involve human subjects and used publicly available data, we did not seek approval of institutional review boards. All generated records were kept confidential, and password protected.

Results

Laboratory test menu fulfillment rate, Uganda, July 2022-June 2023

The overall national laboratory test menu Fulfillment rate was 31.9% (28190/88,234). Regional Referral Hospitals had the highest test menu Fulfillment rate of 35.7 % (834/2336) followed by GHs with a rate of 35.3% (5374/15215), HCIIIs at 30.2% (17298/57288), and HCIVs at 29.6% (3966/13395). A total of 68/146 (46.5%) test types had no Specific provision for Entry (NSE) into DHIS-2.

Continued from page 8

Immune hematology (67%), Serology (60%) and Thyroid function (47%), tests were the most performed tests nationally (Figure 1).

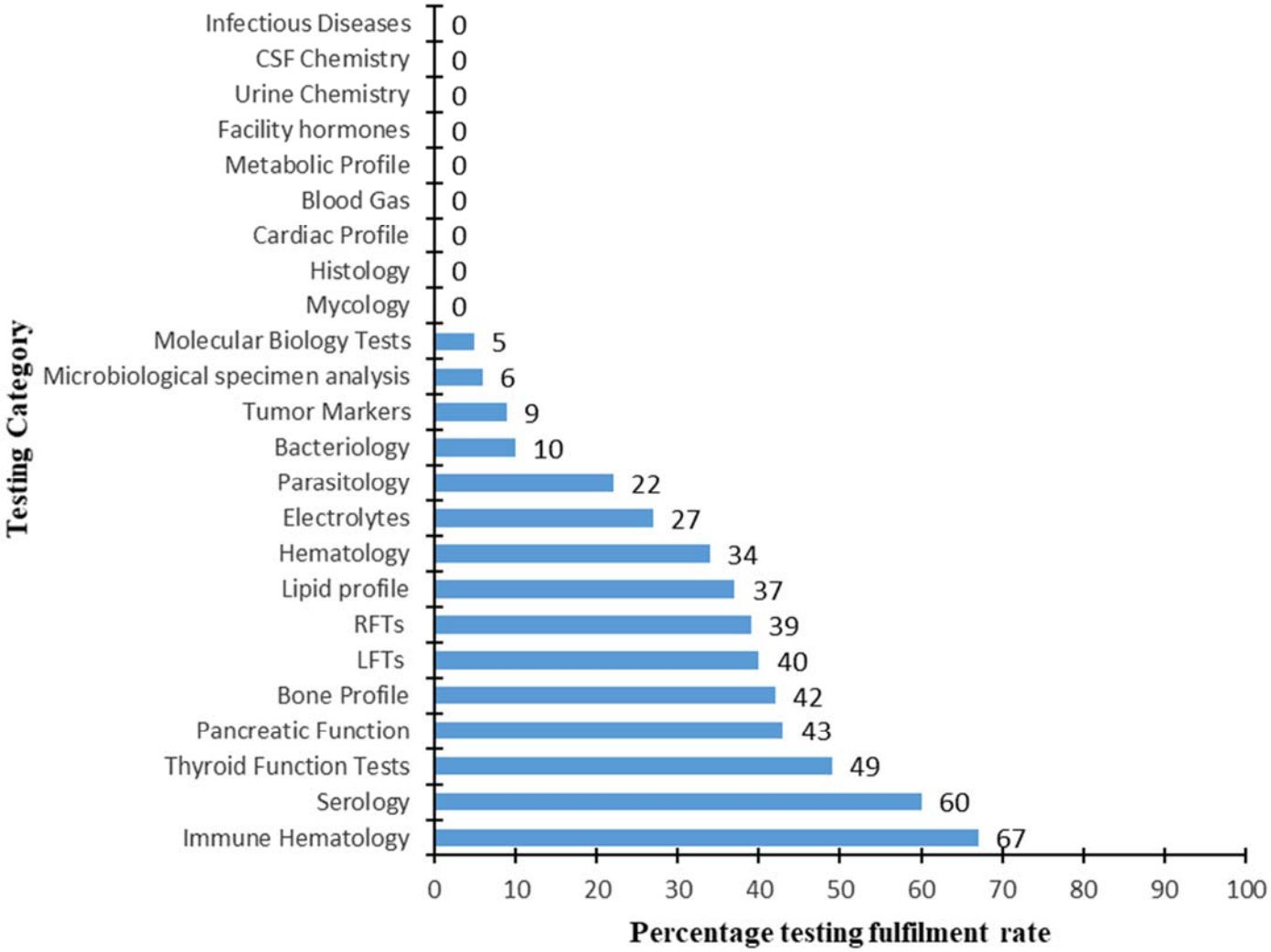


Figure 1: Overall National test fulfillment rates for the specific test categories, July 2022-June 2023

Discussion

The evaluation of laboratory test menu fulfilment rates is crucial for lower health center level (downstream) impact on patient care as well as overall healthcare expenditures. It provides an opportunity to identify opportunities for system improvement and cost saving without compromising clinical efficacy. As such, it is imperative that as a country we continue to assess and update test menu to allow for inclusion of the latest diagnostic technologies and methodologies that align with current medical standards, enhance operational efficiencies by identifying redundant tests or outdated methodologies and allow laboratories to optimize workflow and resource utilization, and to identify tests with very low volume that can result in reagent and supply wastage. This study has demonstrated a low laboratory test menu fulfillment rate across facilities, declining from higher health facility levels (RRHs) to lower facilities generally.

Many HCIVs and HCIIIs primarily rely on DHIS-2 for reporting their data to the national level. This inevitably means that a lot of laboratory testing data is not being well captured for use in informed decision marking. The most performed tests, i.e., Immune hematology (CD4, CD8), Serology (HIV, Syphilis, Pregnancy test, Hepatitis B test, Cryptococcal Antigen) are also supported by donors' hence likely

Continues to page 10

Continued from page 9

affected by low availability of resources (reagents, equipment and infrastructure)(5). The large number of tests (68) with NSE into DHIS2 had a negative effect on test menu fulfilment rates. In essence, the rates could improve with the updating of the system to capture all tests being conducted.

Study limitations
This study presented findings as reported in DHIS-2 only. There could be variations in test menu fulfillment rates in laboratory data from other systems.

Conclusion
A sub-optimal national laboratory test menu fulfillment rate for the period July 2022 to June 2023 was noted according to data extracted from DHIS-2. In addition, a large number of laboratory tests (46.5%) have no specific area for entry into DHIS2. There is need for additional studies with a longer review period to consolidate these findings.

Recommendations
We recommended the updating of the DHIS2 to be consistent in test categorization and nomenclature of laboratory tests with the laboratory national test menu to streamline tests names for example TB genexpert/ TB DNA PCR. Secondly, for facilities that are not using ALIS or use DHIS-2 and the primary database, it is paramount that we ensure all the test menu is fully captured in DHIS-2. This will ensure that no laboratory data is missed out. Furthermore, because of the difference in testing techniques and requirements, it is important to Indicate test platforms and techniques used to inform supply chain and planning activities. There is need for streamlining and standardisation laboratory testing data reporting in line with who reports what, where, in DHIS2 or ALIS. This will guide on where to look for what and will aid data utilisation for research and decision making.

Conflict of interest
The authors declare that they have no conflict of interest.

Authors Contribution
SM, SG conceived and designed the analysis. SM, BM abstracted and analyzed data. SM, SG, BM, and LW wrote the bulletin. SM, LB, LW, and ARA reviewed the bulletin to ensure scientific integrity.

Acknowledgements
We acknowledge the Uganda Public Health Fellowship Program, Central Public Health Laboratories Ministry of Health (CPHL) Uganda, Makerere University School of Public Health. Mildmay Uganda and Baylor Uganda for the technical support and oversight of this project.

We also acknowledge the US Centers for Disease Control and Prevention Uganda for implementation support.

References
1. Health Sector Development Plan 2015/16 - 2019/20.
2. Uganda National Health Laboratory Services Policy - Thomas-Pizaro-Gaspard signed23Mar2018.pdf [Internet]. [cited 2023 Oct 5]. Available from: https://www.cphl.go.ug/sites/default/files/2019-06/UG%20NHLS%20Policy%20%20LTC%20Final%20draft%20-%20Thomas-Pizaro-Gaspard%20signed23Mar2018.pdf
3. The Maputo Declaration on Strengthening of Laboratory Systems [Internet]. [cited 2023 Oct 5]. Available from: https://www.who.int/publications/m/item/the-maputo-declaration-on-strengthening-of-laboratory-systems
4. National Standard Test Menu, Techniques and Supplies List for Laboratories.pdf [Internet]. [cited 2023 Oct 5]. Available from: https://www.cphl.go.ug/sites/default/files/2019-06/NSTMT%20TEST%20MENU.pdf
5. PEPFAR 2023 Country and Regional Operational Plan (COP/ROP) Guidance for all PEPFAR-Supported Countries [Internet]. 2022. Available from: https://www.state.gov/wp-content/uploads/2023/02/PEPFAR-2023-Country-and-Regional-Operational-Plan.pdf

Continued from page 10

Trends of HIV viral load suppression among patients switched from Non-nucleoside Reverse Transcriptase Inhibitors to Dolutegravir-based therapy, Kampala, Uganda, 2019−2022

Authors: Anthony Kiyimba[1,2]*, Samuel Gidudu[1], Patrick Semanda[2], Flaviano Mugalula[2], Isaac Ssewanyana[2], Priscilla Atim[1,3], Lilian Bulage[1] and Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda National Institute of Public Health, Ministry of Health, Kampala, Uganda, [2]National Health Laboratory and Diagnostics Services, Ministry of Health, Kampala, Uganda, [3]Infectious Diseases Institute, Kampala, Uganda
Correspondence*: Tel: +256 784 049340, Email: anthkiyimba@uniph.go.ug,

Summary

Background: The impact of dolutegravir-based antiretroviral therapy (ART) on viral load suppression for People Living With HIV (PLHIV) who switched from non–dolutegravir-based therapy over time is not well documented in Uganda. In addition, there were sub-optimal modalities for the rollout of Dolutegravir (DTG) especially concerning the previous viral suppression, viral load threshold allowing for transition, and the timing of viral load measurement before transitioning. We described the trends of HIV viral load outcomes after the programmatic switching of PLWH to DTG-based regimens in 2019 using HIV viral load routine program data between 2019 and 2022.
Method: We analyzed routine HIV viral load surveillance data for patients switched to and maintained on DTG-based ART regimens between 2019 and 2022. We utilized HIV viral load data from five treatment facilities in Kampala, Uganda. Viral load outcomes were grouped into three categories: non-detectable viremia, Low-Level Viremia (LLV) with measurements between ≥ 50-999 copies/mL, and high-level viremia with ≥1000 copies/mL.
Results: Most patients switched to DTG-based therapy had suppressed viral loads throughout the study period. Males had more undetectable viremia 841 (52%), low viremia 23 (70%), and high viremia 23 (74%). Viral load results varied across different age groups. Undetectable viremia 316 (50%) was common in those aged 41-60 years, while low viremia 13 (39%) and high viremia 17 (55%) were common in those under 20 years. **Conclusion:** Programmatic switching of PLWH to DTG-based ART maintained high viral suppression rates, suggesting that it has been beneficial to individuals and the population.

Background

In 2018, the World Health Organisation (WHO) recommended a transition to DTG-based antiretroviral treatment (ART) as the preferred first-line treatment for children and adults living with HIV(1,2). Since then, 116/127 (91%) Member states including Uganda, have implemented this recommendation. The introduction of DTG as a first-line regimen brought not only clinical benefits but also public health benefits through viral suppression, potentially reducing transmission and therefore lowering the number of newly acquired HIV infections (3).

In Uganda's current 2022 Consolidated Guidelines for the Prevention and Treatment of HIV/AIDS, there are three possible treatment outcomes including; Undetectable viremia(TND), Low-Level Viremia (LLV) between ≥ 50-999 copies/ml, and high-level viremia or treatment failures with ≥1000copies/ml (4). A non-detectable viral load indicates good adherence to ART and minimizes the chances of transmitting HIV and the development of drug resistance(5). While DTG-containing ART achieves excellent virological outcomes when used in triple and dual drug regimens(6,7) virological failure and the emergence of DTG-related drug resistance mutations (DRMs) have been observed in individuals receiving DTG monotherapy (7). Cases of mutations associated with DTG resistance have also been described in randomized trials, even in triple therapy in people with and without prior exposure to first-generation Integrase Strand Transfer Inhibitors (INSTIs) **(8,9)**. Furthermore, the uncertainty due to sub-optimal modalities during the rollout of DTG leaves questions about the effect of the previous viral suppression, drug resistance profile, viral load threshold allowing transition, and the timing of viral load measurement before transition that weren't considered at the time of regimen switch. In addition, HIV viral suppression is essential for optimal outcomes and prevention efforts. We described the trends of HIV viral load outcomes over time following a switch to DTG-based ART in 2019 to understand its effect on HIV treatment outcomes.

Methods

We conducted a descriptive study using routinely generated HIV-1 viral load surveillance data for all age groups and genders switched and maintained on DTG-based ART regimens from the National Health Laboratory and Diagnostics Services, 2019-2022.

Continues to page 12

Continued from page 11

We abstracted data on viral load testing outcomes following the programmatic switch to DTG from 2019 to 2022, stratified by health facility, sex, age group, regimen, adherence levels, and year of viral load monitoring. These were summarized as frequency and proportions.

We received a non-research determination from the US CDC clearance as this project used secondary data with no interaction with the patients and minimal risk. We obtained permission from the Department of National Health Laboratory Diagnostics and Services, Ministry of Health, to use the data. Patient identifiers were excluded during data abstraction.

Results

People Living With HIV switched and maintained on Dolutegravir-based antiretroviral therapy from selected health facilities, Kampala, Uganda, 2019–2022

We identified 1,682 PLHIV who were transitioned to DTG-based therapy in 2019 throughout 2022. Over 95% of patients who switched to and maintained DTG-based therapy sustained undetectable viremia during the study period. The majority of them were male 900 (53.5%), persons aged 41-60 years 833 (49.5%), persons with good adherence 1,634 (97.1%), persons on TDF-3TC 1,505 (89.5%), and persons from MJAP clinic 1,181 (70.2%) (Table 1).

Table 1: People Living With HIV switched and maintained on therapy from selected health facilities, Kampala, Uganda, 2019–2022

Table 1: People Living With HIV switched and maintained on therapy from selected health facilities, Kampala, Uganda, 2019–2022		
Characteristics	**Frequency N=1,682)**	**Percentage (%)**
Gender		
Male	900	53.5
Female	782	46.5
Age groups in years		
0-20	394	23.4
21-40	342	20.4
41-60	833	49.5
> 60	113	6.7
Adherence levels		
Good (>95%)	1,634	97.1
Fair (85-94%)	37	2.2
Poor (<85%)	11	0.7
Backbone Regimen		
TDF-3TC	1,505	89.5
ABC-3TC	175	10.4
Others	2	0.1
Health facility		
Health facility A	1,181	70.2
Health facility B	497	29.6
Health facility X	2	0.1
Health facility Z	2	0.1

Continued from page 12

HIV Viral load outcomes for People Living with HIV switched and maintained on Dolutegravir-based antiretroviral therapy from selected healthy facilities, Kampala, Uganda, 2019−2022
Males had more non detectable viremia 841 (52%), low viremia 23 (70%), and high viremia 23 (74%). Persons aged 41-60 years had more non-detectable viremia 316 (50%) while those <20 years had more low viremia 13 (39%) and high viremia 17 (55%). Persons with good adherence had more non-detected viremia 1585 (98%), low viremia 32 (97%), and high viremia 28 (90%). Persons on TDF-3TC had more non-detected viremia 1498 (93%), low viremia 30 (91%), and high viremia 30 (97%). Persons from MJAP had more not detected outcomes 1,154 (71%) and low viremia 18 (55%) while those from Baylor Mulago had more high viremia 28 (90%) (Table 2).

Table 2: HIV Viral load outcomes for People Living with HIV switched and maintained on Dolutegravir-based antiretroviral therapy from selected healthy facilities, Kampala, Uganda, 2019−2022

Table 2: HIV Viral load outcomes for People Living with HIV switched and maintained on Dolutegravir-based antiretroviral therapy from selected healthy facilities, Kampala, Uganda, 2019−2022

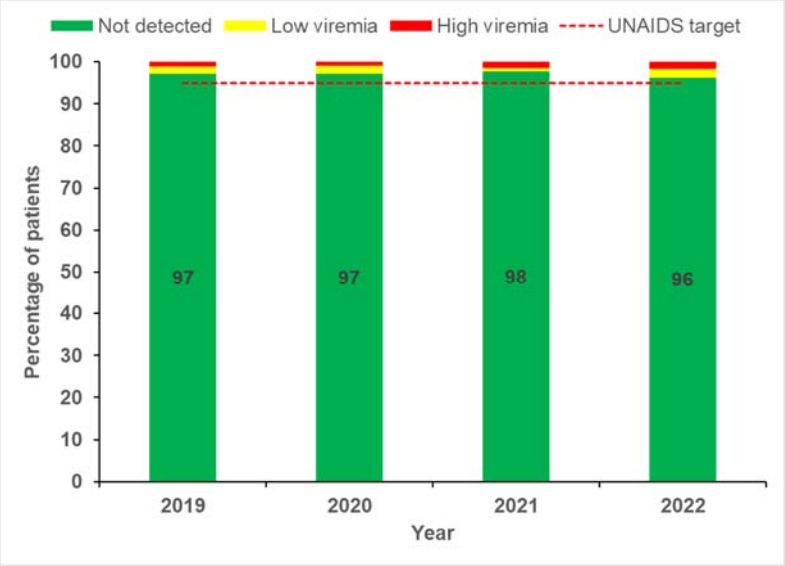
Variable	Not detected: N=1,618 (%)	Low viremia N=33 (%)	High viremia N=31 (%)
Sex			
Male	841 (52)	23 (70)	23 (74)
Female	777 (48)	10 (30)	8 (26)
Age group in years			
<20	364 (22)	13 (39)	17 (55)
21-40	329 (20)	10 (30)	7 (23)
41-60	816 (50)	11 (33)	5 (16)
>61	109 (7)	2 (6)	2 (6)
Adherence levels			
Good (>95%)	1,585 (98)	32 (97)	28 (90)
Fair (85-94%)	28 (2)	1 (3)	3 (10)
Poor (<85%)	5 (0)	0 (0)	0 (0)
Backbone Regimen			
TDF-3TC	1,498 (93)	30 (91)	30 (97)
ABC-3TC	119 (7)	3 (9)	3 (10)
Others	1 (0)	0 (0)	0 (0)
Health facility			
Health facility A	1,154 (71)	18 (55)	11 (35)
Health facility B	462 (29)	15 (45)	20 (65)
Health facility X	1 (0)	0 (0)	0 (0)
Health facility Z	1 (0)	0 (0)	0 (0)

Continues to page 14

Continued from page 13

Trends of HIV Viral load outcomes by category among People Living with HIV from selected health facilities, Kampala, Uganda, 2019−2022

PLHIV with non-detectable viremia slightly reduced but still above the UNAIDS target of 95% while 4% of PLHIV had either low or high-level viremia by the fourth year after transitioning compared to 3% in 2019 (Figure 1).



1: Trends of HIV Viral load outcomes by category among People Living with HIV from selected health facilities, Kampala, Uganda, 2019−2022

Discussion

We assessed the trends of HIV viral load treatment outcomes among PLWH over time from selected health facilities in Kampala, Uganda. The percentage of VL test outcomes showing suppression differed among key demographic groups such as males versus females, and across the different age categories. Over 95% of patients who switched to and maintained DTG-based therapy maintained undetectable viremia. These results corroborate with studies in Nigeria and Lesotho, which showed that after switching to a DTG combination therapy composed of Tenofovir/ Lamivudine/Dolutegravir (TLD), a VL of < 200 copies/mL was attained within 3 months compared to a similar group of patients maintained on Tenofovir/ Lamivudine/Efervirez (TLE) for another 6 months before switching and the proportion of participants with a VL <100 copies/mL increased from 96% to 98% respectively(10,11). This supports the programmatic switching of PLHIV to DTG-based therapy to maximize viral suppression and reduce individual and community viral loads. The more widespread use of DTG-based ART with well-known greater tolerability, enhanced potency, single-tablet regimens thus convenient to swallow, higher resistance genetic barrier, and good adherence by PLWH resulted in excellent viral suppression levels over time.

The higher proportions of males with low viremia and high viremia are probably due to adherence challenges and inconsistency in clinic visits and drug refills(12). This is a proven success for Uganda in the fight against HIV illustrated by the suppression rates collateral to the 95% UNAIDS target of PLHIV on treatment achieving a suppressed viral load(12). However, a decline in patients with non-detectable viremia was observed between 2021 and 2022 with a 1.8% reduction rate. This could have been attributed to the COVID-19 pandemic which affected medical services, including the HIV programs through restriction of movement that limited patients' ability to attend ART clinics for appointments and drug refills thus impacting adherence levels (13). This proportion of patients with high viremia indicates a strong implication for virological failure necessitating a call for early detection(14,15). Interventions that improve the management of virologic non-suppressors are urgently needed as this seemingly small percentage of PLHIV with high viremia might compromise the attainment of the UNAIDS target of having 95% of patients on treatment virally suppressed as well as the development and spread of resistant strains.

Furthermore, our findings indicate that non-viral load suppression is also still possible even with a DTG-based regimen as shown by oscillating patterns in the percentages of the PLWH having low viremia and high viremia over the four years. However, this category needs to be studied further to identify the factors contributing to non-suppression since it may not entirely be due to resistance. The switch to DTG-based therapy supports an unconditional transition strategy. However, viral load monitoring and dolutegravir-resistance surveillance more so with the possibility of existing nucleoside reverse transcriptase inhibitor resistance remains key. This will enable early detection of resistance at the individual and population levels and ensure the long-term sustainability of ART.

Study limitations

We did not analyze data for a whole country and thus can not generalize the outcomes since different settings have different challenges related to HIV care and management.

Continued from page 14

Conclusion

This study shows that programmatic switching of PLHIV to DTG combination therapy maintained HIV viral suppression levels above the 95% set target. However, 4% of these patients had either low or high-level viremia by the fourth year after transitioning compared to 3% in 2019, suggesting the likelihood of poor adherence, treatment failure, or development of drug resistance.

Conflict of interest

The authors declare that they have no conflict of interest.

Author contributions

AK and IS conceptualized and designed the study. AK analyzed and wrote the draft manuscript, PS and FM participated in the extraction and data cleaning. SG, PA, LB and ARA reviewed the drafts of the bulletin for intellectual content, and made multiple reviews untill the final manuscript. All authors read and approved the final bulletin.

Acknowledgments

The authors appreciate the laboratory personnel at the National Health Laboratories and Diagnostic Services, HIV Viral Load Laboratory who ensure routine HIV viral load monitoring is done and access to data on request. We also appreciate the Uganda Public Health Fellowship Program and the Ministry of Health for the technical support and guidance offered during the execution of this study.

References

1. Gilks CF, Alemu YA. A WHO Public Health Approach to Ending AIDS in the Global South: Lessons for NCD Control and Universal Health Coverage [Internet]. Taylor & Francis; 2024 [cited 2024 Oct 23]. Available from: https://books.google.com/books?=en&lr=&id=PKwOEQAAQBAJ&oi=fnd&pg=PA1972&dq=Gilks+CF,+Alemu+YA.+A+WHO+Public+Health+Approach+to+Ending+AIDS+in+the+Global+South:+Lessons+for+NCD+Control+and+Universal+Health+Coverage+%5BInternet%5D.+Taylor+%

2. Rhee SY, Grant PM, Tzou PL, Barrow G, Harrigan PR, Ioannidis JP, et al. A systematic review of the genetic mechanisms of dolutegravir resistance. Journal of Antimicrobial Chemotherapy. 2019;74(11):3135–49.

3. Blanco JL, Rojas J, Negredo E, Group DS. Planned 24-week analysis of two dolutegravir (DTG)-based simplification strategies (abstract PS1/3). In: 16th European AIDS Conference. 2017.

4. Nanyeenya N. Viral non-suppression, perceptions and effectiveness of intensive adherence counselling among people living with HIV/AIDS on antiretroviral therapy with low-level Viraemia in Uganda [Internet] [PhD Thesis]. Makerere University; 2023 [cited 2024 Oct 23]. Available from: http://dspace.mak.ac.ug/handle/10570/12859

5. MOH. CONSOLIDATED GUIDELINES FOR THE PREVENTION AND TREATMENT OF HIV AND AIDS IN UGANDA, 2022. Ministry of Health, EQUINET Uganda; 2023.

6. Cahn P, Madero JS, Arribas JR, Antinori A, Ortiz R, Clarke AE, et al. Dolutegravir plus lamivudine versus dolutegravir plus tenofovir disoproxil fumarate and emtricitabine in antiretroviral-naive adults with HIV-1 infection (GEMINI-1 and GEMINI-2): week 48 results from two multicentre, double-blind, randomised, non-inferiority, phase 3 trials. The Lancet. 2019;393(10167):143–55.

7. Sculier D, Wandeler G, Yerly S, Marinosci A, Stoeckle M, Bernasconi E, et al. Efficacy and safety of dolutegravir plus emtricitabine versus standard ART for the maintenance of HIV-1 suppression: 48-week results of the factorial, randomized, non-inferiority SIMPL'HIV trial. PLoS medicine. 2020;17(11):e1003421.

8. Rhee SY, Grant PM, Tzou PL, Barrow G, Harrigan PR, Ioannidis JP, et al. A systematic review of the genetic mechanisms of dolutegravir resistance. Journal of Antimicrobial Chemotherapy. 2019;74(11):3135–49.

Continues to page 16

Continued from page 15

9. Paton N, Musaazi J, Kityo CM. Nucleosides and darunavir/dolutegravir in Africa (NADIA) trial: 48wks primary outcome. In: Conference on Retroviruses and Opportunistic Infections, virtual. 2021.
10. Katbi M, Adeoye O, Adedoyin A, Faturiyele I, Adegboye A, Bello M. Virologic response among key populations living with HIV following a switch to dolutegravir-based regimen in Southern Nigeria. Int J Virol AIDS. 2020;7(69):8.
11. Brown JA, Nsakala BL, Mokhele K, Rakuoane I, Muhairwe J, Urda L, et al. Viral suppression after transition from nonnucleoside reverse transcriptase inhibitor- to dolutegravir-based antiretroviral therapy: A prospective cohort study in Lesotho (DO-REAL study). HIV Medicine. 2022 Mar;23(3):287–93.
12. Kabiibi F, Tamukong R, Muyindike W, Yadesa T. Virological Non-Suppression, Non-Adherence and the Associated Factors Among People Living with HIV on Dolutegravir-Based Regimens: A Retrospective Cohort Study. HIV. 2024 Mar;Volume 16:95–107.
13. Izudi J, Kiragga AN, Okoboi S, Bajunirwe F, Castelnuovo B. Adaptations to HIV services delivery amidst the COVID-19 pandemic restrictions in Kampala, Uganda: a qualitative study. PLOS global public health. 2022;2(8):e0000908.
14. Kamgaing N, Njom-Nlend AE, Koki PN, Kesseng D, Tetang SN, Lifanda LE, et al. Viral suppression in the era of transition to dolutegravir-based therapy in Cameroon. [cited 2024 Oct 4]; Available from: https://www.researchgate.net/profile/Yagai-Bouba/publication/370896447_Viral_suppression_in_the_era_of_transition_to_dolutegravir-based_therapy_in_Cameroon_Children_at_high_risk_of_virological_failure_due_to_the_lowly_transition_in_pediatrics/links/64688ce370202663165c28cf/Viral-suppression-in-the-era-of-transition-to-dolutegravir-based-therapy-in-Cameroon-Children-at-high-risk-of-virological-failure-due-to-the-lowly-transition-in-pediatrics.pdf
15. Katz IT, Ryu AE, Onuegbu AG, Psaros C, Weiser SD, Bangsberg DR, et al. Impact of HIV-related stigma on treatment adherence: systematic review and meta-synthesis. Journal of the International AIDS Society. 2013 Nov;16(3S2):18640.

Continued from page 16

Trends and distribution of *Vibrio cholerae* isolates at the National Microbiology Reference Laboratory, Ministry of Health, Uganda, 2014 –2023

Authors: Leah Naluwagga Baliruno*[1, 2], Rita Namusoosa[1, 2], Samuel Gidudu[1], Paul Edward Okello[1], Harriet Nakigozi[2], Chris Okiria[2], Isaac Ssewanyana[2], Suzan Nabadda[2], Grace Najjuka[2], and Alex Riolexus Ario[1]

Institutional affiliations

[1]Uganda Public Health Fellowship Program, National Institute of Public Health, Kampala Uganda, Ministry of Health, Uganda, [2]National Health Laboratories and Diagnostic Services (NHLDS), Ministry of Health, Uganda

Correspondence*: Tel: +256702533694, Email: lnaluwagga@uniph.go.ug

Summary

Background: As per the World Health Organization, countries including Uganda are to end cholera by 2030 through prevention and treatment. This achievement can be hindered due to rapid changes in antimicrobial response patterns and serotype among other factors. We described confirmed cholera cases by person, place, time, serotype, antimicrobial resistance, and multi-antimicrobial-resistant phenotype patterns, Uganda, 2014–2023.

Methods: We conducted a descriptive study using the 2014 – 2023 data on confirmed cholera cases abstracted from the National Microbiology Reference Laboratory (NMRL) register. We described the cases by age group, sex, district, serotype, reporting period, antimicrobial resistance (resistant and intermediate)(rates), and multi-antimicrobial-resistant phenotype patterns. We described the confirmed cases and the antimicrobial resistance patterns over time. Mann-Kendall tests for trends were used to test the significance of AMR trends.

Results: We identified 489 confirmed cholera cases between January 2014 to December 2023 whose *V. cholerae* isolates were referred by 35 districts in Uganda. The majority of the identified confirmed cholera cases were male (239, 49%), aged 21-40 years (170, 38%), had *V. cholerae* 01 Ogawa (256, 52%) and were from Kampala District (138, 28%). We observed a gradual decline in confirmed cholera cases over time with peaks in 2015, 2018 and 2023. *Vibro cholerae* 01 ogawa was observed to dominate throughout the period. We observed consistent resistance by *V. cholerae* to 6 antimicrobials from 2014 to 2023. 194 (39.7%) isolates showed multiple antimicrobial-resistant with 90 (18.6%) resistant to more than one class of antimicrobials.

Conclusion: We observed males, persons aged 21-40 years, and Kampala District as being most affected with cholera in Uganda with peaks in 2015, 2018, and 2023 and *Vibro cholerae* 01 Ogawa as the predominate serotype. Consistent antimicrobial resistance was exhibited over time between 2014 and 2023. Intensifying cholera disease prevention by the Ministry of Health targeting males, persons aged 21-40 years, and Kampala District is critical. Routine antimicrobial surveillance to guide informed antimicrobial use and prevent the spread of AMR, especially during cholera outbreaks is important.

Background

Vibrio cholerae (V.cholerae), a gram-negative bacillus and the causative agent for cholera disease, an acute diarrheal illness transmitted mainly through the fecal-oral route. The serogroups of this bacteria include *V. cholerae* O1 and O139. *V. cholerae* O1 has serotypes Inaba and Ogawa (1). Cholera disease if not treated on time, leads to severe dehydration, shock (within 6 to 12 hours), and possibly death (2). Uganda has reported cholera outbreaks almost every year in the last two decades (3) with an average of 11,000 cholera confirmed cases annually, and 61 to 182 deaths each year (4). According to the United Nations Children's Fund (UNICEF) children under 5 years are more affected by the disease (5).

During cholera outbreak investigations, stool samples are analyzed to confirm and monitor outbreak progression, particularly in endemic areas where sporadic cases and small outbreaks frequently occur (2). The collected data is then examined to identify the affected populations, outbreak locations, and timing. Additionally, the data is used to track changes in *Vibrio cholerae* serotypes and antimicrobial susceptibility patterns. Common antimicrobial agents employed in this context include tetracycline, doxycycline, trimethoprim-sulfamethoxazole (SXT), erythromycin, and chloramphenicol safeguarding the effectiveness of antimicrobial agents in the face of emerging resistance (6). We described confirmed cholera cases in Uganda by person, place, time, and serotype as well as characterize *V.cholerae* isolates by antimicrobial resistance trends and multi-antimicrobial-resistant phenotypes, Uganda, 2014-2023.

Continues to page 18

Continued from page 17

Methods

We conducted a descriptive study using the 2014 – 2023 data on confirmed cholera cases abstracted from the National Microbiology Reference Laboratory (NMRL) register. We described the cases by age group, sex, district, serotype, reporting period, antimicrobial resistance (rates), and multi-antimicrobial-resistant phenotype patterns. We further described trends of the confirmed cholera cases and the anti-microbial resistance patterns. The rates of antimicrobial resistance (AMR) were calculated as the proportion of resistant (resistant and intermediate) out of the total number of organisms tested for antimicrobial susceptibility per drug, per year. Antimicrobial resistance (AMR) rates for each antibiotic were calculated separately and AMR trends demonstrated using line graphs. Mann-Kendall tests for trends were used to test the significance of AMR trends.

This study utilized routinely collected aggregated confirmed cholera surveillance data associated with minimal risk to the individual to achieve the study objectives. We sought permission to access and use the data from the NMRL. The Centre for Global Health, US Centre for Disease Control and Prevention (US CDC) determined that this project was not human subject research and its primary intent was for public health practice or disease control, therefore it was classified as non-research. This study project was reviewed by the CDC and conducted consistent with applicable federal law and CDC policy.

Results

Description of cholera-confirmed cases by sex, age group, and serotype, Uganda, 2014-2023

We identified 489 confirmed cholera cases during January 2014 to December 2023 whose *V. cholerae* isolates were referred by 35 districts in Uganda.

The majority of the identified confirmed cholera cases were male (239, 49%), aged 21-40 years (170, 38%), and had *V. cholerae* 01 Ogawa (256, 52%) (Table 1). Most of these cases were from Kampala (138, 28%) (Figure 1).

Table 1: Description of cholera-confirmed cases by sex, age group, and serotype, Uganda, 2014

Table 1: Description of cholera-confirmed cases by sex, age group, and serotype, Uganda, 2014-2023

Variable	Frequency (n=489)	Proportion (%)
Sex		
Male	239	48.9
Female	207	42.3
Unknown	43	8.8
Age group (years)		
≤ 2	18	3.7
3-5	53	10.8
6-20	145	29.7
21-40	170	34.8
41-60	42	8.6
≥ 61	15	3.1
Unknown	46	9.4
Serotype		
O1 Inaba	151	30.9
O1 Ogawa	256	52.3
not serotyped	82	16.8

-2023

Continued from page 18

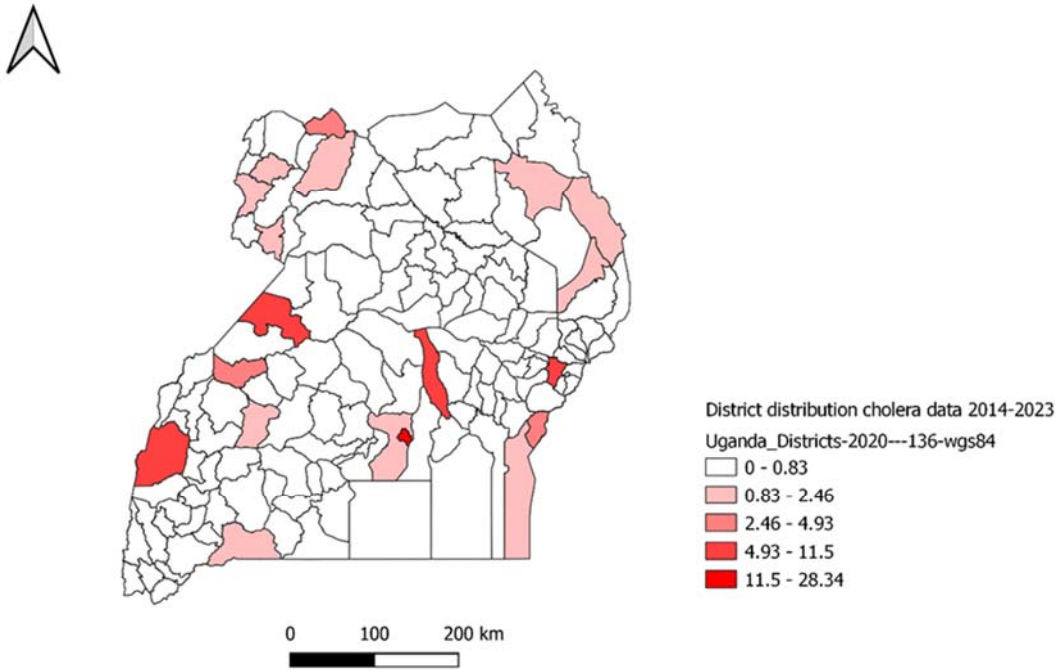


Figure 1: Distribution of confirmed cholera cases by district, Uganda, 2014-2023

Number of cholera cases, Uganda, 2014-2023

The number of confirmed cholera cases gradually declined over time, with peaks in 2015, at 137 (28%), in 2018, at 109 (22%), and in 2023, at 23, 65 (13%) (Figure 2).

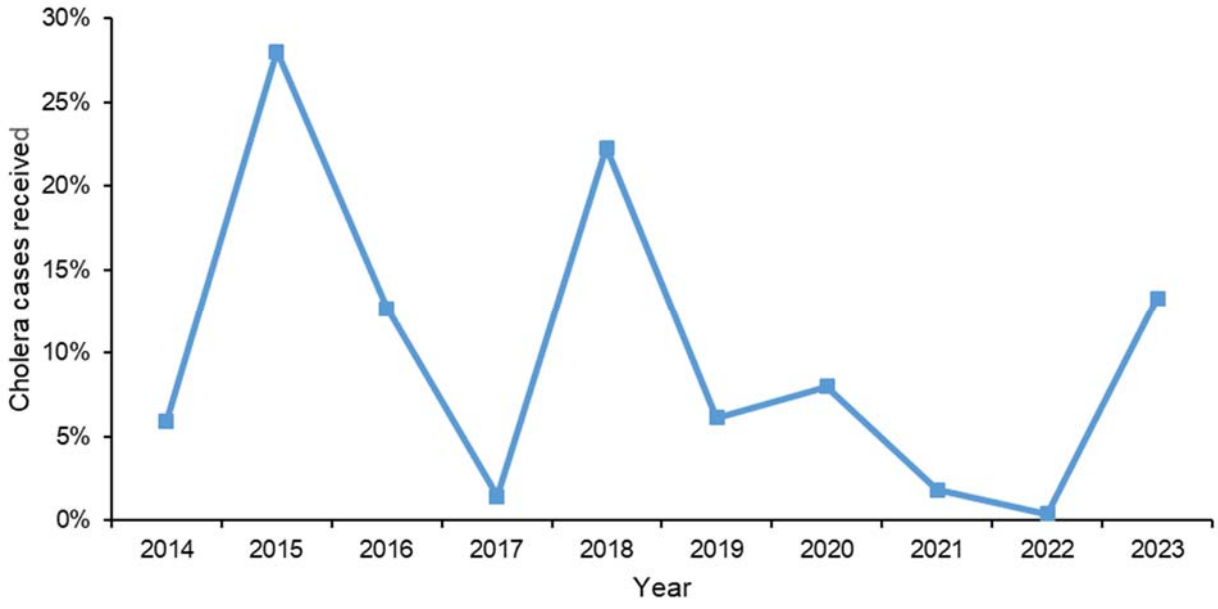


Figure 2: Number of cholera cases, Uganda, 2014-2023

Continues to page 20

Continued from page 19

Trends of confirmed cholera confirmed cases by serotype, Uganda, 2014-2023
We observed a gradual decline in confirmed cholera cases over time with peaks in 2015, 2018, and 2023. *Vibro cholerae* 01 ogawa was observed to dominate throughout the period (Figure 3).

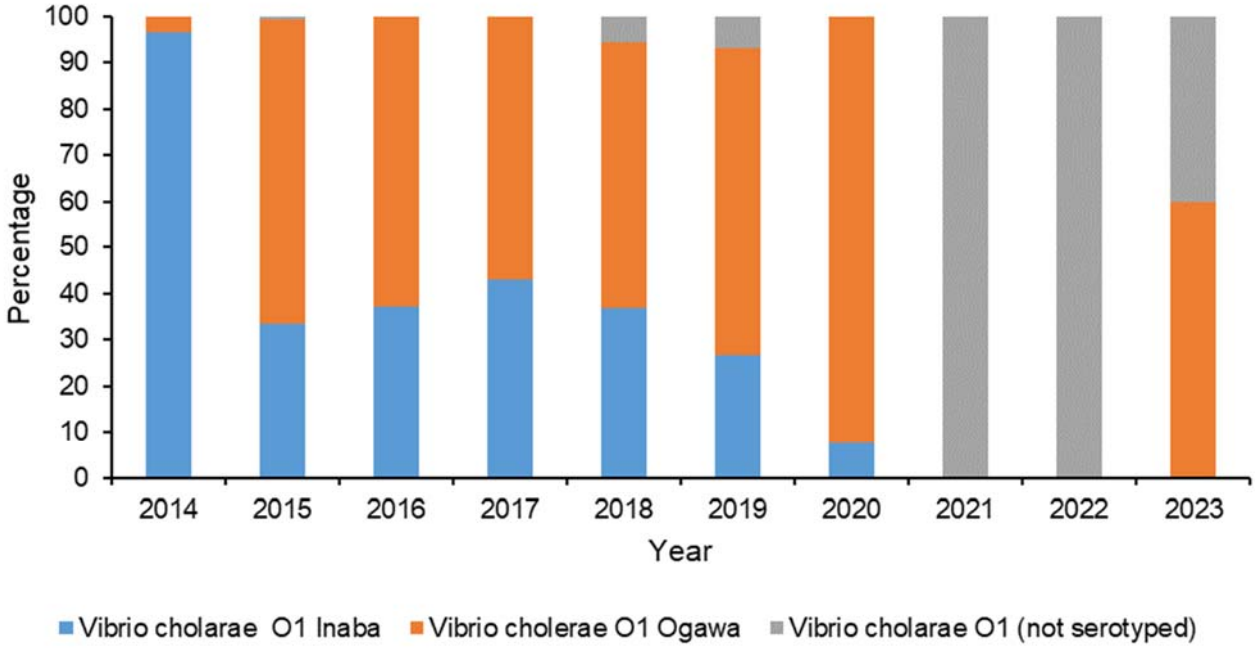


Figure 3: *Vibrio cholerae* O1 Ogawa, Inaba, and not serotyped, Uganda, 2014-2023

Trends of antimicrobial resistance of *Vibro cholerae* isolates, Uganda, 2014-2023
We observed consistent resistance by *V. cholerae* to 6 antimicrobials from 2014 to 2023. Increased resistance was mainly observed to nalidixic acid (100%, p=1.000), ciprofloxacin (1.3%– 85%, p=0.2207) and trimethoprim-sulfamethoxazole (SXT) (31.2 – 52.6%, p=0.0864). There was decreased *V. cholerae* resistance for tetracycline, (7.5 – 1.8% p=0.0864) and chloramphenicol, (36.3– 0% p=0.0864) (Figure 4).

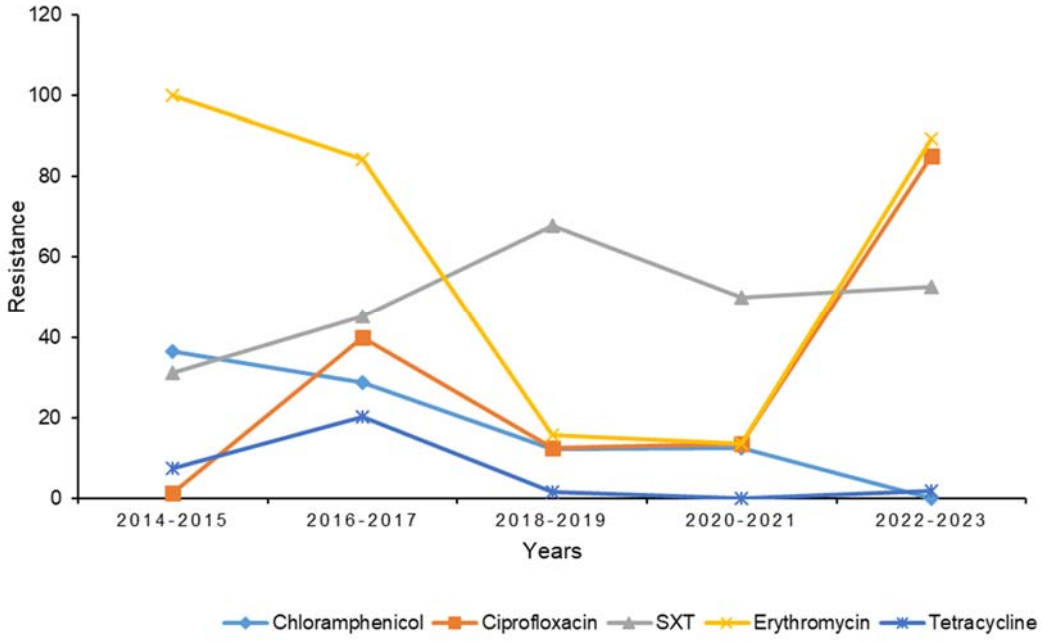


Figure 4: Trends of antimicrobial resistance among *V.cholerae* isolates, Uganda, 2014-2023

Continued from page 20

Distribution of *V. cholerae* by multiple antimicrobial-resistant phenotypes, Uganda, 2014-2023
Out of 489 *V. cholerae* isolates, 194 (39.7%) were multiple antimicrobial-resistant with 90 (18.6%) resistant to more than one class of antimicrobials. The most common resistotype was exhibiting simultaneous resistance to erythromycin, nalidixic acid, and SXT, 49 (10%) (Table 2).

Table 2: Multiple antimicrobial-resistant phenotypes of *V. cholerae* by class, Uganda, 2014-2023

Property: MDR Phenotype	Frequency (n=489)	Percentage (%)
Resistance to 5 classes of antimicrobials:		
Chloramphenicol, erythromycin, nalidixic acid, tetracycline, SXT	2	0.4
Resistance to 4 classes of antimicrobials:		
Chloramphenicol, erythromycin, tetracycline, SXT	11	2.2
Chloramphenicol, erythromycin, nalidixic acid, tetracycline	2	0.4
Ciprofloxacin, erythromycin, nalidixic acid, SXT	2	0.4
Chloramphenicol, ciprofloxacin/ nalidixic acid, erythromycin, SXT	1	0.2
Resistance to 3 classes of antimicrobials:		
Erythromycin, nalidixic acid, SXT	49	10
Chloramphenicol, nalidixic acid, SXT	25	5.1
Chloramphenicol, erythromycin, SXT	2	0.4
Erythromycin, tetracycline, SXT	2	0.4
Nalidixic acid, tetracycline, SXT	1	0.2
Ciprofloxacin, erythromycin, SXT	1	0.2
Erythromycin, nalidixic acid, tetracycline	1	0.2

Discussion

Our study reported on the trends of *V. cholerae* serotypes and antimicrobial susceptibility in Uganda from 2014 to 2023. We identified males, persons aged 21-40 years, and Kampala District as being the most affected with peaks in 2015, 2018, and 2023 and *Vibro cholerae* 01 Ogawa as the predominate serotype. Consistent antimicrobial resistance was exhibited over time between 2014 and 2023.

V. cholerae 01 Ogawa was pre-dominant over the years likely because of ongoing public health challenges associated with inadequate water and or sanitation infrastructure (18). This finding is similar to other studies that have also identified the *v.cholerae* 01 Ogawa as a pre-dominant serotype in Zambia which accounted for 70% of the 2009 and 2016 outbreaks (19).

Continues to page 22

Continued from page 21

The observed increase in antimicrobial resistance to *V.cholerae* could be associated with widespread and inappropriate use of antibiotics (20); the acquisition of resistant genes through horizontal gene transfer, a process that allows the bacterial to adapt to the presence of antibiotics (29) rapidly; exchange of plasmids that carry resistance genes between different strains (17); environmental factors such as contaminated waters sources that act as reservoirs for resistant bacteria (21) and lack of adequate surveillance of antibiotic resistance in the country (22).

Study limitations

Our data source was characterized with missing and incomplete information due to frequent stockouts of antimicrobial disks and antisera. Thus leading to either under or over estimation of the study outcomes and limiting the generalizability of the findings.

Conclusion

Our study reveals a disproportionate burden of cholera among males, young adults, and Kampala residents, with *Vibro cholerae* 01 Ogawa as the predominant serotype, recurring outbreaks and persistent antimicrobial resistance. These results highlight the need for targeted interventions and enhanced surveillance to address the ongoing cholera epidemic in Uganda. The consistent antimicrobial resistance observed over time underscores the importance of antibiotic stewardship and alternative treatment strategies.

The Ministry of Health should prioritize targeted cholera prevention measures for high-risk groups, including males, persons aged 21-40, and Kampala District through improving sanitation and hygiene measures. Continuous antimicrobial surveillance is also crucial to inform evidence-based treatment decisions and mitigate antimicrobial resistance.

Conflict of interest

None

Authors Contribution

LNB, RN, PO, HN, and SG conceived and designed the analysis. LNB and RN collected the data. LNB, RN, PO, and HN contributed to the data analysis. LNB and RN performed data analysis. LNB, RN, PO, HN, and SG wrote the bulletin. IS, SN, GN, and AA reviewed the bulletin to ensure scientific integrity.

Acknowledgements

We acknowledge the Uganda Public Health Fellowship Program and the National Microbiology and Reference Laboratory (NMRL) for the technical support and oversight of this project. We acknowledge the US Centers for Disease Control and Prevention thorugh Makerere University School of Public Health, and Baylor Uganda for implementation support.

References

1. Alsamarai MA, Cheesbrough M. BOOK REVIEW Title: District Laboratory Practice in Tropical Countries Part 1 Second Edition Author. IJMS January. 2018;1(1):65–8.
2. Allen G, Aj N, Chowdhury F, Ross AG, Islam T, Mcmillan NAJ. Diagnosis, Management, and Future Control of Cholera. Clinical Microbiology Reviewa. 2022;
3. Bwire G, Munier A, Ouedraogo I, Heyerdahl L, Komakech H, Kagirita A, et al. Epidemiology of cholera outbreaks and socio-economic characteristics of the communities in the fishing villages of Uganda: 2011-2015. PLoS Neglected Tropical Diseases. 2017;11 (3):2011–5.
4. Bwire G, Malimbo M, Maskery B, Kim YE, Mogasale V, Levin A. The burden of cholera in Uganda. PLoS neglected tropical diseases. 2013;7(12):e2545.
5. UNICEF. Cholera is endangering children globally [Internet]. Available from: https://www.unicef.org/stories/cholera-is-endangering-children-globally
6. Khan AI, Chowdhury F, Harris JB, Larocque RC, Faruque ASG, Ryan ET, et al. Comparison of clinical features and immunological parameters of patients with dehydrating diarrhoea infected with Inaba or Ogawa serotypes of Vibrio cholerae O1. Scandinavian Journal of Infectious Diseases. 2010;42 (1):48–56.
7. Humphreys H, Fitzpatick F, Harvey BJ. Gender differences in rates of carriage and bloodstream infection caused by methicillin-resistant Staphylococcus aureus: are they real, do they matter and why? Clinical Infectious Diseases. 2015;61(11):1708–14.

Continued from page 22

8. Study of Vibrio Cholerae with its Virulence Factors Isolated from Diarrheal Patients in Babylon Province. 2017;
9. Ngere P, Langat D, Ngere I, Dawa J, Okunga E, Nasimiyu C, et al. A protracted cholera outbreak in Nairobi City County accentuated by mass gathering events, Kenya, 2017. PloS one. 2024;19 (8):e0297324.
10. Endris AA, Addissie A, Ahmed M, Abagero A, Techane B, Tadesse M. Epidemiology of cholera outbreak and summary of the preparedness and response activities in Addis Ababa, Ethiopia, 2016. Journal of Environmental and Public Health. 2022;2022(1):4671719.
11. Maponga BA, Chirundu D, Gombe NT. Cholera: a comparison of the 2008-9 and 2010 outbreaks in Kadoma City, Zimbabwe. Pan Afr Med J 20: 221. 2015.
12. Chaudhary N, Biswas T, Ghosh P, Chattopadhyay S, Mondal R. Emergence of Multidrug Resistant Vibrio cholerae O139 in Acute Diarrhoea Patients Attending a Tertiary Care Hospital, West Bengal, India. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2023;17(1):DC14–8.
13. Ismail S. 'Informal Settlements'a Great Threat to Uganda's Realization of Sustainable Development: A Case Study of Slums in Kampala Capital City/Uganda. Ismail, S(2020)'Informal Settlements'a Great Threat to Uganda's Realization of Sustainable Development: A Case Study of Slums in Kampala Capital City/Uganda International Journal of Humanities, Arts and Social Sciences. 2020;6(5):195–201.
14. Eurien D, Mirembe BB, Musewa A, Kisaakye E, Kwesiga B, Ogole F, et al. Cholera outbreak caused by drinking unprotected well water contaminated with faeces from an open storm water drainage: Kampala City, Uganda, January 2019. BMC Infectious Diseases. 2021;21:1–9.
15. Vermeiren K, Van Rompaey A, Loopmans M, Serwajja E, Mukwaya P. Urban growth of Kampala, Uganda: Pattern analysis and scenario development. Landscape and urban planning. 2012;106(2):199–206.
16. Bwire G, Waniaye JB, Otim JS, Matseketse D, Kagirita A, Orach CG. Cholera risk in cities in Uganda: understanding cases and contacts centered strategy (3CS) for rapid cholera outbreak control. Pan African Medical Journal. 2021;39(1).
17. Rijal N, Acharya J, Adhikari S, Upadhaya BP, Shakya G, Kansakar P. Changing epidemiology and antimicrobial resistance in Vibrio cholerae : AMR surveillance findings (2006 – 2016) from Nepal. 2019;1–8.
18. Iramiot JS, Rwego IB, Kansiime C, Asiimwe BB. Epidemiology and antibiotic susceptibility of Vibrio cholerae associated with the 2017 outbreak in Kasese district, Uganda. BMC public health. 2019;19:1–9.
19. Mwape K, Kwenda G, Kalonda A, Mwaba J, Lukwesa-Musyani C, Ngulube J. Characterisation of Vibrio cholerae isolates from the 2009, 2010 and 2016 cholera outbreaks in Lusaka province, Zambia. Pan Afr Med J. 2020; 35: 1–10.
20. Ilić K, Jakovljević E, Škodrić-Trifunović V. Social-economic factors and irrational antibiotic use as reasons for antibiotic resistance of bacteria causing common childhood infections in primary healthcare. European journal of pediatrics. 2012;171:767–77.
21. Uppal B, Mehra B, Panda PS, Kumar SK. Changing epidemiology and antimicrobial resistance pattern of Vibrio cholerae isolates at a tertiary care health laboratory in North India (2011–2015). water supply. 2017;4:6.
22. Mohammed Y, Aboderin AO, Okeke IN, Olayinka AT. Antimicrobial resistance of Vibrio cholerae from sub-Saharan Africa: A systematic review. African Journal of Laboratory Medicine. 2018;7(2):1–7.

Continues to page 24

Continued from page 23

Improving HIV testing kits inventory management in a high-volume testing laboratory, Uganda, 2023

Authors: Priscilla Atim[1,2*], Samuel Gidudu[1], Bernard Ssentalo Bagaya[2,3], Andrew Kambugu[2], Kwabena Sarpong[2], Bosco Kafufu[2], Benedict Kiwanuka[2], Betty Natukunda[2], Edith Nekesa[2], David Okiror[2], Lucy Apeduno[2], Audrey Nimwesiga[2], Lilian Bulage[1], Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, National institute of Public Health, Kampala Uganda, [2]Infectious Diseases Institute, Makerere University, Kampala, Uganda, [3]Department of Immunology and Molecular Biology, Makerere University, Kampala, Uganda
[*]**Correspondence:** Tel: +256774505696 Email: patim@uniph.go.ug

Summary

Background: An evaluation of the HIV-testing kit inventory management in a high-volume testing laboratory showed 22% stock card inaccuracy, 33% stockout of HIV test-kits with a stock out trend of at least one HIV-testing kit every month from July 2022 to March 2023. This consistent stockout of HIV-testing kits resulted in delay in issuing laboratory test results and complaints from clinicians and patients. We conducted a continuous quality improvement (CQI) project to reduce stock out rates of HIV-testing kits from 33% to 0% from March to July 2023 and provided a case study for scaling up the improvement to other test kits inventory in the laboratory.
Methods: We analyzed the laboratory's HIV-testing kit inventory data to serve as our baseline data. We formed a CQI team in the laboratory to coordinate the implementation of activities. We identified gaps in the inventory system based on analysis of the baseline data. We identified the root cause of the gaps in the system using the "five whys" method. We proposed interventions to identified gaps in the system and ranked the proposed interventions. Based on the proposed interventions, we identified tools to implement the suggested changes. We came up with measurable quality indicators that were used to monitor effectiveness towards improving the HIV test-kits inventory system and evaluated the project at the end of 5 months. We used a Plan Do Check Act (PDCA) cycle to plan and test the implemented interventions in the laboratory.
Results: The root cause for stockout was lack of a standardized reorder system. The implemented changes included: Standardizing the reorder system to use minimum stock levels, creating a consolidated tracking tool, and assigning a focal person. The quality indicator to measure progress towards reducing the stock out rates was the percentage of HIV test-kit stock out in the laboratory. The interventions reduced HIV test-kit stock out from 33% to 0% during May to July 2023.

Conclusion: A quality improvement approach improved inventory management in the short term. The improvement was attributed to standardizing the reordering system, creating a consolidated inventory tracking tool, and assigning a focal person to monitor stock. We recommend continuous monitoring that enables sustainable inventory management.

Introduction

Access to accurate and timely HIV testing is critical for early diagnosis and treatment as the HIV/AIDS epidemic continues to impact populations worldwide (1). Globally, 19% of people living with HIV are undiagnosed and unaware of their status, which is higher than the United Nations Program on HIV/AIDS (UNAIDS) target of 5% (2). Although testing has increased over the years, many people in sub-Saharan Africa are still unaware of their HIV status (3). The effectiveness of HIV testing relies heavily on adequate supply and accurate inventory management of testing kits in health facilities offering this service and adherence to testing algorithms (4)(5).
An effective inventory system is essential to ensure the availability of HIV testing supplies (6). Poor inventory management practices lead to out-of-stock testing kits, which is a common occurrence in healthcare facilities in sub-Saharan Africa (7). In Uganda, from April to September 2023, the average monthly stock-out in government facilities for SD Bioline test kits was 36%, HIV Determine 31% and Stat-pak 24%, with the overall average stockout of 27% above the of 5% target (8). These stock-outs resulted in delayed results release, which was a common complaint among clinicians. The objective of this CQI was to identify the factors leading to laboratory stockouts of HIV test kits from March to July 2023 and to reduce stockout for HIV test kit types to 0%.

Methods

Project implementation setting and design

From March to July 2023, the quality improvement team conducted a project in a high-volume HIV testing laboratory in Kampala. The team chose this laboratory as one of the case study sites because of frequent experienced stockouts of HIV test kits. The goal was to eliminate stockouts for HIV test kit types entirely . To achieve this, The team applied the Plan Do Check Act (PDCA) model, formed a continuous quality improvement team, conducted baseline data collection,

Continued from page 24

measures, implemented necessary changes, and monitored the changes using a quality improvement indicator (9,10). The continuous quality improvement model aimed to identify the factors that led to laboratory stockouts of HIV test kit from March to July 2023 and generate interventions for improvement. A final assessment was conducted in July 2023 to assess the improvement.

Ethical approval
We received permission from the laboratory management to carry out this project in the laboratory. Additionally, CDC determined that this investigation was a quality improvement project whose primary intent was to improve HIV testing kit availability and therefore it was classified as non-research.

Problems associated with HIV-testing kit stock out in the laboratory, July 2022-March 2023
The laboratory generally used a manual inventory management system with tools such as stock cards, requisition forms, order forms, and delivery notes.

Ordering system challenges

The common challenge with the inventory ordering system was that there was no defined system for laboratory technologists to send orders for HIV-testing kits to the accounting assistant, which posed a challenge in tracking orders.

Procurement Challenges
While the facility had procurement guidelines for laboratory supplies, including HIV testing kits, the laboratory did not have a procurement plan for them. Additionally, it took an average of 1-2 months for the laboratory to receive supplies of HIV testing kit. As a result, the procurement department had no established procurement cycle and lead time.

Documentation Challenges
The inventory tracking system was largely manual, and, although the average accuracy of the stock cards was 78%, there were problems and errors when filling them. In addition, the available data on order numbers and expiration dates of orders received was limited.

Baseline assessment of inventory management systems for HIV-test supplies
Quantitative Results

Availability status of Rapid HIV-testing kits
At the time of the physical count, 67% of HIV testing kits were available. This was a proportion of available kits at the time of stock assessment N=9.

Stock out of HIV-testing kits
From June 2022 to March 2023, the laboratory experienced stockouts of at least one of the HIV-testing kits in the last six months (Figure 1). The highest peak of stock out (24% stockout) occurred in October 2022, indicating a critical period that required attention.

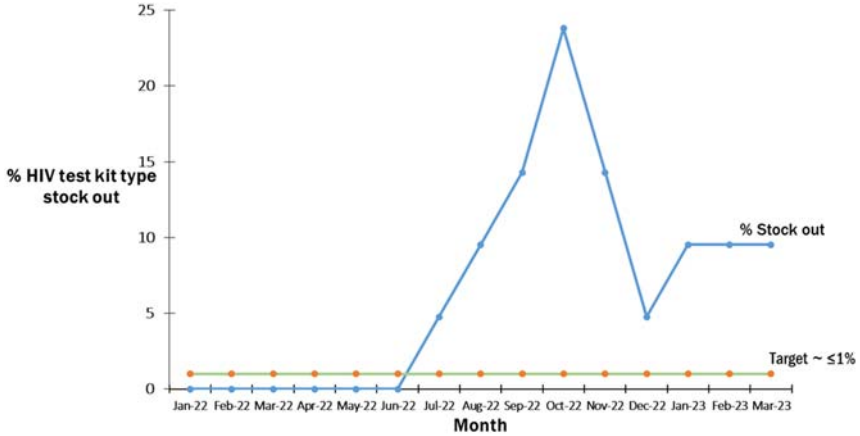


Figure 1:Stock out of HIV-testing kits in the laboratory from January-2022 to March 2023

Continues to page 26

Continued from page 25

Data accuracy of stock cards

The stock cards documentation practice was good with an average accuracy of 78% for the HIV-testing kits.

Interventions: We proposed the following changes to address the issues identified. The proposed changes included: standardizing the reordering and restocking system, assigning a focal person to monitor inventory stock levels, and developing a consolidated tool to track the quantity of HIV-testing kits.

Final evaluation of the quality improvement project
After implementing the QI project in the high-volume HIV testing laboratory, the stockout of HIV-testing kits was reduced to 0%.

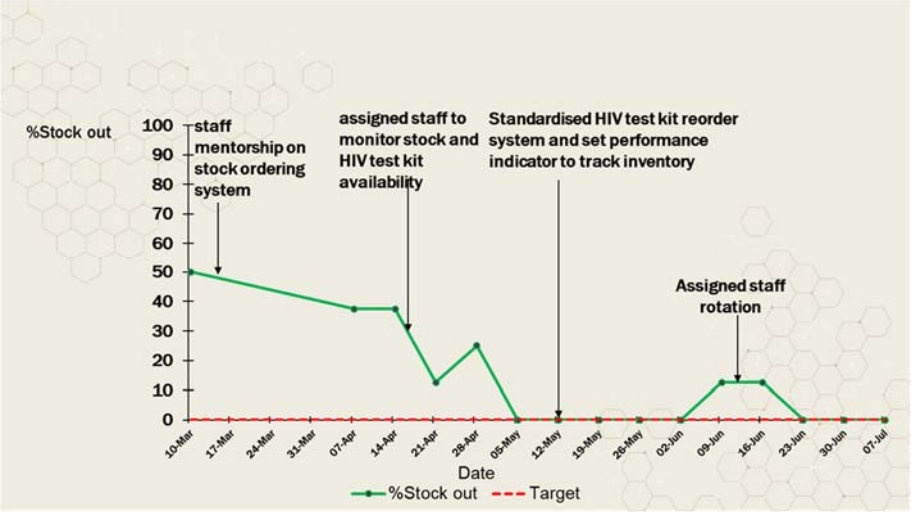


Figure 2: Tested changes implemented in the laboratory March to June 2023

Discussion

The WHO guidelines emphasize the role of HIV testing and counseling services as an entry point to diagnosis and in facilitating access to appropriate HIV prevention, treatment and care (13). Therefore, scaling up HIV testing plays an important role in HIV control in sub-Saharan Africa (14). Proper inventory management of HIV testing kits is critical to ensure timely availability of testing kits (7). In this regard, we implemented a quality improvement project at a high-volume testing laboratory in Kampala between March and July 2023. Overall, our Quality Improvement Project (QIP) demonstrated an improvement of HIV-testing kit availability at a high-volume testing laboratory in Kampala from 67% to 100%.

This was attributed to the implementation of a standardized reordering system with tracking tools and the assignment of a trained focal person to monitor the inventory of HIV testing kits. The formation of a quality improvement team, which included the laboratory's quality manager, store staff and laboratory technologists who provided bi-weekly reports to management, was also a key component in this project as it maintained the implementation of the QIP and encouraged staff to take a proactive measure like placing timely orders to avoid stock-outs. As trained staff were transferred to other departments in the laboratory, stock-outs increased, demonstrating the importance of trained staff to monitor stock. Teamwork within the QIP team may have resulted in improved reporting of HIV testing kit inventory status. In addition, the use of appropriate data collection tools contributed to improved availability of HIV-testing kit. Training the team on the standardized reordering system also contributed to improved availability of HIV-testing kit.

Study limitations
We did not directly involve all laboratory staff in this quality improvement (QI) project. Consequently, the success of the project may be impacted if key staff members are no longer available, such as when they transfer to another department without adequately training new personnel, or when new staff members join without receiving proper orientation.

Conclusion and recommendations
The CQI project resulted into no stockout of HIV-testing kits in the laboratory during the entire study period. Improving the availability of HIV-testing kits was associated with standardizing of the HIV testing kit reordering system and the assigning trained focal staff to monitor stock. We recommend the laboratory to institutionalize the standardized reordering system to sustain the improvement and expand the strategies to include other test kits used in the laboratory.

Conflict of Interest
The authors declare that they had no conflict of interest.

Authors contribution
AP, designed the study and contributed to data analysis. AP led the

Continued from page 26

writing of the bulletin. SG, BSB, AK, KS, BK, BK, BN, EN, DO, LA, AN, LB, and ARA participated in bulletin writing and review to ensure scientific integrity and intellectual content. All authors contributed to the final draft of the bulletin. All authors read and approved the final bulletin.

Acknowledgements
The authors are indebted to the Infectious Diseases Institute, and Uganda Public Health Fellowship for the technical support during the execution of the project and article writing. We thank Laboratory Leadership Fellowship Program cohort 2023 Fellows for the technical support during the execution of this investigation.

References

1. Frescura L, Godfrey-Faussett P, Feizzadeh A A, El-Sadr W, Syarif O, Ghys PD. Achieving the 95 95 95 targets for all: A pathway to ending AIDS. PLoS One. 2022;17(8):e0272405.
2. UNAIDS. Global HIV & AIDS statistics — Fact sheet. Fact Sheet 2023 [Internet]. 2023;1–6. Available from: +
http://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf
3. Sibanda EL, Taegtmeyer M. Inequalities in uptake of HIV testing despite scale-up. Lancet Glob Heal. 2020 Jun;8(6):e744–5.
4. Tania C, Doug T, Greet B, Katrien F, Lut VD. Performance of a Rapid and Simple HIV Testing Algorithm in a Multicenter Phase III Microbicide Clinical Trial. Clin Vaccine Immunol [Internet]. 2011 Sep 1;18(9):1480–5. Available from: https://doi.org/10.1128/CVI.05069-11
5. Lule F, Rajab K, Banzimana S, Asingizwe D. Assessing determinants of the availability of HIV tracer commodities in health facilities in Wakiso District, Uganda. J Pharm policy Pract. 2024;17 (1):2306846.
6. Lugada E, Ochola I, Kirunda A, Sembatya M, Mwebaze S, Olowo M, et al. Health supply chain system in Uganda: assessment of status and of performance of health facilities. J Pharm Policy Pract [Internet]. 2022;15(1):58. Available from: https://doi.org/10.1186/s40545-022-00452-w
7. Bekele A, Gemechu F, Ayalew M. Assessment of HIV Rapid Test Kits Inventory Management Practice and Challenges in Public Health Facilities of Addis Ababa, Ethiopia. Integr Pharm Res Pract [Internet]. 2022 Mar 25;11(null):85–94. Available from: https://www.tandfonline.com/doi/abs/10.2147/IPRP.S356134
8. MOH. Facility Tracer Medicines Stock Status Summary Report September 2023. 2023; (September):79–81.
9. Nguyen V, Nguyen N, Schumacher B, Tran T. applied sciences Practical Application of Plan – Do – Check – Act Cycle for Quality Improvement of Sustainable Packaging : Appl Sci [Internet]. 2020;10(6332):1–15. Available from: doi:10.3390/app10186332
10. Taufik DA. PDCA Cycle Method implementation in Industries: A Systematic Literature Review. IJIEM - Indones J Ind Eng Manag. 2020;1(3):157.
11. Kits HIVT. Logistics Indicators Assessment Tool (Liat) Hiv Test Kits. 2008;(June):1–44. Available from: https://pdf.usaid.gov/pdf_docs/Pnade735.pdf
12. Agency U. The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities. USAID | Deliv Proj Task Order 1 [Internet]. 2011;174. Available from: http://deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/LogiHand.pdf
13. WHO. Consolidated guidelines on HIV testing services. N C Med J [Internet]. 2019;53(1):55. Available from: https://www.who.int/publications/i/item/978-92-4-155058-1
14. Mannoh I, Amundsen D, Turpin G, Lyons CE, Viswasam N, Hahn E, et al. A Systematic Review of HIV Testing Implementation Strategies in Sub-Saharan African Countries. AIDS Behav. 2022 May;26(5):1660–71.

Continues to page 28

Continued from page 27

Laboratory response to an acute conjunctivitis outbreak, Uganda Prisons Luzira, Kampala, Uganda March, 2024

Authors: Wilfred Opeli*[1,2], Anne Martha Nankya[1,3], Alisen Ayitewala[4], Moses Kisakye[2], Emma Amalai[5], Javis Tumwesige[5], Bryn Odaga[6], Richard Walwema[7], Esther Nabatta[1,8], Ronald Samuel Lugwana[1,9], Ritah Namusoosa[1,4], Tracy Rutogire[1,3], Winnie Agwang[1,10], Hannington Katumba[1], Charity Mutesi[1], Emmanuel Mfitundinda[1], Owens Joyce Kobusingye[1], Daniel Wenani[1], Loryndah Olive Namakula[1], Emmanuel Okiror Okello[1], Janet Lubega Kobusinge[1], Getrude Abbo[1], Annet Mary Namusisi[1], Bridget Ainembabazi[1], Patrick Kwizera[1], Joshua Kayiwa[1], Milton Wetaka[1], Stephen Balinandi[3], John Kayiwa[3], Rebecca Nakidde[3], Ibrahim Mugerwa[3], Grace Najjuka[3], Isaac Ssewanyana[3], Atek Kagirita[3], Susan Nabadda[3], Samuel Gidudu[1] and Alex Riolexus Ario[1]

Institutional affiliations

[1]Uganda National Institute of Public Health, Ministry of Health, Kampala, [2]Uganda Prisons Services, Kampala, Uganda, [3]Uganda Virus Research Institute, Ministry of Health, Entebbe, Wakiso, [4]National Health Laboratory and Diagnostics Services, Ministry of Health, Kampala, Uganda, [5]Kampala Capital City Authority, Kampala, Uganda, [6]Kampala Metropolitan Area Public Health Emergency Operations Centre, Kampala, Uganda, [7]Infectious Disease Institute of Uganda, Kampala, Uganda, [8]National Animal Disease Diagnostics and Epidemiology Center, MAAIF, Entebbe, Wakiso, [9]Mengo Hospital, Kampala, Uganda, [10]Baylor College of Medicine Children's Foundation, Kampala, Uganda,

Correspondence: Tel: +256773229025, Email: wopeli@uniph.go.ug

Summary

Background: In March 2024, Kampala Capital City Authority (KCCA) and Ministry of Health Uganda (MOH) reported a suspected outbreak of conjunctivitis (red eye) in Uganda Prisons, Luzira. On March 12, 2024, the Ministry of Health (MOH) deployed a multi-disciplinary team to support the Uganda Prisons Service (UPS) respond to the conjunctivitis outbreak. The Laboratory Leadership Track supported the UPS in coordinating laboratory activities; mentor staff, monitoring sample collection, referral, tracking and receipt of results. We suggested recommendations to strengthen laboratory systems for any future outbreak responses.

Methods: We had meetings with prisons' management. We assessed capacity of UPS laboratories in Luzira to conduct the outbreak investigation and conducted mentorships, coordinated the collection tracking of samples, referral and relay of test results for timely public intervention and patient management.

Results: The Luzira laboratory testing capacity was identified to be at 43%, below the 80% WHO target. The prisons laboratory team collected and referred a total of 116 eye swab samples from 56 suspected cases. The turnaround time (TAT) from sample collection to pick up and result dispatch was within 1 and 7 days respectively for samples referred. Sample results from Uganda Virus Research Institute (UVRI) identified enterovirus C as the causative agent for the conjunctivitis outbreak in UPS Luzira.

Conclusion: The UPS laboratory and response team ably responded to the conjunctivitis outbreak. Stakeholders were identified and engaged in coordinating laboratory activities from sample collection to receipt of results. However, a need to build laboratory testing capacity for any future outbreak response is recommended.

Background

Conjunctivitis is an infection characterized by a red eye with any or all of the following symptoms; swelling, itching, tearing, irritation and sticky discharge of the eyes whose lids may be stuck together by a mucopurulent exudate on awakening (1). The cause of conjunctivitis infection can either be bacteria, viruses, fungal or an allergic reaction.

Conjunctivitis in a closed setting like prisons is declared when there is a rapid increase in cases especially when they are clustered by time and location and if there is evidence of transmission from person to person (5)**.** The Uganda Prison Services on the 7th of March 2024 notified the Kampala Capital City Authority (KCCA) of a possible outbreak of conjunctivitis (red eye infection) in Kampala Remand prisons with 314 suspects registered. On the 12th of March, 2024, the MOH deployed a multi-disciplinary team of national rapid responders (laboratory leaders and field epidemiologists) to support UPS response to the conjunctivitis outbreak. The source of the infection for Luzira prisons was reported to be Makindye police station, with the initial index case originating from Nabutiti zone, Kansanga, Makindye division. In addition to prisons, schools in Nakawa and Rubaga divisions of Kampala district also registered suspected cases of conjunctivitis.

We identified key stakeholders and partners to offer technical and logistical support to the conjunctivitis outbreak response.

Continued from page 28

We also sought to assess and build the capacity of the Uganda Prisons laboratories in Luzira in coordinating the conjunctivitis outbreak response by mentoring laboratory staff monitoring on sample collection, referral, transportation, receipt at referral testing laboratory and time of return of results to the referring laboratory. We suggested recommendations for future laboratory interventions during an outbreak response based on their findings.

Methods

The Outbreak occurred at the four prison units under the Kampala Extra Region (KER), namely: Murchison Bay, Kampala Remand, Luzira Upper and Luzira Women prisons. The KER is one of 16 Regional Prisons in the Uganda Prisons Service located approximately 6 km east of Kampala Capital City Centre with a population of 8,098 inmates and 13,897 staff, family, and neighboring community. KER has 5 health facilities with laboratories; Murchison Bay Hospital, Luzira staff clinic HC IV, Kampala Remand Prison HC III, Luzira Upper Maximum Prison HCIII and Luzira Women Prison HC III.

We identified partners and stakeholders in this response that would support the laboratory outbreak response investigation. We defined their roles and responsibilities according to the needs found at the prison laboratory.

We assessed the capacity of Luzira prison laboratories to coordinate laboratory response activities using the WHO laboratory assessment tool, 2012.

Luzira staff clinic HCIV was the sample collection hub and national sample transport system was used to refer samples to the testing laboratories. Together with partners, we mobilized sample collection materials. Two or three samples were collected from each suspected case depending on sample adequacy and tests to be performed. Samples were collected and transported to the National Microbiology Reference Laboratory (NMRL) at the National Health Laboratory and Diagnostic Services (NHLDS) for testing.

This investigation was in response to the conjunctivitis outbreak in Uganda Prisons**.** The office of the Center for Global Health, US Center for Disease Control and Prevention determined that this activity was not a human subject research and its primary intent was for disease control. Permission was obtained from the Uganda Prisons authorities to access the facilities and inmates. Verbal consent was sought from all participants participants and their identities kept private by use of codes and no personal identifiers. Participation was voluntary and without coercion and no penalties imposed for refusal.

Results

Partners and stakeholders identified to participate in the laboratory response

We identified two reference laboratories (Uganda National Health Laboratory and Diagnostic Services and Uganda Virus Research Institute) which were charged with transportation and testing of samples collected from the outbreak response area. Other partners include the Luzira prisons clinical and surveillance team and National Medical Stores. Stakeholders identified included Baylor College of Medicine – Uganda and Infectious Disease Institute that supported the outbreak response with development of conjunctivitis outbreak response guidelines, logistical and technical support. **Laboratory capacity assessment and capacity building**

The Uganda prison Luzira laboratory's capacity to respond to the red eye outbreak was at an average of 43% which is below the recommended 80 (Figure 1).

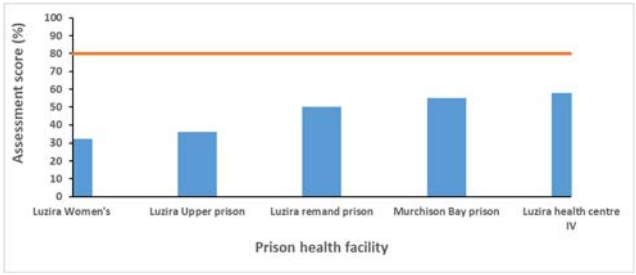


Figure 1: Average assessment score for the different laboratories in Uganda prisons Luzira, March 2024

All key functions assessed were below the required 80% target.. Scores below 50% required immediate interventions; sample management, response management, data management, lab surveillance, supply availability, bio-risk management and testing capacity (Figure 2).

Continues to page 30

Continued from page 29

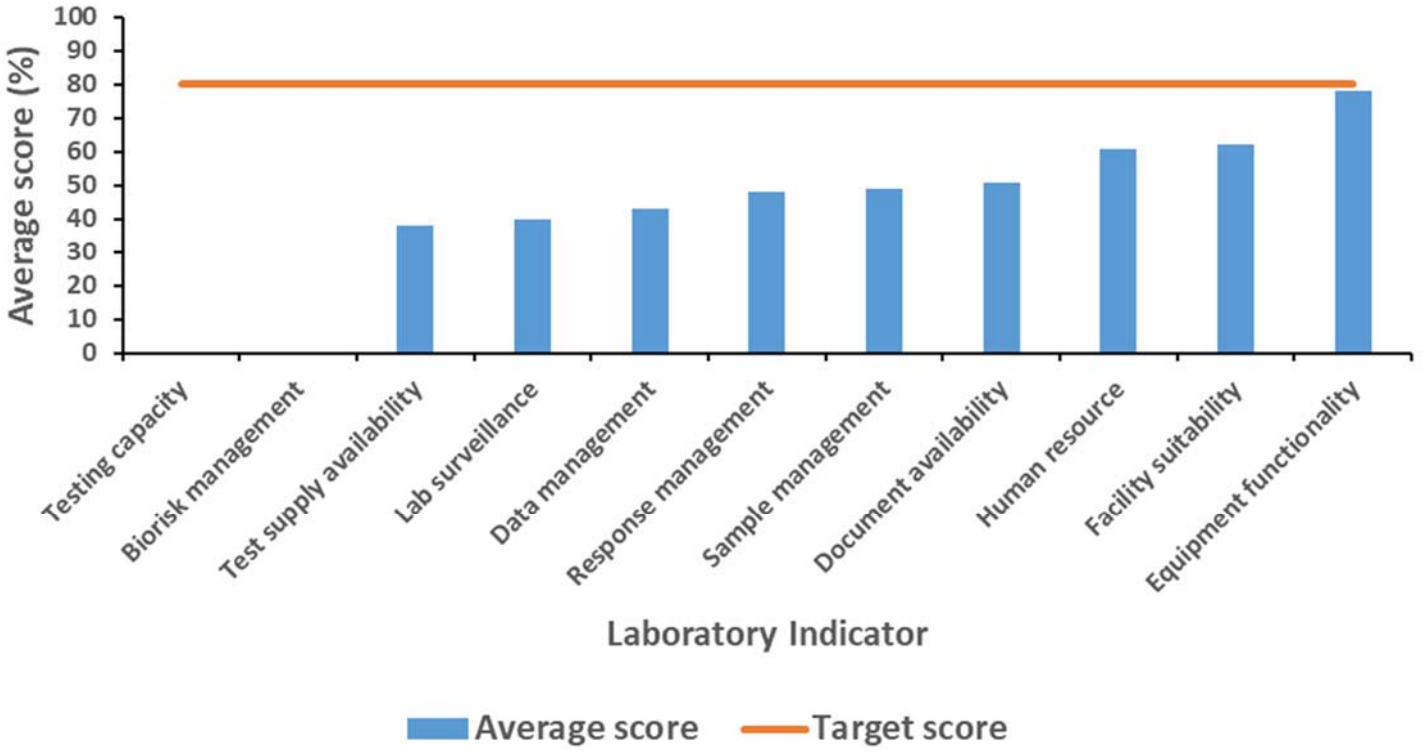


Figure 2: Scores for key indicators, Uganda prisons Luzira Laboratories, during a conjunctivitis outbreak response, March 2024

Based on the assessment results, we facilitated the development of sample and logistics trackers, and carried out staff mentorship on sample collection, packaging and transportation, laboratory data and logistics management. Twelve laboratory personnel and 1 ophthalmic officer were mentored.

Sample collection, transportation, and testing

As of 26th, March 2024, 116 samples were collected from 59 suspected cases. All samples collected were transported within 24 hours after collection to the NHLDS and UVRI reference laboratories.

Enterovirus C nucleic acid was confirmed present in four patients with red eyes in Murchison Bay (3) and Kampala Remand prisons (1).

Discussion

This investigation of conjunctivitis in a Uganda prisons highlighted and provided critical insights into laboratory capacity for infectious disease outbreak preparedness and response in a closed setting. The investigation found the UPS Luzira laboratory capacity at 43% which is below the 80% WHO recommendation indicating a low capacity to adequately respond to the conjunctivitis outbreak.

Laboratory infrastructure, supply shortages and the lack of bio-safety/biosecurity measures were some of the major challenges identified during the outbreak response. Given that the institution has adequate laboratory staffing, it's essential that the facilities are supplied and equipped so as to be able to provide baseline investigations such as gram staining for screening purposes. There is also need to put in place biosafety/biosecurity measures for infection, prevention and control purposes.

It is important to maintain a proper laboratory data management system for effective infectious disease surveillance. This not only helps in the monitoring of disease trends and patterns but also helps in early case detection and follow-up. Though the prisons health system was able to detect the conjunctivitis outbreak early, there was poor record keeping and documentation of suspected cases.

Continued from page 30

There was generally a lack of a preparedness and response plan aimed at addressing any eventual infectious disease outbreak. A functional system designed to forecast and respond to a public health emergency ensures resource availability, active surveillance, data management, adequate supplies, equipment functionality, testing capacity and a well oriented laboratory work force for any eventual outbreaks in peace time.

The laboratory capacity at Luzira prisons to conduct screening tests like Gram staining technique was limited and lacked a basic microbiology section to perform culture tests.

Study limitations

The findings of this conjunctivitis outbreak response cannot be generalized to the other up country prisons units and national situation given its limited coverage area, environmental and short intervention period.

Conclusions

The laboratory response team assessed the capacity of the Luzira prisons laboratory to respond to the conjunctivitis outbreak and with the support of reference laboratory's identified *Enterococcus* type C virus as the causative agent which helped inform public health interventions.

Recommendations

We recommend that the Prisons Health authority develop of a laboratory outbreak response plan and carry out regular training of laboratory staff in outbreak response preparation and response, biosafety and biorisk management.

Conflict of interest: The authors declare that they had no conflict of interest.

Acknowledgements: We are grateful to the administration of Uganda Prisons Service for allowing us carry out this intervention. We also thank Baylor Uganda and Infectious Diseases Institute for their technical and logistical support and US Centers for Disease Control and Prevention through Makerere University School of Public Health and Baylor Uganda financial and technical support.

References

1. Azari AA, Arabi A. Conjunctivitis: a systematic review. Journal of ophthalmic & vision research. 2020;15(3):372.

2. Yeu E, Hauswirth S. A review of the differential diagnosis of acute infectious conjunctivitis: implications for treatment and management. Clinical Ophthalmology. 2020:805-13.

3. Kowalski RP, Nayyar SV, Romanowski EG, Shanks RM, Mammen A, Dhaliwal DK, et al. The prevalence of bacteria, fungi, viruses, and acanthamoeba from 3,004 cases of keratitis, endophthalmitis, and conjunctivitis. Eye & contact lens. 2020;46(5):265-8.

4. Johnson D, Liu D, Simel D. Does this patient with acute infectious conjunctivitis have a bacterial infection?: The rational clinical examination systematic review. JAMA. 2022;327(22):2231-7.

5. Kaur G, Seitzman GD, Lietman TM, McLeod SD, Porco TC, Doan T, et al. Keeping an eye on pink eye: a global conjunctivitis outbreak expert survey. International Health. 2022;14(5):542-4.

Continues to page 32

Continued from page 31

Perinatal deaths in Kampala Metropolitan Area: A descriptive analysis of trends, 2020-2023

Authors: Joanita Nalwanga[1], Benon Kwesiga[1], Richard Migisha[1], Patricia Eyu[1], Alex Ndyabakira[2], Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Uganda, [2]Directorate of Public Health and Environment, Kampala Capital City Authority, Kampala, Uganda
Correspondence: Tel: +256775637042, Email: jnalwanga@uniph.go.ug

Summary
Background: Uganda's perinatal death (PD) rate was 17.8/1,000 births in 2022/2023, higher than Every Newborn Action Plan and SDG 3 target of ≤12 per 1,000 births by 2030. To reduce the burden, Uganda is implementing the maternal and perinatal death surveillance and response (MPDSR) in health facilities. We described the trends, and distribution of perinatal deaths in Kampala Metropolitan Area (KMA) and avoidable delays contributing to perinatal deaths in Kampala city, 2020-2023.
Method: We abstracted quarterly PD and total births data for KMA, i.e., Kampala, Wakiso, Mukono, and Mpigi districts from the District Health Information Software (DHIS2) for the period 2020–2023. Data on delays were available from the PD reviews that are carried out by health facilities using the MPDSR tool and uploaded into the DHIS2. PDs were calculated as a sum of macerated stillbirths (MSB), fresh stillbirths (FSB), and early neonatal deaths (END). PD rate was calculated as number of PDs per 1,000 births and stratified by district. Descriptive statistics and trend analysis were used to summarize changes in PD overall and at district level. We assessed the significance of PD rate trends using the Mann-Kendall test. We analyzed the Kampala PD reviews results to identify delays contributing to PD.
Results: Overall, KMA recorded 17,184 PDs during 2020–2023: 13,008 (75.7%) from Kampala, 2,498 (14.5%) for Wakiso, 1,154 (6.7%) for Mukono, and 524 (3.1%) for Mpigi. The average annual PD rate in KMA was 17/1,000 births, declining from 18.2/1,000 births (2020) to 15.8/1,000 births (2023) (p=0.0078). The average PD rate was highest in Kampala: (29.2/1,000 births) and lower in Mpigi (12.7/1,000 births), Mukono (12.2/1,000 births), and Wakiso (12.1/1,000 births) districts. The most common contributing factors for PDs in Kampala were delays in seeking healthcare (28%, n=10,192) and delays in reaching the health facility (23%, n=10,192).
Conclusion: The reduction in PD rate shows positive progress towards prevention of perinatal deaths in KMA particularly in Mpigi, Mukono, and Wakiso where the target has almost been achieved. higher compared to the target of 12/1,000 births.

Continuous education of mothers on timely seeking of care will be needed to save the lives of babies.

Background

A perinatal death is a fetal demise at 28 weeks of gestation onwards to a 7 days' brief survival of a live birth(1). Perinatal deaths comprise of stillbirths (fresh still births (FSB), macerated still births (MSB) and early neonatal deaths (END) that survive for only a week. In the financial year 2022/2023, Uganda registered a perinatal death rate of 17.8/1,000 births reported by health facilities(3).

To avert perinatal deaths, Uganda conducts surveillance on perinatal deaths using the maternal perinatal death surveillance and response (MPDSR) guidelines as a quality improvement tool for preventing their reoccurrence (1). Under the MPDSR system, perinatal deaths are reviewed using the three delays model to identify gaps at deciding to seek care (delay 1), reaching/ linking to care (delay 2), and the quality of care received before, during and after child birth (delay 3)(1). Uganda is working towards achieving and maintaining the ENAP and SDG 3 target of reducing perinatal deaths by decreasing the still birth rate to ≤12/1,000 births and neonatal death rate to ≤ 12/1,000 live births by 2030 (4).

The country has continued to implement several interventions towards quality perinatal health, including increased access to care for pregnant women, surveillance, and perinatal death reviews (3,5). Despite the increased access to care among urban dwellers, the KMA continues to experience perinatal deaths. We described the trends, and distribution of perinatal deaths in KMA and avoidable delays contributing to perinatal deaths in Kampala city, 2020-2023.

Methods: We considered the four districts that fall under the political jurisdiction of the Ministry of Kampala metropolitan affairs. These include Kampala, Wakiso, Mukono, and Mpigi ..We conducted a descriptive study using perinatal deaths surveillance data for KMA and avoidable delays that contributed to perinatal deaths in Kampala, 2020-2023.

Continued from page 32

Data was abstracted from the District Health Information Software 2 (DHIS2). Additionally, health facilities carry out perinatal death reviews using the MPDSR guidelines and upload the findings on possible delays contributing to perinatal deaths into DHIS2.

We abstracted quarterly data on macerated stillbirths (MSB), fresh stillbirths (FSB), and early neonatal deaths (END), total births, livebirths from 2020 to 2023, from Wakiso, Mukono, Mpigi and Kampala. Perinatal deaths were a sum of MSB, FSB and END.

We further abstracted data on delays to calculate the proportions of the delays contributing to perinatal deaths in Kampala city over the study period.

We calculated quarterly and annual perinatal death rate for the districts in KMA. The study used ≤12/1,000 births as the target against which to measure perinatal death rate. We further calculated the average annual percentage change in perinatal death rate for KMA and the districts. We calculated the proportions of each avoidable delays as a percentage of the total number of delays abstracted for Kampala city over the study period.
We described annual trends in perinatal death rates using line graphs and performed Mann Kendal test to establish significance of the trends.

We obtained a non-research determination from the US CDC. The data was aggregated with no individual identifiers, stored on a password protected computer and only accessed by the study team.

Results

Perinatal death rate in Kampala metropolitan area, 2020–2023

A total of 17,184 perinatal deaths for KMA were reported during 2020-2023. Of these, 6,438 (37.5%) were MSB, 5,225 (30.4) FSB and 5,521 (32.1%) END. Most of the perinatal deaths were from Kampala District at 13,008 (75.7%), followed by Wakiso with 2,498 (14.5), Mukono, 1,154 (6.7%), and Mpigi 524 (3.1%). Overall, the average perinatal death rate for KMA for the study period was 17/1,000 births of which Kampala District reported 29.2/1,000 births, Mukono,12.2/1,000 births, Mpigi, 12.7/1,000 births, and Wakiso,12.1/1,000.

Temporal trends in perinatal death rate KMA, 2020 – 2023

Overall, KMA had a 13% reduction in perinatal death rate over the study period, from 18/1,000 in 2020 to 16/1,000 in 2023 (P=0.028). Similarly, Mpigi reduced by 33% from 16/1,000 births to 11/1,000 births (P=0.036), Mukono dropped by 25% from 14/1,000 births to 11/1,000 births (P=0.002), Kampala and Wakiso had nonsignificant (P=0.78) reduction in perinatal death rates (Figure 1).

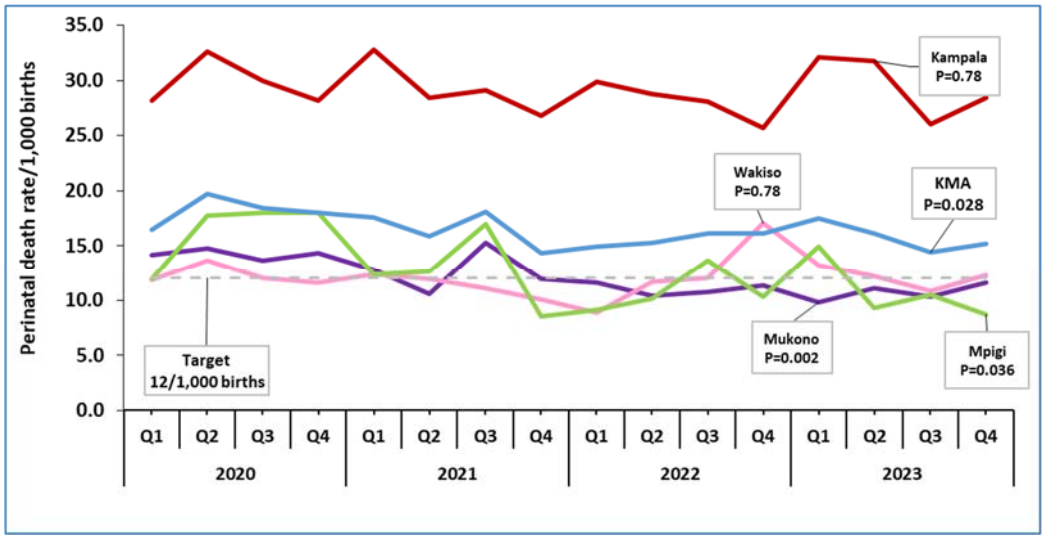


Figure 1: Trends of perinatal deaths in Kampala Metropolitan Area districts, 2020-2023

Continues to page 34

Continued from page 33

Proportion of avoidable delays that lead to perinatal deaths, Kampala, 2020-2023
The most common avoidable risk influencing perinatal deaths was delay for mothers to seek health care services (Figure 2).

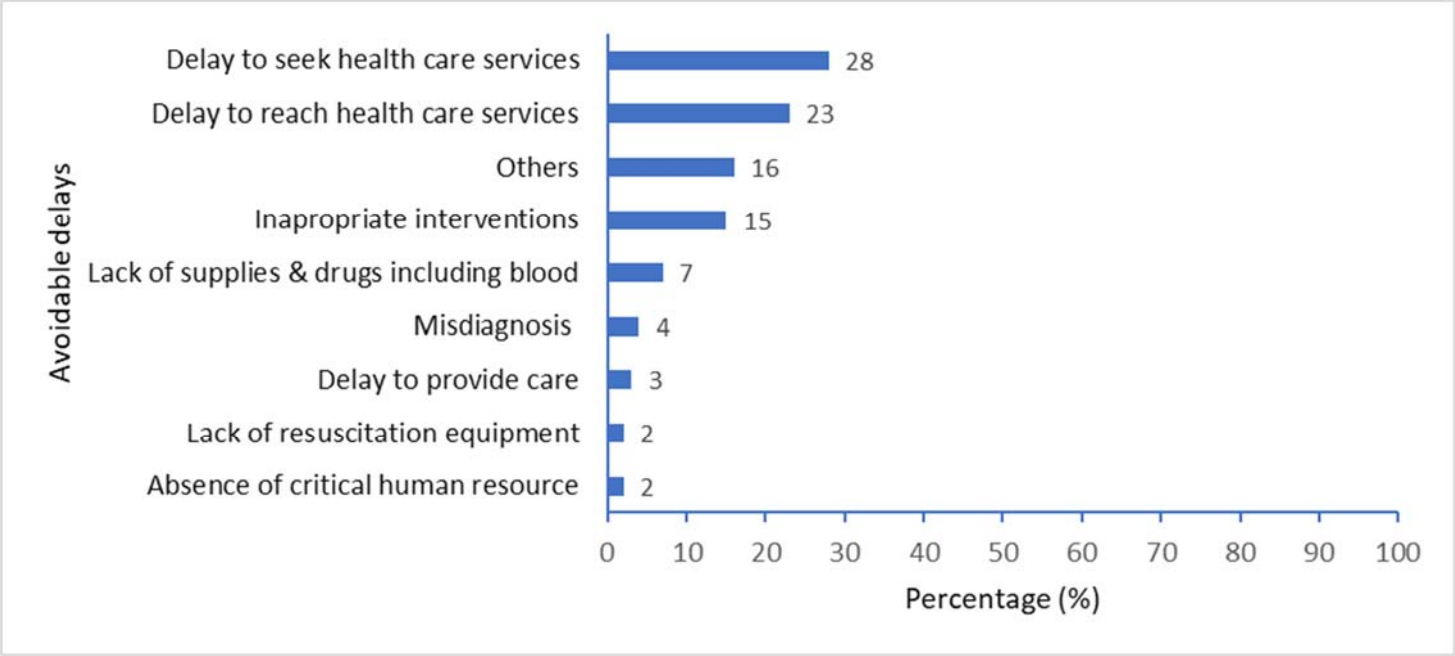


Figure 2: Avoidable delays for perinatal deaths, Kampala, 2020-2023

Discussion

We described the temporal and spatial trends of perinatal deaths at KMA. We further described the delays contributing to perinatal deaths in Kampala city. We observed that although there was a significant reduction in perinatal death rate in KMA, it was still above the ≤ 12/1,000 births target. Most of the perinatal deaths within KMA were from Kampala. Delay to seek health services contributed to most of the avoidable linked to perinatal deaths within Kampala City. The decline in the perinatal death rate for KMA is similar to the global and national picture (2,3). This could be due to the continued implementation of MPDSR in Uganda through which gaps are identified and interventions are implemented to prevent similar occurrences (3).

There were variations in the perinatal death rate for each of the individual KMA districts with Kampala having a consistently high rate during the study period. This could be because Kampala hosts the national referral and specialized women's hospitals hence receives most of the critical patients in addition to its numerous social challenges associated with slums and informal settlements (6,7,8).

This study found out that delay in seeking care was the most frequently reported avoidable factor linked to perinatal deaths in Kampala. This can be addressed by continuously educating women to prioritize women related health needs such as antenatal care and community engagement using already existing structures like the Village Health Team (VHT) system (9,10,11).

Study limitations
The study utilized secondary data characterized by missing data. This could lead to either over or under estimation of the study outcomes.

Conclusion
There was a significant reduction in perinatal death rate for KMA showing positive progress towards prevention of perinatal deaths. The most reported avoidable delay contributing to perinatal deaths in Kampala was a delay in seeking care.

Continued from page 34

Recommendations
Further studies are recommended to determine where mothers who utilize KMA health facilities reside in order for the Ministry of health to assess and address specific challenges associated with the quality of maternal and newborn care in those particular regions. Additionally, Kampala Capital City Authority may consider involving the community in their own health by engaging community health workers or VHTs teams to carry out community sensitization and conduct home visits to pregnant women and newborns, as a way of ensuring that they attend and receive timely antenatal and postnatal services.

Conflict of interest
None

Authors Contribution
JN, AN, GM conceived and designed the analysis. JN and GM contributed to the data analysis. JN, wrote the bulletin. AN, GM, PA, and AA reviewed the bulletin to ensure scientific integrity.

Acknowledgements
We thank all MPDSR stakeholders in Kampala metropolitan area for reviewing and documenting perinatal deaths hence making the data available. We acknowledge the Uganda Public Health Fellowship Program for technical support. We also acknowledge Makerere University School of Public Health and the US Centers for Disease Control and Prevention for implementation support.

References

1. Maternal-and-Perinatal-Death-Surveillance-and-Response-Guidelines-August-2017.pdf [MoH]. [cited 2024 Aug 7]. Available from: https://www.health.go.ug/wp-content/uploads/2019/11/Maternal-And-Perinatal-Death-Surveillance-And-Response-Guidelines-August-2017.pdf
2. Newborn mortality [WHO]. [cited 2024 Aug 7]. Available from: https://www.who.int/news-room/fact-sheets/detail/newborn-mortality
3. National MPDSR Report for FY 2022-2023, 7th Edition.pdf [MoH]. [cited 2024 Aug 7]. Available from: http://library.health.go.ug/sites/default/files/resources/National%20MPDSR%20Report%20for%20FY%202022-2023%2C%207th%20Edition.pdf
4. World Health Organization. Every newborn: an action plan to end preventable deaths [Internet]. Geneva: World Health Organization; 2014 [cited 2024 Aug 7]. 55 p. Available from: https://iris.who.int/handle/10665/127938
5. World health statistics 2024 [WHO]. [cited 2024 Aug 6]. Available from: https://iris.who.int/bitstream/handle/10665/376869/9789240094703-eng.pdf?sequence=1

6. Hospitals. Ministry of Health | Government of Uganda. 2022 [cited 2024 Nov 24]. Available from: https://www.health.go.ug/hospitals/
7. Macharia PM, Beňová L, Pinchoff J, Semaan A, Pembe AB, Christou A, et al. Neonatal and perinatal mortality in the urban continuum: a geospatial analysis of the household survey, satellite imagery and travel time data in Tanzania. BMJ Glob Health. 2023 Apr 1;8(4):e011253.
8. Every Newborn Action Plan [Internet]. [cited 2024 Aug 7]. Available from: https://www.who.int/initiatives/every-newborn-action-plan
9. Tumwizere G, K. Mbonye M, Ndugga P. Determinants of late antenatal care attendance among high parity women in Uganda: analysis of the 2016 Uganda demographic and health survey. BMC Pregnancy Childbirth. 2024 Jan 5;24(1):32.
10. Atukunda EC, Mugyenyi GR, Obua C, Musiimenta A, Najjuma JN, Agaba E, et al. When Women Deliver at Home Without a Skilled Birth Attendant: A Qualitative Study on the Role of Health Care Systems in the Increasing Home Births Among Rural Women in Southwestern Uganda. Int J Womens Health. 2020 May 27;12(null):423–34.

Continues to page 36

Spatial and temporal trends of conjunctivitis, Uganda, 2020-2023: An analysis of Health Management Information System

Authors: Gertrude Abbo[1*], Benon Kwesiga[1], Richard Migisha[1], Patricia Eyu[1], Hilda Nansikombi[1], Alex Riolexus Ario[1]
Institutional Affiliations:[1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health
Correspondence*: Tel: +256 773 237156, Email: abbog@uniph.go.ug

Summary

Background: Annually, an estimated 30 million people in Sub-Saharan Africa are affected by conjunctivitis. Little is known about the temporal and spatial trends of conjunctivitis in Uganda. We described the spatial and temporal trends of conjunctivitis, Uganda, 2020–2023.
Methods: We conducted a descriptive study using conjunctivitis surveillance data abstracted from the District Health Information System 2 (DHIS2), 2020-2023. As per DHIS2, conjunctivitis was defined as the aggregate of allergic, bacterial, and other forms of conjunctivitis cases. Data were abstracted monthly and incidence rates were calculated by sex, age, and year. We generated trends and tested the significance of trends using Man Kendall test.
Results: Up to 4,550,193 cases of conjunctivitis were reported over the 4-year period, with an overall incidence of 26/1,000 population. Children aged 0-4years were most affected with an average incidence rate of 74 /1,000 population. Males were more affected than females with an incidence rate of 27 /1,000 population. Annual seasonal spikes were observed throughout the study period in March and September. Allergic conjunctivitis was the most frequently reported type constituting almost half of the cases (48%). Annual incidence increased from 26 /1,000 population in 2020 to 27/1,000 population in 2023. However, this increase was not statistically significant (p=0.67).
Conclusion: The country experienced annual seasonal spikes in the months of March and September each year. Children aged 0-4 years and males were the high-risk groups. We recommend health education on avoiding allergens during the spike seasons to reduce on the incidence of allergic conjunctivitis, and surveillance for viral subtypes that are more likely to cause outbreaks

Introduction

Conjunctivitis is a common condition of the eye that occurs worldwide and affects all ages and social strata, affecting more than two percent of the population. It is caused by a variety of bacterial or viral pathogens but may also be caused by allergies, irritants or medications. Although the bacterial type of conjunctivitis characterized by swollen eyelids and pus like discharge are mainly there is no age limit. seen at a young age, there is no age limit. Allergic conjunctivitis is common in children by contact with allergens such as pollen, dust, or pet dander. It presents with redness, itching, and watering of the eyes (1).

In Uganda, an outbreak of bacterial conjunctivitis was reported in 2017 in Gulu District by the Ministry of Health among prisoners(7). On the 7th of March, 2024, the Ugandan Ministry of Health issued a public health notice regarding an ongoing outbreak of conjunctivitis, also known as red eye, in schools and prisons within Kampala District. The outbreak had also been identified in eight prisons in other districts across the country. As of March 13, 2024, a total of 954 cases had been confirmed across Kampala and the affected prisons. Health officials actively conducted surveillance alongside the Kampala City Council Authority to respond to the outbreak(8). However, there remains limited data on the trends and distribution of conjunctivitis in Uganda. Prior to 2020, no data was reported on conjunctivitis and there are limited published studies in our setting on this. We established the spatial and temporal trends of conjunctivitis in Uganda from 2020–2023 and recommend evidence-based control measures that can be used for public health action.

Methods

We conducted a descriptive study using conjunctivitis surveillance data for the entire country abstracted from the District Health Information System 2 (DHIS2), 2020-2023. As per DHIS2, conjunctivitis was defined as the aggregate number of allergic, bacterial and other forms of conjunctivitis. Beginning in 2020, conjunctivitis was reported to the Ministry of Health in Uganda as a count of the number of cases per month from each of the health facilities in the 15 administrative health regions of the country.

We abstracted data about monthly reported conjunctivitis cases classified as allergic, bacterial, and other forms.

Data was summed to obtain the total number of conjunctivitis cases. We calculated the incidence rates by dividing the total number of conjunctivitis cases by the total populations at risk in the different districts

Continued from page 36

per 1,000 in the districts from January 2020 to December 2023. We demonstrated the trends of incidence by age group and year using line graphs.

Data was imported into R software for analysis so as to determine the significance of the trends using Man Kendall test for trends and Sen's slope test for the direction of the trend.

The Uganda ministry of health through the office of the Director General Health Services (DGHS) gave approval to access data from the DHIS-2. We stored the abstracted data set in a password protected computer and only shared it with the investigation team. In addition, the office of the Associate Director for Science, U.S. Centers for Disease Control and Prevention, determined that this study was not human subjects research with the primary intent of improving use of data to guide public health planning and practice.

Results

Proportion of conjunctivitis cases by etiology, Uganda, 2020-2023

Allergic conjunctivitis was the most frequently reported type constituting almost half of the cases (48%) followed by bacterial type of conjunctivitis (45%) in the 4year study period. Other forms of conjunctivitis were the least reported over the 4year period (7%).

Trends of conjunctivitis incidence by Sex, Uganda, 2020-2023

Both males and females were at risk for conjunctivitis with an incidence of 27/1,000 population and 25/1,000 population respectively. The incidence of conjunctivitis reduced over the years among both males and females from an average of 42/1,000 in 2021 to 26/1,000 in 2023. The overall incidence of conjunctivitis in the 4-year period was 26 cases/1,000 population. There was a gradual increase in the incidence of conjunctivitis from 26/1,000 population in 2022 to 27/1,000 population in 2023 [Figure 1].

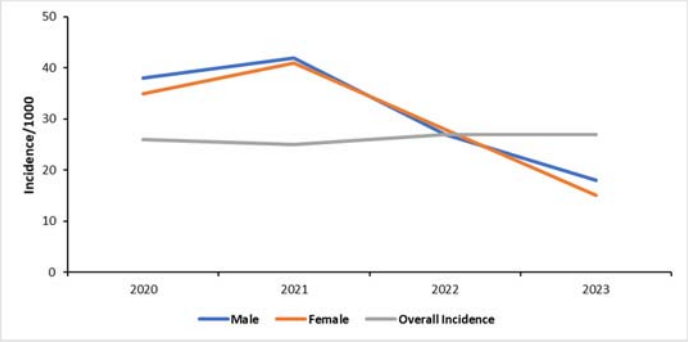


Figure 1: Trends of conjunctivitis incidence by Sex, Uganda, 2020-2023

Trends of conjunctivitis incidence by age group, Uganda, 2020-2023

Children aged 0-4 years were most affected compared to all the other age groups with an average incidence of 74/1,000 population. The incidence of conjunctivitis among this age group increased from 68/1,000 population in 2021 to 81/1,000 population in 2023. Similar increase was observed among age group of those over 5 years [Figure 2].

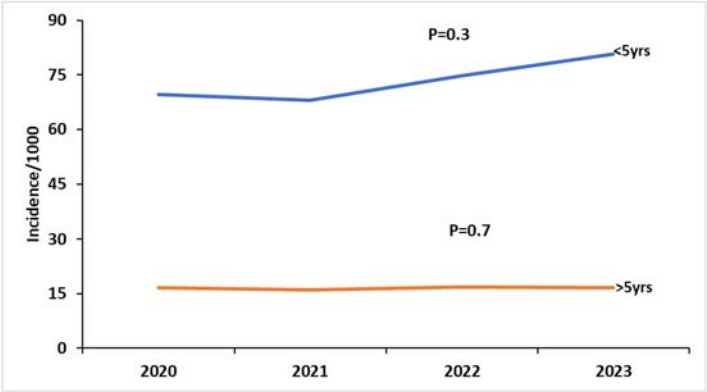


Figure 2: Trends of conjunctivitis incidence by age group, Uganda, 2020-2023

Trends of conjunctivitis cases by year, Uganda, 2020-2023

A total of 4,550,193 cases were reported in the 4-year period with an overall incidence of 26 cases/1000 population. We observed a significant gradual increase in cases reported p=0.002. The incidence rates were relatively low with the highest peak reported in 2020. Seasonal spikes were observed throughout the study period with the seasonal peaks in March and September each year. There was a distinct seasonal pattern each year, with cases peaking in March and or September each year (p=0.002 for seasonal trend) [Figure 3]. No outbreaks were detected throughout the 4-year period.

Continues to page 38

Continued from page 37

The number of cases dropped in November 2023 (Figure 3).

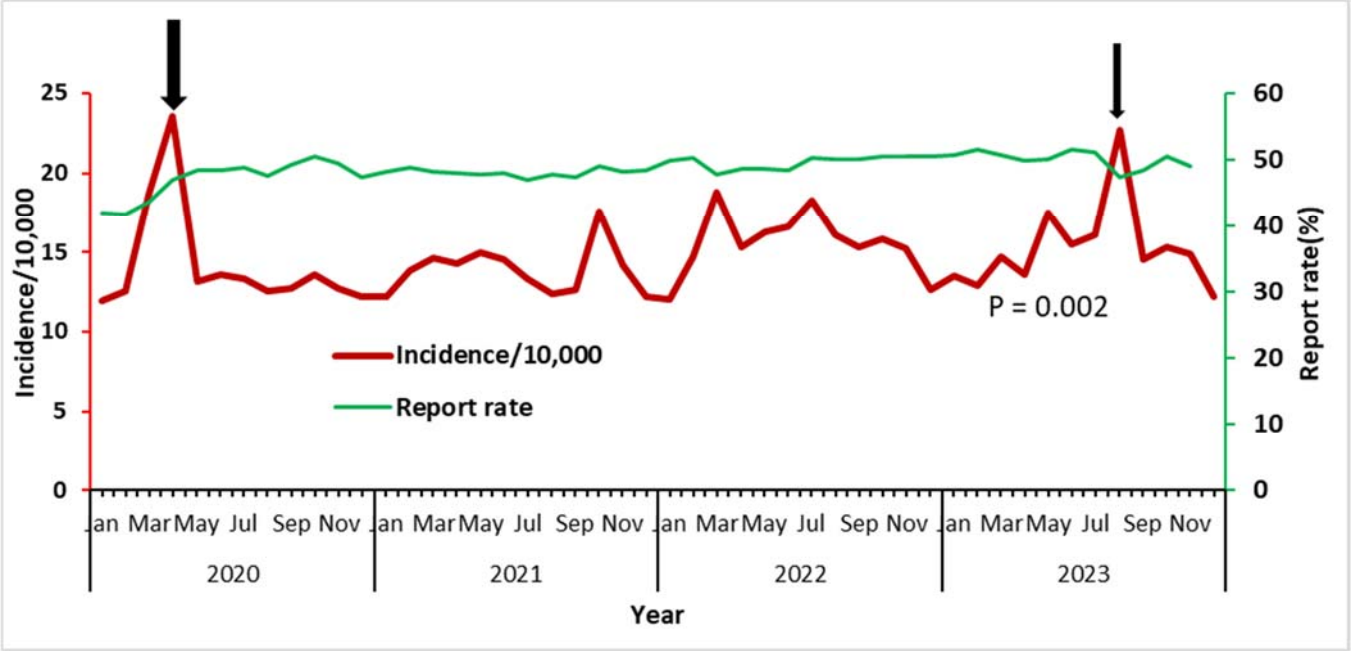


Figure 3: Trends of conjunctivitis cases by year, Uganda, 2020-2023

Spatial distribution of conjunctivitis cases, Uganda, 2020–2023

There was no difference in the incidence across the country within the 4-year period. Overall, Obongi and Adjumani districts had the highest burden of conjunctivitis throughout the four-year period with a mean annual incidence of 47/1,000 population and 38/1,000 population respectively (Figure 4).

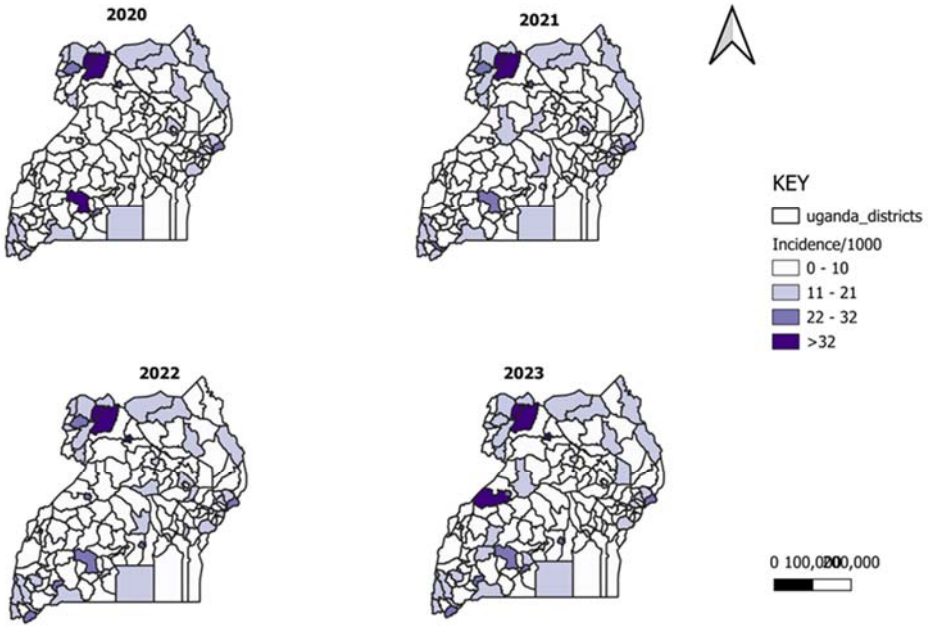


Figure 4: Spatial distribution of conjunctivitis cases, Uganda, 2020–2023

Continued from page 38

Discussion

In this study conducted to describe the trends and distribution of conjunctivitis in Uganda, children aged 0-4years were most affected and there was no difference in the incidence among females and males. Cases of conjunctivitis peaked in the months of March and September in the reporting period of the 4 years.

Children 0-4 years were more affected compared to those above 5years. Our findings are consistent with findings from a study on risk factors for conjunctivitis among children that revealed that conjunctivitis occurs mostly in children aged > 3 years, and continues until puberty (9). This could be explained by the fact that these children play outdoors where its dusty, have other allergens such as pollen grains, and are likely to wipe their eyes using the dirty arms, hence introducing foreign substances to the conjunctiva.

There was no significant gender difference observed in the incidence between males and females. However, males may have had a slightly higher incidence compared to their female counter parts due to the difference in lifestyle and hygiene habits as suggested by other studies(10). Males are hyperactive or have poor hygiene awareness and are engaged in different types of occupational labor unlike females.

Relevant reports point out that conjunctivitis is a seasonal infectious disease which occurs mostly in summer/dry season(12) . Our study also found that the onset season of conjunctivitis in Uganda was mainly concentrated in March and September, with the highest incidence in March. The incidence trend of conjunctivitis was significant showing a distinct seasonal pattern each year with cases peaking in March and September each year. This means that conjunctivitis outbreaks are likely to take place in particular seasons throughout the year since there were notable peaks in the months of March and September which follow dry spells across the country. This information is useful to intensify preparedness in institutions such as schools and prison settings where the disease easily breaks out. The consistency of the seasonal pattern implicates environmental risk factors, and we hypothesize that seasonal allergies from pollen and other allergens may ultimately be responsible, although this is subjective.

Study limitations

This analysis had some limitations. The DHIS2 national-level surveillance data only provides information on cases of conjunctivitis reported at the out-patient departments for all available health facilities in the country. This data may be subject to the constraints of administrative data such as some missing information especially from private health facilities which equally serve a significant proportion of the population. The incidence estimates herein are certainly an underestimate of the true incidence of conjunctivitis in Uganda.

Conclusion

The country experienced annual seasonal spikes in the months of March and September each year with children aged 0-4 years being the prime high-risk group. There was no difference in the incidence of conjunctivitis among males and females. We further recommend routine surveillance and monitoring of surveillance data to aid in early detection of epidemics specially to detect seasonal spikes in the months of the year. Lastly, we recommend heightened health education during the peak seasons on avoidance of allergens especially among children.

Conflict of interest

The authors declare no conflict of interest.

Author Contributions

GA, DK, BK, and RM wrote the protocol of the study. GA and RM analyzed and interpreted the data. GA drafted the initial bulletin. BK, HN, and AA contributed to the first draft and all authors read and approved the final bulletin. Permission to publish the article was obtained from all the authors.

Acknowledgements

The authors appreciate the Ministry of Health for providing access to DHIS2 data that was used for this analysis. We further appreciate the other stakeholders for raising questions that initiated this analysis.

Continues to page 40

Continued from page 39

References

1. Azari AA, Barney NP. Conjunctivitis. JAMA J Am Med Assoc. 2013 Oct 23;310(16):1721–9.
2. Acute bacterial conjunctivitis - Høvding - 2008 - Acta Ophthalmologica - Wiley Online Library [Internet]. [cited 2024 Oct 8]. Available from: https://onlinelibrary.wiley.com/doi/10.1111/j.1600-0420.2007.01006.x
3. Bacterial Conjunctivitis (Pink Eye): Practice Essentials, Background, Pathophysiology. 2024 Aug 17 [cited 2024 Oct 8]; Available from: https://emedicine.medscape.com/article/1191730-overview?form=fpf
4. Mohamed AA, Atukunda I, Sereke SG, Orishaba P, Kajumbula H, Nakiyingi L, et al. Bacteriological Profile, Culture, Sensitivity, and Associated Factors of Bacterial Conjunctivitis Among Patients Attending Eye Clinic at a Tertiary Hospital in Uganda [Internet]. 2022 [cited 2024 May 15]. Available from: https://www.researchsquare.com/article/rs-2008574/v1
5. Miyazaki D, Fukagawa K, Okamoto S, Fukushima A, Uchio E, Ebihara N, et al. Epidemiological aspects of allergic conjunctivitis. Allergol Int. 2020 Oct 1;69(4):487–95.
6. Liu R, Chen Y, Liu H, Huang X, Zhou F. Epidemiological trends and sociodemographic factors associated with acute hemorrhagic conjunctivitis in mainland China from 2004 to 2018. Virol J. 2022 Mar 1;19(1):34.
7. Mohamed AA, Atukunda I, Sereke SG, Orishaba P, Kajumbula H, Nakiyingi L, et al. Bacteriological Profile, Culture, Sensitivity, and Associated Factors of Bacterial Conjunctivitis Among Patients Attending Eye Clinic at a Tertiary Hospital in Uganda [Internet]. 2024 [cited 2024 Mar 27]. Available from: https://www.researchsquare.com/article/rs-2008574/v1
8. Waswa S. Pulse Uganda. 100AD [cited 2024 Apr 5]. Kampala schools on alert as Health Ministry confirms 900 conjunctivitis cases. Available from: https://www.pulse.ug/lifestyle/health-ministry-confirms-900-conjunctivitis-cases-in-kampala-schools/n8fz210
9. Ireri R, Njaramba V, Kiarie P. Factors Contributing to Allergic Conjunctivitis Among Children Aged Below Five Years Attending Murang'a County Referral Hospital. Int J Health Sci Res. 2022 Dec 22;12(12):113–8.
10. Jing D, Zhao H, Ou R, Zhu H, Hu L, Giri M, et al. Epidemiological Characteristics and Spatiotemporal Analysis of Acute Hemorrhagic Conjunctivitis from 2004 to 2018 in Chongqing, China. Sci Rep. 2020 Jun 9;10(1):9286.
11. Why is red eye disease on the rise in Uganda? | Monitor [Internet]. [cited 2024 May 15]. Available from: https://www.monitor.co.ug/uganda/news/national/why-is-red-eye-disease-on-the-rise-in-uganda--4604018
12. Liu J, Zhang H. Epidemiological Investigation and Risk Factor Analysis of Acute Hemorrhagic Conjunctivitis in Huangshi Port District, Huangshi City. Comput Math Methods Med. 2022;2022(1):3009589.

Continued from page 40

Increasing cases of malaria in Kampala City, Uganda: A descriptive analysis of surveillance data, January 2020–December 2023

Authors: John Rek[1], Daniel Orit[1], Gerald Rukundo[2], Benon Kwesiga[1], Richard Migisha[1], Lilian Bulage[1], Catherine Maiteki Sebuguzi[2], Jimmy Opigo[2], Alex Riolexus Ario[1]
Institutional affiliation: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]National Malaria Elimination Division, Ministry of Health, Kampala, Uganda
Correspondence: Tel: +256-782-387-857, Email: jrek@uniph.go.ug

Summary

Background: Uganda ranks third in the global malaria burden. The country is experiencing rapid urbanization which predisposes the urban population to malaria transmission risks. Kampala City is the largest urban settlement in Uganda with poor housing in slums, encroachment on wetlands, and road construction with water stagnation which are high-risk factors for malaria transmission. We described the epidemiology of malaria in Kampala City to inform planning and malaria service delivery for city residents.
Methods: We conducted a descriptive study using secondary data abstracted from the District Health Information System-2 (DHIS-2) on patients tested for malaria, confirmed cases, hospital admissions, and reported deaths. Data was from 1,936 reporting health facilities, both public and private in Kampala City, between 2020 and 2023. We estimated the malaria incidence per 1,000 population per year by calendar year, gender, age group, and test positivity rates per calendar year. We used the Mann-Kendell test to test for the significance of the trends of cases, admissions, incidence, and test positivity rate.
Results: Between 2020 and 2023, there were a total of 680,955 malaria cases, 25,836 malaria admissions, and 614 malaria-related deaths in Kampala City. Malaria cases increased by 29% from 144,697 to 203,842 (p-value=0.0001) and admissions by 55% from 4,319 to 9,592 (p-value 0.0001). Most (57.9%) admissions were among persons >5 years. Malaria incidence increased from 165 to 233/1,000 (p-value 0.0001) and was overall highest in females (405/1,000), adults ≥20 years (420/1,000), and in the Central Division (368/1,000). The mean monthly malaria test positivity rate from 2020 to 2023 was 17% (sd 4.4), with no significant trend (p-value=0.9). Most deaths were reported in children under 5 years (73%, n=448).
Conclusion: Malaria cases and incidence increased in Kampala City between 2020 and 2023. Targeting children under 5 and hotspot mapping to identify and characterize foci of malaria transmission in Kampala City will facilitate targeted interventions.

Targeting children under 5 and hotspot mapping to identify and characterize foci of malaria transmission in Kampala City will facilitate targeted interventions.

Introduction

Like the rest of Sub-Saharan Africa, Uganda is facing growth in the urban population and urbanization. The urbanization rate in Uganda is estimated at 5.2% and over 20% of the population is resident in urban centers[1]. The number of urban centers has increased from 259 in 2014 to 625 in 2021[2] and the urban proportion of the national population has grown between 15% in 2000 to 26% in 2022[3].

Along with urbanization are challenges that predispose people to malaria. These include poor urban planning leading to the proliferation of slums and informal settlements characterized by poverty, poor living conditions, substandard housing, overcrowding, and poor access to services; deterioration of the urban environment due to wetland encroachment for house construction; stagnant water in many places due to the poor state of roads creating breeding sites; and the proliferation of house construction sites. Several man-made breeding sites, including swimming pools, improperly disposed containers acting as breeding sites, tire tracks, and even overhead water tanks, are also common. All these factors provide a suitable environment for mosquito breeding thus increasing transmission[5]. In addition, urban malaria is characterized by low immunity due to low exposure from low transmission, importation of malaria from travelers, and private sector-led service delivery[4–6]. Severe forms of malaria are also common in urban settings due to the low immunity of the city residents.

Kampala is the capital city of Uganda and the largest urban settlement in the country. The city is characterized by a low malaria burden and reported to have a *Plasmodium falciparum* prevalence in 2-10 year old of <1%[7].

Continues to page 42

Continued from page 41

Like other cities, a challenge for malaria is an understanding of whether malaria in the city arises from local transmission or importation from nearby rural areas[4]. To better plan for malaria control in the city, a proper understanding of the epidemiology of malaria is thus important.

We described malaria patients reported in Kampala, trends in malaria test positivity rates and cases, and the spatiotemporal distribution of malaria incidence Kampala, 2020-2023.

Methods

This was a descriptive study of monthly passively collected malaria surveillance data submitted into the DHIS2 by health facilities in Kampala using the Health Management Information System (HMIS – 105 and 108), 2020-2023.

The capital city of Uganda is Kampala, with the Kampala Capital City Authority being the administrative unit. It is located in the southern part of the country, on the northern shores of Lake Victoria, and has five administrative divisions. Fifteen percent of the city is made of valleys filled with rivers and swamps that make good breeding sites for malaria vectors.

We abstracted monthly data from DHIS-2 at the division level including malaria cases (outpatient and inpatient), malaria tests done, tests positive by blood slide and rapid diagnostic test, and malaria deaths. Population data to calculate incidence was obtained from the Uganda Bureau of Statistics (UBOS). These included population estimates for Kampala city and divisions. Age-specific proportions provided by UBOS were applied to the populations to determine age-specific populations.

The proportion of malaria cases reported from the outpatient department was determined by gender and age group, and inpatient cases (admissions) by age groups (<5 and ≥5 years). Incidence was estimated as the cases per 1000 population per year, age group, and division. The test positivity rate was estimated as the proportion of all fever cases tested and positive for malaria. The seasonal Mann-Kendall test was used to test for significance of trends. Finally, the spatiotemporal distribution of malaria incidence per division were mapped.

We conducted a descriptive study using aggregated malaria surveillance data from all health facilities across Kampala Capital City that report through the DHIS-2. The Ugandan Ministry of Health permitted us to access and utilize the data.

In addition, the office of the Center for Global Health, US Center for Disease Control and Prevention determined that this activity was not human subject research and with its primary intent being for public health practice or disease control. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy. § § See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Results

Characteristics of malaria cases, Kampala, 2020-2023

Between 2020 and 2023, 680,955 malaria cases, 25,836 admissions, and 613 deaths were reported in Kampala. The majority 71.4% (486,003) of the cases were reported from Private For-Profit health facilities (Figure 1) and 73% (448) of deaths in children under 5 years of age.

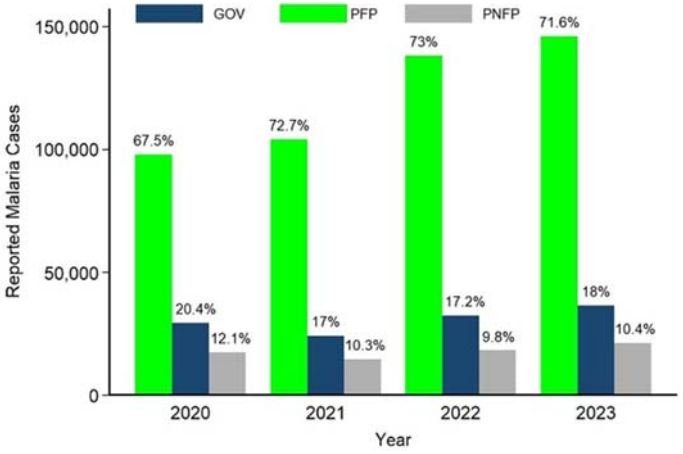


Figure 1: Distribution of malaria cases by ownership of reporting healthy facilities, Kampala, 2020-2023

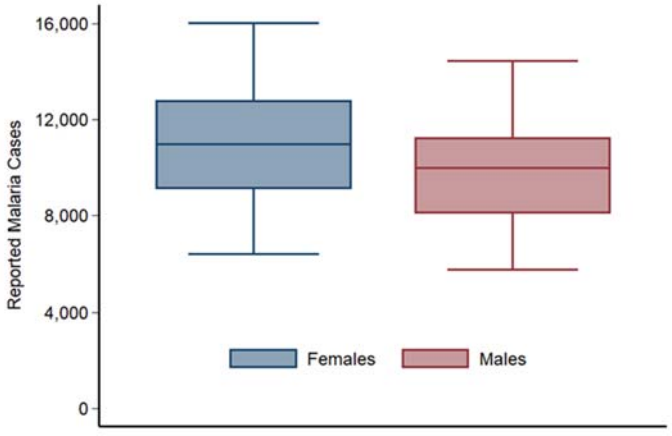


Figure 2: Distribution of malaria cases by gender, Kampala, 2020-2023

Continued from page 42

Most malaria cases were reported in females at 52% (356,833) compared to males at 48% (324,122), with the median number of cases in females higher than in males across the years (Figure 2).

Adults >20 years old contributed the most cases with the median number of malaria cases reported higher i**Figure 3: Distribution of malaria cases by age group across divisions of Kampala, 2020-2023**

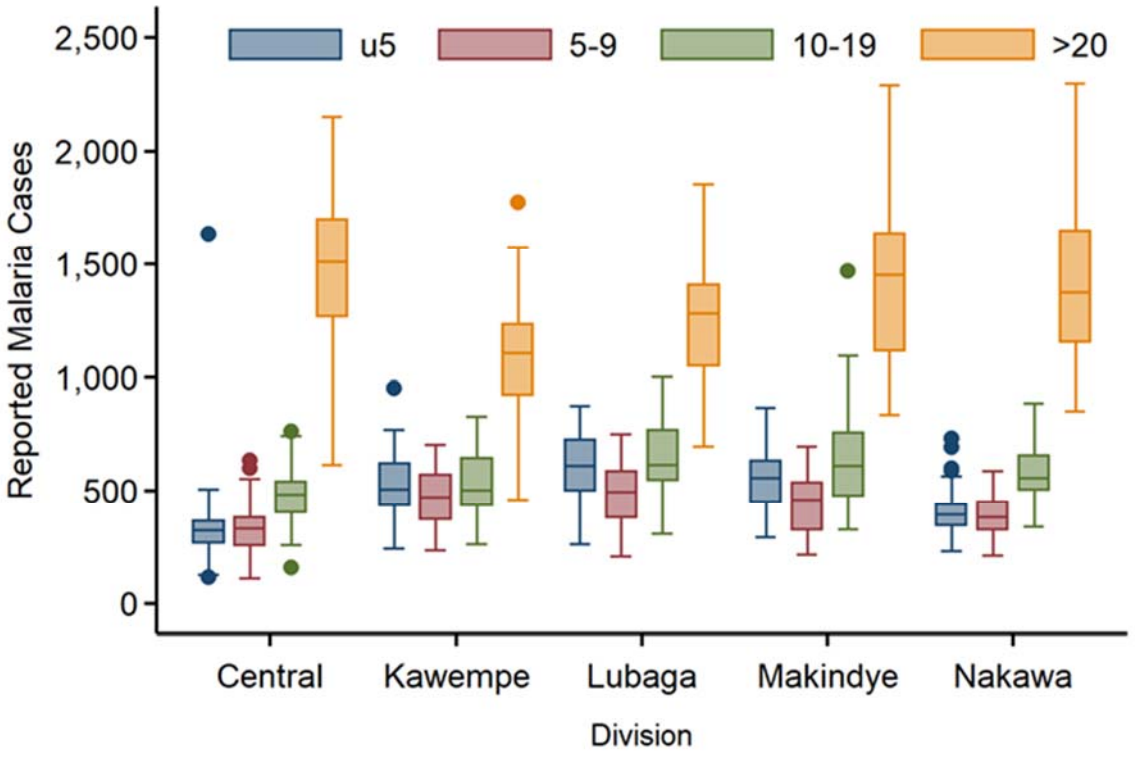


Figure 3: Distribution of malaria cases by age group across divisions of Kampala, 2020-2023

Proportion of admissions and admission incidence by age group per year, Kampala, 2020-2023
A total of 25,836 malaria admissions were reported in the study period. The majority 58% (14,930) of admissions were in the > 5-year age group. However, the average incidence of admissions in the children <5vears was 95/10,000, and has been increasing since 2020 (Table 1).

Table 1: Proportion of admissions and admission incidence by age group per year, Kampala,

	u5				>5			
year	n	%	Population	incidence/10,000	n	%	Population	incidence/10,000
2020	1916	43.8	278,980	69	2403	55.6	1,401,620	17
2021	1512	38.0	283,843	53	2410	61.4	1,426,057	17
2022	3560	44.2	288,608	123	4443	55.5	1,449,992	31
2023	3918	40.6	293,239	134	5674	59.2	1,473,261	39
Overall	10906	41.6		95	14930	57.9		26

2020-2023

Trend of incidence of malaria, Kampala, 2020-2023
There was a general increase in the overall incidence of malaria in Kampala by 34%, from 86/1000 in 2020 to 115/1000 population in 2023. Additionally, incidence increased in all age groups. The incidence was higher in the ≥ 20-year age group in 2020 and 2021. In 2023, the incidence is comparable between

Continues to page 44

Continued from page 43

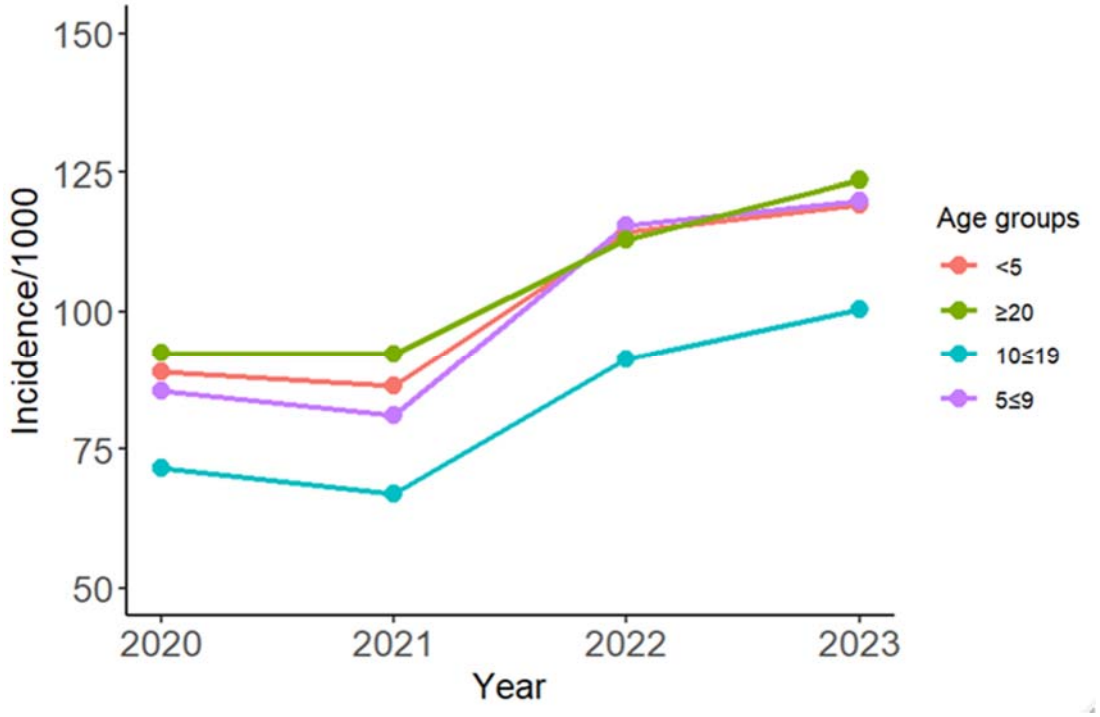


Figure 4: Incidence of malaria by year and age group, Kampala, 2020-2023

Spatiotemporal distribution of malaria incidence, Kampala, 2020-2023

The Central division of Kampala had a consistently higher incidence from 2020 to 2023. Incidence in the central division increased from 314/1000 in 2020 to 444/1000 in 2023 (Figure 5).

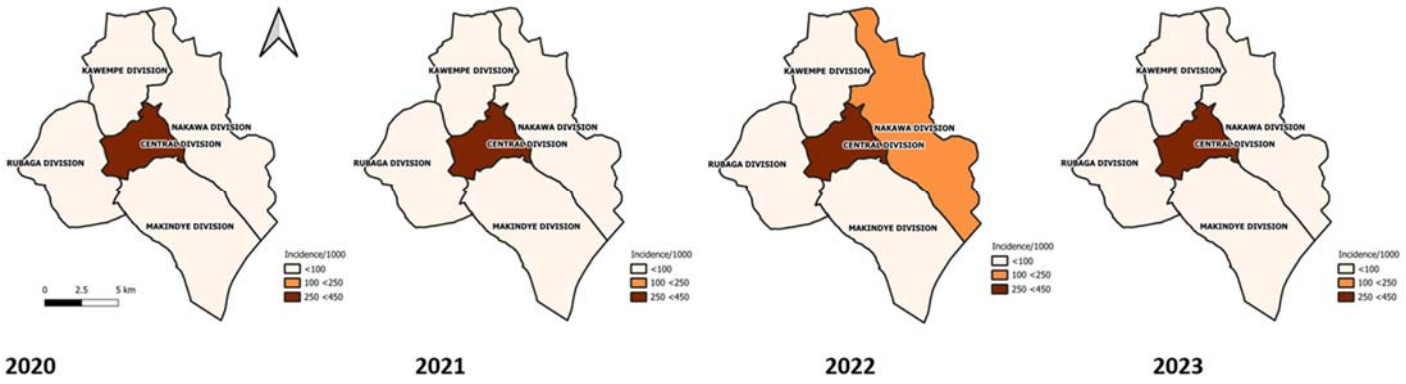


Figure 5: Spatiotemporal distribution of malaria incidence, Kampala, 2020-2023

Discussion

This descriptive analysis of malaria in Kampala, shows an increasing trend since 2020, females and adults above 20 years contributing the most cases and children under 5 years are the most affected by malaria. We also show that central division had the highest malaria incidence, and private for-profit health care providers are the predominant channels for malaria treatment.

These findings are also consistent with other studies that indicated increasing cases of malaria in most urban settings since 2003[8]. They also confirm the long known fact that urbanisation in Africa may be challenged by increases in malaria transmission, contrary to the earlier beliefs that urbanisation would result in declines in transmission.[9,10]

Continued from page 44

The study found that adults ≥ 20 years reported the most malaria in Kampala city. This finding was consistent across the divisions of Kampala city. This could be due to the population structure of the city, where adults above 20 years constitute approximately 44% of population[11]. It is also possible that the day time population from the metropolitan area that travel into the city, is diagnosed in the city, constituting malaria importation in the city. Considering the low transmission levels in Kampala, importation of malaria by the travelling adult population is another potential source of malaria infection and disease in the adults[12].

Malaria affected children under five years more than other age groups. Findings from this study are consistent with those from other studies, that show that indeed children under five years suffer more from malaria[13,14]. Children under five are more susceptible to malaria because of the low and immature immune response to malaria unlike the older children and adults[14]. Due to repeated exposures, older children and adults tend to develop better antiparasitic immune responses, thus lowering their susceptibility to malaria[15]. Malaria infection in the children could arise from local transmission within the city or from infection during recent overnight travel out of Kampala. A study in Kampala showed recent overnight travel away from Kampala –in a low transmission setting, was associated with malaria. It also showed that more cases than controls in children under five years diagnosed with malaria in Kampala, had recent overnight travel[12].

The high incidence of malaria in the central division compared to other divisions of Kampala could be attributed to the high day time population coming to the central business district for trade and consequently seeking care within the health centres in the central division. The day time population is approximately 4 million people, originating from the greater Kampala metropolitan area in addition to the city residents. These non-resident population could be diagnosed with malaria within the central division, creating a pseudo higher burden in the city. Knowledge of the geolocations of the people testing positive for malaria in the central division, would improve understanding of the spatial epidemiology of malaria in the division.

A study in Maputo City, Mozambique emphasizes the importance of enhanced surveillance including collection of geolocation data for better characterisation of malaria in the urban setting[16]. The role of importation of malaria parasites into cities that was demonstrated in a study in Madagascar [17], that showed that travel into the cities that form major “sinks” by parasitized individuals contributes to malaria burden in the cities.

The majority (60%) of people in Uganda seek care first from the private sector[7], and yet in Kampala, over 80% of health facilities are private for profit owned. This implies, a higher proportion of city residents access care from the private sector compared to the rest of the country. The role of the private sector in malaria service provision has been reported elsewhere, as of importance[18]. Malaria is a leading killer of children, especially those under 5 years. Like other studies and reports, Kampala city malaria mortalities show that u5s suffered the most deaths due to malaria, at 72.2%. These findings are comparable to reports from the WHO world malaria report of 2023 that showed that though there were declines in u5 deaths due to malaria, this has since stalled at 76% since 2015[19]. Children u5 years are at risk of severe malaria due to loss of maternal protection and an immature immune system[14].

Study limitations

This study had some limitations including, the data from DHIS-2 is aggregate data and the age groups are predetermined in the dataset. We were thus not able to describe the epidemiology of malaria at individual level. Most of the facilities providing care in the city are private for-profit entities. These are challenged by reporting using the HMIS system. The true magnitude of malaria in the city may thus have been underestimated.

Conclusion

Malaria in Kampala city, the largest urban settlement in Uganda has been increasing since 2020. The most affected are females, children under 5 years and the central division of Kampala. Malaria mortalities are high in the under 5s. Most of the malaria cases in Kampala are treated in the private sector. We recommend, identifying hotspots for malaria in Kampala for better intervention targeting, Prioritization of malaria surveillance and case management in the private sector, and risk communication for

Continues to page 46

Continued from page 45

prevention and early treatment of malaria should be tailored for Kampala, to avert malaria deaths.

Conflict of Interest
The authors declare that they had no conflict of interest.

Authors contribution
JR, designed the study and contributed to data analysis. JR led the writing of the bulletin. DO, GR, BK, RM, LB, CM, JO, and ARA participated in bulletin writing and review to ensure scientific integrity and intellectual content. All authors contributed to the final draft of the bulletin. All authors read and approved the final bulletin.

Acknowledgments
The authors would like to thank the staff of the PHFP for the technical support offered during the conduct of this study.

References

1. Ministry of Lands Housing and Urban Development. Uganda National Urban Policy, 2017. https://mlhud.go.ug/wp-content/uploads/2019/07/National-Urban-Policy-2017-printed-copy.pdf.

2. Ministry of Lands Housing and Urban Development. Uganda State of Urban Sector Report 2021-2022. (2022).

3. The World Bank. World Bank Open Data. *World Bank Open Data* https://data.worldbank.org.

4. Wilson, M. L. *et al.* Urban Malaria: Understanding its Epidemiology, Ecology, and Transmission Across Seven Diverse ICEMR Network Sites. *Am J Trop Med Hyg* **93**, 110–123 (2015).

5. Kigozi, S. P. *et al.* Associations between urbanicity and malaria at local scales in Uganda. *Malaria Journal* **14**, 374 (2015).

6. Hay, S., Guerra, C., Tatem, A., Atkinson, P. & Snow, R. Urbanization, malaria transmission and disease burden in Africa. *Nat Rev Microbiol* **3**, (2005).

7. NMCD, UBOS. Uganda Malaria Indicator Survey 2018-2019. https://www.dhsprogram.com/pubs/pdf/MIS34/MIS34.pdf.

8. Doumbe-Belisse, P. *et al.* Urban malaria in sub-Saharan Africa: dynamic of the vectorial system and the entomological inoculation rate. *Malar J* **20**, 364 (2021).

9. De Silva, P. M. & Marshall, J. M. Factors Contributing to Urban Malaria Transmission in Sub-Saharan Africa: A Systematic Review. *Journal of Tropical Medicine* **2012**, e819563 (2012).

10. Donnelly, M. J. *et al.* Malaria and urbanization in sub-Saharan Africa. *Malaria Journal* **4**, 12 (2005).

11. Uganda Bureau of Statistics. Statistical Abstract, 2022. (2022).

12. Arinaitwe, E. *et al.* Malaria Diagnosed in an Urban Setting Strongly Associated with Recent Overnight Travel: A Case-Control Study from Kampala, Uganda. *Am J Trop Med Hyg* **103**, 1517–1524 (2020).

13. Geneva: World Health Organisation, 2022, C. World malaria report 2022. (2022).

14. Ranjha, R., Singh, K., Mohan, M., Anvikar, A. R. & Bharti, P. K. Age-specific malaria vulnerability and transmission reservoir among children. *Global Pediatrics* **6**, 100085 (2023).

15. Rodriguez-Barraquer, I. *et al.* Quantification of anti-parasite and anti-disease immunity to malaria as a function of age and exposure. *eLife* **7**, e35832.

16. Stresman, G. *et al.* Optimizing Routine Malaria Surveillance Data in Urban Environments: A Case Study in Maputo City, Mozambique. *The American Journal of Tropical Medicine and Hygiene* **108**, 24–31 (2023).

17. Ihantamalala, F. A. *et al.* Estimating sources and sinks of malaria parasites in Madagascar. *Nat Commun* **9**, 3897 (2018).

18. Silverman, R., Rosen, D., Regan, L., Vernon, J. & Yadav, P. Malaria Case Management in the Private Sector in Africa: A Call for Action to Identify Sustainable Solutions.

19. Geneva: World Health Organisation, 2023, C. World malaria report 2023.

Continued from page 46

Bottlenecks and enablers for measles outbreak detection, notification, and response using the 7-1-7 matrix in Bunyoro Mubende and Toro regions, Uganda, January–May 2024

Authors: Brian Kibwika[1,2]*, Robert Majwala Kaos[2], Evaristo Ayebazibwe[2], Damali Igune[2], Doreen N. Gonahasa[1], Benon Kwesiga[1], Alex Riolexus Ario[1], Peter James Elyanu[2]
Institutional affiliations: [1]Uganda National Institute of Public Health, Kampala, Uganda, [2]Baylor Foundation Uganda, Kampala, Uganda
***Correspondence**: Tel: +256782007573, Email: bkibwika@uniph.go.ug

Summary

Background: Early action during outbreaks is important in limiting spread of infections, deaths, and socio-economic impact. Uganda has had numerous measles outbreaks and most of them have been attributed to refugee settlements. Suboptimal detection and response to recent measles outbreaks in Uganda have shown insufficiency in preparedness by the country for such emergencies. We utilized the 7-1-7 matrix to measure the timeliness of detection, notification, response, identify bottlenecks and enablers of system performance for measles outbreaks, Bunyoro, Mubende, and Toro regions, January–May 2024.
Methods: Seven measles outbreaks were recorded between January and May, 2024. For each, early action review meetings using the standard 7-1-7 assessment tool were conducted with the respective District Rapid Response Team (DRRT) officials to document the milestone dates of detection, notification, response as well as bottlenecks and enablers. The median time and range in days were computed for each milestone. Timeliness was considered as detection of ≤7 days, notification of ≤1 day, and response ≤7 days. Bottlenecks and enablers, were summarized into predetermined categories and analyzed thematically
Results: None of the outbreaks met all the three 7-1-7 targets of timeliness in full. The median time to detection was 4 days (range: 1-34), notification 0 days (0-27), response 16 days (9-35). Most of outbreaks 4/7 (57%) met the target for detection, 5/7 (71%) met the target for notification while none (0%) met the response target. Most of the bottlenecks to detection, 10/18 (56%) were due to insufficient community linkages to the health facilities, low knowledge on how to notify (80%) for notification, vaccination related gaps (36%), and delays in the laboratory system for response. Enablers for detection were active trained Village Health Team (VHT) members (43%) and a high suspicion index among health workers (43%). Active trained VHTs (60%), for notification and having a sufficient workforce, well established coordination and partner support for response
Conclusion: The measles outbreaks in Bunyoro, Mubende, and Toro regions had suboptimal timeliness as per the 7-1-7 matrix. We recommend refresher training of health workers on measles surveillance and improvement of vaccination campaigns in outbreak areas.

Introduction

Early action during outbreaks is important in limiting spread of infections, deaths, and socio-economic impact Uganda has had numerous measles outbreaks and most of them have been attributed to refugee settlement (1,2).
Suboptimal detection and response to recent measles outbreaks in Uganda have shown insufficiency in preparedness by the country for such emergencies(3).
It is important to routinely assess institutional ability to quickly detect and contain any outbreak at its source. Monitoring the timeliness of outbreak detection, verification, notification, and response can provide insight on surveillance capabilities and indicate where performance might be improved (4).

The 7-1-7 matrix has been proposed as a tool for outbreak detection, notification, and early response, whereby every suspected outbreak is detected within 7 days of emergence and reported to public health authorities within 1 day of detection, and seven early response actions are completed within 7 days from reporting to public health authorities, indicating timely initiation of response(5).

We utilized the 7-1-7 matrix to measure the timeliness of detection, notification, response, identify bottlenecks and enablers of system performance for measles outbreaks, Bunyoro, Mubende, and Toro regions, January–May 2024.

Methods

We conducted the study in districts in Bunyoro, Mubende, and Toro regions that experienced measles outbreaks in 2024. We used the 7-1-7 assessment tool for rapid performance improvement for outbreak detection and response to measure timelines for the 7-1-7 milestones, and identify bottlenecks and enablers in the measles outbreaks (6).

Continues to page 48

Continued from page 47

Early action review meetings were conducted with the respective District Rapid Response Team (DRRT) officials to document the milestone dates (date of emergence, date of detection, date of notification, and dates of each of seven early response actions), as well as bottlenecks and enablers.

We calculated median timelines to get the overall performance at each of the milestones of; detection, notification, and completion of early response actions.
We computed proportions of milestones that met the set 7-1-7 timelines as follows; timely detection (≤7 days), notification (≤1 day), start date for the last early response action (≤7 days). The full 7-1-7 target will be achieved if the milestones for outbreak do not exceed the 7-1-7 targets. The full 7-1-7 target was met when an event did not exceed any of the three targets. Bottlenecks and enablers, as qualitative data, were summarized into predetermined categories and analyzed by thematic analysis.

The study used routine surveillance data reported by the District Health Office during outbreaks. There are no individual patient identifiers in the data.
Permission to utilize the data was from Ministry of Health through the National Public Health Emergency Operations Center. This activity was reviewed by the US CDC and was conducted consistent with applicable federal law and the US CDC policy. §§See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq. The protocol was approved as non-research by the Centers for Disease Control and Prevention.

Results

Measles outbreaks that met the detection, notification, and response timelines, Bunyoro, Mubende, and Rwenzori regions, Uganda, January-April, 2024
The regions of Bunyoro, Mubende, and Rwenzori experienced seven measles outbreaks between January and April, 2024, with the majority, 4/7 (57%) in Rwenzori and 2/7 (29%) in Bunyoro regions. None of the outbreaks met all the three 7-1-7 targets of timeliness in full.
The median time for detection of the measles outbreaks was 4 days (range 1-34; IQR 2-7). Bunyoro region had the slowest detection time of 34 days for one of the two outbreaks responded to in the region.
The median time to notification of the measles outbreaks to a public health authority responsible for action was 0 days (range 0-27; IQR 0-2.5). Mubende region had the slowest notification time of 27 days for the single outbreak responded to in the region.
The median time for completion of all applicable early response actions were completed was 16 days (range 9-35; IQR 10.5-24). Early response action five had the slowest response time, with a median of 16 days (range 9-35; IQR 12-25.5), while action one had the fastest response time with a median of one day (range 0-23; IQR 0-5)
The majority, 4 (57%) of the outbreaks met the target for detection, 5 (71%) met the target for notification while none met the target for completion of early response actions (Table 1).
We identified 18 bottlenecks to detection, 5 for notification, and 11 for completion of early response activities. There were 7 enablers to detection, 5 for notification and 3 for completion of early response activities.
The majority of the bottlenecks to detection, 10/18 (56%) were due to insufficient community linkages to the health facilities, followed by distant health centers and low measles suspicion index for among health workers (17%). Knowledge on how to notify (80%) and low use of the electronic integrated disease surveillance and response system (eIDSR) were the reported bottlenecks to notification. The bottlenecks to completion of early response actions were; vaccination related gaps (36%), delays in the laboratory system (18%) and hard to reach outbreak areas (18%). Enablers for detection were active trained Village Health Team (VHT) members (43%) and a high suspicion index among health workers (43%). Active trained VHTs (60%), Use of passive surveillance (20%) and knowledge of reporting hierarchy (20%) were the enablers for notification. The enablers for completion of early response actions were; having a sufficient workforce, well established coordination and partner support.

Discussion

In this review of measles outbreaks, we applied the 7-1-7 matrix district to measure capacity for detection, notification, and early response initiation. We found that the median time for detection (4 days), notification (0 days) were good performances, but completion of early response actions (16 days), with none of the outbreaks meeting all of the three targets. Most of the bottlenecks identified were for detection, with insufficient community linkages to the

Table 1: Measles outbreaks that met the detection, notification, and response timelines, Bunyoro, Mubende, and Rwenzori regions, Uganda, January-April, 2024

Metric	Median	(Range)	Target met
Date of detection (Target: 7 days)	4.0	(1-34)	4/7 (57%)
Date of notification (Target: 1 day)	0.0	(0-27)	5/7 (71%)
Early response action 1	1.0	(0-23)	
Early response action 2	15.0	(6-33)	
Early response action 3	8.0	(2-20)	
Early response action 4	10.0	(0-33)	
Early response action 5	16.0	(9-35)	
Early response action 6	15.0	(3-34)	
Early response action 7	15.0	(6-35)	
Date of early response initiation	2.0	(0-16)	
Date of early response completion (Target: 7 days)	16.0	(9-35)	0/7 (0%)

Continues to page 50

Continued from page 49

to the health facilities accounting for largest proportion. Detection still had the highest proportion of enablers, with most citing a high suspicion index among health workers.

Detection of measles outbreaks was suboptimal, with just over half of the outbreaks detected in a timely manner. This was mainly due to inadequate community surveillance linkage to health facilities, with Village Health Team (VHT) members having inadequate knowledge on measles signs and symptoms. (2,7,8). Late detection leads to further quick spread of the disease in the community as it limits the progress of the subsequent steps in the response.

Notification of the measles outbreaks was the best done of the three 7-1-7 matrix actions. This finding was consistent with other studies that show notification as one the meets the targets the most(3,9). Timely notification was attributed to VHTs and health facility workers who had knowledge of the hierarchy of reporting to Public Health authorities.

Conclusion

The measles outbreaks in Bunyoro, Mubende and Toro regions had suboptimal timeliness as per the 7-1-7 matrix, with none of them meeting all the three targets of timeliness in full. Linkages between communities, health facilities, low health worker suspicion index, and delays in initiating appropriate public health countermeasure of vaccination were the main bottlenecks. On the other hand, VHTs and health facility workers who had knowledge of the hierarchy of reporting to Public Health authorities were major enablers. We recommend refresher training of health workers on measles surveillance and improvement of vaccination campaigns in outbreak areas .

Conflict of interest

The authors declare no conflict of interest

Author contribution

BK, EA, DI, PJE, conceived and designed the study. BK, EA contributed to data abstraction, cleaning and analysis. BK, DNG took lead in developing the bulletin. BK, DK, AAR, PJE supervised the entire writeup process. All authors contributed to the final draft of the bulletin. All authors read and approved the final bulletin.

Acknowledgements

We thank Baylor Foundation Uganda, Global Health Security Program for availing data and offering technical support in data management.

References

1. Namusisi AM, Nuwamanya Y, Migisha R, Atugonza R, Immaculate A, Nsubuga F, et al. Measles outbreak Investigation in Terego District, Uganda, May- June, 2024. 2024;9(3).
2. Coughlin MM, Beck AS, Bankamp B, Rota PA. Perspective on Global Measles Epidemiology and Control and the Role of Novel Vaccination Strategies. Viruses. 2017 Jan;9 (1):11.
3. Bochner AF, Makumbi I, Aderinola O, Abayneh A, Jetoh R, Yemanaberhan RL, et al. Implementation of the 7-1-7 target for detection, notification, and response to public health threats in five countries: a retrospective, observational study. Lancet Glob Health. 2023 Jun 1;11(6):e871–9.
4. Stoto MA, Nelson C, Piltch-Loeb R, Mayigane LN, Copper F, Chungong S. Getting the most from after action reviews to improve global health security. Glob Health. 2019 Oct 10;15(1):58.
5. 7-1-7-Implementation-Toolkit-7-1-7-Alliance.pdf [Internet]. [cited 2024 Jan 5]. Available from: https://717alliance.org/app/uploads/2023/10/7-1-7-Implementation-Toolkit-7-1-7-Alliance.pdf
6. 7-1-7-Asssessment-Tool-.pdf [Internet]. [cited 2024 May 11]. Available from: https://717alliance.org/app/uploads/2023/11/7-1-7-Asssessment-Tool-.pdf
7. Drago F, Ciccarese G, Gasparini G, Cogorno L, Javor S, Toniolo A, et al. Contemporary Infectious Exanthems: An Update. Future Microbiol. 2017 Feb 1;12(2):171–93.
8. Husada D, Kusdwijono, Puspitasari D, Kartina L, Basuki PS, Ismoedijanto. An evaluation of the clinical features of measles virus infection for diagnosis in children within a limited resources setting. BMC Pediatr. 2020 Jan 6;20(1):5.
9. Impouma B, Roelens M, Williams GS, Flahault A, Codeço CT, Moussana F, et al. Measuring Timeliness of Outbreak Response in the World Health Organization African Region, 2017–2019. Emerg Infect Dis. 2020

Continued from page 50

Measles outbreak imported through the porous border in Moroto District, Uganda, March–July, 2024

Authors: Emmanuel Mfitundinda[1*], Annet Namusisi[1], Daniel Wenani[1], Ruth Ayeerwot[2], Emmanuel Korobe[3], Druscillah Ssekandi[4], Richard Migisha[1], Benon Kwesiga[1], Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]Karamoja Regional Emergency Operations Centre, Moroto, Uganda, [3]Moroto District Local Government, Moroto, Uganda, [4]Uganda National Expanded Program on Immunization, Ministry of Health, Kampala, Uganda
Correspondence*: Tel: +256 777 166 851, Email: emmamfitundinda@uniph.go.ug

Summary

Background: On 26 June, 2024, Ministry of Health Uganda was notified of a measles outbreak in Moroto District. We investigated the outbreak to determine its magnitude, identify the source, identify risk factors for transmission, and recommend evidence-based control measures.
Methods: We defined a suspected case as onset of fever and maculopapular rash, plus ≥1 of: cough, coryza, or conjunctivitis in a resident of Moroto District from 15 March to 23 July, 2024. A confirmed case was a suspected case with a positive measles-specific IgM test. Cases were identified through review of health facility records and active case search within the health facilities. We calculated case fatality rate (CFR), and attack rates (AR) by sub-county and age group. We conducted an unmatched case-control study (1:2) and used logistic regression to identify risk factors. We estimated the vaccine effectiveness (VE) from adjusted odds ratio (aOR) associated with vaccination (VE=1-aOR) % and vaccination coverage (VC) from percentage of vaccinated controls.
Results: We identified 236 case-patients (218 suspected cases, and 13 confirmed cases). There were five deaths (CFR=2%) of suspected cases. The index case was a 10-month-old male who had travelled with the mother from the Western Turkana Region of Kenya, where a measles outbreak was ongoing. The overall Attack Rate (AR) was 19/10,000. Lotisan Sub-county (AR=50/10,000) and children <1 year (AR=194/10,000) were the most affected. Being vaccinated was 89% protective (aOR=0.11, 95%CI=0.03-0.4). Visiting a health facility 7–21 days before the onset of rash (aOR=3.8, 95%CI=1.3-11) and malnutrition (aOR=6.1, 95%CI=1.3-27) increased the odds of contracting measles. Estimated VC was 67% and VE was 89% (95%CI=60-97).
Conclusion: The outbreak was likely imported from Kenya, and was propagated by low vaccination coverage, nosocomial infections and malnutrition. Improved triage, mass vaccination campaigns for children aged 6–59 months and strengthened cross-border disease surveillance could prevent future similar outbreaks.

Introduction

Measles is a highly infectious viral vaccine preventable disease with a high burden in children <5 years of age. Without vaccination, >90 % of people would be infected by the age of 10 years with a symptomatic form of the disease (1). It is transmitted through respiratory droplets and by direct contact with infected nasal or throat secretions (1, 2). The incubation period of measles is 7–21 days. Measles presents with high-grade fever, maculopapular rash, cough, running nose and conjunctivitis. The maculopapular rash erupts 3–5 days after the onset of the fever, it starts from the face and spreads to the rest of the body. The Case Fatality Rate (CFR) of measles is 3-10% in developing countries. Complications of measles include pneumonia, diarrhea, otitis media and encephalitis in rare cases. Risk factors for severe disease include malnutrition, advanced HIV disease, age < 5 years and living in very crowded conditions (1).

The World Health Organization (WHO) recommends two doses of MCV with the first dose administered between 9 and 12 months of age and the second dose administered at the age of 15–18 months of age, the second dose should be at least one month apart from the first one(1). In Uganda, the coverage for MCV1 was suboptimal at 85% in 2022. The country introduced the second dose of MCV in 2022 but it's coverage remains suboptimal at 44% in 2022 (5, 6). To achieve herd immunity and prevent outbreaks, the coverage should be at least >93% at a district level. As a result of this suboptimal MCV coverage, Uganda has experienced numerous measles outbreaks since 2018 as a result of the suboptimal coverage across the country (7,8, 9, 10, 11).

On June 26, 2024, the Ministry of Health (MoH) through the National Emergency Operations Centre received a notification of a measles outbreak in Moroto District, Karamoja Region, Uganda. Nine out of the13 suspected case-patients tested at the Uganda Virus Research

Continues to page 52

Continued from page 51

(UVRI) were positive for measles-specific Immunoglobulin M (IgM) antibodies. We investigated to determine the scope, identify the source of the outbreak, assess risk factors for transmission, vaccine effectiveness, and vaccine coverage, and recommend evidence-based control and prevention measures.

Methods

Outbreak area

We conducted the investigation in Moroto District in Karamoja Region, North Eastern Uganda (Figure 1). This region is inhabited by the Karamojongs who are nomadic pastoralists in nature. The district neighbors the Turkana region of Kenya which is also occupied by nomadic pastoralists known as the Turkana people (10). Both people have intertwined cultures with a lot in common Moroto District has 18 health facilities and of them, 17 offer immunization services.

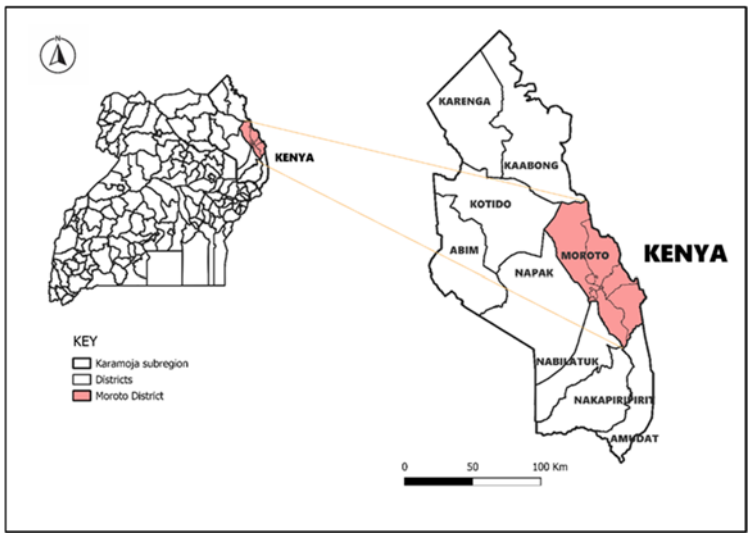


Figure 1: Location of Moroto District, Uganda

Case definition and finding

We defined a suspected case as onset of fever and maculopapular rash and one or more of the following symptoms: cough, runny nose or conjunctivitis in a resident of Moroto District from March 15, 2024 to July 23, 2024. A confirmed case was a suspected case with positive results for IgM measles-specific antibody test in a resident of Moroto District from March 15, 2024 to July 23, 2024.

We line-listed suspected measles cases by reviewing health facility records at Moroto RRH and St. Pius, Kidepo HC III. We found additional cases with the help of Health Facility Surveillance Focal Persons (HFSFP) who reviewed records at their health facilities where we couldn't reach because of insecurity. We used standard case investigation forms to collect data on demographics, clinical characteristics, vaccination status, exposure history, treatment, and admission history of the case-patients.

Laboratory investigations

Samples of whole blood from 13 suspected case-patients were collected and sent to Uganda Virus Research Institute (UVRI) for Measles specific IgM testing.

Descriptive epidemiology

We constructed an epidemic curve to determine the distribution of measles cases over time. We computed Attack Rates (AR) by person, and place using projected populations from the Uganda Bureau of Statistics (UBOS) as the denominator and presented the results using tables. We described AR by place by depicting on maps using Quantum Geographic Information System (QGIS).

Hypothesis generation and case control study

We conducted 30 hypothesis generating interviews from suspected case-patients using the measles case investigation form. We asked the caretakers about the potential exposures that could have occurred within three weeks prior to the onset of symptoms. We also held interviews with the District Health Team (DHT) about the possible exposure factors and the source.

We conducted a case-control study to evaluate the generated hypotheses. We recruited 83 case patients. For each case, we selected two controls with no history of fever, rash and conjunctivitis from March 15 to July 23, 2024 with an alternative diagnosis on admission made by either a pediatrician or a medical officer, aged 6 months – 5 years and residents of Moroto District. We identified factors associated with measles transmission using logistic regression.

Vaccine coverage (VC) and vaccine effectiveness estimation (VE)

We estimated the VC using the percentage of controls with a history of measles vaccination in the case control study, assuming that the controls were representative of the general population.

Continued from page 52

We calculated VE using the formula:

VE = 1- aOR

Where aOR is the odds ratio associated with having been vaccinated for at least one dose of measles vaccine, adjuster for risk factors that were significant during the univariate analysis, using conditional logistical regression.

Ethical considerations

The Ministry of Health of Uganda gave the directive and gave approval to investigate this outbreak. The Office of the Associate Director for Science at the US Centres for Disease Control and Prevention (CDC) Uganda determined that this research did not involve human subject research and that its primary intent was public health practice or disease control. Verbal informed consent was obtained from participants or, if the interviewee was a minor, guardians before the start of each interview .

Results

Descriptive epidemiology

We identified 290 (269 suspected cases, 15 confirmed cases and 6 deaths). The epidemic curve shows a propagated pattern with multiple peaks over the outbreak period (Figure 2). The index case was a 10-month-old from Kosiroi Village in Tapac Sub-county that is next to the Kenyan border of Western Turkana Region (Figure 3). He had received one dose of MCV. He had recently travelled from this region of Kenya alongside his mother. This region had an ongoing measles outbreak. Five deaths were recorded during this outbreak. All the deaths occurred at Moroto RRH and died of complications of severe pneumonia with underlying malnutrition. Three of the deaths were unvaccinated and two had unknown history of vaccination.

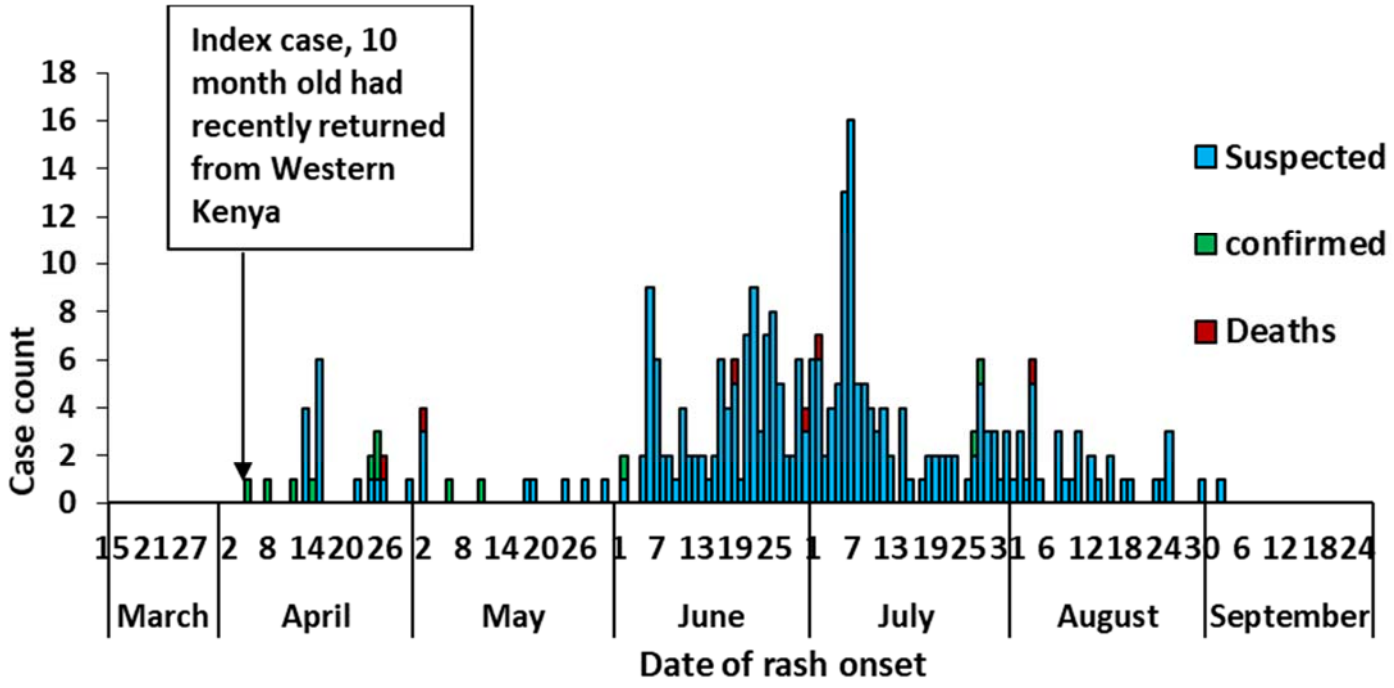


Figure 2: Distribution of measles cases by the date of onset of symptoms in Moroto District, Uganda, March–July, 2024 (n = 290)

All cases presented with fever and generalized rash. The majority of the cases had running nose (71%), and red eyes (67%). Other symptoms were cough, diarrhea, generalized body weakness, poor feeding. 22% (52/236) of the cases had complications. The common complications during this outbreak were diarrhea (16%), diarrhea and pneumonia (3%), and pneumonia alone (2.5%). The most affected age group was less than one year of age (194/10,000) followed by the 1-4 years age group (47/10,0000), and 5-15 years (2/10,000). The most affected Sub-counties were Lotisan (50/10,000) and Rupa (41/10,000).

Continues to page 54

Continued from page 53

These were followed by Nandunget (17/10,000), Northern Division (14/10,000), Loputuk (13/10,000), Katikekile (9/10,000), Southern Division (7/10,000), and Tapac (1/10,000) sub-counties. The overall AR was 19/10,000.

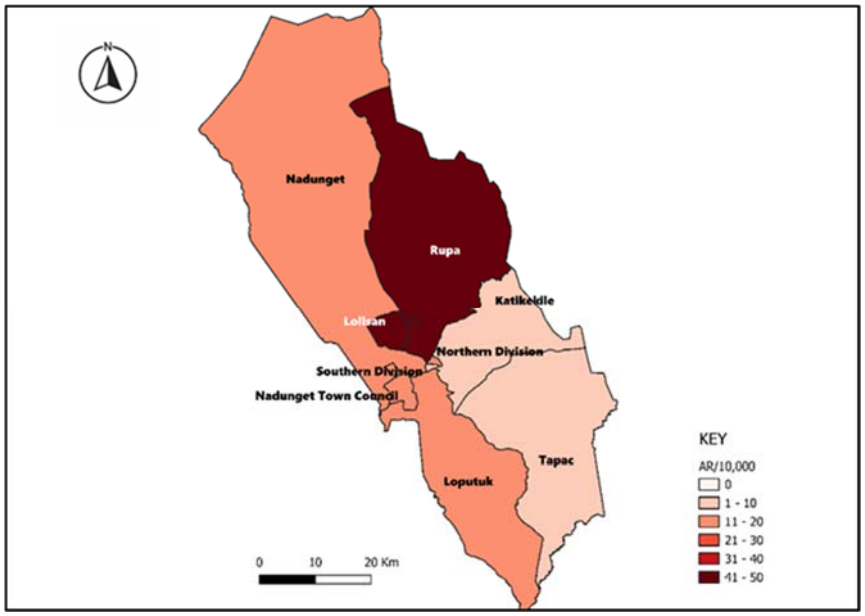


Figure 3: Attack Rate (per 10,000) by sub-county of residence in measles outbreak, Moroto District, Uganda, March–July, 2024.

Hypothesis generation and case control study findings

Of the 30 cases interviewed: 25 (83%) were not vaccinated; 19 (63%) had visited a health facility, eight (27%) were malnourished, 2 (7%) had a visitor from a neighboring district.

Interviews with the district health officer, and district surveillance focal person (DSFP) revealed that there was frequent movement across the Ugandan border with Kenya and they had been on high alert since the beginning of the year following information from their Kenyan counterparts about a measles outbreak that was ongoing in the Western Turkana Region.

Table 1: Factors associated with measles transmission during the outbreak in Moroto District, Uganda, March–July 2024

Risk factor	Cases n (%)	Controls n (%)	Crude OR (95% CI)	aOR (95%CI)
Vaccination				
Yes	22 (50)	111 (91)	0.099 (0.04 – 0.26)	0.11 (0.03–0.4)
No	22 (50)	11 (9)	Ref	Ref
Malnutrition				
Yes	24 (29)	24 (15)	2.4 (1.3 – 4.6)	6.1 (1.3 – 27)
No	59 (71)	142 (85)	Ref	Ref
Visiting a health facility				
Yes	37 (45)	14 (18)	3.6 (1.7 – 7.7)	3.8 (1.3 – 11)
No	46 (55)	63 (82)	Ref	Ref
Visitor from another district				
Yes	11 (13)	9 (5)	2.7 (1.1 – 6.8)	3.9 (0.3 – 53)
No	72 (87)	157 (95)	Ref	Ref
Vitamin A in the last 6 months				
Yes	69 (83)	153 (92)	0.42 (0.19 – 0.95)	0.5 (0.1–3.0)
No	14 (17)	13 (8)	Ref	Ref

Continued from page 54

Vaccination (aOR=0.11, 95%CI=0.03–0.4), malnutrition (aOR=6.1, 95%CI=1.3–27), and visiting a health facility 7–21 days prior to onset of rash (aOR=3.8, 95%CI=1.3–11) were significantly associated with measles transmission (Table 1).

Vaccine coverage and vaccine effectiveness estimation findings

The estimated VE was 89% (95% CI= 60 – 97). The estimated VC, based on the percent of controls that had a history of being vaccinated against measles, was 91% among those ≥ 9 months of age and 67% overall for MCV1.

Discussion

Our investigation revealed that the outbreak was most likely introduced into the area from the Western part of Kenya; Turkana that neighbours the outbreak area and had been experiencing a large measles outbreak. Low measles vaccination coverage coupled with malnutrition and nosocomial spread propagated the outbreak. Rupa and Lotisan sub-counties were the most affected sub-counties.

This measles outbreak was likely introduced in Moroto through cross border importation from the Western Turkana Region that had been experiencing a measles outbreak since December 2023 (11). Both communities are nomadic pastoralists and there are frequent movements across the border for cultural and grazing reasons. Improving cross border information sharing at district and regional levels, and improved surveillance at border points can mitigate future spread of diseases by cross border movements (12).

The outbreak was further facilitated by mixing of measles and non-measles patients prior to the confirmation of the outbreak and the designation of an isolation unit at Moroto RRH. Nosocomial spread of measles has previously been found to propagate outbreaks in Uganda and elsewhere (8, 16, 17). The WHO recommends that individuals with rash and fever should not share common waiting areas at health facilities (15).

Malnutrition which was common in this outbreak area was associated with increased odds of measles infection. Studies in Afar District of North Eastern Ethiopia and Yemen found similar findings with malnutrition increasing the odds of measles disease(19, 20). This area had been experiencing an increase in acute food insecurity and malnutrition levels during the period of the outbreak (18).

In this study, history of measles vaccination was protective against measles disease. Measles vaccination is the recommended strategy for preventing measles outbreaks worldwide and subsequently achieving elimination. The WHO recommends two doses of MCV with the first dose administered at 9 months and the second dose at 15 – 18 months of age, and a VC of at least 80% for MCV2 (1). The estimated VE during this investigation for MCV1 was 89% which was higher than in a previous study of 85% (19), but lower than in another study in Uganda that found 95% VE but within the range of findings of systematic review of measles VE to be between 77%, IQR (62 – 91 %) . VE findings from the field vary and depend on the number of doses administered, vaccine handling and storage, cold chain failure and host factors such as malnutrition and HIV infection (20).

Study limitations

This investigation had some limitations. There was ongoing insecurity in the most affected communities of Lotisan and Rupa Sub-counties of the district during this outbreak (20). We could not access the insecure sub-counties for comprehensive case finding and investigations. This could have led to underestimation of the magnitude of the outbreak. Additionally, it is likely that we interviewed only severe cases who were more likely to seek care. Because of the insecurity, we enrolled hospital controls, this possibility likely introduced a misclassification bias. The bias was minimized by careful selection of the controls and only considering those without symptoms of measles and with a diagnosis other than measles made by either a pediatrician or a medical officer at the hospital.

Recommendations and public health actions

During the investigation, mass MCV campaign was conducted targeting children aged 6 months to 5 years in all the sub counties and divisions of Moroto district. Outreaches for vaccination were also extended to underserved and insecure areas with the support of the security forces in the district. Screening at all points of care for children was done and isolating suspected measles cases, an isolation and treatment wards were designated at Moroto RRH and St. Pius Kidepo HC III. We also participated in provision of relief food at the lowest administrative units coupled with screening for measles to prevent malnutrition and also avoid further spread of measles and reduce measles associated mortality.

Continues to page 56

Continued from page 55

To prevent and control future outbreaks, we recommended strengthening and supporting routine vaccination program; a policy shift in the national immunization schedule for the MCV1 to be administered at six months of age; integrating animal and human vaccination programs to improve on the vaccination coverage in this nomadic population and improved cross border information sharing at district level and enhancing cross border surveillance.

Conclusion

This measles outbreak was imported from the Western Turkana Region of Kenya to Moroto District, Karamoja Region through cross border movement by the nomadic people who live in both regions. The outbreak was propagated by interaction of cases with other children seeking care at different health facilities through nosocomial transmission. Malnutrition and low measles vaccination rates in the area further facilitated the outbreak.

Conflict of interest

The authors declared no conflict of interest

Author contribution

All authors contributed to the write-up and review of the bulletin. EM wrote the drafts of the bulletin and revised the bulletin for substantial intellectual content. DW, AN, DS, EK, RA, and RM participated in the investigation. RM, BK, and ARA were involved in the review of the bulletin for substantial intellectual content. RM participated in the supervision of field data collection and reviewed the draft bulletin for substantial intellectual content.

Acknowledgements

We acknowledge the support of the Moroto District local government and Karamoja Regional Emergency Operations Centre (EOC) who worked with us during this outbreak investigation and response for their cooperation. We thank the frontline health workers, whom we worked with during case finding, implementation of public health actions, and enrollment of controls for their time, support and cooperation. We also acknowledge the Ministry of Health through Uganda National Expanded Program on Immunization (UNEPI) for the logistical and technical support to the outbreak response especially the mass measles campaign.

References

1. WHO. Measles vaccines: WHO position paper, April 2017 – Recommendations. Vaccine. 2019 Jan 7;37(2):219–22.
2. Measles [Internet]. [cited 2024 Jul 15]. Available from: https://www.who.int/news-room/fact-sheets/detail/measles
3. Minta AA. Progress Toward Measles Elimination — Worldwide, 2000–2022. MMWR Morb Mortal Wkly Rep [Internet]. 2023 [cited 2024 Jul 15];72. Available from: https://www.cdc.gov/mmwr/volumes/72/wr/mm7246a3.htm
4. WHO U. WHO and UNICEF estimates of immunization coverage [Internet]. 2024 Jul. Available from: https://data.unicef.org/wp-content/uploads/cp/immunisation/uga.pdf
5. Majwala RK, Nakiire L, Kadobera D, Ario AR, Kusiima J, Atuhairwe JA, et al. Measles outbreak propagated by children congregating at water collection points in Mayuge District, eastern Uganda, July – October, 2016. BMC Infect Dis. 2018 Aug 20;18(1):412.
6. Biribawa C, Atuhairwe JA, Bulage L, Okethwangu DO, Kwesiga B, Ario AR, et al. Measles outbreak amplified in a pediatric ward: Lyantonde District, Uganda, August 2017. BMC Infect Dis. 2020 Jun 5;20(1):398.
7. Walekhwa AW, Ntaro M, Kawungezi PC, Achangwa C, Muhindo R, Baguma E, et al. Measles outbreak in Western Uganda: a case-control study. BMC Infect Dis. 2021 Jun 22;21(1):596.

8. Investigation of a Measles Outbreak in Semuto Subcounty, Nakaseke District, Uganda, June–August 2021 - UNIPH [Internet]. 2022 [cited 2024 Jul 15]. Available from: https://uniph.go.ug/investigation-of-a-measles-outbreak-in-semuto-subcounty-nakaseke-district-uganda-june-august-2021/

9. WHO | Regional Office for Africa [Internet]. 2024 [cited 2024 Jul 15]. Weekly bulletins on outbreaks and other emergencies. Available from: https://www.afro.who.int/health-topics/disease-outbreaks/outbreaks-and-other-emergencies-updates

10. Emerging and reemerging epidemic-prone diseases among settling nomadic pastoralists in Uganda. Acta Tropica. 2014 Sep 1;137:19–24.

11. WHO Afro. OMS | Escritório Regional para a África. 2024 [cited 2024 Jul 16]. Outbreak and other Emergencies: Week 23: 3 - 9 June 2024. Available from: https://www.afro.who.int/countries/kenya/publication/outbreak-and-other-emergencies-week-23-3-9-june-2024

12. Akinloluwa OO, Lokossou V, Okatubo G, Okunromade O, Nwitte-Eze O, Alabi S, et al. Towards a multi-lateral framework for cross-border surveillance and information sharing between Nigeria and neighbouring countries. BMJ Global Health. 2024 Mar 1;9(3):e013011.

13. Nosocomial transmission of measles: An updated review. Vaccine. 2012 Jun 8;30(27):3996–4001.

14. Farizo: Pediatric emergency room visits: a risk factor... - Google Scholar [Internet]. [cited 2024 Jul 19]. Available from: https://scholar.google.com/scholar_lookup?&title=Pediatric%20emergency%20room%20visits%3A%20a%20risk%20factor%20for%20acquiring%20measles&journal=Pediatrics&volume=87&issue=1&pages=74-79&publication_year=1991&author=Farizo%2CKM&author=Stehr-Green%2CPA&author=Simpson%2CDM&author=Markowitz%2CLE

15. Biellik RJ, Clements CJ. Strategies for minimizing nosocomial measles transmission. Bull World Health Organ. 1997;75(4):367–75.

16. Ayele WM. Malnutrition Precipitated Measles Outbreak in Gewane District, Afar Regional State, Northeastern Ethiopia, 2016 [Internet]. 2020 [cited 2024 Jul 19]. Available from: https://www.researchsquare.com/article/rs-32423/v1

17. Nassar AAH, Al Amad MA, Qasim M, Dureab F. Risk factors for measles outbreak in Ataq and Habban districts, Shabwah governorate, Yemen, February to May 2018. BMC Infect Dis. 2021 Jun 10;21(1):551.

18. Uganda - Karamoja, IPC Acute Food Insecurity and Acute Malnutrition Analysis, March 2024 - February 2025 (Issued 12 June 2024) - Uganda | ReliefWeb [Internet]. 2024 [cited 2024 Jul 19]. Available from: https://reliefweb.int/report/uganda/uganda-karamoja-ipc-acute-food-insecurity-and-acute-malnutrition-analysis-march-2024-february-2025-issued-12-june-2024

19. Namulondo E, Ssemanda I, Komugisha M, Nuwamanya Y, Nsubuga EJ, Wako S, et al. Measles Outbreak in a Refugee Settlement, Kiryandongo District, Uganda, July– October 2023 [Internet]. 2024 [cited 2024 Jul 19]. Available from: https://www.researchsquare.com/article/rs-4497006/v1

20. Oyel R. Nilepost News. 2024 [cited 2024 Jul 19]. Death toll in Moroto warrior attacks increases to 11. Available from: https://nilepost.co.ug/crime/206192/death-toll-in-moroto-warrior-attacks-increases-to-11

Continues to page 58

Continued from page 57

Trends of anemia in pregnancy and uptake of prevention measures during antenatal care, Uganda, 2020-2024

Authors: Janet Kobusinge Lubega[1*], Richard Migisha[1], Benon Kwesiga[1], Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda
Correspondence*: Tel: +256 772 773664896, Email: jklubega@uniph.go.ug

Background: Anemia remains a significant health challenge in Uganda, particularly for pregnant women, leading to complications like maternal mortality and preterm births. Despite Ministry of Health guidelines for free antenatal services, including iron and folic acid supplementation, 23%-37% of pregnant women remain anemic. We analyzed trends in anemia and the uptake of anemia prevention services, Uganda, 2020–2024 to inform programming.
Methods: We analyzed DHIS2 data on ANC1 and ANC4 visits in Uganda between 2020 and 2024. Anemia was defined as hemoglobin levels below 10 g/dL. We also calculated the percentage uptake of iron/folate supplements (IFA), intermittent preventive therapy (IPT), and long-lasting insecticidal nets (LLINs). Trends were assessed using the Mann-Kendall test at $p < 0.05$.
Results: Anemia prevalence at ANC4 significantly declined from 20% in 2020 to 10% by 2021 (p = 0.001), while ANC1 prevalence remained stable at 7% to 10%, both above the 5% target. Screening coverage at ANC4 improved significantly from 14% in 2020 to 25% in 2024 (p = 0.001), whereas ANC1 coverage increased modestly from 5% to 9% (p = 0.14). IFAS coverage consistently exceeded the 65% target, ranging from 67% to 70%, though variability was observed at ANC4 (p = 0.1). IPT1 coverage declined significantly from 98% in 2020 to 75% in 2024 (p = 0.001), while IPT3 averaged 56% and remained below the 66% target (p = 0.29). LLIN distribution improved significantly from 59% in 2020 to 66% in 2024 (p = 0.01) but remained below the 100% target.
Conclusion: Anemia rates declined from 2020 to 2024, with significant trend observed in the prevalence of anemia and screening at ANC4. Strengthening prevention measures including IFA, IPT, and LLIN uptake, is crucial to addressing anemia, particularly in high-burden regions. Further studies are needed to understand factors driving high anemia prevalence at the district level.

Introduction

Anemia remains a major public health challenge, with the highest burden observed in low- and lower-middle-income countries such as Uganda. It disproportionately affects vulnerable populations, including young children, menstruating adolescent girls, pregnant, and postpartum women (1, 2). Anemia in pregnancy, defined by hemoglobin levels below 11g/dL, compromises the oxygen-carrying capacity of blood and increases the risks of maternal and perinatal morbidity and mortality, preterm birth, low birth weight, and complications such as cardiac failure and postpartum hemorrhage (3) (4).

In Uganda, with the 2018 UDHS reporting that 32% of women aged 15-49 are anemic (7). Among pregnant women, a pooled prevalence of 43.2% was observed from UDHS data between 2006-2016(8). Anemia rates were higher in rural areas (33%) than urban areas (27%), with regional variation ranging from 17% in Kigezi to 47% in Acholi(9).

The Uganda Ministry of Health (MoH) has established guidelines to prevent and manage anemia in pregnancy, as recommended by the World health Organization (WHO), a minimum of eight ANC contacts for pregnant women. Additionally, promoting routine iron and folic acid supplementation (IFAS), intermittent preventive treatment for malaria (IPTp), and distribution of long-lasting insecticidal nets (LLINs) (10) (11, 12) (3). Despite this, adherence to this guideline in Uganda remains suboptimal. Many women attend fewer than the recommended number of ANC visits, limiting their access to essential preventive services such as anemia screening, iron supplementation, and malaria prophylaxis (13). This indicating ongoing challenges in healthcare delivery and adherence to treatment protocols. While the intervention package has clear goals, understanding its uptake over time and evaluating its effectiveness in reducing anemia prevalence among pregnant women is critical. Previous studies assessing anemia prevalence among pregnant women have relied primarily on survey data from specific districts or regions. However, none have utilized the comprehensive District Health Information System (DHIS2) datasets to explore nationwide trends in anemia and the associated prevention interventions.

Continued from page 58

This study addressed this gap by providing a detailed analysis of anemia in pregnancy, focusing on its prevalence, trends, as well as the uptake and trends of prevention measures provided during antenatal care (ANC) from 2020 to 2024.

Methods

We conducted a descriptive analysis of anemia trends and the uptake of prevention services (iron and folic acid supplementation, long-lasting insecticidal net distribution, and intermittent preventive treatment with fansidar) among pregnant women attending their first antenatal visit (ANC1) and fourth antenatal visit (ANC4) antenatal care visits, Uganda, 2020-2024. We utilized anemia and anemia-prevention services surveillance data from Uganda's District Health Information Software version 2 (DHIS2), managed by the Ministry of Health.

Data on anemia prevalence and uptake of preventive services were extracted from DHIS2 and analyzed using Microsoft Excel and STATA 16. Indicators were summarized and disaggregated by period for ANC1 and ANC4 to evaluate trends over time. Data was analyzed quarterly rather then annually to capture higher frequency, allowing for finer resolution in trend identification, better detection of seasonal variations, short-term fluctuations, and emerging patterns that might be obscured in annual aggregates.

From the total ANC attendance, we identified those tested for anemia and calculated the proportion diagnosed with anemia with those having a hemoglobin concentration level of less than 10 g/dL. The data was then disaggregated into quarters. Anemia was then classified into public health significance categories ranging from severe to normal(14). Uptake of iron and folic acid supplementation (IFAS), intermittent preventive treatment (IPT), and insecticidal net distribution was calculated separately for ANC1 and ANC4. For IFAS, the percentage was determined by dividing the number of women who received supplementation at ANC1 or ANC4 by the total number of ANC visits at the respective stage. IPT was calculated as IPT1 and IPT3, where IPT1 was determined by dividing the number of women who received the first dose of IPT at ANC1 by the total ANC1 visits, and IPT3 was calculated as the number of women who received the third dose of IPT divided by the total number of ANC1 visits. For insecticidal net distribution, the percentage was obtained by dividing the number of women who received nets at ANC1 or ANC4 by the total number of ANC visits at the corresponding stage.

These calculations reflect the proportion of women who accessed these interventions at specific points during their ANC visits. The percentage utilization of each intervention was compared to national targets. For anemia screening, the target was set at 65% at ANC1, while iron and folic acid supplementation (IFAS) aimed for 65% utilization at ANC1, Intermittent preventive therapy (IPT) targeted 66% utilization with a minimum of three doses, and long-lasting insecticidal nets (LLINs) were expected to achieve 100% distribution during ANC1 (15, 16).

To analyze trends in anemia prevalence and service uptake, the Mann-Kendall test was employed at a significance level of $p < 0.05$. Analyses were conducted for national-level data, providing insights into yearly variations and overall changes.

Our study utilized routinely collected aggregated program surveillance data that did not have any personal identifiers. We obtained permission to use the HMIS data from the Ministry of Health Resource Centre which has the overall mandate to collect and store health-related information. Additionally, the U.S. Centers for Disease Control and Prevention (CDC) Center for Global Health determined our study was non-research whose primary intention was to address public health problems. We stored data in password-protected computers and data was not shared with anyone outside the investigation team.

Results

Trends of pregnant women screened for anemia at antenatal care 1 and antenatal care 4, Uganda, 2020-2024

From Quarter 1 2020 to Quarter 3 2024, anemia screening coverage averaged 21% at ANC1 and 8% at ANC4, falling significantly short of the 65% target throughout the period. At ANC1, screening rose from 14% in Q1 2020 to 25% by Q3 2024, while ANC4 screening increased from 5% to 9% but remained consistently lower than ANC1. A statistically significant upward trend was observed for ANC4 screening ($p = 0.001$), whereas the trend for ANC1 was not significant ($p = 0.14$) (Figure 1).

Continues to page 60

Continued from page 59

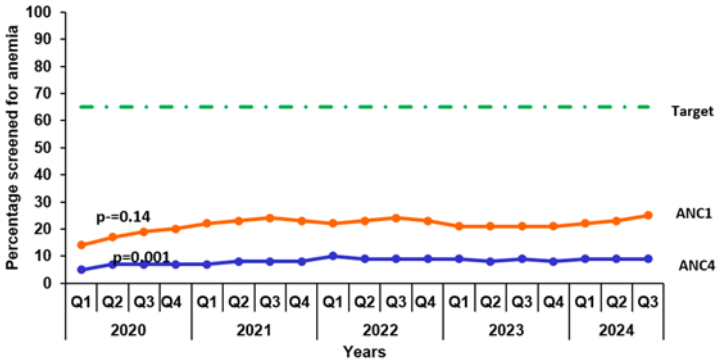


Figure 1: Trends of pregnant women screened for anemia at antenatal care 1 and antenatal care 4, Uganda, 2020-2024

Trends for prevalence of anemia in pregnancy at antenatal 1 and antenatal 4, Uganda, 2020-2024

The average prevalence of anemia was 9% at ANC1 and 13% at ANC4, consistently still above the 5% target throughout the study period. At ANC1, prevalence remained relatively stable, starting at 10% in Q1 2020 and slightly declining to 9% in Q3 2024. In contrast, ANC4 prevalence significantly declined from 22% in Q1 2020 to 10% by Q2 2021, stabilizing thereafter at around 9% by Q3 2024. The decline at ANC4 was statistically significant (p = 0.02), while no significant change occurred at ANC1 (p = 0.42) (Figure 2).

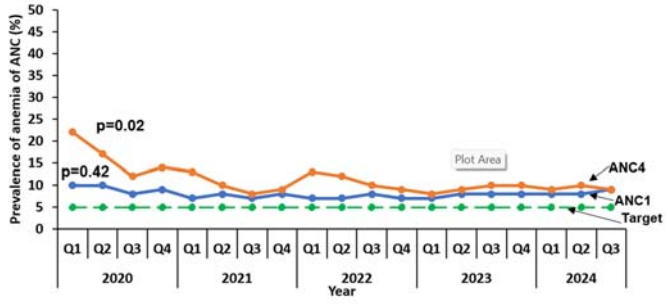


Figure 2: Trends for prevalence of anemia in pregnancy at antenatal 1 and antenatal 4, Uganda, 2020-2024

Trends of iron and folic acid supplementation coverage at antenatal care 1 and antenatal care 4, Uganda, 2020-2024

Quarterly trends in iron and folic acid supplementation (IFAS) uptake during ANC1 and ANC4 from Q1 2020 to Q3 2024 show that coverage was between 67% and 70% which consistently exceeded the national target throughout the study. ANC1 coverage rose steadily from 65% in Q1 2020 to 71% in Q3 2024, showing minimal fluctuations. ANC4 coverage started at 80% in Q1 2020, peaked at 98% in Q4 2021, and declined to 68% by Q3 2024, with notable variability. Neither trend was statistically significant (ANC1: p = 0.91; ANC4: p = 0.1) (Figure 3).

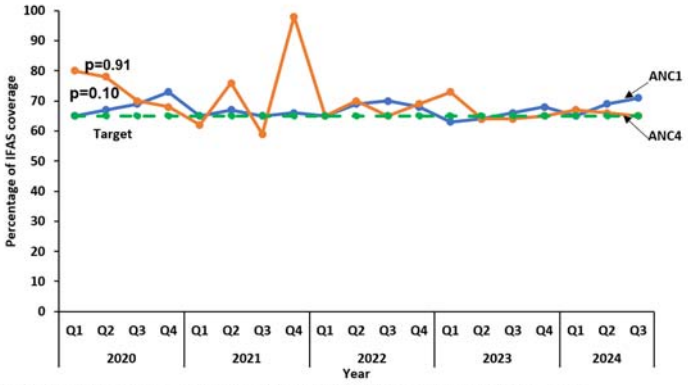


Figure 3: Trends of iron and folic acid supplementation coverage at ANC1 and ANC4, Uganda, 2020-2024

Trends of Intermittent Preventive Treatment coverage at antenatal care 1 and antenatal care 4, Uganda, 2020-2024

Quarterly trends in intermittent preventive treatment (IPT) coverage during ANC1 and ANC4 visits from Q1 2020 to Q3 2024 show that average IPT1 utilization was 77%, consistently exceeding the 66% target, while IPT3 utilization averaged 56% and never met the target. IPT1 coverage significantly declined from 98% in Q1 2020 to 75% in Q3 2024 (p = 0.001). IPT3 coverage increased from 51% in Q1 2020 to 64% in Q3 2024, but the trend was not statistically significant (p = 0.29) (Figure 4).

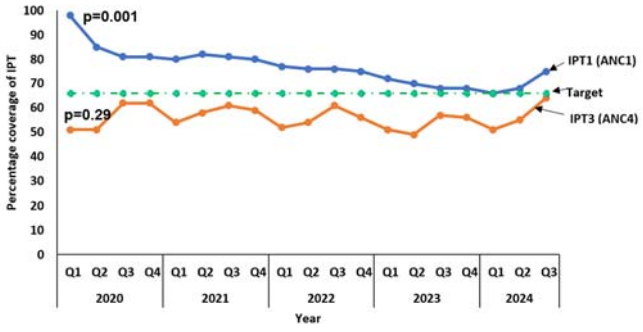


Figure 4: Trends of intermittent preventive treatment coverage at antenatal care 1 and antenatal care 4, Uganda, 2020-2024

Trends of Long-Lasting Insecticidal Nets coverage at antenatal care 1 and antenatal care 4, Uganda, 2020-2024

The quarterly trends in the uptake of LLINs during ANC1 visits from Q1 2020 to Q3 2024. LLIN coverage started at 59% (282,096/480,831) in Q1 2020, and then declined to 37% (175,494/471,341) by Q3 2021. There was a notable increase to 66% (347,721,530,022) in Q3 2024. Overall, average LLIN utilization was 61%, falling below the 100% target.

Continued from page 60

The distribution coverage showed a statistically significant increase (p = 0.01) indicating improvements over the study period (Figure 5).

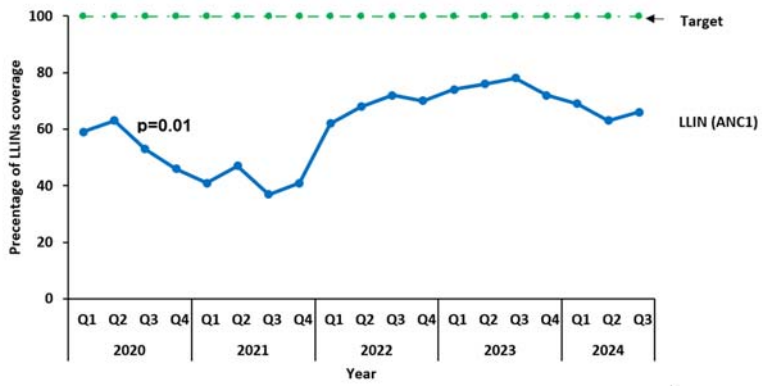


Figure 5: Trends of Long-Lasting Insecticidal Nets coverage at ANC1 and ANC4, Uganda, 2020-2024

Discussion

From 2020 to 2024, maternal health interventions in Uganda showed mixed progress. Anemia screening coverage remained below target, with improvements observed at ANC4, while anemia prevalence declined significantly only at later stages of care. Iron and folic acid supplementation consistently exceeded targets, but intermittent preventive treatment showed declining coverage for initial doses and unmet targets for subsequent doses. Long-Lasting Insecticidal Net distribution improved over time but still fell short of the target. These findings underscore the need for stronger efforts to meet maternal health objectives.

The prevalence of anemia among pregnant women in Uganda remains a significant public health concern. Higher anemia rates at ANC4 compared to ANC1 suggest reduced ANC attendance later in pregnancy, consistent with findings from Uganda and Ghana, where social, financial, and geographical barriers, along with knowledge gaps, limit access to care beyond initial visits (17, 18, 19). As a result, achieving the WHO recommended eight ANC visits is rare, with many women receiving far fewer than the recommended number.

Preventive measures such as iron and folic acid supplementation, IPT for malaria, and LLINs are critical in managing anemia. However, uptake of these interventions remains suboptimal. This study found that iron and folic acid supplementation never exceeded 75% coverage, and IPT coverage showed a downward trend over time. Low adherence to supplementation and IPT, along with inadequate dietary intake and malaria burden, especially in regions with high malaria transmission contributes to the anemia (26, 27, 28).

The poor coverage of anemia prevention measures can be attributed to several factors, including inconsistent access to healthcare services, particularly in rural areas. Barriers such as healthcare access, long distances to facilities, financial constraints, and frequent stock-outs of supplements exacerbate the issue. Cultural beliefs, misconceptions, and inadequate health literacy further reduce adherence to preventive measures (27). Addressing these challenges requires improved healthcare access, consistent supply chains for preventive interventions, and enhanced community education to promote adherence to ANC recommendations. Strengthening these areas is essential for reducing anemia in pregnancy and improving maternal health outcomes (24, 26). Additionally, healthcare system inefficiencies, such as frequent stock-outs of essential supplements and commodities, further reduce access. Low health literacy, cultural beliefs, and misconceptions about the importance of these preventive measures also contribute to poor adherence, with healthcare providers sometimes failing to emphasize the importance of continued care and treatment adherence during ANC visits.
Addressing these gaps requires improving healthcare access and ensuring that pregnant women receive consistent and adequate testing and prevention measures throughout their pregnancy. Enhancing health literacy through community engagement and education campaigns can improve adherence to ANC recommendations. At the healthcare system level, strengthening supply chains to ensure the availability of key preventive interventions, such as iron/folic acid supplements and antimalarial prophylaxis, is critical to reducing anemia in pregnancy.

Study limitations

We utilized secondary data associated with missing data. This likely led to an underestimation of the magnitude of the study outcomes. A number of private health facilities do not report or inconsistently report data to the DHIS2. This also likely led to an underestimation of the magnitude of the study outcomes.

Continues to page 62

Continued from page 61

Conclusion

While anemia prevalence showed a declining trend, it still did not reach below the national target, indicating a persistent burden that requires intensified prevention and management efforts. The reduction in prevalence reflects the impact of ongoing interventions but underscores the need for continued focus on maternal anemia as a significant health risk.

Screening at ANC4 improved but remained sub-optimal, indicating the need to strengthen service delivery later in pregnancy. IPT1 coverage declined, pointing to challenges in early preventive care, while LLIN distribution increased but did not meet targets, highlighting gaps in accessibility. In contrast, IFAS coverage consistently exceeded the target, demonstrating the success of supplementation programs. These trends show progress in some areas while revealing critical gaps in achieving universal coverage for maternal health interventions.

Addressing these challenges will require enhanced service delivery, improved preventive care, and strengthened efforts to ensure comprehensive coverage of essential maternal health interventions throughout pregnancy.

Conflict of interest

The authors declare that they no conflict of interest

Authors' contribution

JKL conceptualized the idea, analyzed and interpreted the data, and drafted the manuscript. a. RM, BK, LB, and ARA reviewed the bulletin for intellectual content.

Acknowledgements

We thank the staff of the Public Health Fellowship Program for the technical support and guidance offered during this study.

References

1. WHO. Anemia-Fact sheet 2023 [Available from: https://www.who.int/news-room/fact-sheets.
2. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, et al. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. The Lancet Global Health. 2013;1(1):e16-e25.
3. Organization WWH. The global prevalence of anaemia in 2011. Geneva; 2015.
4. Edelson PK, Cao D, James KE, Ngonzi J, Roberts DJ, Bebell LM, et al. Maternal anemia is associated with adverse maternal and neonatal outcomes in Mbarara, Uganda. The Journal of Maternal-Fetal & Neonatal Medicine. 2023;36(1):2190834.
5. Sun D, McLeod A, Gandhi S, Malinowski AK, Shehata N. Anemia in pregnancy: a pragmatic approach. Obstetrical & gynecological survey. 2017;72(12):730-7.
6. Gebreweld A, Tsegaye A. Prevalence and factors associated with anemia among pregnant women attending antenatal clinic at St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia. Advances in hematology. 2018;2018(1):3942301.
7. Report UBoSP. Uganda Demographic and Health

Survey.
8. Bongomin F, Olum R, Kyazze AP, Ninsiima S, Nattabi G, Nakyagaba L, et al. Anemia in Ugandan pregnant women: a cross-sectional, systematic review and meta-analysis study. Trop Med Health. 2021;49(1):19.
9. Wasswa R, Kananura RM, Muhanguzi H, Waiswa P. Spatial variation and attributable risk factors of anaemia among young children in Uganda: Evidence from a nationally representative survey. PLOS Global Public Health. 2023;3(5):e0001899.research notes. 2017;10:1-6.

Continued from page 62

10. Kiwanuka TS, Ononge S, Kiondo P, Namusoke F. Adherence to iron supplements among women receiving antenatal care at Mulago National Referral Hospital, Uganda-cross-sectional study. BMC research notes. 2017;10:1-6.
11. Uganda Malaria Indicator Survey 2018-2019 [Internet]. Available from: https://www.dhsprogram.com/pubs/pdf/MIS34/MIS34.pdf.
12. Organization WH. Guideline: Daily iron and folic acid supplementation in pregnant women 2012.
13. UBoS I. Uganda demographic and health survey 2016. Kampala, Uganda and Rockville, Maryland, USA. 2018.
14. Organization WH. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. World Health Organization; 2011.
15. Health Mo. Annual Health Sector Performance Report 2022/23. Kampala: Ministry of Health; 2023.; 2023.
16. ICF UBoSUa. Uganda Demographic and Health Survey 2022: Key Indicators Report. Kampala, Uganda: UBOS, and Rockville, Maryland USA. 2022.
17. Duodu PA, Bayuo J, Mensah JA, Aduse-Poku L, Arthur-Holmes F, Dzomeku VM, et al. Trends in antenatal care visits and associated factors in Ghana from 2006 to 2018. BMC Pregnancy and childbirth. 2022;22(1):59.
18. Nachinab GT-e, Adjei CA, Ziba FA, Asamoah R, Attafuah PA. Research Article Exploring the Determinants of Antenatal Care Services Uptake: A Qualitative Study among Women in a Rural Community in Northern Ghana. 2019.
19. Wilson M, Patterson K, Nkalubo J, Lwasa S, Namanya D, Twesigomwe S, et al. Assessing the determinants of antenatal care adherence for Indigenous and non-Indigenous women in southwestern Uganda. Midwifery. 2019;78:16-24.
20. Mahamoud NK, Mwambi B, Oyet C, Segujja F, Webbo F, Okiria JC, et al. Prevalence of anemia and its associated socio-demographic factors among pregnant women attending an antenatal care clinic at Kisugu Health Center IV, Makindye Division, Kampala, Uganda. Journal of blood medicine. 2020:13-8.
21. Zerfu TA, Baye K, Faber M. Dietary diversity cutoff values predicting anemia varied between mid and term of pregnancy: a prospective cohort study. Journal of Health, Population and Nutrition. 2019;38:1-9.
22. Wilunda C, Massawe S, Jackson C. Determinants of moderate-to-severe anaemia among women of reproductive age in T anzania: Analysis of data from the 2010 T anzania demographic and health survey. Tropical Medicine & International Health. 2013;18(12):1488-97.
23. Nankinga O, Aguta D. Determinants of Anemia among women in Uganda: further analysis of the Uganda demographic and health surveys. BMC public health. 2019;19(1):1757.
24. Obai G, Odongo P, Wanyama R. Prevalence of anaemia and associated risk factors among pregnant women attending antenatal care in Gulu and Hoima Regional Hospitals in Uganda: A cross sectional study. BMC pregnancy and childbirth. 2016;16:1-7.
25. Udho S, Nankumbi J, Namutebi M, Mukunya D, Ndeezi G, Tumwine JK. Prevalence of anaemia in pregnancy and associated factors in northern Uganda: a cross-sectional study. South African Journal of Clinical Nutrition. 2023;36(4):136-41.
26. Dickson KS, Boateng EN, Adde KS, Ameyaw EK, Munro-Kramer ML. Non-adherence to WHO's recommended 8-contact model: geospatial analysis of the 2017 Maternal Health Survey. BMC Pregnancy and Childbirth. 2023;23(1):192.
27. Uldbjerg CS, Schramm S, Kaducu FO, Ovuga E, Sodemann M. Perceived barriers to utilization of antenatal care services in northern Uganda: a qualitative study. Sexual & Reproductive Healthcare. 2020;23:100464.
28. Gebremichael TG, Welesamuel TG. Adherence to iron-folic acid supplement and associated factors among antenatal care attending pregnant mothers in governmental health institutions of Adwa town, Tigray, Ethiopia: Cross-sectional study. PLoS One. 2020;15(1):e0227090.

Continues to page 64

Continued from page 63

World Health Awareness Days, and International Health Days

Introduction

Global public health awareness days are intended to raise awareness, publicity, and profile of particular diseases or conditions among the general population. Every year, different organizations and communities actively promote and support World Health Days globally.

30th January, World Neglected Tropical Diseases Day

The World Health Assembly (WHA) recognised January 30 as World Neglected Tropical Disease (NTD) Day. It is a global event that is used to raise awareness of these diseases and millions of people affected across the world, especially among the poorest populations around the world. It's also aimed at building momentum for the control, elimination, and eradication of the diseases.

24th March, World Tuberculosis (TB) Day

The world commemorates World TB Day to raise public awareness about the devastating health, social, and economic consequences of TB and set up efforts to end the global epidemic. TB kills more than one and a half million people every year, with the majority of them in developing countries such as Uganda. It falls on the same day when the German medical scientist, Dr. Robert Koch, announced the discovery of the causative agent of TB in 1882.

Public health Emergencies Responded to by Uganda Public health Fellowship Program, October - December, 2024

The Uganda Public Health Fellowship Program has responded to several outbreaks during this quarter as part of the national rapid response team and suggested recommendations per outbreak investigation as follows;

Multi-Drug Resistant Tuberculosis (MDR-TB) outbreak investigation in Buikwe and Kayunga districts: 21st–28th October 2024

There was a rise in number of MDR-TB cases in Buikwe and Kayunga districts. There were six cases reported in Buikwe District and two cases reported in Kayunga District as of November 1, 2024. The rise in cases was likely driven by transmission in the local drinking points.

Recommendations included; intensifying TB case finding through contact tracing and screening, reconsider switch treatment model for MDR/RR-TB cases to hospitalization, enhance community sensitization for TB prevention, timely evacuation of of MDR-TB cases to treatment unit.

Mpox outbreak investigation in Masindi District and Hoima City: 14th–26th October 2024

Mpox cases were reported in Masindi and Nakasongola prisons. A traceback investigations identified communities in Kijunjubwa Subcounty as the possible source of the outbreak in the prisons. The first Mpox death was reported during this investigation in Masindi and had been living in Hoima City. As of November 24, 2024, there were four confirmed cases in the two prisons and one confirmed case in the communities. Several cases had been managed in the community and there was evidence of ongoing transmission in the communities of both areas. We recommended strengthening surveillance to improve case identification, prompt isolation, and management. We activated the district task force of Masindi District and trained health workers on Mpox.

Mpox outbreak in Paradise island, Mukono District: 15th–22nd November, 2024

Following a report of a confirmed Mpox case on the island, a team of fellows was sent to investigate the outbreak at the island. Most cases had healed in the community and although there were some active cases. The index case had travelled from school with symptoms to the island. There were clusters of cases with evidence of ongoing transmission at the island. There were three confirmed cases and about 27 suspected cases as of November 22, 2024. The team conducted health education using the community radio, strengthened surveillance at the island by building capacity of the village health team Members (VHT).

Continued from page 64

Mpox outbreak response in Nakasongola District, Uganda August–November, 2024

Fellows have been responding to an outbreak of Mpox in Nakasongola District since September, 2024. As of November 30, 2024, there were 66 confirmed cases investigated with males more affected than females. Lwampanga Town Council had the highest number of cases, of whom; majority were fisherfolks and commercial sex workers. There was a total of 66 confirmed cases as of November 30, 2024. The district task force was activated with meetings to respond and control the outbreak. Surveillance and alert management were heightened to identify cases and monitor the occurrence of new cases. Identified cases were isolated and treated at Lwampanga Health Centre (HC) III and Nakasongola HC IV. Community sensitization has been ongoing and has prevented spread to other areas.

Mpox outbreak in Kampala Metropolitan Area (KMA) September–to date

An Mpox outbreak was first reported in KMA in September, 2024. Since then, fellows have been deployed in turns to respond to this outbreak that has been growing in magnitude. The cases are isolated and managed at Entebbe isolation and treatment unit in Entebbe Municipality, Wakiso District. There are total of 508 cases in total as of December 5, 2024. Kampala City is the most affected with most cases being reported from Kawempe Division. Majority of the cases had contact with sex workers and they are the likely drivers of the outbreak. The teams conducted case investigations, active case search in the communities, health education on community radios, supported the divisions and districts in building capacity of village health teams (VHT) members and heightened surveillance for Mpox cases.

Mpox outbreak in Mbarara, October–to date

Mbarara reported her first Mpox case on 14th October, 2024 and a team of fellows was deployed to support the response on 20th October, 2024 since then. So far, a total of 10 cases have been reported with most of the cases in Mbarara City. The team conducted case investigations, activated the surveillance system, an isolation and treatment unit was set up at Mbarara Regional Referral Hospital, and behavioral change communication was conducted in the area.

Yellow fever outbreak in Kibuku District, November, 2024–to date

In December, 2024, Kibuku District reported an outbreak of Yellow Fever with three confirmed cases. A team of fellows was deployed to the district to support the investigation. As of December 1, 2024, they were three confirmed yellow fever cases in the district.

Pictorials

Dr. Daniel Wenani (left), Cohort 2024 Fellow, interviewing one of the confirmed Mpox cases at Nakasongola HC IV, Nakasongola District, October 2024

Continues to page 66

Continued from page 65

Annet Namusisi and Daniel Wenani, Cohort 2024 Fellows (wearing rapid response jackets) conducting an interview in the community during yellow fever outbreak investigation in Kibuku District, December 2024

Dr. Olive Namakula and Dr. Emmanuel Mfitundinda in rapid response jackets with World Health Organization staff and Kawempe Division team during Mpox investigation in Kikoni Zone, Kawempe Division, Kampala City, October 2024

Dr. Yasiini Nuwamanya, Cohort 2023 Fellow, and Charity Mutesi, Cohort 2024 Fellow doing community visits during the MDR TB investigation, Kayunga District, October 2024

Dr. Janet Lubega Kobusinge and Emmanuel Okiror, Cohort 2024 Fellows during an active case search of Mpox in Kijunjubwa Sub-county, Masindi District, November 2024

Continued from page 66

Dorothy Aanyu, Cohort 2023 Fellow with Dr. Emmanuel Mfitundinda and Joanita Nalwanga, Cohort 2024 Fellows reviewing the initial line list with the VHT during Mpox outbreak investigation at Paradise island in L. Victoria, November, 2024

Dorothy Aanyu and Joanita Nalwanga together with Makindye Division team aboard a boat on their way to Paradise island for Mpox investigation, November, 2024

Continues to page 68