MINISTRY OF HEALTH UGANDA

UNIPH

Epidemiological Bulletin

Volume 8| Issue 1| January—March, 2023

Quarterly Epidemiological Bulletin of the Uganda National Institute of Public Health, Ministry of Health

January - March, 2023

Dear Reader,

We take great pleasure in welcoming you to Issue 1 Volume 8 of the Uganda National Institute of Public Health (UNIPH) Quarterly Epidemiological 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 events in Uganda.

In this issue, we present a variety of articles including; syndromic surveillance during the 2022 martyrs day commemoration, trends of antimicrobial resistance in Uganda, trends of perinatal deaths in Uganda, timeliness and completeness of monthly reporting, COVID-19 vaccine uptake and coverage in Uganda, COVID-19 related stigma amongst survivors, and COVID-19 outbreak in refugees.
Should you have any questions or require additional information related to articles in this bulletin please contact us on:

rzavuga@uniph.go.ug, skizito@uniph.go.ug, anthkiyimba@uniph.go.ug, issemanda@uniph.go.ug, swaako@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:

02 SYNDROMIC SURVEILLANCE

08 ANTI MICROBIAL RESISTANCE

14 COVID-19 STIGMA

50 UPDATES

Change of name from Uganda National Institute of Public Health Quarterly Epidemiological Bulletin to Uganda Public Health Bulletin

Dear reader and authors,

We appreciate your continuous contribution to the success of the Uganda National Institute of Public Health Quarterly Epidemiological Bulletin (UQEB) since its inception in 2015. As you might have noted, the UQEB has achieved a lot including its consistent production since 2015, improved dissemination through creation and consistent updating of a contact data base, development of a website to ensure access to the articles at any time, and sharing experiences and offering technical guidance to other countries in Africa on public health bulletin-related issues among other things. Overall, we are confident that the evidence documented and disseminated by the UQEB has positively impacted Uganda's public health arena and policy formulation.

Despite the highlighted achievements, we have noted over time that the bulletin publishes articles across the entire public health domain making the current name (Uganda National Institute of Public Health Quarterly Epidemiological Bulletin) not inclusive enough. The current name likely discourages contribution and access to the documented scientific evidence by other public health professionals who are not necessarily practicing epidemiological-related work. We will therefore change the bulletin name to the "Uganda Public Health Bulletin" to accommodate articles regarding all the public health-related issues experienced in Uganda. Otherwise, the production will still continue on a quarterly basis.

Effective next quarter (April-June 2023), the Uganda National Institute of Public Health Quarterly Epidemiological Bulletin will change its name to "Uganda Public Health Bulletin". We request our readers, reviewers, and authors to embrace the new bulletin name. We also express our gratitude to all of you for the overwhelming support. We will continue to provide you with insightful peer reviewed work.

Please send your queries or inquiries in regard to the name change to:

riolexus@uniph.go.ug: Editor in Chief and
lbulage@uniph.go.ug: Managing/Scientific Editor

Syndromic Surveillance during 2022 Uganda Martyrs' Commemoration

Authors: Mackline Ninsiima[1,2*], Mercy Wanyana[1,3], Thomas Kiggundu[1,2], Patrick King[1,3], Bernard Lubwama[3], Richard Migisha[1], Lillian Bulage[1], Daniel Kadobera[1], Alex Ario Riolexus[1]
Institution affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]Kampala Capital City Authority, Kampala, Uganda, [3]Division of Integrated Epidemiology and Surveillance, Ministry of Health, Uganda
Correspondence*: Email: mninsiima@uniph.go.ug, +256787819496

Summary

Background: Mass gatherings frequently include close, prolonged interactions between people, which can present opportunities for infectious disease transmission. During May 25−June 5, 2022, over 4 million pilgrims gathered at Namugongo Catholic and Protestant shrines to commemorate the annual Uganda Martyr's Day. We described syndromes suggestive of key priority diseases among visiting pilgrims during this period to inform future planning for mass gatherings in Uganda.
Methods: We conducted a survey among visiting pilgrims at the Catholic and Protestant shrines based on signs and symptoms for key priority diseases: COVID-19 and Viral Hemorrhagic Fevers (VHFs). A suspected COVID-19 case was defined as ≥2 of: fever >37.5^{0}C, flu, cough, and difficulty breathing. A suspected VHF case was defined as fever >37.5^{0}C and unexplained bleeding. We sampled systematically every 10th pilgrim in the line at main entrance gates. Other pilgrims were selected randomly from demarcated zonal areas. Overall, 1,350 pilgrims participated voluntarily in the survey. We also extracted secondary data on 5,582 pilgrims who sought medical care from on-site emergency medical services at designated medical tents from Health Management Information Systems (HMIS) registers. Descriptive analysis was conducted to identify syndromes suggestive of key priority diseases.
Results: Among 1,350 pilgrims interviewed, 767 (57%) were female and mean age was 37.9 (±17.9) years. A total of 236 (18%) reported ≥1 case definition symptom and 25 (2%) reported ≥2 symptoms. Twenty-two (1.6%) were suspected COVID–19 cases and three (0.2%)

Continued from page 2

were suspected VHF cases, two from Kampala City and Lira District bleeding from the nose and one from Sironko District had bloody vomitus and urine. Among the 5,582 pilgrims who sought medical care from the medical tents (70.1%, n=3,901) were females whereas (27.5%, n=1,521) were aged 50 years and above. Of these, 538 (9.6%) had suspected COVID-19 and one had suspected VHF. None of the suspected cases had samples collected for laboratory testing.

Conclusion: Almost one in fifty pilgrims at the 2022 Uganda Martyrs' commemoration had symptoms of COVID-19 or VHF. Despite the epidemic potential for these diseases, none of the case-patients were tested, providing an opportunity for disease introduction and spread. Both intensified syndromic surveillance and planned laboratory testing capacity at mass multi-day gatherings could facilitate early detection of public health emergencies that could stem from such events.

Background

According to World Health Organization (WHO), a mass gathering is an event, either organized or spontaneous, characterized by concentration of people at a specific location for a specific purpose over a set period of time and has the potential to strain planning and response resources of the host country or community (1). During mass gatherings, overcrowding of attendees and influx of non-local travelers may present favourable and conducive environments for close, prolonged and frequent interactions increasing the opportunities for infectious disease transmission. What is quite challenging is that any adverse health outcome associated to mass gatherings would most likely be magnified by media and political attention. Furthermore, occurrence of a disease outbreak at or during an international mass gathering has an increased potential for spreading to neighboring countries or even globally; thus, the need for reporting under the 2005 International Health Regulations (IHR) (2). Influx of people during mass gatherings impacts a strain on existing surveillance and response systems. This presents a challenge to the hosting community or country to strengthen surveillance and response systems during preparation, operational and post-event phases of mass gatherings.

Syndromic surveillance — the utilization of health-related data based on clinical observations and symptoms rather than confirmed diagnosis, can serve as an effective strategy for appropriate real time monitoring, early detection, and timely response to public health events during mass gatherings (1, 3, 4). A provisional diagnosis or a "syndrome" can be established through synthesis of a group of symptoms and clinical observations which consistently occur together. During mass gatherings, syndromic surveillance has been implemented through surveys recording symptoms, review of medical registers completed by medical teams and utilization of automated alert systems; followed by real-time analysis of data to generate incident reports necessary for informing timely response actions (5). To date, syndromic surveillance has been utilized in several mass gathering settings: 2002 Winter Olympic Games in Salt Lake City; 2012 Summer Olympic and Paralympic Games in London; 8th Micronesian Games in 2014, 2015 Los Angeles Special Olympic World Games; religious mass gatherings in Southern India; 2016 Grand Magal of Touba in Senegal; and 2016 Arbaeenia mass gathering in Iraq (3, 5-8). Following the declaration of Ebola Virus Disease Outbreak in Democratic Republic of Congo, the Ministry of Health in collaboration with African Field Epidemiology Network (AFENET) conducted syndromic surveillance for Viral Hemorrhagic Fevers during the 2018 Uganda Martyrs' commemoration (9).

Every year, pilgrims from Uganda and neighboring countries gather at Namugongo Catholic and Protestant shrines to commemorate the lives of Uganda martyrs on June 3, a religious commemoration of great significance. In 2020 and 2021, Uganda Martyr's Day was not physically commemorated due to stringent strategies deployed by Ministry of Health to curb the spread of the COVID-19 pandemic during mass gatherings. In February 2022, the Ugandan Government relaxed the restrictions that had been put in place to control COVID-19 thus approving full economy operation. Following the relaxation of the COVID-19 restrictions, Catholic and Protestant religious bodies were permitted to organize the commemoration of Uganda Martyr's Day; a historical religious event that calls for a mass gathering at Namugongo Catholic and Protestant shrines from May 25−June 5, 2022. Due to the distances people travel to attend this event, an infectious disease outbreak that starts during this mass gathering has high potential to spread to neighboring districts or even to other countries.

During the commemoration of the Uganda Martyrs in 2022, the Ministry of Health in collabora-

Continues to page 4

tion with the Uganda Catholic and Protestant Medical Bureaus provided health services, including on-site emergency medical services in designated tents from May 25−June 5, 2022. The medical teams available included emergency medicine specialists, doctors, nurses, laboratory attendants, and ambulance teams from Ministry of Health, Mulago National Referral Hospital, St. Francis Hospital Nsambya, Uganda Martyrs Hospital Rubaga, Uganda People's Defence Forces, Uganda Police Force, Uganda Red Cross Society, St. John's Ambulance, Holy Family Virika Hospital, Mengo Hospital, Zia Angellina Health Centre, and St. Stephens Hospital. The Ministry of Health also provided HMIS registers where data for pilgrims who sought medical care were captured by the medical teams to achieve harmonized reporting from the different institutions. Additionally, Field Epidemiology Fellows from the Public Health Fellowship Programme were assigned to conduct syndromic surveillance for key priority diseases during the event. In this context, we described syndromes suggestive of key priority diseases among visiting pilgrims, May 25−June 5, 2022 to inform future planning for mass gatherings in Uganda.

Methods

Study site and study population

This assessment was conducted among over 4 million visiting pilgrims from Uganda and neighboring countries gathered at Namugongo Catholic and Protestant shrines located in Namugongo Division, Wakiso District, Uganda.

Data Collection

We utilized two different methods for data collection. First, we conducted a survey among pilgrims at the Catholic and Protestant shrines based on signs and symptoms for key priority diseases from June 2−5, 2022. The data collection tool was developed in KoboCollect based on signs and symptoms for selected priority diseases: COVID–19 and Viral Hemorrhagic Fevers inclusive of Ebola Virus Disease, Crimean Congo Hemorrhagic Fever, Yellow Fever, Rift Valley Fever, and Marburg Hemorrhagic Fever. Signs and symptoms investigated were based on suspect case definitions as per the National Technical Guidelines for Integrated Disease Surveillance and Response. Signs and symptoms under investigation were: fever (temperature above 37.5^{o}C), cough, flu, headache, generalized body weakness, difficulty in breathing, jaundice, fainting or sudden collapse, and unexplained bleeding. Any other signs and symptoms reported by the participants were also recorded by the surveillance officers.

We sampled systematically every 10th pilgrim in the line at main entrance gates. Other pilgrims were selected randomly from demarcated zonal areas. Verbal informed consent was obtained prior to anonymous interviews. Overall, surveillance officers from Makerere University School of Public Health interviewed 1,350 pilgrims who voluntarily participated in the survey. Survey data were downloaded in the Excel (.xls) format from the Kobo Collect server and processed for analysis.

Second, we conducted records review based on the on-site emergency medical services provided at the Catholic and Protestant shrines from May 25−June 5, 2022. We extracted all the available data on 5,582 pilgrims who sought medical care from HMIS registers for review including age, sex, district of residence, signs and symptoms or provisional diagnosis.

Data analysis

Data analysis was performed using Epi Info 7 software (Centers for Disease Control and Prevention, Atlanta, Georgia). Frequencies of demographic characteristics and syndromes suggestive of public health emergencies among pilgrims who participated in the survey or sought care from the medical tents were presented. Only syndromes suggestive of key priority diseases were of interest to the investigative team. At analysis phase, a suspected COVID-19 case was defined as ≥2 of: fever >37.5^{0}C, flu, cough, and difficulty breathing whereas a suspected VHF case was defined as fever >37.5^{0}C and unexplained bleeding.

Ethical considerations

Approval to conduct this project under the Non-Research Determination criteria was obtained from the U. S. Centers of Disease Control and Prevention (CDC). Administrative clearance to extract patient data from the HMIS registers was obtained from the Ministry of Health. All methods were performed in accordance with the approval and administrative clearance.

Results

Characteristics of pilgrims who participated in the survey during, Uganda Martyrs' commemoration mass gathering, June 2−5, 2022

Among the 1,350 pilgrims who participated in the survey, (56.8%, n=767) were females. Nearly all pilgrims (98.6%, n=1,331) were Ugandans. Only (14.3%, n=153) had visited the Protestant shrine (Table 1).

Continued from page 4

Table 1: Characteristics of pilgrims who participated in the survey during, Uganda Martyrs' commemoration mass gathering, June 2−5, 2022

Characteristic	Frequency (n = 1,350)	Percentage (%)
Age*		
<18 years	85	6.3
18–29 years	409	30.3
30–39 years	284	21.0
40–49 years	237	17.6
≥50 years	335	24.8
Sex		
Male	583	43.2
Female	767	56.8
Country of residence		
Uganda	1331	98.6
Kenya	9	0.7
South Sudan	4	0.3
Rwanda	2	0.2
DRC	1	0.1
Nigeria	3	0.2
Religious site visited		
Catholic shrine	1157	85.7
Protestant shrine	153	14.3

***Median age (IQR):** 35 (25 – 49)* ***Mean Age (SD):** 37.9 (17.6)*

Characteristics of pilgrims who sought medical care from medical tents during Uganda Martyrs' commemoration mass gathering, May 25−June 5, 2022

Among the 5,582 pilgrims who sought medical care from the medical tents (70.1%, n=3,901) were females whereas (27.5%, n=1,521) were aged 50 years and above (Table 2).

Table 2: Characteristics of pilgrims who sought medical care from medical tents during, Uganda Martyrs' commemoration mass gathering, May 25–June 5, 2022

***Median age (IQR):** 38 (25 - 51)* ***Mean Age (SD):** 38.6 (18.0)*

Characteristics	Frequency (n = 5,582)	Percentage (%)
Age* (n = 5,525)**		
<18 years	726	13.1
18–29 years	1,143	20.7
30–39 years	1,051	19.0
40–49 years	1,084	19.6
≥50 years	1,521	27.5
Sex		
Male	1,668	29.9
Female	3,914	70.1
Chronic illness		
Diabetes	33	0.6
Hypertension	111	2.0

***Age was not recorded among 57 pilgrims who sought medical care from the medical tents*

Suspected priority diseases during Uganda Martyrs' commemoration mass gathering, May 25–June 5, 2022

Among the 1,350 pilgrims who participated in the survey, (48.4%, n=653) reported at least one sign or symptom during their visit to the Catholic and Protestant shrines. Of these, 236 (18%) reported ≥1 suspected COVID-19 and Viral Hemorrhagic Fever case definition signs and symptoms and 25 (2%) reported ≥2 symptoms (Figure 1). Twenty-two (1.6%) were suspected COVID–19 cases and three (0.2%) were suspected VHF cases, two from Kampala City and Lira District bleeding from the nose and one from Sironko District had bloody vomitus and urine.

Continues to page 6

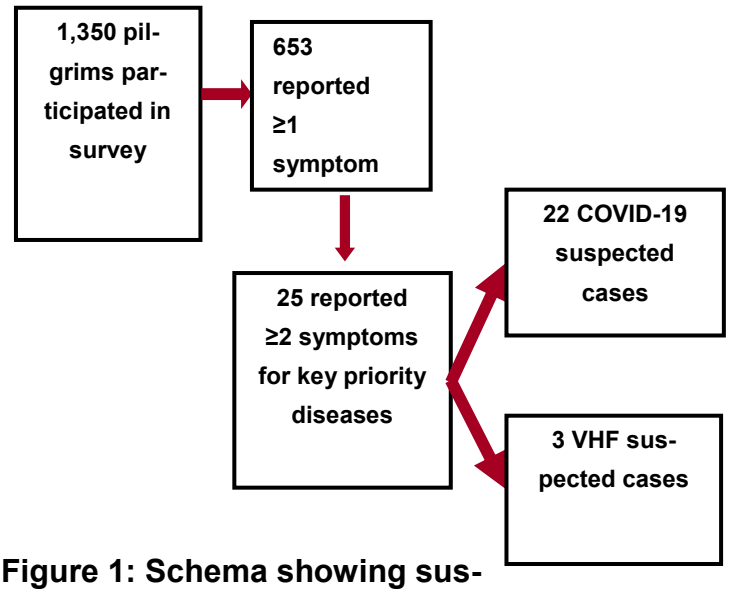


Figure 1: Schema showing suspected priority diseases among pilgrims who participated in the survey during the Uganda Martyrs' commemoration mass gathering, June 2−5, 2022

Among 5,582 pilgrims who sought care at the medical tents, 3,796 records specified the presenting signs and symptoms whereas 1,786 records did not have specified signs and symptoms but only had a provisional diagnosis based on the clinician's assessment. Of 3,796 records, 539 pilgrims reported at least 2 symptoms suggestive of key priority diseases. Of these, 538 (9.6%) had suspected COVID-19 and one had suspected VHF with bloody vomitus (Figure).

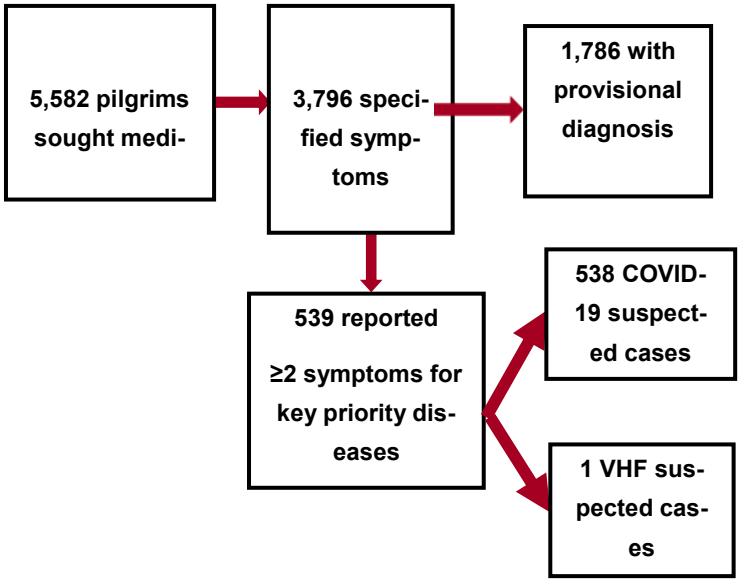


Figure 2: Schema showing suspected priority diseases among pilgrims who sought medical care from medical tents during the Uganda Martyrs' commemoration mass gathering, May 25–June 5, 2022

Discussion

In this study, we described syndromes suggestive of key priority diseases among visiting pilgrims from May 25−June 5, 2022 to inform future planning for mass gatherings in Uganda. We identified 4 Viral Haemorrhagic Fever and 560 COVID-19 suspected cases through syndromic surveillance during the 2022 Uganda Martyrs' commemoration. The findings agree with previous incidences where outbreaks have been reported following festive, religious and sporting-related mass gatherings including a COVID-19 outbreak after festivities in Spain; outbreaks of diarrheal diseases during the 2019 Hijja pilgrimage in Saudi Arabia; mumps following festive activities in Austria and Spain; measles after an international youth sporting event in United States of America; meningococcal disease associated with the 23rd World Scout Jamboree gathering in Japan; and influenza H1N1 outbreaks after music festivals in Belgium and Hungary (1, 10-15). Mass gatherings have been highly characterized as transmission sites for infectious diseases due to close proximity and possibility of dissemination of infectious agents after the mass dispersion to different locations (16).

During the COVID -19 pandemic, mass gatherings were highlighted among the sources of transmission due to overcrowding and close interaction between attendees. In 2020, a social gathering at Church X provided an opportunity for a COVID-19 superspreading event in Omoro District, Northern Uganda (17). A recent systematic review reported that religious gatherings in places of worship were vital in COVID-19 transmission accounting for over 50 worship related clusters especially during the first wave of the pandemic (18). Mass gatherings have been significantly associated with COVID-19 transmission (10, 19-21). It should also be noted that risk of transmission of infectious diseases could be partly influenced by the type, venue, location, and demographics of participants who attend the mass gatherings (22-24). Evidence of COVID-19 transmission during mass gatherings has also been reported in Malaysia during the Sri Petaling moslem missionary movement (25). Due to such scenarios, the WHO published interventions which should be implemented to mitigate the spread of COVID-19 during mass gatherings (26).

Limited evidence has been presented on the incidence of Viral Hemorrhagic Fevers during mass gatherings. However, there is still need

Continued from page 6

for great vigilance since most Viral Hemorrhagic Fevers are largely characterized by person to person transmission which could be highly favored by the close contact between attendees during mass gatherings. Experience from mass gathering events held during the West African Ebola epidemic illustrates that these events can be held safely provided interventions are instituted for enhanced surveillance and response systems for infectious diseases (27). This underscores the urgent need of implementing effective measures to mitigate the spread of any Viral Hemorrhagic Fever during a mass gathering; or if possible, postpone the event most especially following the declaration of any Viral Hemorrhagic Fever outbreak.

Study limitations

It should be noted that there were only seventeen trained surveillance officers despite the masses at the Namugongo Protestant and Catholic shrines; who started administering the survey questionnaire on June 2, 2022 instead of having commenced on the May 25, 2022, at the time when pilgrims started gathering. Therefore, it was difficult to generalize the findings on the signs and symptoms for selected priority diseases to the entire population that converged during the 2022 Uganda Martyrs' commemoration. Additionally, 1,786 out of 5,582 records did not have specified signs and symptoms but only had a provisional diagnosis based on the clinician's assessment. We could not categorize these pilgrims under any of the key priority diseases since they did not have specified signs and symptoms.

Conclusion

Almost one in fifty pilgrims at the 2022 Uganda Martyrs' commemoration had symptoms of COVID -19 or Viral Hemorrhagic Fever. Unfortunately, none of the suspected COVID-19 or VHF cases were tested and we do not know what condition they had. While we have no evidence that the suspected VHF cases had any link to the 2022 Ebola Virus Disease outbreak in Uganda, it is clear from these findings that a surveillance system at mass gatherings and the ability to actively respond to possible cases is critical. It is important for us to prioritize intensified syndromic surveillance during mass gatherings to ensure that we reduce the risk for an outbreak at mass gatherings in Uganda and reduce the impact if one should occur. Furthermore, there is utmost need to set up isolation facilities for any suspected cases and provide laboratory testing capacity to facilitate early detection and response to priority key diseases that could stem from such events.

Conflict of interest

The authors declare that they had no conflict of interest.

Acknowledgments

The authors would like to thank medical teams from Ministry of Health, Mulago National Referral Hospital, St. Francis Hospital Nsambya, Uganda Martyrs Hospital Rubaga, Uganda People's Defence Forces, Uganda Police Force, Uganda Red Cross Society, St. John's Ambulance, Holy Family Virika Hospital, Mengo Hospital, Zia Angellina Health Centre, and St. Stephens Hospital who provided onsite emergency medical services at the Catholic and Protestant shrines. Additional thanks to surveillance officers from Makerere University School of Public Health who administered survey questionnaires to pilgrims at the Catholic and Protestant shrines.

References

1. WHO. Public health for mass gatherings: key considerations. Available from: https://apps.who.int/iris/bitstream/handle/10665/162109/WHO_HSE_GCR_2015.5_eng.pdf?sequence=1&isAllowed=y. Accessed on: June 12, 2022.
2. WHO. International health regulations (2005): Third Edition. Available from: file:///C:/Users/HP/Downloads/9789241580496-eng.pdf. Accessed on: June 12, 2022: World Health Organization; 2016.
3. Berry A. Syndromic surveillance and its utilisation for mass gatherings. Epidemiology & Infection. 2019;147.
4. Fleischauer AT, Gaines J. Enhancing surveillance for mass gatherings: the role of syndromic surveillance. Public Health Reports. 2017;132(1_suppl):95S-8S.
5. Spector E, Zhang Y, Guo Y, Bost S, Yang X, Prosperi M, et al. Syndromic Surveillance Systems for Mass Gatherings: A Scoping Re-

Continues to page 8

view. International journal of environmental research and public health. 2022;19(8):4673.
6. Ganeshkumar P, Muthappan S, Ponnaiah M, Virumbhi V, Thangaraj JV, Muthuperumal P, et al. Syndromic surveillance during religious mass gatherings, southern India 2015–2018. Travel Medicine and Infectious Disease. 2022;47:102290.
7. Lami F, Hameed I, Jewad AW, Khader Y, Amiri M. Real-time surveillance of infectious diseases and other health conditions during Iraq's Arbaeenia mass gathering: cross-Sectional Study. JMIR public health and surveillance. 2019;5(4):e14510.
8. Sokhna C, Goumballa N, Van Thuan Hoang BMM, Dieng M, Sylla AB, Diallo A, et al. Senegal's grand Magal of Touba: syndromic surveillance during the 2016 mass gathering. The American Journal of Tropical Medicine and Hygiene. 2020;102(2):476.
9. AFENET. Public Health Surveillance at Namugongo: Martyrs' Day celebration, Uganda. Available: http://www.afenet.net/index.php/world/63-news-events/420-public-health-surveillance-at-namugongo-martyrs-day-celebration-uganda. Accessed on: 24th August 2022. 2018.
10. Domènech-Montoliu S, Pac-Sa MR, Vidal-Utrillas P, Latorre-Poveda M, Del Rio-González A, Ferrando-Rubert S, et al. Mass gathering events and COVID-19 transmission in Borriana (Spain): A retrospective cohort study. PloS one. 2021;16(8):e0256747.
11. Karami M, Doosti-Irani A, Ardalan A, Gohari-Ensaf F, Berangi Z, Massad E, et al. Public health threats in mass gatherings: A systematic review. Disaster medicine and public health preparedness. 2019;13(5-6):1035-46.
12. Nunan D, Brassey J. What is the evidence for mass gatherings during global pandemics? A rapid summary of best-available evidence. Center for Evidene-Based Medicine (CEBM). 2020.
13. Rainey JJ, Phelps T, Shi J. Mass gatherings and respiratory disease outbreaks in the United States–should we be worried? results from a systematic literature review and analysis of the national outbreak reporting system. PloS one. 2016;11(8):e0160378.
14. Sassano M, McKee M, Ricciardi W, Boccia S. Transmission of SARS-CoV-2 and other infections at large sports gatherings: a surprising gap in our knowledge. Frontiers in medicine. 2020;7:277.
15. Yezli S, Assiri AM, Alhakeem RF, Turkistani AM, Alotaibi B. Meningococcal disease during the Hajj and Umrah mass gatherings. International Journal of Infectious Diseases. 2016;47:60-4.
16. Kok J, Blyth CC, Dwyer DE. Mass gatherings and the implications for the spread of infectious diseases. Future Microbiology. 2012;7(5):551-3.
17. Thiwe P, Amodan D, Kadobera B, Bulage D, Namayanja L, Akusekera J, et al. Epidemiological assessment of a COVID-19 cluster among attendees of a church activity, Omoro District, Northern Uganda, September 2020. UNIPH Bulletin. 2021;6(3).
18. Peano A, Bert F, Lo Moro G, Previti C, Scaioli G, Siliquini R. COVID-19 outbreaks in places of worship worldwide: a systematic review. European Journal of Public Health. 2021;31(Supplement_3):ckab165. 647.
19. Furuse Y. Risk at mass-gathering events and the usefulness of complementary events during COVID-19 pandemic. Journal of Infection. 2021;82(3):e20-e1.
20. Suñer C, Coma E, Ouchi D, Hermosilla E, Baro B, Rodríguez-Arias MÀ, et al. Association between two mass-gathering outdoor events and incidence of SARS-CoV-2 infections during the fifth wave of COVID-19 in north-east Spain: A population-based control-matched analysis. The Lancet Regional Health-Europe. 2022;15:100337.
21. Yasutaka T, Murakami M, Iwasaki Y, Naito W, Onishi M, Fujita T, et al. Assessment of COVID-19 risk and prevention effectiveness among spectators of mass gathering events. Microbial risk analysis. 2022:100215.
22. Ebrahim SH, Memish ZA. COVID-19–the role of mass gatherings. Travel medicine and infectious disease. 2020;34:101617.
23. Kelvin AA, Halperin S. COVID-19 in children: the link in the transmission chain. The Lancet Infectious Diseases. 2020;20(6):633-4.
24. Shi P, Keskinocak P, Swann JL, Lee BY. The impact of mass gatherings and holiday traveling on the course of an influenza pandemic: a computational model. BMC public health. 2010;10(1):1-12.
25. Che Mat NF, Edinur HA, Abdul Razab MKA, Safuan S. A single mass gathering resulted in massive transmission of COVID-19 infections in Malaysia with further international spread. Journal of Travel Medicine. 2020;27(3):taaa059.
26. WHO. Key planning recommendations for mass gatherings in the context of the current COVID-19 outbreak: interim guidance, 14 February 2020. World Health Organization; 2020.
27. Blumberg L, Regmi J, Endricks T, McCloskey B, Petersen E, Zumla A, et al. Hosting of mass gathering sporting events during the 2013–2016 Ebola virus outbreak in West Africa: experience from three African countries. International Journal of Infectious Diseases. 2016;47:38-41.

Continued from page 8

Increasing Trends of Antibiotic Resistance, Uganda: Analysis of National Antimicrobial Resistance Surveillance Data, 2018-2021

Authors: Saudah Namubiru Kizito[1]*, Richard Migisha[1], Paul Edward Okello[1], Brenda Simbwa[1], Zainah Kabami[1], Brian Agaba[1], Jane Frances Zalwango[1], Helen Nelly Naiga[1], Rebecca Akunzirwe[1], Rita Namusosa[2], Ibrahim Mugerwa[2], Winnie Atuhaire[2], Grace Najjuka[2], Daniel Kadobera[1], Alex R. Ario[1], Susan Nabadda[2]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, National Institute of Public Health, Kampala, Uganda, [2]National Health Laboratory and Diagnostic Services Department, Ministry of Health, Kampala, Uganda
***Correspondence**: Email: skizito@musph.ac.ug, Tel: +256704518351

Summary

Background: Continuous monitoring of antimicrobial resistance (AMR) among isolates from clinical samples can inform effective drug selection for patients. In Uganda, human AMR surveillance occurs at national and regional referral hospitals and in selected public universities. Bacterial isolates from patients are subjected to drug susceptibility testing; the results are used in real-time for patient care. Isolates are then sent to the National Microbiology Reference Laboratory (NMRL) for re-analysis to generate national AMR surveillance data and for global reporting. Although isolate analysis results from NMRL are considered, the official AMR surveillance data, there is limited utilization of this data to inform public health planning. We evaluated trends and spatial distribution of AMR to common antibiotics used in Uganda.
Methods: We analyzed data from pathogenic bacterial isolates from blood, cerebrospinal, peritoneal, and pleural fluid from AMR surveillance data from 2018-2021. We calculated the proportions of isolates that were resistant to common antimicrobial classes. We use the chi-square test for trends to evaluate changes in AMR resistance over the study period.
Results: Out of 537 isolates with 15 pathogenic bacteria, 478 (89%) were from blood, 34 (6.3%) from pleural fluid, 21(4%) from cerebrospinal fluid, and 4 (0.7%) from peritoneal fluid. The most common pathogen was *Staphylococcus aureus* (20.1%), followed by *Salmonella species* (18.8%). Overall change in resistance over the four years was 63–84% for sulphonamides, fluoroquinolones macrolides (46–76%), phenicols (48–71%), penicillins (42–97%), β-lactamase inhibitors (20–92%), aminoglycosides (17–53%), cephalosporins (8.3–90%), carbapenems (5.3-26%), and glycopeptides- (0–20%). Annual resistance rates to ciprofloxacin increased from 2018-2021 for Gram-positive organisms (26-45% p=0.02). Among Gram-negative organisms, there were increases in resistance to tetracycline (29-78% p<0.001), ciprofloxacin (17-43%, p=0.004), ceftriaxone (8-72%, p=0.003), imipenem (6-26%, p=0.004), and meropenem (7-18, p=0.03).

Conclusions: There is a significant increase in the trends of drug resistance to antibiotics such as ciprofloxacin ceftriaxone, meropenem, imipenem, and tetracycline (among the Gram-negative organisms) in Uganda. Continuous monitoring of AMR trends at the national level to improve the efforts to reduce the AMR problem in Uganda through public health policy and planning is crucial.

Background

Globally, antimicrobial resistance (AMR) is an increasing health concern. Antimicrobial resistance is the ability of microorganisms to resist the effects of medicines that were previously used to treat such diseases [1]. Over 700,000 individuals worldwide die every year from illnesses linked to AMR. It is predicted that 10 million deaths will have occurred by 2050, costing the world $100 trillion [2].

Antimicrobial resistance has increased as a result of the use of broad-spectrum antibiotics to treat invasive infections, such as bloodstream and cerebrospinal fluid (CSF) infections. As a result, treating these infections is getting more challenging, which increases treatment failures and death [3].Over-the-counter medication access in underdeveloped countries like Uganda is one of the drivers of AMR in such nations[4]. Indiscriminate usage of antimicrobials exerts increased selection pressure on the bacterial population resulting in the accelerated emergence of AMR [5]. Antibiotic usage has led to the rise of germs that are widely multi-drug resistant, rendering even the most potent medications useless[6].

Recent estimates suggested that invasive infections, in particular antimicrobial-resistant inva-

Continues to page 10

sive infections, account for 5.3 million deaths around the world annually. A significant proportion of these deaths occurs in low to middle-income countries (LMIC). While developing countries are battling an accelerated spread of AMR, developed countries are also experiencing the same trend [7].

The unavailability of reliable data in developing countries like Uganda makes it difficult to develop efficient methods to monitor and control AMR. Despite this urgent need to investigate AMR trends, only a handful of studies to date have reported [5] trends of resistance in Uganda. In a study that investigated antibiotic resistance in Uganda found that E. coli and K. pneumoniae was carried in the gut of clients attending outpatient clinics in Kampala and two rural districts [8]. It further showed high rates of resistance to commonly used antibiotics such as ampicillin and septrin and relatively lower resistance rates to amoxicillin/ clavulanate, chloramphenicol, ciprofloxacin, gentamicin, nitrofurantoin and ceftriaxone.

We described the organisms that are isolated from patients' sterile site samples and their antibiotic resistance trends in Uganda, to inform planning and AMR control interventions.

Methods

Study setting, design, and data source

We conducted a descriptive analysis of Uganda's national AMR surveillance data, 2018-2021. National surveillance sites for AMR in human health comprise of microbiology laboratories of Regional referral hospitals, National referral hospitals, and selected institutions of learning. These sites analyze clinical samples (pathogen identification and Antimicrobial susceptibility testing -AST) for routine patient care. The decision to do a bacterial culture test is entirely at the discretion of the attending clinician. For quality control purposes, these sites also refer isolates with their relevant identifiers to the National Microbiology Reference Laboratory (NMRL) (at the National Health Laboratory and Diagnostic Services (NHLDS) department of the Ministry of Health) for re-identification and antimicrobial susceptibility re-testing. NMRL is accredited by the College of American Pathologists (CAP) in accordance with the recognized international standard ISO 15189:2012. The accredited microbiology tests include microscopy, culture, identification, and antibiotic sensitivity tests. The laboratory's main catchment area is national.

Inclusion and exclusion

All Isolates received from all the surveillance sites as patient samples were re-analyzed by the laboratory. However only isolates with re-identification results matching with primary sites were analyzed in this study.

Study variables

We extracted individual-level data from the NMRL database. Data was extracted as an excel sheet from this electronic database containing patients' reports, organism identified, and sentinel sites. Information obtained on each case included: patient's age, patient's sex, year of sample collection, specimen source, hospital in which the sample was drawn, isolated pathogen in the positive culture, and susceptibility results (defined as susceptible, intermediate, or resistant).

Data management and analysis

The variables analyzed included the age, sex, specimen type (i.e., blood, and cerebrospinal fluid), organisms isolated, and antibiotics tested (i.e., ampicillin, amoxicillin, augmentin, ciprofloxacin, cotrimoxazole, ceftriaxone, penicillin, gentamicin, carbapenems, vancomycin). The outcome was the antibiotic resistance of the isolates to common antibiotics. Isolates were classified as either susceptible or resistant to an antimicrobial and all isolates with intermediate reactions were classified as resistant. Data quality was checked using the completeness of data entries in the Laboratory Information System. Rates of resistance were calculated as a proportion of resistant organisms out of total number of that organisms that is tested for antimicrobial susceptibility per year. Resistance to each antibiotic was analyzed separately and Microsoft Excel 2016 was used to plot the trends from 2018 to 2021. Chi square test for trends was used to test the significance of antibiotic resistance trends over time. Epi-Info™ 7- (CDC, Atlanta, Georgia) statistical package was used for additional statistical analysis. The p-value < 0.05 was considered statistically significant.

Ethical considerations

We obtained permission to use data from the NHLDS. Data was stored on a password protected computer and only accessed by the study team. Data abstracted did not have individual unique identifier information. We also obtained a non-research determination from the US CDC

Continued from page 10

Results

Attributes of organisms isolated from sterile sample cultures, Uganda, 2018 -2022

Of the 537 isolates analyzed, 188 (52.6%), were from children were 0-5years followed by 67(18.7%) which were from persons 6-18years then 19-45years 59(16.2%) and were from adults above 66years. Fifty-five percent of isolates were from females. Over time, 2018 had the highest number of isolates 151(28.1%), while 2019 had the least number of isolates 93(17%). Geographically, most isolates were from Mbarara Regional Referral Hospital 186 (48%) while the least came from Kiruddu National Referral Hospital and the General Military Hospital, each having 1 (0.3%). 108(20.1%) of isolates were *Staphylococcus aureus* followed by *Salmonella species* which were 101(18.8%) (Table 1).

Table 1: Attributes of organisms isolated from sterile sample cultures, Uganda, 2018-2022

Variable	Number of pathogens (n=537)	Percent
Age (years) *n=357		
0-5	188	52.7
6-18	67	18.8
19-45	59	16.5
46-65	26	7.3
66 and above	17	4.8
Sex *n=480		
Male	216	45
Female	264	55
Sample type analyzed		
Blood	478	89
Cerebral spinal fluid	21	3.9
Peritoneal fluid	4	0.7
Pleural fluid	34	6.3
Year of isolation		
2018	151	28.1
2019	93	17.3
2020	179	33.3
2021	114	21.2
Location of primary testing laboratory		
Arua RRH	35	6.5
Fortportal RRH	50	9.3
Hoima RRH	6	1.1
General Military Hospital Bombo	1	0.2
1DI/DMM-Makerere	139	25.9
Jinja RRH	38	7.1
Kabale RRH	24	4.5
Kiruddu N	1	0.2
Mbale RRH	17	3.2
Mbarara RRH	217	40.4
Soroti RRH	8	1.5
Gram class of organisms		
Negative	351	65
Positive	186	35
Organisms isolated *n=534		
Acinetobacter spp	22	4.1
Citrobacter spp	11	2.1
Enterobacter spp		4.7
Enterococcus spp		
Escherichia coli	80	15
Klebsiella pneumoniae	83	15.5
Proteus spp	9	1.7
Pseudomonas aeruginosa	15	2.8
Salmonella typhii/paratyphii	101	18.9
Staphylococcus aureus	108	20.1
Streptococcus spp	14	2.6
Others	7	1.3

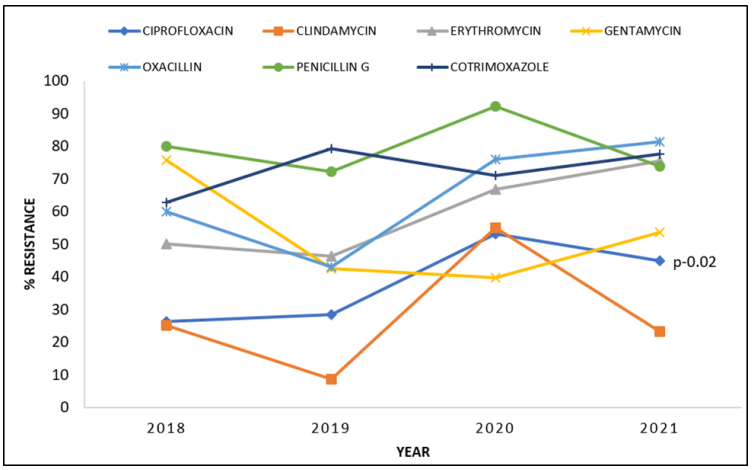
IDI/DMM=Infectious Diseases Institute/Department of Medical Microbiology
RRH=Regional Referral Hospital, NRH=National Referral Hospital
Spp = species, Others=Bacillus spp, Morganella morganii, Providencia spp

Continues to page 12

Trends of total antimicrobial resistance of Gram-positive organisms to common antibiotics, Uganda, 2018–2021

Increasing resistance to Ciprofloxacin over the four-year study period was observed (26.2-44.9%; p < 0.01) (Figure 1).

Figure 1: Trends of antimicrobial resistance rates of Gram-positive isolates to common antibiotics isolated in Uganda 2018-2021



Trends of total antimicrobial resistance of Gram-negative organisms to common antibiotics, Uganda 2018–2021

Overall, percentage antibiotic resistance of Gram-negative organisms increased over the years. Resistance to penicillins (Piperacillin and Ampicillin) was highest among Gram negative bacteria. Specifically, increase in resistance over years were noted for Ceftriaxone (8.3-78.6%; p-0.003), Ciprofloxacin (17.1-42.6%; p-0.004), Imipenem (5.7-29.7%; p-0.004), Meropenem (5.3-18.4%; p-0.03), and Tetracycline (28.6%-81.6%; p-0.02) (Table 2).

Table 2: Rates of resistance of Gram-negative organisms to common antibiotics, Uganda, 2018 -2021

Antibiotic/Year	2018 n (%)	2019 n (%)	2020 n (%)	2021 n (%)	Chi² Value for Trends	p-value
Amikacin	11(52.4)	8(22.9)	12(20.3)	14(38.9)	0.24	0.63
Ampicillin	41(62.1)	35(89.7)	58(89.2)	19(76)	0.93	0.34
Amoxiclav	6(46.2)	23(54.8)	28(87.5)	23(92)	2.83	0.09
Cefotaxime	9(39.1)	20(60.6)	44(78.6)	34(87.2)	3.39	0.07
Ceftriaxone	3(8.3)	25(62.5)	66(78.6)	41(71.9)	8.77	<0.001
Cefoxitin	4(80)	8(25.4)	14(33.3)	4(50)	0.01	0.92
Cefepime	13(56.5)	13(50)	48(71.6)	29(90.6)	1.95	0.16
Chloramphenicol	28(48.3)	26(51)	51(71.6)	26(48.1)	0.03	0.87
Ciprofloxacin	12(17.1)	16(30.2)	48(5.8)	20(42.6)	8.35	<0.001
Gentamycin	15(75)	16(45.7)	21(45.7)	14(70)	0.04	0.84
Imipenem	4(5.7)	3(8.8)	11(19)	14(25.9)	8.42	<0.001
Meropenem	5(7.2)	2(5.3)	7(18.4)	5(2.5)	4.82	0.03
Piperacillin		20(76.9)	38(97.4)	36(87.8)	0.07	0.79
TPZ	1(20)	4(57.1)	13(68.4)	15(68.2)	0.80	0.37
SXT	60(62.5)	37(84.1)	59(78.7)	31(75.6)	0.68	0.41
Tetracycline	14(28.6)	23(71.6)	18(81.8)	14(77.8)	0.5	0.02

TPZ=Piperacillin tazobactam , SXT=Sulfamethoxazole trimethoprim

Trends of resistance to ciprofloxacin by health region, 2018-2021

There was increasing resistance to Ciprofloxacin across the health sub-regions. The significant decline observed in 2021.There is an increasing resistance that is observed in the Elgon sub-region over time, starting with pale green in 2018, and increasing to dark green in 2020 which is sustained in 2021 (Figure 2).

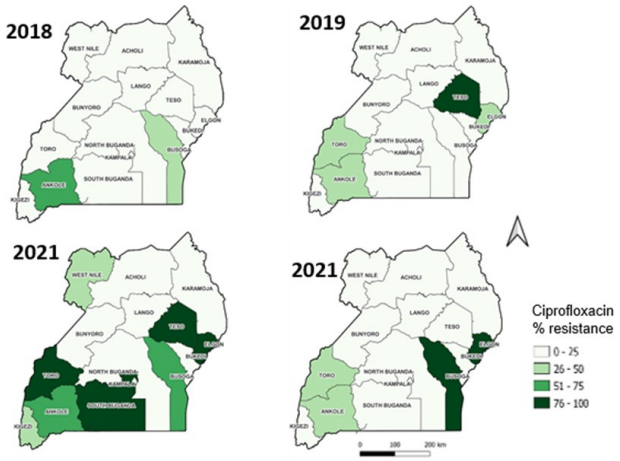


Figure 2: Trends of resistance to ciprofloxacin by health region, 2018-2021

Discussion

We reported trends and patterns of antimicrobial resistance of organisms isolated from patients' sterile site samples in Uganda, 2018-2021 with an emphasis on the antibiotics frequently utilized to treat common infections and the bacterial Gram classifi-

Continued from page 12

cation. We found increases in rates of resistance to commonly used antibiotics over time. The most commonly encountered Gram-positive organisms was *Staphylococcus aureus* while the commonest Gram-negative organisms were *Salmonella typhii/ paratyphii species and Escherichia coli*.

Gram positive organisms were increasingly resistant to Ciprofloxacin and Gram-negative organisms increasing resistance to Ceftriaxone, Ciprofloxacin, and Tetracycline as well as last resort antibiotics like Meropenem and Imipenem. The growing resistance rates to carbapenems is worrisome and may lead to the spread of fatal infections especially in hospitals[9].

Although a number of studies have previously detailed the susceptibility rates in a number of infectious isolates, Ugandan data are restricted to either single-center studies or to research focusing on the susceptibility to specific patient categories, wards, organism groups, or antibiotic classes. There is limited utilization of nationwide AMR surveillance data. This is important because lack of nationwide trends of resistance, and underutilization of routine surveillance data may slow AMR control due to the lack of generalizable data.

The increasing in resistance to these antibiotic classes over time is consistent with literature which states that the more an antibiotic is used, the more the bacteria can develop resistance against it [10].These findings are similar to those obtained from the Global Point Prevalence Survey on antimicrobial use and stewardship study carried out in 2021, where 52% of prescriptions in Uganda were from WHO Access class of antibiotics while 39% were from the Watch class of antibiotics[11]. Also, in a study in Tertiary care facilities in Uganda, 50.6% of participants were prescribed Ceftriaxone while 25.5% were prescribed Levofloxacin [12].

Our study showed that over the course of four years, both Gram-positive and Gram-negative bacteria had an increase in resistance to ciprofloxacin from 26 to 56 percent. This is similar to the findings from a systematic review that included studies addressing the prevalence of ciprofloxacin-resistant clinical isolates in Ethiopia which revealed that one in five clinical isolates were found to be ciprofloxacin resistant in both gram-positive and gram-negative bacteria [13]. A similar study done in Ethiopia, in 2015 observed that the rates of resistance to Ciprofloxacin were high (20-70%) among bacterial organisms isolated from blood which is a sterile site sample[14].

Another salient finding is the increase in resistance of Gram-negative organisms to antibiotics; Ceftriaxone (8-79%), Tetracycline (28-81%), and Imipenem (6-26%). This is similar to other Ugandan/regional resistance rates. Ampaire et al conducted a systematic review in 2018 where he found that there is an overall increase in resistance to Cefotaxime (46-49%) and Cefuroxime both of which are third generation Cephalosporins, whose resistance can be used to infer Ceftriaxone resistance [15]. On the contrally, in this same study Ciprofloxacin was found to be generally susceptible and hence the recommended drug of choice for infections caused by Gram negative organisms. Mackay and others, who conducted a 12-month AMR survey from October 2011 to September 2012 at a tertiary facility in Cape Town, South Africa, [16] found that for health-care associated Enterobacteriaceae bloodstream isolates, susceptibility rates were 58.5% to ceftriaxone, and 70% to ciprofloxacin.

Study limitations

We only analyzed data for pathogenic bacterial isolates from blood, cerebrospinal fluid peritoneal fluid, and pleural fluid. Other sources of bacterial infections such as urinary tract infections were not included in this analysis.

Conclusion

There is a significant increase in the trends of drug resistance to antibiotics such as ciprofloxacin ceftriaxone, meropenem, imipenem, and tetracycline (among the Gram-negative organisms) in Uganda. Continuous monitoring of AMR trends at the national level to improve the efforts to reduce the AMR problem in Uganda through public health policy and planning is crucial.

Conflict of Interest

The authors declare that they had no conflict of interest.

Acknowledgments

The authors would like to thank Ministry of Health who initiated questions that led to this analysis, Department of Laboratory and Diagnostic Services, National Microbiology Reference Laboratory and all regional and national

Continues to page 14

referral hospital microbiology laboratories who generated the data that we analyzed.

References

1. !!! INVALID CITATION !!! [1].
2. Mhondoro, M., et al., *Trends in antimicrobial resistance of bacterial pathogens in Harare, Zimbabwe, 2012–2017: a secondary dataset analysis.* BMC Infectious Diseases, 2019. **19**(1): p. 746.
3. Javaid, N., et al., *Trends in antimicrobial resistance amongst pathogens isolated from blood and cerebrospinal fluid cultures in Pakistan (2011-2015): A retrospective cross-sectional study.* PLOS ONE, 2021. **16**(4): p. e0250226.
4. Ayukekbong, J.A., M. Ntemgwa, and A.N. Atabe, *The threat of antimicrobial resistance in developing countries: causes and control strategies.* Antimicrobial Resistance & Infection Control, 2017. **6**(1): p. 1-8.
5. Ferri, M., et al., *Antimicrobial resistance: A global emerging threat to public health systems.* Critical reviews in food science and nutrition, 2017. **57**(13): p. 2857-2876.
6. Santajit, S. and N. Indrawattana, *Mechanisms of Antimicrobial Resistance in ESKAPE Pathogens.* Biomed Res Int, 2016. **2016**: p. 2475067.
7. !!! INVALID CITATION !!! [5].
8. Najjuka, C.F., et al., *Antimicrobial susceptibility profiles of Escherichia coli and Klebsiella pneumoniae isolated from outpatients in urban and rural districts of Uganda.* BMC research notes, 2016. **9**: p. 1-14.
9. Nordmann, P., T. Naas, and L. Poirel, *Global spread of carbapenemase-producing Enterobacteriaceae.* Emerging infectious diseases, 2011. **17**(10): p. 1791.
10. Llor, C. and L. Bjerrum, *Antimicrobial resistance: risk associated with antibiotic overuse and initiatives to reduce the problem.* Therapeutic advances in drug safety, 2014. **5**(6): p. 229-241.
11. D'Arcy, N., et al., *Antibiotic prescribing patterns in Ghana, Uganda, Zambia and Tanzania hospitals: results from the global point prevalence survey (G-PPS) on antimicrobial use and stewardship interventions implemented.* Antibiotics, 2021. **10** (9): p. 1122.
12. Kizito, M., et al., *Antibiotic Prevalence Study and Factors Influencing Prescription of WHO Watch Category Antibiotic Ceftriaxone in a Tertiary Care Private Not for Profit Hospital in Uganda.* Antibiotics, 2021. **10**(10): p. 1167.
13. Sisay, M., et al., *Resistance profile of clinically relevant bacterial isolates against fluoroquinolone in Ethiopia: a systematic review and meta-analysis.* BMC Pharmacology and Toxicology, 2018. **19**: p. 1-14.
14. Ulhas, A.A., *Prevalence and Characterization of carbapenem resistant organisms causing urinary tract infections among hospitalized patients and outcomes of these infections in a tertiary care center*. 2018, Christian Medical College, Vellore.
15. Ampaire, L., E. Nduhura, and I. Wewedru, *Phenotypic prevalence of extended spectrum beta-lactamases among enterobacteriaceae isolated at Mulago National Referral Hospital: Uganda.* BMC research notes, 2017. **10**(1): p. 1-4.
16. Carroll, M., et al., *Five-year antimicrobial susceptibility trends among bacterial isolates from a tertiary health-care facility in Kigali, Rwanda.* The American journal of tropical medicine and hygiene, 2016. **95** (6): p. 1277.

Continued from page 14

Trends and Spatial Distribution of Perinatal Deaths, Uganda: Descriptive Analysis of Surveillance Data, 2017 – 2021

Authors: Brian Agaba[1*], Hellen Naiga Nelly[1], Zainah Kabami[1], Saudah Namubiru Kizito[1], Brenda Simbwa[1], Robert Zavuga[1], Robert Mutumba[2], Bruno Ssemwanga[2], Carol Nanziri[1], Daniel Kadobera[1], Lilian Bulage[1], Richard Migisha[1], Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]Reproductive Health Division, Ministry of Health, Kampala, Uganda
***Correspondence:** Email: agababrian@uniph.go.ug, Tel: +256774125554

Summary

Background: Over the last two decades, there have been multiple interventions aimed at reducing the burden of perinatal deaths in Uganda. These include perinatal death audits and newborn care packages. Despite this, the country has not reached the World Health Organization (WHO)/Every newborn action plan (ENAP) target of <12 still births per 1,000 births and <12 newborn deaths per 1,000 live births. We describe temporal and spatial trends of perinatal deaths during 2017 to 2021 to evaluate progress towards targets.
Methods: We extracted data on macerated stillbirths (MSB), fresh stillbirths (FSB), early newborn deaths (END), livebirths, and total births from the District Health Information System (DHIS2), 2017–2021. As per the DHIS2, FSB was intrauterine death of a fetus ≥28 weeks of gestation or ≥1,000 grams; MSB was intrauterine death of a fetus before labor onset in which the fetus showed degenerative changes, and END was death of a baby (≥28 weeks of gestation/≥1,000g) at 0-7 days of life. MSB, FSB, and END were summed to obtain total perinatal deaths; rates were calculated per 1,000 total births. We analyzed trends using logistic regression and described spatial distribution by district.
Results: Among 139,948 perinatal deaths (53,001 MSB, 51,566 FSB and 35,381 END), the annual average perinatal death rate was 23/1,000 births, reducing by an average of 8% per year from 28/1,000 in 2017 to 19/1,000 in 2021 (OR=0.92, CI=0.91-0.92). Stillbirths declined by an annual average of 6%(OR=0.94, CI=0.94-0.95). Early newborn deaths declined at an annual average of 9%(OR=0.91, CI=0.90-0.9). Districts with regional referral hospitals such as Masaka, Hoima, Mubende, Jinja, and Kampala reported the highest perinatal death rates.
Conclusion: Perinatal deaths declined between 2017 and2021 but remained above the WHO /ENAP target. The ministry of health could focus perinatal death reduction interventions and resources to districts with regional referral hospitals.

Introduction

A perinatal death is defined as death of a fetus after 28 weeks of pregnancy up to 7 days of life. It encompasses both stillbirths and early newborn deaths. Perinatal deaths persist as a global public health problem. In 2021, perinatal deaths were responsible for 75% of the 2.3 million children that died in the first month and 47% of all under-5 year child deaths in the world[1]. Each year, 1.4 million perinatal deaths occur in Sub-Saharan Africa[2-4]. Developing countries contribute 98% of the global burden of perinatal deaths[5].

In Uganda, perinatal deaths are still persistently high. The 2016 demographic health survey indicates a perinatal death rate of 38 per 1,000 births[6]. In Uganda, perinatal deaths are caused by prematurity, birth asphyxia, obstructed labor, birth trauma, infections, and congenital anomalies[7, 8]. The causes of perinatal deaths in Uganda are largely preventable thus providing opportunities for prevention and reduction strategies.

In response to the high rates, Uganda has implemented interventions to end preventable perinatal deaths for over two decades. Interventions such as perinatal death notification and audits, increasing antenatal care coverage, increasing proportion of births attended

Continues to page 16

to by a skilled birth attendant, essential newborn care package, and family planning have been implemented[9, 10]. However, these interventions have yielded less than expected outcomes as perinatal death rates remain above the World Health Organization/Every Newborn Action Plan target of less than 12 stillbirths per 1,000 total births and less than 12 newborn deaths per 1,000 livebirths[11].

Through perinatal death surveillance, Uganda collects perinatal death data from all health facilities that conduct deliveries. This data is critical in understanding the progress towards meeting targets and is essential in evaluating effectiveness and impact of prevention strategies. Despite this, there is limited national level analysis and documentation of trends and distribution of perinatal deaths. We described trends and spatial distribution of perinatal deaths in Uganda, 2017 – 2021, to inform interventions.

Methods

Study design and data source

We conducted a descriptive analysis of perinatal surveillance data captured in the District Health Information System version 2 (DHIS2). The DHIS2 is an electronic database that contains nationwide data on health conditions of interest. All health facilities that conduct deliveries are mandated to report data. This data is stored in DHIS2. As per DHIS2, perinatal death was defined as the death of a fetus after 28 completed weeks of pregnancy up to seven days of life. Perinatal deaths are the sum of macerated stillbirths (MSB), fresh stillbirths (FSB), and early (0-7 days) newborn deaths (END). FSB was defined as the intrauterine death of a fetus ≥28 weeks of gestation / ≥ 1,000 grams during labor or delivery. MSB was defined as the intrauterine death of a fetus sometime before the onset of labor, where the fetus showed degenerative changes. END was defined as death of a baby (≥28 weeks of gestation/≥1,000g) between birth and 7 days of life.[4]

Study variables, data collection, and data management and analysis

We abstracted nationwide data using pivot tables from DHIS2 on MSB, FSB, END, livebirths, total deliveries in the health facilities and reporting rates, January 2017- December 2021.

Data on MSB, FSB, and END were summed up to generate total number of Perinatal Deaths. Perinatal death rate was calculated by dividing the perinatal deaths by total number of deliveries. The perinatal death rate was expressed per 1,000 total births. Perinatal death rates were calculated by health facility level, district, and year. We calculated average annual percentage change in stillbirth, END, and perinatal deaths rate.

We demonstrated annual trends in perinatal death rates using line graphs. We performed logistic regression analysis to determine significance of trends using Epi info version 7.25. Choropleth maps were drawn using Quantum Geographic Information System (QGIS) to show the distribution of districts with perinatal deaths twice (>24/1,000) the WHO target.

Ethical considerations

We obtained permission to use data from the Ministry of health. Data was stored on a password protected computer and only accessed by the study team. Data abstracted did not have unique identifier information. We also obtained a non-research determination from the US CDC.

Results

Annual average perinatal death rate, Uganda, 2017-2021

Over the study period (2017 – 2021), 139,948 perinatal deaths were reported in DHIS2. Of these, 53,001(38%) were MSB,

Continued from page 16

51,566 (37%) were FSB, and 35,381(25%) were END. The annual average perinatal death rate was 23/1,000 births.

Temporal trends in annual perinatal deaths incidence, Uganda, 2017 – 2021

The perinatal death rate declined by an average of 8% per year from 28/1,000 births in 2017 to 19/1,000 births in 2021. The greatest decline was between 2017 and 2018 (Figure 1). Reporting rates where stable over the study period (74% –76%) (Figure 1).

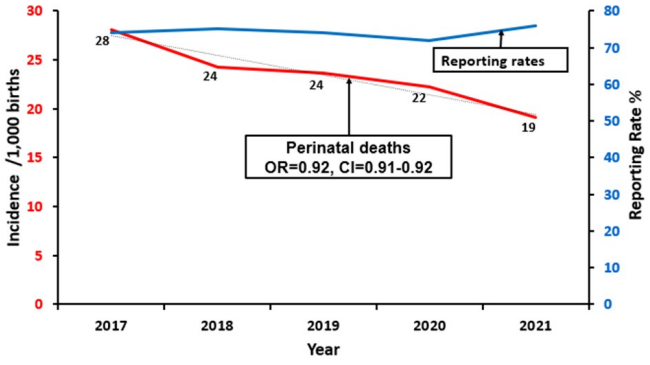


Figure 1: Trend of annual incidence of perinatal deaths per 1,000 total births, Uganda, 2017–2021

Stillbirths declined at a slower rate of 6% per year compared to END that declined at 9% per year (Figure 2).

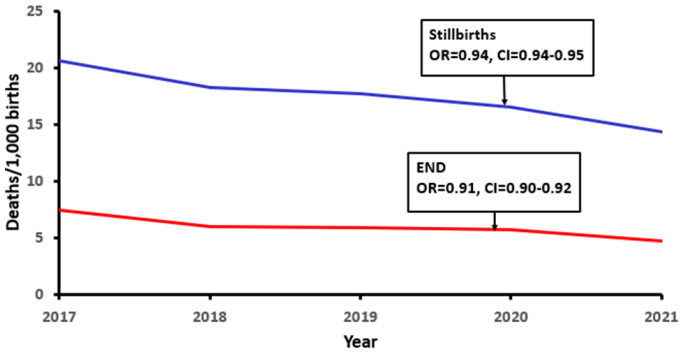


Figure 2: Trends in stillbirths and early newborn deaths incidence, Uganda, 2017–2021

Trends in perinatal deaths incidence, health facility level, Uganda, 2017 – 2021

We observed that regional referral hospitals (RRH) and general hospitals had higher perinatal death rates compared to lower health facilities (Health center IV and III) (Figure 3).

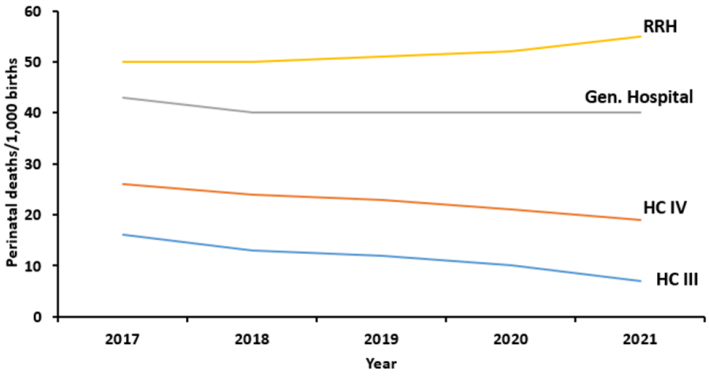


Figure 3: Trends in perinatal deaths incidence stratified by level of health facilities, Uganda, 2017 – 2021

RRH: Regional referral hospital, Gen. Hospital: General hospital, HC IV: Health centre four, HC III: Health centre three

Distribution of perinatal deaths incidence, district level, Uganda, 2017–2021

The proportion of districts with perinatal deaths > 24/1,000 decreased from 48% in 2017 to 20% in 2021. Masaka, Hoima, Mubende, Jinja, and Kampala and other districts with regional referral hospitals had perinatal deaths > 24/1,000 throughout the study period. (Figure 4).

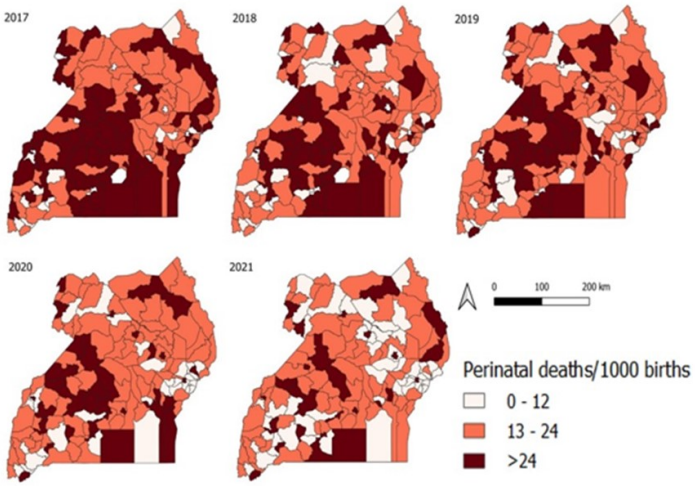


Figure 4: Distribution of perinatal deaths by district, Uganda, 2017 – 2021

Continues to page 18

Discussion

In our assessment of the distribution, temporal, and spatial trends of perinatal deaths in Uganda, 2017 to 2021, we observed a significant decline of perinatal deaths by an average of 8% per year. Stillbirths contributed the bulk of perinatal deaths over the study period. Districts with regional referral hospitals had higher perinatal deaths compared to other districts.

The positive trend in reduction of perinatal deaths in Uganda mirrors that of the world. The WHO estimates that the global number of newborn deaths declined from 5 million in 1990 to 2.4 million in 2020[12]. However, our study highlights a higher reduction in perinatal deaths compared to other African countries. Between 1990 and 2021, neonatal mortality decreased by 1.7% per year in sub-Saharan Africa[13]. In the last decade, Uganda was a beneficiary of increased funding, technical assistance, and political will for newborn and child health interventions. This could have led to the great magnitude in reduction of perinatal deaths.

Stillbirths contributed the bulk of perinatal deaths, consistent with other studies that have reported that stillbirths contribute more than 50% of perinatal deaths in developing countries[14]. Stillbirth rates are an indicator of quality of obstetric care. In developing countries such as Uganda, high stillbirth rates are due to lack of access to quality antenatal and delivery care[15-17]. A study in Western Uganda found that none of the mothers received appropriate intrapartum care[15, 18]. Another study done at the national referral hospital in Uganda found that monitoring of labor was incomplete in 61% of patients[19]. Despite making gains in antenatal care attendance and proportion of births attended by a skilled birth attendant, stillbirths in Uganda remain high suggesting a lack of quality in these services.

Districts with regional referral hospitals had perinatal deaths in excess of 24/1000 births throughout the study period. Perinatal deaths are reported from the health facility where they occur and not the health facility of origin[20]. Therefore, districts with regional referral hospitals receive patients from facilities in districts without referral hospitals. Uganda's health care referral system is plagued by several shortfalls such as delays in transportation, poor transportation means, and incomplete referrals [21].This could explain the high perinatal death rates at regional referral hospitals.

Limitations

This study had a couple of limitations. First, it only looked at reported perinatal deaths. These were more likely to be health facility perinatal deaths. A number of community perinatal deaths could have been missed out leading to underestimation of the burden of perinatal deaths. Second, we utilized secondary data. There was missing data on the full range of variables necessary to comprehensively assess the problem of perinatal deaths in the country.

Conclusion

Although Uganda registered significant decline in perinatal deaths from 2017 to 2021, there is still need for improved efforts to meet the global reduction target by 2030. The ministry of health and its partners could focus on areas and health facilities that had persistently high perinatal deaths during this time period.

Conflict of interest

The authors declare that they had no conflict of interest.

Acknowledgments

The authors would like to thank the Ministry of Health and the Reproductive Health Division for their permission and support in accessing the data utilized in this project.

Continued from page 18

References

1. WHO, *Fact sheet: Newborn Mortality*. 2022, WHO.
2. Network, H.N. *Africa Newborn Network*. 2022 [cited 2022 8/12/2022]; Available from: https://www.healthynewbornnetwork.org/partner/africa-newborn-network/.
3. UNICEF. *Stillbirth*. 2020 October 2020 [cited 2022 7/12/2022]; Available from: https://data.unicef.org/topic/child-survival/stillbirths/.
4. WHO, *Stillbirths*. 2022, WHO: Geneva Switizerland.
5. UNICEF, *Neonatal Mortality*. 2021: New York , USA.
6. UDHS, U.B.o.S., *Uganda demographic and health survey 2016*. 2016, UBOS: Kampala.
7. Arach, A.A.O., et al., *Perinatal death in Northern Uganda: incidence and risk factors in a community-based prospective cohort study.* Glob Health Action, 2021. **14**(1): p. 1859823.
8. Musaba, M.W., et al., *Incidence and determinants of perinatal mortality among women with obstructed labour in eastern Uganda: a prospective cohort study.* Maternal Health, Neonatology and Perinatology, 2021. **7**(1): p. 13.
9. Serbanescu, F., et al., *Impact of the Saving Mothers, Giving Life Approach on Decreasing Maternal and Perinatal Deaths in Uganda and Zambia.* Global Health: Science and Practice, 2019. **7**(Supplement 1): p. S27-S47.
10. Sensalire, S., et al., *Saving Mothers, Giving Life Approach for Strengthening Health Systems to Reduce Maternal and Newborn Deaths in 7 Scale-up Districts in Northern Uganda.* Glob Health Sci Pract, 2019. **7**(Suppl 1): p. S168-s187.
11. WHO, *The Every Newborn Action Plan*. 2015: Geneva, Switzerland.
12. WHO, *Newborns: improving survival and well-being*. 2020: Geneva, Switzerland.
13. UNICEF. *Neonatal mortality*. The neonatal period is the most vulnerable time for a child 2023 january 2023 [cited 2023 31/1/2023]; Available from: https://data.unicef.org/topic/child-survival/neonatal-mortality/.
14. Cnattingius, S. and O. Stephansson, *The epidemiology of stillbirth.* Semin Perinatol, 2002. **26**(1): p. 25-30.
15. Benova, L., et al., *Two decades of antenatal and delivery care in Uganda: a cross-sectional study using Demographic and Health Surveys.* BMC Health Services Research, 2018. **18**(1): p. 758.
16. Sserwanja, Q., et al., *Continuum of care for maternal health in Uganda: A national cross-sectional study.* PLOS ONE, 2022. **17**(2): p. e0264190.
17. Ssetaala, A., et al., *Antenatal Care Practices Among Hard-to-Reach Fishing Communities on Lake Victoria: A Community-Based Cross-Sectional Survey.* Journal of Primary Care & Community Health, 2020. **11**: p. 2150132720923101.
18. Muwema, M., et al., *Perinatal care in Western Uganda: Prevalence and factors associated with appropriate care among women attending three district hospitals.* PLOS ONE, 2022. **17**(5): p. e0267015.
19. Mukisa, J., et al., *Level of Partograph completion and healthcare workers' perspectives on its use in Mulago National Referral and teaching hospital, Kampala, Uganda.* BMC Health Serv Res, 2019. **19**(1): p. 107.
20. Kamwesiga, J., *Uganda Health Care System.* Kampala, Uganda: Makerere University, 2011.
21. Mwanga-Amumpaire, J., et al., *A Qualitative Exploration of the Referral Process of Children with Common Infections from Private Low-Level Health Facilities in Western Uganda.* Children, 2021. **8**(11): p. 996.

Continues to page 20

Timeliness and Completeness of Monthly Disease Surveillance Data Reporting, Uganda, 2020–2021

Authors: Robert Zavuga*[1], Richard Migisha[1], Doreen Gonahasa[1], Daniel Kadobera[1], Benon Kwesiga[1], Peter Edward Okello[1], Lilian Bulage[1], Freda Loy Aceng[2], Joshua Kayiwa[3], Issa Makumbi[3], Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, Uganda, National Institute of Public Health, Kampala, Uganda, [2]Department of Integrated Epidemiology, Surveillance and Public Health Emergencies, Ministry of Health, Kampala, Uganda, [3]Public Health Emergency Operations Center, Ministry of Health, Kampala, Uganda
*Correspondence: Email: rzavuga@musph.ac.ug, Tel: +256772655723

Summary

Background: In Uganda, electronic District Health Information System (DHIS2) surveillance data are entered by health facilities on a weekly or monthly basis. The monthly outpatient department (OPD) reports are submitted in 3 different categories namely; nationals, refugees, and foreigners. For the purpose of this study, OPD reports from only Ugandan nationals were considered. We assessed completeness and timeliness of monthly OPD data from Ugandan nationals from January 2020 to December 2021.
Methods: We used DHIS2 data from all 15 regions and 146 districts of Uganda from January 2020–December 2021. Completeness was defined as the number of submitted reports divided by the number of expected reports from the same health facility, district, or region. Timeliness was defined as the number of reports submitted by the deadline (15th day of the succeeding month) divided by reports received. Facilities, districts, or regions with completeness or timeliness <80% were regarded as having submitted incomplete or untimely reports.
Results: Overall, there was good general performance with the median completeness of facility OPD reports being high in 2020 (99.5%; IQR 97.8-100%) and 2021 (100%; IQR 98.7-100%), as was the median timeliness (2020, 82.8%, IQR 74.6-91.8%; 2021, 94.9%, IQR 86.5-99.1%). In terms of regions, no region reported below the 80% OPD completeness target; Kampala region (comprising Kampala, Wakiso, and Mukono districts) was the only region that consistently failed to reach ≥80% OPD timeliness (2020: 44%; 2021: 65%). Nakasongola was the only district which consistently performed poorly in submission of timely reports in both years (2020:54.4%, 2021:58.3%). National Referral Hospitals consistently failed to meet the timeliness target in both years (2020:47.2%;2021:74.1).
Conclusion: There was an overall good performance in submission of complete and timely monthly OPD reports in both 2020 and 2021 in the DHIS2 across most districts and regions in Uganda. There is need to strengthen the good reporting practices exhibited and offer support to regions, districts, and health facilities with challenges to timeliness.

Introduction

Timely and complete reporting of routine public health information about diseases and public health events are important aspects of a robust surveillance system[1]. Through public health disease surveillance systems, information is continuously and systematically collected, analysed, interpreted, and disseminated to guide the planning and implementation of public health programs[2]. Recurrent outbreaks which sometimes can lead to widespread epidemics and transmission to other countries demonstrate the need of having a surveillance system that provides complete information that allows it to detect changes in disease patterns in time so as to mount a response. Despite the increased efforts of strengthening health information reporting at different levels, Low-Income Countries (LIC) are still challenged with untimely, incomplete, and inaccurate surveillance information which in turn affects the planning, monitoring, and evaluation of health sector performance and service delivery[3].

The introduction of a paperless system is one of the ways employed to improve the timeliness and completeness of reporting public health information and events in Uganda. The Ministry of Health (MoH) in Uganda operates a web-based information system known as the District Health Information System (DHIS 2) in which the data that are routinely gener-

Continued from page 20

ated from health facilities are filled in on a weekly and monthly basis. In this system, all the primary data received from lower-level health facilities which are captured in paper format are entered into the DHIS2 at the district level [3]. This interchange and transfer of data from paper into the DHIS2 is likely to cause considerable distortions in terms of accuracy, timeliness, and completeness [4]. The DHIS2 has undergone three significant revisions and upgrades since its inception in 2010 and thus has the following versions: 2010-2014, 2015-2019, and 2020-2024. These revisions and upgrades were aimed at improving system performance and to also incorporate the new districts and regions that have been created from time to time.

The Integrated Disease Surveillance and Response (IDSR) indicators guide that for a report to be timely, 80% of health facilities must have submitted in time and for a report to be complete 80% of the expected reports should have been submitted [5]. A weekly epidemiological report published in January 2022 indicated that only 8 of the 15 regions in Uganda met the completeness target of 80% and no region met the timeliness target [6]. Subpar timeliness or completeness may lead to delayed detection of infectious diseases and the potential for larger outbreaks than would otherwise occur. Although data on completeness and timeliness of surveillance data is collected in the DHIS2 version 2020-2024; it has not been routinely analysed. The reporting of outpatient department (OPD) data in the years 2020 and 2021 could have been interrupted by the coronavirus disease 2019 (COVID-19) pandemic that was at the peak in this period [7], and therefore there could be some areas of weakness in the surveillance system. Therefore, by periodically evaluating the timeliness and completeness of reporting of routine surveillance data, it is possible that specific barriers and challenges to reporting can be identified and immediately improved upon. Ultimately, improvement across these metrics should enable rapid and timely response to disease outbreaks and mounting of control measures. We estimated the timeliness and completeness of monthly OPD disease surveillance reports submitted to the DHIS2 in Uganda from January 2020-December 2021 so as to provide evidence-based recommendations to the Ministry of Health.

Methods

Study setting and design

We conducted a descriptive quantitative study that involved analysis of monthly OPD disease surveillance reports submitted to the DHIS2 from January 2020 to December 2021. Uganda has 146 districts which are distributed across 15 regions as designated by Ministry of Health[8]. These regions are Acholi, Ankole, Bugisu, Buekdi, Bunyoro, Busoga, Kampala, Karamoja, Kigezi, Lango, North central, South Central, Teso, Tooro and West Nile.

The health care system has several government and privately owned health facilities which are organized in a hierarchical order[9]. At the bottom are the community health works also known as the Village Health Team (VHT) members who report observations to the lowest Health Centers (HC) at the community level all way to the highest level of health facilities. That is, the lowest health centers being HCIIs (found at parish level), HCIIIs (found at sub-county level), HCIVs (found at county/health sub-district level), district hospitals (found at district level), regional referral hospitals (found at region level) and the national referral Hospital found at national level.

Data source

We extracted data from the DHIS2 from all the regions of Uganda which comprise the 146 districts. The DHSI2 is a web-based open-source health management information system used to collect aggregate data which is routinely generated across health facilities [10]. The DHIS2 also has capabilities for data analysis, data management, and data visualization. The DHIS2 automatically determines completeness and timeliness. The reports that are submitted by the deadline date are considered to be timely and the proportion of the actual number of reports submitted against the expected number of reports are regarded as complete. The monthly OPD reports are submitted in 3 different categories namely; nationals, refugees, and foreigners. For the purpose of this study, OPD reports from only nationals were considered.

Generation of surveillance data

Routine surveillance data are generated at the community through routine surveillance

Continues to page 22

activities carried out by the VHTs. The disease surveillance reporting system follows a hierarchical order from the community level to the national level through the DHIS2.

At the health facility level, information is first collected as patient-specific data using paper-based IDSR surveillance tools and later transferred into the electronic format-the DHIS2 as aggregated data. The monthly OPD report is an aggregated report for all OPD occurrences at each health facility. It contains data on OPD attendances, referrals, diagnosis, infectious disease and epidemic prone diseases, non-communicable diseases, maternal and child health, family planning, and immunisation services.

The IDSR defines completeness as the proportion of reports submitted divided by the number of expected reports from the same health facility, district or region in a given time period while timeliness is defined as proportion of reports submitted by the deadline divided by actual reports received in the given time period. Health facilities are expected to submit complete monthly reports by the 15th of the succeeding month. The facilities with percentages below the 80% are regarded as having submitted incomplete or untimely reports. Data from different health centers are sent to the district and then later merged into regions constituting different districts.

Data abstraction and analysis

We captured different variables for the years of 2020 and 2021. These years were considered because we wanted to evaluate the immediate past performance trends of the reporting indicators especially after the COVID 19 response period of 2020-2021. A data abstraction form was used to extract information on expected number of reports, actual number of reports, actual number reports on time. It is from these variables that the monthly completeness and timeliness were computed. Completeness was calculated as the number of actual monthly OPD reports received divided by the expected number of reports in a given year and expressed as a percentage. Timeliness was calculated as the number of actual monthly OPD reports received on time (by the 15th of every month) divided by the expected number of reports in a given year and was also expressed as a percentage. We determined the overall proportions of completeness and timeliness of reporting by year at national level, region, district, level of health facility, and health facility ownership. We analysed data using EPI INFO version 7.0

Ethical considerations

Since our study used routine surveillance data reported by health facilities in the DHIS2 which were also aggregated with no individual patient identifiers, we did not seek for ethical approval. However, we sought permission to use the data from the Uganda Ministry of Health. The US Centers for Disease Control and Prevention (CDC) also provided the non-research determination (NRD) for non-human subjects. Data were only accessed by the study team.

Results

Completeness and timeliness of monthly outpatient department reporting, overall, region, level of health facility, and level of ownership, Uganda, 2020-2021

Overall, in 2020 the expected number of reports was 69,468 and of these, 68,935 reports were submitted and 52,430 were submitted in time corresponding to 99.2% completeness and 75.5% timeliness. However, in 2021, the expected number of reports of was 69,659 and of these 61,490 were submitted in time corresponding to 99.8% completeness and 88.1% timeliness. The median completeness of facility OPD reports was high in 2020 (99.5%; IQR 97.8-100%) and 2021 (100%; IQR 98.7-100%), as was the median timeliness (2020, 82.8%, IQR 74.6-91.8%; 2021, 94.9%, IQR 86.5-99.1%).

There was a general improvement in reporting in terms of completeness and timeliness from 2020 to 2021. This trend is similar across all regions, level of health facilities, and type of ownership of health facility. Regarding completeness, all regions scored above the required reporting target of 80% in 2020 and 2021. However, 7 out of 15 regions did not reach the timeliness reporting target in 2020 and in 2021, only Kampala region did not score above the timeliness target. Kampala region was the only region which consistently failed to meet the 80% timeliness target in both years (2020: 44.4%; 2021: 64.7%).

Continued from page 22

All levels of health facilities scored above the required completeness target in both years. National Referral Hospitals were the only facilities that consistently failed to meet the timeliness target in both years (2020:47.2%;2021:74.1).

Privately owned health facilities failed to score above the required timeliness target in 2020. Although they improved and scored above the timeliness target in 2021, they still performed poorer than government owned facilities (Table 1).

Table 1: Completeness and timeliness of monthly outpatient department reporting per region, level of health facility, and level of ownership, Uganda, 2020-2021

	2020		2021	
	Completeness (%)	Timeliness (%)	Completeness (%)	Timeliness (%)
Region				
Acholi	98.7	73.2	98.9	88.7
Ankole	99.8	77.1	100	89.9
Bugisu	98.3	84	100	96.9
Bukedi	97.1	82.5	96.8	86.3
Bunyoro	96.8	72.9	99.1	87.7
Busoga	98.6	74.1	99.9	86.1
Kampala	100	44.4	100	64.7
Karamoja	98.8	81.1	98.9	93.4
Kigezi	99.1	95.2	100	99.6
Lango	100	83.6	100	87.4
North Central	100	70.1	100	88.2
South Central	96.4	75.3	97.6	88.8
Teso	98.6	81.1	97.3	89.4
Tooro	98.4	81.4	99.4	95.5
West Nile	100	91.3	100	97.9
National Level	99.2	75.5	99.8	88.1
Level of health facility				
Health Center II	96.6	73.8	99.8	87.4
Health Center IIII	98.7	80.0	99.1	90.9
Health Center IV	97.9	79.7	99	89.9
District Hospital	99.8	75.9	100	88.6
Regional Referral	99.0	67.2	100	83.8
National Referral	100	47.2	100	74.1
Health facility ownership				
Government	99.1	80.4	99.7	91.6
Private	100	69.9	100	84.2

District monthly completeness and timeliness of outpatient department reports, Uganda, 2020-2021

In 2020, all districts scored above the recommended target for completeness except Namisindwa while in 2021 all districts scored above the required target. In regard to timeliness, 59 (40%) districts failed to submit monthly OPD reports on time in 2020 and 21 (14.4%) districts failed to submit on time in 2021 (Figure 1a). Nakasongola was the only district which consistently performed poorly in submission of timely reports by scoring below 80% in both years (2020:54.4%, 2021:58.3%) (Figure 1b).

Continues to page 24

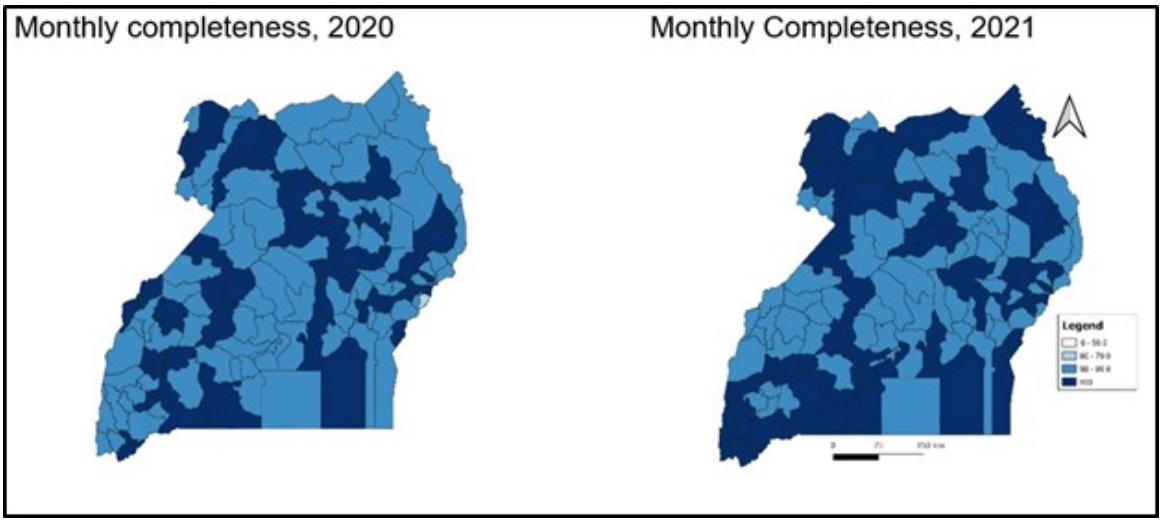


Figure 1a: Completeness of monthly outpatient department reports, Uganda, by district, 2020-2021

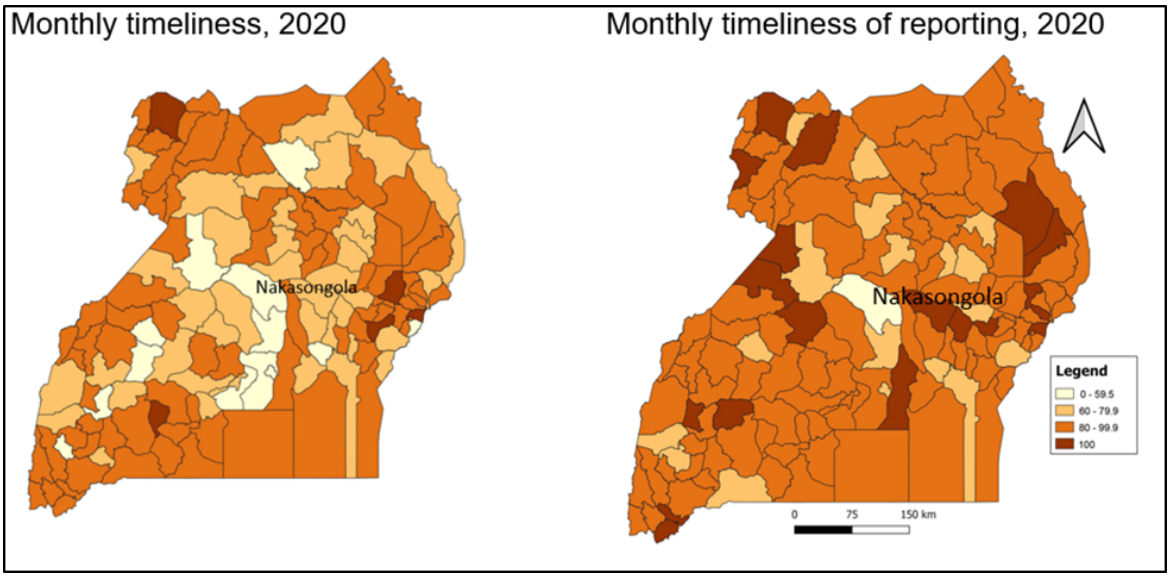


Figure 1b: Timeliness of monthly outpatient department reports, Uganda, by district, 2020-2021

Discussion

In our analysis of the monthly disease surveillance reporting data, we found that there was good general performance in completeness and timeliness of reporting. In 2020 almost half the number of regions did not submit reports in time. Kampala region was the only region which consistently failed to reach the timeliness target in both years. At district level, Nakasongola District was the only district which consistently failed to score the timeliness target. Additionally, higher level health facilities like national referral hospitals and referral hospitals performed poorer than lower-level health facilities in terms of submission of timely reports. This study addresses the importance of monitoring routine surveillance data especially that which is collected on a monthly basis for public health action.

There was good general good performance in completeness and timeliness of reporting. This is due to regular mentorship and improved capacity of district biostatisticians and data personnel to collect and submit disease surveillance data [11]. Additionally, the switch from paper-based reporting to electronic internet based reporting and improved Information and Communication Technology (ICT)

Continued from page 24

capabilities has played a big role in improving performance [12]. These observations are in line with other studies. A study which was done to explore the challenges in implementing surveillance tools of High Income Countries (HIC) in Low Middle Income Countries (LMICs) indicates that improvement of capacity of health workers in data collection through education and mentorship improves on the performance of surveillance information reporting[13]. Furthermore, a study which was done in Tanzania about use of technology innovations and ICT reported that improved ICT services provide an opportunity for better reporting and early detection of diseases[14].

In 2020, almost half of the regions did not achieve the 80% timeliness target. This was likely because of task shifting which was characterized by the COVID-19 pandemic during this time. Various health carders including medical data personnel were assigned other duties of active case finding and contact tracing and left the data departments understaffed thus affecting the timeliness of reporting [15]. Task shifting has been identified as an effective strategy in times of human resource scarcity. However, a Ugandan study, revealed that it may lead to low efficiency in performance of core functions and this affects quality of the tasks assigned [16]. On the other hand, a systematic review done on task shifting in Sub Saharan Africa recognizes that although it is cost effective, it has a risk of competing with other health service priorities [17]. Task shifting should be done without stifling the responsibilities of the mother departments.

At district level, Nakasongola was the only district which consistently performed poorly in submission of timely reports in both years. The reason for this poor performance is not well known but it could be because Nakasongola is a district with several remote areas with low information access[18]. Submission of untimely reporting has been linked to health facilities located in remote areas. A study done in Solomon islands revealed that health facilities located in remote areas had challenges in submitting timely reports[19].

Kampala region did not reach the timeliness target in the period of two years. It is not certain why this region performed this way, but it could be attributed to the large volume of patients it handles because of its big population and the corresponding patient flow. Kampala is the largest city in Uganda with a population of about 1.5 million people[20]. The high workload experienced by Kampala health facilities may have an impact on timeliness of reporting. High workload is known to affect timeliness and completeness of reporting. A study done in the Oceania region in Solomon Islands about malaria surveillance reporting system in the DHSIS2 revealed that high work overload leads to delays in timely reporting [19].

At health facility level, low timeliness was observed in higher health facilities like regional referral hospitals and national referral hospitals as compared to the lower health facilities. The reason for low timeliness in higher level health facilities in Uganda is not well documented. The disease surveillance function and data reporting at higher health facilities is given as an additional task to health workers many of them clinicians who are also involved in other clinical duties. Additionally, the few available data officers at these health facilities are involved in several other duties. These could be one of contributing factors to delays in submitting reports in time.

Limitations

Our study only utilized DHIS2 information in the years of 2020 and 2021. We did not analyze reporting rates for a long duration of time that is, the years before 2020. This could have allowed us ascertain the true reporting trends over the years. We intended to analyze reporting rates during the COVID 19 period to ascertain if surveillance data reporting was affected since this period was characterized with disturbances in the health system.

Conclusion

There was good reporting in terms of completeness and timeliness in both years. However, despite the good reporting, timeliness of reporting was low in Nakasongala District, Kampala Region and in higher level health facilities. We recommend strengthening the practices leading to good reporting and offer support to health facilities with challenges to timeliness through mentorships and continuous support supervision. Further studies are needed to understand and identify barriers to timely reporting.

Continues to page 26

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

Acknowledgements
The authors appreciate the bio-statisticians and surveillance officers who ensure that reporting of surveillance data is routinely done at their respective districts and as well as the DHIS team at the Ministry of Health for managing the DHSIS2 platform. We also appreciate Public Health Fellowship Program and the Ministry of Health, Public Health Emergency Operations Centre for the technical support and guidance offered during this study.

References

1. Williams, F., A. Oke, and I. Zachary, Public health delivery in the information age: the role of informatics and technology. Perspectives in public health, 2019. **139**(5): p. 236-254.
2. Dureab, F., et al., Assessment of electronic disease early warning system for improved disease surveillance and outbreak response in Yemen. BMC Public Health, 2020. **20**(1): p. 1422.
3. Kiberu, V.M., et al., Strengthening district-based health reporting through the district health management information software system: the Ugandan experience. BMC medical informatics and decision making, 2014. **14**: p. 40-40.
4. Garrib, A., et al., An evaluation of the District Health Information System in rural South Africa. S Afr Med J, 2008. **98**(7): p. 549-52.
5. Lukwago, L., et al., The implementation of Integrated Disease Surveillance and Response in Uganda: a review of progress and challenges between 2001 and 2007. Health Policy and Planning, 2012. **28**(1): p. 30-40.
6. MOH, Ministry of Health Uganda: Weekly Epidemiological Bulletin; Week 4: 24th-30th Jan 2022. 2022.
7. Bakamutumaho, B., et al., Severe COVID-19 in uganda across two epidemic phases: a prospective cohort study. The American journal of tropical medicine and hygiene, 2021. **105**(3): p. 740.
8. UBOS. Uganda Bereau of Statistics; Statistical Abstract. 2020 [cited 2022 22nd, May]; Available from: https://www.ubos.org/wp-content/uploads/publications/11_2020STATISTICAL__ABSTRACT_2020.pdf.
9. Ssempiira, J., et al., Measuring health facility readiness and its effects on severe malaria outcomes in Uganda. Scientific reports, 2018. **8**(1): p. 17928.
10. Dehnavieh, R., et al., The District Health Information System (DHIS2): A literature review and meta-synthesis of its strengths and operational challenges based on the experiences of 11 countries. Health Inf Manag, 2019. **48**(2): p. 62-75.
11. Westercamp, N., et al., Effectiveness of in-service training plus the collaborative improvement strategy on the quality of routine malaria surveillance data: results of a pilot study in Kayunga District, Uganda. Malaria journal, 2021. **20**(1): p. 1-12.
12. Youssef, D., et al., Converting the existing disease surveillance from a paper-based to an electronic-based system using district health information system (DHIS-2) for real-time information: the Lebanese experience. BMC health services research, 2022. **22**(1): p. 1-12.
13. Jayatilleke, K., Challenges in implementing surveillance tools of high-income countries (HICs) in low middle income countries (LMICs). Current treatment options in infectious diseases, 2020. **12**: p. 191-201.
14. Karimuribo, E.D., et al., A smartphone app (AfyaData) for innovative one health disease surveillance from community to national levels in Africa: intervention in

Continued from page 26

disease surveillance. JMIR public health and surveillance, 2017. **3**(4): p. e7373.
15. Hardhantyo, M., et al., Quality of National Disease Surveillance Reporting before and during COVID-19: A Mixed-Method Study in Indonesia. International journal of environmental research and public health, 2022. **19**(5): p. 2728.
16. Baine, S.O., A. Kasangaki, and E.M.M. Baine, Task shifting in health service delivery from a decision and policy makers' perspective: a case of Uganda. Human resources for health, 2018. **16** (1): p. 1-8.
17. Callaghan, M., N. Ford, and H. Schneider, A systematic review of task-shifting for HIV treatment and care in Africa. Human resources for health, 2010. **8**: p. 1-9.
18. Majalija, S., et al., Pastoral community practices, microbial quality and associated health risks of raw milk in the milk value chain of Nakasongola District, Uganda. Pastoralism, 2020. **10**(1): p. 3.
19. Wangdi, K., et al., Evaluation of the malaria reporting system supported by the District Health Information System 2 in Solomon Islands. Malaria journal, 2020. **19**: p. 1-14.
20. Twinomuhangi, R., et al., Perceptions and vulnerability to climate change among the urban poor in Kampala City, Uganda. Regional Environmental Change, 2021. **21**: p. 1-13.

COVID-19 Vaccine Uptake and Coverage, Uganda, 2021-2022

Authors: Patrick King[1*], Mercy Wendy Wanyana[1], Richard Migisha[1], Daniel Kadobera[1], Benon Kwesiga[1], Claire Biribawa[2], Michael Baganizi[2], and Alfred Driwale[2]
Institution affiliation: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]Uganda National Expanded Program on Immunization, Ministry of Health, Kampala, Uganda
[*]**Correspondence:** Email: kingp@uniph.go.ug, Tel: +256775432193

Summary

Background: Vaccination against COVID-19 reduces COVID-19-associated mortality, severe disease, and hospitalization, and the potential for the severity of future COVID-19 waves. Uganda began COVID-19 vaccination in March 2021 and has used a variety of vaccines, including AstraZeneca, Johnson & Johnson, Moderna, Pfizer, Sinopharm, and Sinovac. The World Health Organization (WHO) Global strategy on COVID-19 vaccination targeted national coverage of 10% by September 2021, 40% by December 2021, and 70% by June 2022. We assessed COVID-19 vaccination uptake and coverage in Uganda during March 2021 through June 2022 to evaluate progress towards targets and identify gaps for evidence-based recommendations.
Methods: We conducted descriptive analysis of COVID19 vaccination data from the national COVID-19 vaccination database, March 2021-June 2022. Vaccine uptake was defined as the proportion of the population vaccinated with ≥1 COVID-19 vaccine dose. Coverage was the proportion of persons who had received the full number of doses ('schedule') of the relevant vaccine. For single-dose vaccines, uptake equaled coverage. We calculated uptake and coverage at national, regional, and district levels and also disaggregated by sex and age groups. We used chi-square test to assess differences between categories.
Results: In total, 17,369,476 individuals received ≥1 COVID-19 vaccine dose, and 11,833,911 individuals had received the full schedule by June 2022. National uptake (6% in September (Q3) 2021, 42% in December (Q4) 2021, and 63% by June (Q2) 2022) and coverage (2% in Q3 2021, 16% in Q4, 2021, and 42% in Q2 2022) were be-

Continues to page 28

low WHO targets. Western Region (33.2%) had significantly higher coverage than Eastern (31.4%), Central (22.4%), and Northern regions (21.6%) (p<0.0001). Females (10.6%) had higher coverage than males (8.6%) (p<0.0001). Persons >50 years of age had higher coverage (24.9%) than persons aged 40-49 (21.8%), 30-39 (19.0%), 18-29 (4.7%), and 12-17 (2.9%) years (p<0.0001).

Conclusion: COVID-19 vaccine coverage and uptake were below WHO targets in Uganda by June 2022. The Uganda National Expanded Program for Immunization should carry out targeted vaccination campaigns to improve vaccine uptake and coverage, particularly for groups and areas with the lowest coverage. Programs to continuously monitor the extent of vaccine hesitancy could help increase vaccine demand among the population.

Background

COVID-19 has had massive health and economic impacts globally(1). By June 2022, COVID-19 had contributed to 6 million deaths and more than 38 million infections globally as reported on the World health organization (WHO) dashboard(2). COVID-19 vaccine showed that they could prevent more deaths(3). Consequently, various countries developed several vaccines, with 11 vaccines licensed for emergency use by the WHO. Following this, WHO through the Strategy to Achieve Global COVID-19 Vaccination set a target for each country to vaccinate 70% total population coverage by mid-2022 in order to end the COVID-19 pandemic (4).

Initially, Uganda particularly received its first batch of COVID-19 vaccine in March 2021 through the COVID-19 Vaccines Global Access (COVAX) facility which is a group of organizations that included Coalition for Epidemic Preparedness Innovations (CEPI), Gavi, WHO, and United Nations International Children's Fund(5). The COVAX facility aimed to ensuring equitable access to COVID-19 vaccines for all countries, regardless of their income level. The first consignment received in Uganda comprised part of 864,000 doses of AstraZeneca vaccine from serum institute of India. Later in December 2021 more than 742,000 doses of AstraZeneca and Moderna vaccines were received from European governments. A total of 1,606,000 doses were availed to the country between March and December 2021 and more doses were received from the United States and other European countries in 2022. Uganda was expected to achieve the initial COVAX short term targets of 3% coverage, and then 20% vaccine coverage through COVAX-secured doses by the end of 2021. This would eventually lead to achievement of the WHO target of 70% of the 44 million population which approximates to 30,800,000 coverage by mid-2022.

Uganda's COVID-19 Vaccination Implementation Plan (UCVIP) set out to implement COVID-19 vaccination in a coordinated stepwise approach adopting the WHO prioritization framework. The first phase that covered the high priority was from January to March 2021 (Quarter 1) and second phases from April to May 2021 (Quarter 2) prioritized individuals above 18 years (4). The high priority groups included health workers in public and private health facilities, people with co-morbidities above 18 years and teachers; humanitarian and those aged above 50 years of age. There after the third phase (Quarter 3 of 2021) focused on all individuals above 18 years. With current evidence suggesting the safety of vaccines among children aged 5 – 17 years (6, 7), the final phase included on full schedule vaccination for the entire population aged ≥12 years.

Vaccination was initially offered at static sites but to increase uptake, the Ministry of Health (MoH) shifted its strategy to Accelerated Mass Vaccination Campaigns (AMVC). In AMVC, the Ugandan, Ministry of Health increased the number of vaccination points and expanded vaccination access through the establishment of outreaches in communities and at churches, taxi parks, markets among other places.

With the country having a fully re-opened economy and a clearly noted non-adherence to COVID-19 Standard Operating Procedures (SOPs), vaccines remain the most effective public health measure to mitigate the impact of COVID 19. The effectiveness of any vaccination program is dependent on uptake of the vaccine. Although

Continued from page 28

periodic reports on vaccines delivered have been made, no formal assessment of the country's COVID-19 vaccine uptake and coverage has been made. We assessed progress, compared COVID-19 vaccine uptake and coverage across demographic groups and determined spatial distribution of COVID-19 vaccination uptake and coverage, Uganda, March 2021-June 2022.

Methods

We conducted a descriptive analysis of routinely collected COVID19 vaccination surveillance data obtained from the District Health Information System2 (DHIS2). We specifically obtained data from the EPIVAC, a data base for COVID-19 vaccination in DHIS2. This database contains COVID-19 vaccines administered and social demographic information on vaccinated individuals since March 2021.

We abstracted aggregate data on brand of vaccine received, number of doses received, residence (district, region), risk category (including: Health Care Workers (HCW), Elderly, persons with co-morbidities, and teachers) and socio-demographic variables including: age and gender.

We defined COVID-19 vaccine uptake as the proportion of people vaccinated with at least one COVID-19 vaccine dose. We defined COVID-19 coverage as the proportion of people who had received the full schedule of COVID-19 vaccine (at least two doses of AstraZeneca, Pfizer, Moderna, Sinopharm, Sinovac or one dose Johnson and Johnson).

Data were downloaded in an excel file and imported to Epi info 7 software for analysis. Descriptive statistics including counts and percentages were calculated. Counts on the of type vaccine received and percentages for COVID-19 uptake and coverage were calculated at various time points and across population categories. We calculated uptake as the number of people who had received at least one vaccine dose divided by the eligible population using population statistics obtained from the Uganda Bureau of Statistics. We calculated coverage as the number of people who had received at least one vaccine dose divided by the eligible population using population statistics obtained from the Uganda Bureau of Statistics.

We used logistic regression to evaluate the overall trend for COVID-19 vaccination uptake and coverage using Epi info 7. Chi- square test was used to compare the COVID-19 vaccine coverage and COVID-19 uptake across regions. We drew choropleth maps using QGIS to show the spatial distribution across districts.

We obtained permission to use the COVID19 vaccination data from the Ministry of health. Data was stored on a password protected computer and only accessed by the study team. Data abstracted did not have unique identifier information. We also obtained a non-research determination from the US CDC.

Results

Vaccine doses received by eligible population, Uganda, March 2021-June2022

Between March 2021 and June 2022, the eligible population received both single (Johnson & Johnson) and two dose vaccines regimens (AstraZeneca, Moderna, Pfizer, Sinopharm and Sinovac). Johnson and Johnson vaccine was only one single dose vaccine received. Among two dose vaccine regimens, AstraZeneca was the commonest (4,538,682 doses) vaccine received at first dose. While Pfizer was the commonest vaccine received for the second dose (27361366 doses). Sinovac and Sinopharm vaccines were the least received throughout this period (Figure1).

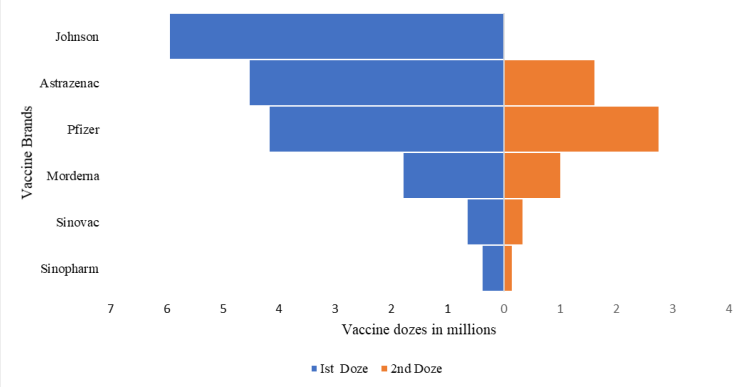


Figure 1: Vaccine doses received by eligible population, Uganda, March 2021 – June 2022

Continues to page 30

National COVID-19 vaccine uptake progress, Uganda, March 2021- June 2022

For the first phase (Q1) uptake was 33% among teachers, 70% among HCW, 47% among people living with comorbidities. For the second phase (Q2) uptake was 7% among the elderly. The national vaccine uptake was < 10% from March to end of September 2022. Thereafter there was a rapid increase (35%) in vaccine uptake between September and December 2022. By the end of June 2022, vaccine uptake was 62.5%. Overall, the national vaccine uptake increased by 45% (OR:1.45, CI:1.44-1.45, p-value <0.001) between march 2021-June 2022 (Figure 2).

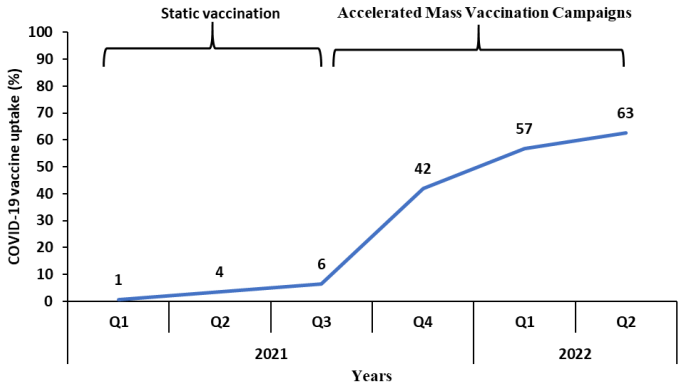


Figure 2: National COVID-19 vaccine uptake, Uganda, March 2021- June 2022

National COVID-17 vaccine coverage progress, Uganda, March 2021- June 2022

The national COVID-19 vaccination coverage was < 10% between quarter 1 and 3, 2021. Thereafter national COVID-19 vaccination coverage rapidly increased between quarter 3 2021 and quarter 1, 2022. By end of quarter 2, 2022 the national vaccine coverage was 42.4%. Overall, there was a 41% increase (OR:1.41, CI:1.41-1.41, p-value <0.001) increase in COVID-19 vaccine coverage, March 2021-June 2022.

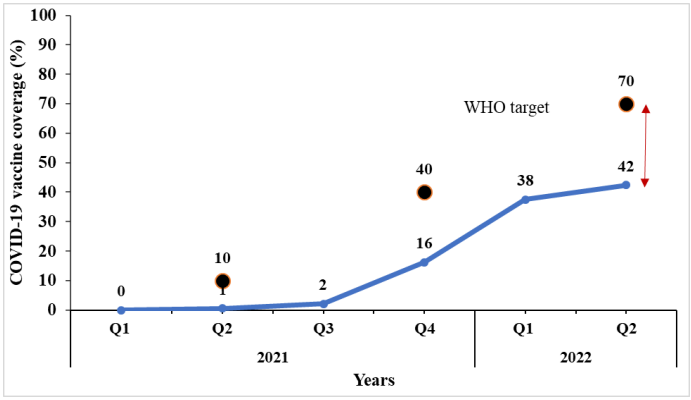


Figure 3: National COVID-19 vaccine coverage, Uganda, March 2021-June 2022

Difference in COVID19 Vaccine uptake and Coverage, Uganda, March 2021-June 2022

Differences in COVID19 vaccine uptake and coverage were observed across age groups, gender, and region (Table 1). Both coverage and uptake were higher among females compared to males. The oldest age group (> 50 years) had higher coverage and uptake compared to younger age groups. The Western Region had the highest coverage and uptake compared to the other regions

Table 1: Differences in COVID19 Vaccine uptake and Coverage, Uganda, March 2021 – June 2022

Characteristics	Uptake %	P-value	Coverage %	P-value
Age group		<0.001		<0.001
12-17	5.9		2.9	
18-29	17.4		4.7	
30-39	26.7		19.0	
40-49	36.5		21.8	
> 50	40.8		24.9	
Gender		<0.001		<0.001
Male	49.2		13.8	
Female	58.2		16.4	
Region		<0.001		<0.001
Central	35.2		22.6	
Eastern	40.5		31.4	
Northern	32.8		21.6	
Western	51.2		33.2	

Continued from page 30

Spatial distribution of COVID-19 vaccine uptake, Uganda, March 2021-June 2022

The national COVID19 vaccine uptake was generally low across all districts between quarter 1 and quarter 3 2021. By the end of quarter 2, 25 districts had a COVID19 vaccine uptake above 80% with the highest percentage of vaccine uptake captured in Obongi District. The lowest recorded vaccine uptake by June 2022 in Uganda was in Kabarole District (Figure.4).

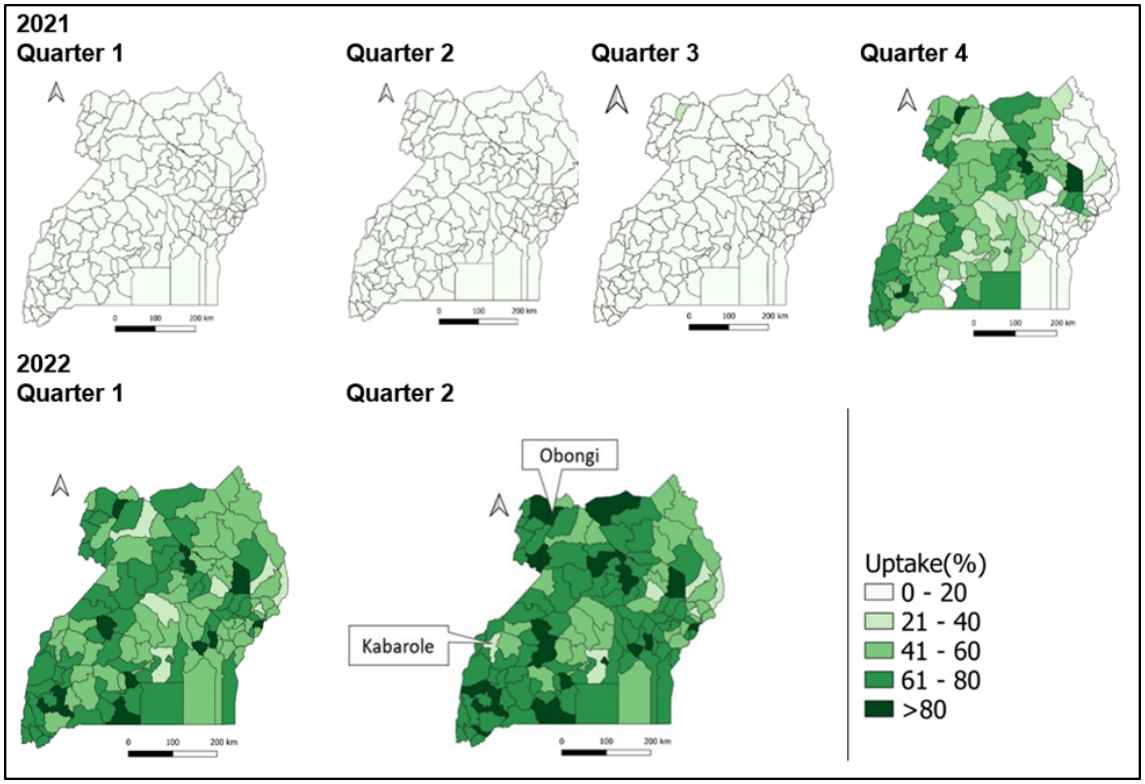


Figure 4: Spatial distribution of COVID-19 vaccine uptake, Uganda, March 2021-June 2022

Spatial distribution of COVID-19 vaccine coverage, Uganda, March 2021-June 2022

Overall, 25 districts were able to achieve the WHO target of having 70% of their population fully vaccinated by June 2022. These districts were mainly in the western, eastern, and central parts of the country (Figure 5). Among the districts that did not achieve the target, coverage ranged between 1% to 69%. Twenty-four districts mainly in the Nothern Region had <10% of their populations fully vaccinated against COVID-19 by June 2022.

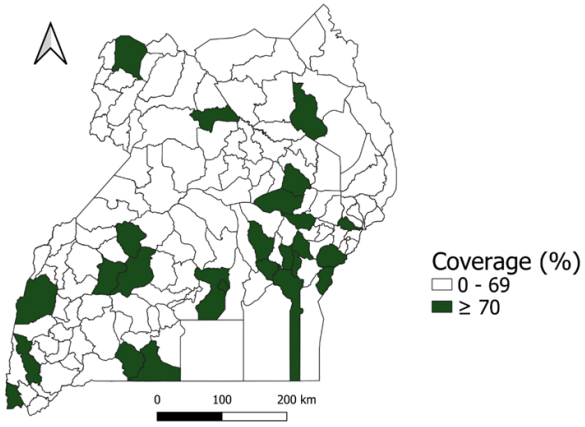


Figure 5: Spatial distribution of COVID-19 vaccine coverage, Uganda, June 2022

Continues to page 32

Discussion

Our findings showed that a variety of COVID-19 vaccines were received by the Ugandan population with a national COVID-19 vaccine uptake of 63% and coverage of 42%, females, individuals >50 years, and those residing in Western Region had significantly higher coverage compared to males, individuals aged 12-17 years, and those residing in the Northern Region by the end of June 2022.

COVID-19 vaccination uptake steadily increased, however, remained lower than anticipated by the Uganda COVID-19 Vaccination Implementation Plan (UCVIP). This plan targeted to have all eligible persons vaccinated by the end of 2022. Previous studies conducted in Uganda had indicated that a high proportion of people was willing or intended to receive a COVID-19 vaccine(8) . The low uptake despite a high willingness to be vaccinated suggests the presence of other barriers that may influence COVID-19 vaccination uptake. A study in Ghana indicated that barriers such as limited supplies of vaccines and long queues could negatively influence COVID19 vaccine uptake (9).

Similar to other studies(10, 11) conducted in Africa, coverage was low. A study by Afolabi et al (11) in 15 West African countries indicated that coverage was on 0.27% by June '21 which is comparable to 0.4% in Uganda in the same period. In other East African countries like Kenya, a study by Muchiri et al (10) showed coverage to be 30.75% by March 2022 which is below the anticipated WHO target. The low coverage of the COVID-19 vaccine could be attributed to several factors such as lack of competence, infrastructure, logistics and financial resource (12). Another study by Kabagenyi et al in Uganda attributes low coverage to vaccine hesitancy among the population(13).

Our study found differences in COVID-19 coverage across gender, age group, and region, suggesting health inequalities(14, 15). However, unlike other studies in low income countries, vaccine coverage in our study was higher among females compared to males(14). This might suggest unique differences in the Ugandan context. The low coverage of the COVID-19 vaccine among the 12–17year age group could be attributed for the delayed approval of COVID-19 vaccines and eventual roll out in this age group. Globally, approval was obtained mid-2021 and roll out in Uganda only began in 2022(16). The higher coverage among older age groups compared to the other groups could be attributed to their perceived severity of the COVID-19 infection, making them more likely to complete their vaccination(17). Regional differences could be attributed to differences in roll-out of mass vaccination campaigns based on prevalence of COVID-19. The high coverage of COVID-19 vaccination in the eastern and western regions could be attributed to intensified vaccination campaigns following high prevalence of COVID-19 infections.

The study had the following limitations. We used aggregate data therefore our findings can be applied to groups rather individuals (17).We used the national COVID-19 database which may not have been up to date due to delays in data entry. This could have led to underestimation of the true uptake and coverage of COVID-19 vaccination. However, use of nationwide data allows generalization of the findings to the entire country.

Conclusion

By June 2022, Uganda's COVID-19 vaccination coverage fell short of the goals set by the WHO. The COVID-19 vaccine uptake and coverage were increased when vaccination strategy was changed from static to accelerated mass vaccination. The National Expanded Program for Immunization should continue and expand this strategy to focus its efforts to vaccinate a high percentage of persons in the high priority groups with tailored efforts for groups that lie behind. The programs should continuously track progress to identify groups that need intensified efforts in order to increase coverage.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgements

The authors appreciate the Ministry of Health for providing access to DHIS2 data that was used for this analysis. We appreciate the technical support provided by the Division of Surveillance, Information and Knowledge Management and the Uganda National Expanded Program for Immunization. Finally, we thank the US-CDC for supporting the activities of the Uganda Public

Continued from page 32

Health Fellowship Program (UPHFP).

References

1. Oum S, Kates J, Wexler A. Economic Impact of COVID-19 on PEPFAR Countries. KFF; 2022.
2. Kim SY, Yeniova AÖ. Global, regional, and national incidence and mortality of COVID-19 in 237 countries and territories, January 2022: a systematic analysis for World Health Organization COVID-19 Dashboard. Life Cycle. 2022;2.
3. Rahman MA, Islam MS. Early approval of COVID-19 vaccines: Pros and cons. Human Vaccines & Immunotherapeutics. 2021;17(10):3288-96.
4. Organization WH. Strategy to achieve global COVID-19 vaccination by mid-2022. Geneva: World Health Organization. 2021.
5. de Bengy Puyvallée A, Storeng KT. COVAX, vaccine donations and the politics of global vaccine inequity. Globalization and Health. 2022;18(1):1-14.
6. Oliver SE, Wallace M, Link-Gelles R. COVID-19 vaccines: Safe and effective in children aged 5 to 11 years. Pediatrics. 2022;150(2).
7. Rudan I, Millington T, Antal K, Grange Z, Fenton L, Sullivan C, et al. BNT162b2 COVID-19 vaccination uptake, safety, effectiveness and waning in children and young people aged 12–17 years in Scotland. The Lancet Regional Health-Europe. 2022;23:100513.
8. Echoru I, Ajambo PD, Keirania E, Bukenya EEM. Sociodemographic factors associated with acceptance of COVID-19 vaccine and clinical trials in Uganda: a cross-sectional study in western Uganda. BMC Public Health. 2021;21(1):1106.
9. Afrifa-Anane GF, Larbi RT, Addo B, Agyekum MW, Kyei-Arthur F, Appiah M, et al. Facilitators and barriers to COVID-19 vaccine uptake among women in two regions of Ghana: A qualitative study. PLOS ONE. 2022;17 (8):e0272876.
10. Muchiri SK, Muthee R, Kiarie H, Sitienei J, Agweyu A, Atkinson PM, et al. Unmet need for COVID-19 vaccination coverage in Kenya. Vaccine. 2022;40(13):2011-9.
11. Afolabi MO, Wariri O, Saidu Y, Otu A, Omoleke SA, Ebenso B, et al. Tracking the uptake and trajectory of COVID-19 vaccination coverage in 15 West African countries: an interim analysis. BMJ Glob Health. 2021;6(12).
12. Lawal L, Aminu Bello M, Murwira T, Avoka C, Yusuf Ma'aruf S, Harrison Omonhinmin I, et al. Low coverage of COVID-19 vaccines in Africa: current evidence and the way forward. Hum Vaccin Immunother. 2022;18(1):2034457.
13. Kabagenyi A, Wasswa R, Nannyonga BK, Nyachwo EB, Kagirita A, Nabirye J, et al. Factors Associated with COVID-19 Vaccine Hesitancy in Uganda: A Population-Based Cross-Sectional Survey. International Journal of General Medicine. 2022:6837-47.
14. Ali HA, Hartner A-M, Echeverria-Londono S, Roth J, Li X, Abbas K, et al. Vaccine equity in low and middle income countries: a systematic review and meta-analysis. International journal for equity in health. 2022;21(1):1-30.
15. Bayati M, Noroozi R, Ghanbari-Jahromi M, Jalali FS. Inequality in the distribution of Covid-19 vaccine: a systematic review. International journal for equity in health. 2022;21(1):1-9.
16. Olson SM, Newhams MM, Halasa NB, Price AM, Boom JA, Sahni LC, et al. Effectiveness of Pfizer-BioNTech mRNA Vaccination Against COVID-19 Hospitalization Among Persons Aged 12-18 Years -United States, June-September 2021. MMWR Morbidity and mortality weekly report. 2021;70(42):1483.
17. Basta NE, Sohel N, Sulis G, Wolfson C, Maimon G, Griffith LE, et al. Factors associated with willingness to receive a COVID-19 vaccine among 23,819 adults aged 50 years or older: an analysis of the Canadian longitudinal study on aging. American Journal of Epidemiology. 2022;191(6):987-98.

Continues to page 34

Covid-19 Related Stigma among Survivors, Soroti District, Uganda, March 2020-December 2021

Authors: Alice Asio[1*], Veronica Massanja[1], Daniel Kadobera[1], Benon Kwesiga[1], Lilian Bulage[1], Alex R. Ario[1]
Institutional Affiliations: [1]Uganda Public Health Fellowship Program, [-]Uganda National Institute of Public Health, Kampala, Uganda
Correspondence*: Email: aasio@musph.ac.ug, Tel: +256788006553

Summary

Introduction: Much remains unknown about COVID-associated stigma and psychosocial effects among survivors. We estimated the proportion of COVID-19 survivors in Soroti District who experienced stigma, assessed factors with stigma, and described the psychosocial effects of COVID-19-related stigma among survivors.
Methods: A case was any survivor with confirmed COVID-19 infection in Soroti District from March 2020-December 2021. We reviewed records from Soroti Regional Referral Hospital to identify hospitalized and outpatient cases. We interviewed all consenting case-patients in their homes using three tools. We used a semi-structured questionnaire to assess demographics, clinical condition, case management, and family support during illness. We used a validated psychometric tool to assess feelings of enticed, internalized or perceived stigma while ill [score range of 15-20 (no stigma), 21-25 (mild/moderate stigma), and 26–30 (severe stigma)]. We used the Depression, Anxiety, and Stress (DASS-21) tool to assess depression, anxiety, and stress while ill. Logistic regression was used to identify factors associated with experiencing stigma among the participants.
Results: Among 314 cases, 166 (53%) were female. Among 301 (96%) cases who responded to stigma questions, 112 (37%) felt severe stigma, 84 (28%) mild/moderate stigma, and 105 (35%) no stigma. Among cases reporting stigma, 176 (90%) received emotional and/or financial support from household members. Factors associated with stigma included having cough during their COVID-19 episode (PR=1.05, 95%CI: 0.99–1.45) versus no cough and being in home-based care (PR = 1.27, 95%CI: 1.02–1.56) versus being hospitalized. Among 303 participants reporting psychosocial effects, 264 (87%) experienced extremely severe depression, 64 (21%) extremely severe anxiety, and 167 (55%) extremely severe stress.
Conclusion: COVID-19 patients in Soroti District experienced stigma and associated psychosocial effects during their COVID-19 illness. Patient counselling and community sensitization by a psychosocial team might be considered to reduce the burden of psychosocial effects in future outbreaks.

Background

New diseases often confer stigma on affected persons [1]. Such treatment can negatively affect those with the disease as well as their caregivers, family, friends, and communities [2-4] .

According to World Health Organization (WHO) and United Nations Chridren's Fund (UNICEF), the COVID-19 pandemic has incited stigma and discrimination amongst people who have or might have COVID-19[5]. A cross-sectional study conducted in China comparing COVID-19 survivors and those without COVID-19 showed stigma among the COVID-19 survivors in form of rejection, financial insecurity, internalized shame, and social isolation[6]. Further still, the study found out that being a COVID-19 survivor, having family members infected with COVID-19, being married, economic loss during the COVID-19 pandemic, and depressive symptoms were positively associated with higher stigma level[6].

A cross-sectional study conducted among the general population of Colombia indicated an association between high fear of COVID-19 and stigma (63.6%) [7]. Another study conducted in Kenya revealed that COVID-19 related stigma was common in Western Kenya, the teachers reported to have experienced (74%) and witness (48%) discrimination related to COVID-19 at their neighborhood [8].

In Uganda, stigma associated with COVID-19 has been a challenge. COVID-19 patients and survivors have been rejected in some communities, prevented from socializing with others and called derogatory names[2, 3, 9]. This is largely due to low levels of knowledge and misconceptions about COVID-19 among the population [10]. Understanding the burden and types of stigma associated with COVID-19 is important in designing interventions to address it. Stigmatization related to fear from COVID-19 may lead people to deny or ignore early symptoms that are clinically

Continued from page 34

relevant for early stage management [3, 4, 11] . Reducing fear and stigma among individuals is vital to control the spread of COVID-19. We estimated the proportion of COVID-19 survivors who experienced stigma, assessed the factors associated with being stigmatized, and the psychosocial effects of COVID-19-related stigma among survivors and their families to inform control measures.

Methods

Study design

We conducted a cross sectional study to assess COVID-19 related stigma among COVID-19 survivors and their families in Soroti, Uganda. The study involved review of patients records from Soroti RRH COVID-19 treatment unit and other COVID-19 treatment units within Soroti District to generate a line list of survivors. They were then traced to their homes where interviews were conducted.

Study area

Soroti District was purposively selected since it had continued to register high numbers of cases at the time of this study. Soroti is located in Eastern Uganda approximately 325.2Km from Kampala Capital City. It has a population of 363,600 people and the major economic activity is agriculture [12]. The community in Soroti District is well known for drinking a local brew called “malwa” which is taken in a social gathering while sharing one pot and tubes.

Sample Size

At the time of this study, there was limited data on COVID-19-related stigma, we therefore used 50% as the prevalence of COVID19 –related to calculate the sample size, resulting in a sample size of 384.

Study variables and data collection

We collected data on demographics, COVID 19 related illness, and factors likely associated with COVID- 19 related stigma using an interviewer administered questionnaire. We also collected data on psychological effects using a standard psychometric tool.

Interviews were conducted using a semi-structured questionnaire along with a validated psychometric tool [12], the Depression, Anxiety and Stress (DASS-21) scale [13]. The following steps were considered while using the DASS-21 tool.

Depression, Anxiety, and Stress Scale - 21 Items (DASS-21)

The DASS-21- scale has been used in different studies to assess psychological effects of stigma, for example, in assessment of social stigma related to COVID-19 disease conducted in primary and secondary schools in Kenya[14].
The Depression, Anxiety and Stress Scale - 21 Items (DASS-21) is a set of three self-report scales designed to measure the emotional states of depression, anxiety and stress. Each of the three DASS-21 scales contains 7 items, divided into subscales with similar content. The depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia and inertia. The anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The stress scale is sensitive to levels of chronic nonspecific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable /over-reactive and impatient. Scores for depression, anxiety and stress are calculated by summing the scores for the relevant items and multiplying it by 2. The DASS-21 is based on a dimensional rather than a categorical conception of psychological disorder. Recommended cut-off scores for conventional severity is as detailed in Table 1.

Continues to page 36

Table 1: Categorization of psychosocial effects according to DASS-21

Classification	Depression	Anxiety	Stress
Normal	0-9	0-6	0-10
Mild	10-12	7-9	11-18
Moderate	13-20	10-14	19-26
Severe	21-27	15-19	27-34
Extremely severe	28-42	20-42	35-42

Data management and analysis

The data were then extracted from the Kobo collect tool into an excel sheet where the metrics and scores of symptoms and their severity were created and analyzed using Epi Info 7.2.2.6 and Stata 14.

We performed descriptive analysis of demographic characteristics and psychological effects of COVID-19 related stigma experienced by the participants. Results were presented in frequency tables as proportions and percentages, means, standard deviations and graphs. Participants with missing information on some of the stigma and DASS scale items were excluded from the overall scores' generation. Multivariate analysis to determine the factors associated with experiencing stigma was done using a Modified Poison regression model at 0.05 level of significance.

Ethical consideration

The Ministry of Health of Uganda gave the directive and approval to carry out this investigation. In agreement with the International Guidelines for Ethical Review of Epidemiological Studies by the Council for International Organizations of Medical Sciences (1991) and the Office of the Associate Director for Science, CDC/Uganda, it was determined that this activity was not human subject research and that its primary intent was public health practice or disease control activity (specifically, epidemic or endemic disease control activity). This activity was reviewed by the CDC and was conducted consistent with applicable federal law and CDC policy. All experimental protocols were approved by the US CDC human subjects review board and the Uganda Ministry of Health and were performed in accordance with the Declaration of Helsinki. Covid 19 survivors verbal informed consent was obtained before the start of each interviews. We

Results

Demographics characteristics of study participants

Among 314 study participants, 166 (53%) were females. Most (64%) of the participants were married, 91(29%) were single, and (3)1% were cohabiting. Of the 314 participants,11637% had completed tertiary or University level, 106 (34%) reported to have attend secondary school, 72 (23%) attended to primary school and 12 (4%) had never attend to formal education.

COVID-19 illness related factors among the study participants

Of the 314 study participants, 192 (63.7%) could remember when they were diagnosed and 146 (76%) of them were diagnosed in 2021. Most patients 223(75.5%) had experienced fever when they had COVID-19, 46.2% needed to go to the hospital and 60% of them were admitted for 7 to 14 days. Most patients 267 (85%) had been through home-based care, 77 (24.5%) participants had comorbidities and most of them 13 (16.9%) had hypertension. Among 304 participants who reported that their household members knew about their COVID-19 diagnosis, 274 (90.4%) of them reported that they were supportive of them (Table 2).

Continued from page 36

Table 2: COVID-19 illness related characteristics among the study participants

Characteristic (n=314)	Frequency (Percentage)
Year of admission (n=192)	
2020	28(14.6)
2021	146(76)
2022	18(9.4)
Symptoms you experienced during COVID-19?	
Fever	237(75.5)
Headache	199(63.4)
Cough	202(64.3)
Loss of taste	134(42.7)
Loss of smell	121(38.5)
General body weakness	208(66.2)
Flue or running nose	165(52.6)
Number of days in admission (n=145)	**Range (1 day – 2 months)**
0 – 6 days	25(17.2)
7 – 14 days	87(60)
15 – 21 days	15(10.3)
22 – 28 days	8(5.5)
> 28 days	10(6.9)
Was under home-based care at any point	
Yes	267(85)
No	47(15)
Had a co-morbidities (n=77)	
High blood pressure/ hypertension	45(58.4)
Diabetes	13(16.9)
Asthma	8(10.4)
Sickle Cell	0(0)
Cancer	3(3.4)
Hepatitis B	2(2.6)
HIV/AIDS	8(10.4)
TB	1(1.3)
Mental illness	1(1.3)
Household members knew about COVID19 diagnosis	
No	10(3.2)
Yes	304(96.8)
Reaction of the household members	
All were supportive of me	274(90.4)
Some were supportive, but others were not	26(8.6)
None were supportive	3(1)
Kind of support rendered by household members	
Provided food and fruits	176(56.1)
Provided medicines	164(52.2)
Prayers and counselling	86(27.4)
Unsupportive actions by household members	
They kept distance and feared to come near me	17(5.4)
Some household members left	7(2.2)
Refused to wash my clothes	2(0.6)
Laughed at me	2(0.6)
Treatment by household members after recovery	
All were supportive of me	264(88.4)
Some were supportive, but others were not	29(9.6)
None were supportive	6(2)
Supportive actions after recovery	
Provided food and fruits	109(34.7)
Provided medicines	53(16.9)
Prayers and counselling	59(18.8)
Encouraged mask and sanitiser use	35(11.1)
Unsupportive actions after recovery	
Some people kept distance and feared to interact	15(4.8)
Other people besides household members who got to know about participant's illness with COVID 19	
Neighbours	250(79.9)
Extended family	182(58.2)
Co-workers	107(34.2)
Others specify	32(10.2)
0thers	
No one else knew	34(10.9)
Church members	3(0.9)
Friends	17(5.4)
School mates	6(1.9)
Reaction of neighbours or extended family or co-workers	
All were supportive of me	129(41.2)
Some were supportive, but others were not	106(33.9)
None were supportive	78(24.9)

Continues to page 38

Continued from page 37

Characteristic (n=314)	Frequency (Percentage)
Supportive actions from neighbours/extended family/co-workers after you recovered	
Encouraged use of masks and sanitiser	11(3.5)
Visited me at home	25(7.9)
Prayers and encouragement	81(25.8)
Provided food and water	46(14.6)
Provided medicines and drugs	17(5.4)
Provided money and financial assistance	39(12.4)
Helped with my work tasks	12(3.8)
I was given more leave days	5(1.6)
Unsupportive actions by neighbours/extended family/co-workers take after you recovered	
Did not socialise with me	55(17.5)
Avoided my children and family members	31(9.9)
Laughed at me	5(1.6)

Stigma towards COVID-19 infected people and their families during the time of illness

Most of the participants 221 (70.6%), reported that they had been hurt by how people reacted when they learned they had coronavirus disease. One hundred two (61.5%) reported that they had stopped socializing with some people because of their reactions to them having COVID-19 and 200 (63.9%) had lost friends because they had COVID-19. Most (54%) of the participants were very careful who they tell that they had COVID-19 and 172 (55.1%) worried that people who knew they had COVID -19 will tell others. Most (59%) felt that they were not as good as others after having COVID-19. One hundred ninety-seven (62.9%) reported that having had COVID-19 infection made then feel they are bad persons and 186 (59.8%) felt guilty because they were COVID-19 positive (Table 3).

Table 3: Participants responses to questions on stigma towards COVID-19 infected people and their families during the time of illness

Enacted Stigma	Yes (N (%)	No (N (%)
I have been hurt by how people reacted when they learned I had coronavirus disease	221 (70.6)	92 (29.4)
I have stopped socializing with some people because of their reactions to my having COVID-19	120 (38.5)	192 (61.5)
I have lost friends because I had COVID-19	113 (36.1)	200 (63.9)
Disclosure Concerns		
I am very careful who I tell that I had COVID-19	143 (46.0)	168 (54.0)
I worry that people who know I have had COVID-19 will tell others	140 (44.9)	172 (55.1)
Internalized Stigma		
I feel that am not as good as others because I had COVID-19	128 (41.0)	184 (59.0)
Having had COVID-19 infection makes me feel that I am a bad person	116 (37.1)	197 (62.9)
I feel guilty because I was COVID-19 positive	125 (40.2)	186 (59.8)
Perceived External Stigma		
Most people think that a person who has had COVID-19 is disgusting	160 (51.1)	153 (48.9)
Most people are afraid of a person who has had COVID-19	173 (55.6)	138 (44.4)
Most people who have had COVID-19 are rejected when others find out	174 (55.6)	139 (44.4)
People I know would be treat someone who has had COVID-19 as an outcast	151 (48.2)	162 (51.8)
People know would be uncomfortable around someone who has had COVID-19	164 (52.6)	148 (47.4)
People I know would reject someone who has had Covid19	140 (45.2)	170 (54.8)
People I know would not want someone who had COVID-19 around their children	177 (56.7)	135 (43.3)

Continued from page 38

Self-reported stigma scores for the study participants

The participants' responses on the stigma items were given score of 2 for "yes" and 1 for "no", giving a score range of 15 (min) to 30 (Max). Overall final scores were generated, and participants were categorised as follows (15 - 20) as having experienced no stigma, (21 - 25) as mild/moderate and (26 – 30) as severe stigma. Participants with missing information or no responses on some of the items were excluded. Among 301 participants with complete responses to the questions on stigma experiences, 112 (37%, CI:31.9-42.8) were categorised as having experienced severe stigma, 84 (27.9%, CI:23.1-33.3) had experienced mild/moderate stigma, while 105 (34.9%, CI: 29.7-40.5) were categorised as not having experienced stigma.

Factors associated with self-reported stigma among COVID-19 survivors

At multivariate analysis after controlling for covariates, we found that COVID-19 survivors who had cough (PR=1.05, 95% CI: 0.99 – 1.45) and those who were in home-based care at any point of their COVID-19 illness (PR = 1.27, 95% CI: 1.02 –1.56) were more likely to experience stigma (Table 5). All the other factors assessed (time of diagnosis, comorbidities, and length of admission) did not have a statistically significant association with experiencing stigma amongst COVID19 survivors.

Table 4: Factors associated with self-reported stigma among COVID-19 survivors

Characteristic (n=314)	Experienced moderate/no stigma n= 189 (%) ref	Experienced severe stigma n=112 (%)	Crude Prevalence Ratio (95% CI)	Adjusted Prevalence Ratio (95% CI)
Symptoms				
Fever				
No	40 (21.2)	35 (31.3)	1.00	
Yes	149 (78.8)	77 (78.7)	0.73 (0.49 – 1.09)	
Headache				
No	62 (32.8)	49 (43.8)	1.00	
Yes	127 (67.2)	63 (56.3)	0.75 (0.52 – 1.09)	
Cough				
No	67 (35.5)	41 (36.6)	1.00	
Yes	122 (64.5)	71 (63.4)	0.97 (0.66 – 1.42)	1.05 (0.99 – 1.45)
Loss of taste				
No	111 (58.7)	61 (54.5)	1.00	
Yes	78 (41.3)	51 (45.5)	1.11 (0.77 – 1.62)	
Loss of smell				
No	117 (61.9)	64 (57.1)	1.00	
Yes	72 (38.1)	48 (42.9)	1.13 (0.78 – 1.64)	
General body weakness				
No	68 (36.0)	35 (31.3)	1.00	
Yes	121 (64.0)	77 (68.8)	1.44 (0.77 – 1.71)	
Flue or running nose				
No	90 (47.6)	50 (44.6)	1.00	
Yes	99 (52.4)	62 (55.4)	1.08 (0.74 – 1.57)	
Were you in home-based care at any point for your COVID-19?				
Yes	166 (87.3)	88 (78.6)	1.47 (0.94 – 2.31)	1.27 (1.02 –1.56)
No	23 (12.2)	24 (21.4)	1.00	1.00

Psychosocial effects of COVID-19 related stigma

We found that 22 (7.1%) of the study participants reported that they felt that life was meaningless, almost always, while 154 (49.5%) never found it hard to wind down. Most of them 193 (61.9%) never experienced trembling, 210 (67.5%) were never intolerant of anything that kept them from getting on with what they were doing. One hundred ninety-six (62.8%) were never unable to become enthusiastic about anything and 189 (60.6%) were never worried about situations in which they might panic and make a fool of themselves (Table 5).

Continues to page 40

Table 5: Participants responses to questions on psychosocial effects of COVID-19 related stigmaExperiences of self-reported depression, anxiety and stress among COVID-19 survivors

Variable	Frequency (Percentage)			
	Never (0)	Sometimes (1)	Often (2)	Almost always (3)
I found it hard to wind down*	154 (49.5)	121 (38.9)	18 (5.8)	18 (5.8)
I was aware of dryness of my mouth I experienced breathing difficulty (for example, excessively rapid breathing, breathlessness in absence of physical exertion) *	158 (50.6)	124 (39.7)	18 (5.8)	12 (3.9)
I couldn't seem to experience any positive feeling at all*	162 (51.9)	97 (31.1)	39 (12.5)	14 (4.5)
I found it difficult to work up the initiative to do things *	169 (54.2)	102 (32.7)	25 (8.0)	16 (5.1)
I tended to over-react to situations	181 (58.0)	94 (30.1)	28 (9.0)	9 (2.9)
I experienced trembling (for example, in the hands)	193 (61.9)	84 (26.9)	21 (6.7)	14 (4.5)
I felt that I was using a lot of nervous energy	182 (58.2)	85 (27.2)	29 (9.3)	17 (5.4)
I was worried about situations in which I might panic and make a fool of myself	189 (60.6)	90 (28.9)	19 (6.1)	14 (4.5)
I felt that I had nothing to look forward to	181 (58.2)	89 (28.6)	29 (9.3)	12 (3.9)
I found it difficult to relax	145 (46.5)	118 (37.8)	35 (11.2)	14 (4.5)
I felt down-hearted and blue	169 (54.3)	103 (33.1)	29 (9.3)	10 (3.2)
I was intolerant of anything that kept me from getting on with what I was doing	210 (67.5)	74 (23.8)	19 (6.1)	8 (2.6)
I felt I was close to panic	144 (46.2)	111 (35.6)	40 (12.8)	17 (5.5)
I was unable to become enthusiastic about anything	196 (62.8)	91 (29.2)	16 (5.1)	9 (2.9)
I felt I wasn't worth much as a person	183 (58.8)	90 (28.9)	25 (8.0)	13 (4.2)
I felt that I was rather touchy	154 (49.8)	115 (37.2)	32 (10.4)	8 (2.6)
I was aware of the action of my heart in the absence of physical exertion (for example, sense of heart rate increase, heart missing a beat)	191 (61.2)	95 (30.5)	16 (5.1)	10 (3.2)
I felt scared without any good reason	151 (48.4)	104 (33.3)	40 (12.8)	17 (5.6)
I felt that life was meaningless	173 (55.6)	96 (30.9)	20 (6.4)	22 (7.1)

Among 303 participants, 23 (7.6%) had experienced extremely severe depression, 63 (20.8%) extremely severe anxiety and 14 (4.6%) extremely severe stress. Moderate depression experienced by 72 (23.8%), moderate anxiety by 42 (13.9%) and 45 (14.9%) experienced moderate stress. Mild depression 26 (8.6%), 18 (5.9%) mild anxiety and 75 (24.8%) experienced mild stress. A range of 42 – 52% were categorized as having not experienced any form of depression, anxiety, or stress.

Continued from page 40

Discussion

We assessed COVID-19 related stigma among COVID-19 survivors and their families and found a low prevalence of stigma. Most of the cases that reported stigma, also highlighted having received both emotional and financial support from their household members. Having cough and being in home-based care were associated with COVID19-related stigma. Among the COVID-19 survivors who reported psychosocial effects, majority reported to have experienced extreme severe depression, about half experienced extreme stress, and only 21% had extremely anxiety.

Overall, this study found a lower level of prevalence of stigma among participants. However, most people reported having been hurt by how the community reacted towards them upon learning that they had corona virus. These findings are consistent with the study conducted in Uganda which reported rejection, fear and ostracism towards the affected, infected and survivors [15, 16]. Respondents revealed having undergone through enacted stigma as the highest number of them felt hurt by the reaction of the community towards their status, and this made some respondents to conceal their covid-19 positive status due to the perception that, the community was afraid of whoever would be got with the virus and would suffer from rejection. This study further observed that, although a greater percentage of respondents never worried about their positive status, they felt subjected to psychological effects such as; perception of meaningless life and inability to cope with the situation. The experience has been cited by a similar global survey which involved 173 countries, and reported nearly a third of participants believed that people who had COVID-19 were not respected by the community [17].

This study further revealed that people who cough and home-based care were more stigmatized compared to those who were hospitalized.

Conclusion

COVID-19 survivors in Soroti District, Uganda experienced relatively low levels of stigma compared to similar studies in other countries like Iran and Kenya. Having cough and being in home-based care were associated with stigma. The COVID-19 survivors experienced depression, fear, and anxiety during their COVID-19 illness.
We recommended patient counselling and community sensitization by psychosocial specialists to reduce the burden of psychosocial effects in future outbreaks.

Conflict of Interest

All authors declare that they have no competing interests.

Acknowledgements

The authors would like to thank the management and staff of Soroti RRHs for allowing access to the patients' medical files. We also appreciate the District Heath officer for allowing us conduct our study in his District.

References

1. WHO, U., Social Stigma associated with COVID-19. World Heal Organ, 2020.
2. Mak, W., et al., A comparative study of the stigma associated with infectious diseases (SARS, AIDS, TB). Hong Kong Med J, 2009. **15**: p. 34-7.
3. Abdelhafiz, A.S. and M. Alorabi, Social stigma: the hidden threat of COVID-19. Frontiers in public health, 2020. **8**: p. 429.
4. Abuhammad, S., K.H. Alzoubi, and O. Khabour, Fear of COVID-19 and stigmatization towards infected people among Jordanian people. International Journal of Clinical Practice, 2021. **75**(4): p. e13899.
5. WHO, U., Social Stigma associated with COVID-19. 2020.
6. Lin, B., et al., Perceived-stigma level of COVID-19 patients in China in the early stage of the epidemic: A cross-sectional research. PLoS One, 2021. **16**(10): p. e0258042.
7. Campo-Arias, A., J.C. Pedrozo-Pupo, and C.C. Caballero-Domínguez, Relation of perceived discrimination with depression, insomnia and post-traumatic stress

Continues to page 42

in COVID-19 survivors. Psychiatry Research, 2022. **307**: p. 114337.
8. Wangu, J. and F. Githuku, Unpacking the Land and Socio-Economic Effects of the COVID-19 Pandemic in Rural Kenya. Social Sciences, 2022. **11**(10): p. 452.
9. Muthu, S., Evolution of World Journal of Clinical Cases over the past 5 years. World Journal of Clinical Cases, 2022. **10**(24): p. 8432-8435.
10. CDC, Reducing Stigma.
11. CDC, Reducing stigma. 2019.
12. Dickerson, J., et al., 'When will this end? Will it end?'The impact of the March–June 2020 UK COVID-19 lockdown response on mental health: a longitudinal survey of mothers in the Born in Bradford study. BMJ open, 2022. **12**(1): p. e047748.
13. Ahmed, O., et al., The psychometric properties of the Depression Anxiety Stress Scale-21 (DASS-21) Bangla version. Acta Psychologica, 2022. **223**: p. 103509.
14. Chory, A., et al., Social stigma related to covid-19 disease described by primary and secondary school teachers and adolescents living with HIV in Western Kenya. Frontiers in Public Health, 2021. **9**: p. 757267.
15. Amir, K., COVID-19 and its related stigma: A qualitative study among survivors in Kampala, Uganda. Stigma and Health, 2021. **6**: p. 272-276.
16. Faghankhani, M., et al., COVID-19 related stigma among the general population in Iran. BMC Public Health, 2022. **22**(1): p. 1-15.
17. Dye, T.D., et al., Risk of COVID-19-related bullying, harassment and stigma among healthcare workers: an analytical cross-sectional global study. BMJ open, 2020. **10** (12): p. e046620.

COVID-19 Outbreak among Refugees in Nyakabande Transit Centre, Kisoro District, Uganda, June-July 2022

Authors: Peter Chris Kawungezi[1*], Robert Zavuga[1], Brenda Simbwa Nakafeero[1], Jane Frances Zalwango[1], Mackline Ninsiima[1], Thomas Kiggundu[1], Brian Agaba[1], Lawrence Oonyu[1], Richard Migisha[1], Irene Kyamwine[1], Daniel Kadobera[1], Benon Kwesiga[1], Lilian Bulage[1], Robert Kaos Majwala[2,3], and Alex Riolexus Ario[1]
Institutional affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, [2]Ministry of Health, Kampala, Uganda, [3]Department of Global Health Security, Baylor Uganda, [4]Division of Global Health Protection, US Centers for Disease Control and Prevention, Kampala, Uganda
Correspondence*: Tel: +256783401306, Email: peter@uniph.go.ug

Summary

Background: Nyakabande Transit Centre (NTC) is a temporary shelter for refugees arriving in Kisoro District from the Democratic Republic of Congo (DRC). Due to conflict in DRC, approximately 34,000 persons arrived at NTC between March and June 2022. On June 12, 2022, Kisoro District reported >330 cases of COVID-19 among NTC residents over a two months' period. We investigated the outbreak to assess its magnitude, identify risk factors, and recommend control measures.
Methods: We defined a confirmed case as a positive SARS-CoV-2 antigen test in an NTC resident during March 1–June 30, 2022. We generated a line list through medical record reviews and interviews with residents and health workers. We assessed the setting to understand possible infection mechanisms. In a case-control study, we compared exposures between cases (persons staying ≥5 days at NTC between June 26 and July 16, 2022, with a negative COVID-19 test at NTC entry and a positive test at exit) and unmatched controls (persons with a negative COVID-19 test at both entry and exit who stayed ≥5 days at NTC during the same peri-

Continued from page 42

od). We used multivariable logistic regression to identify factors associated with contracting COVID-19.

Results: Among 380 case-persons, 206 (54.2%) were male, mean age was 19.3 years (SD=12.6); none died. The attack rate (AR) at NTC was higher among exiting persons (3.8%) than entering persons (0.6%) (p<0.01). Among 42 cases and 127 controls, close contact with symptomatic persons (aOR=9.6; 95%CI=3.1-30) increased odds of infection; using a face mask (aOR=0.06; 95% CI=0.02-0.17) decreased odds. We observed overcrowding in shelters, poor ventilation, and most NTC residents not wearing face masks.

Conclusion: A COVID-19 outbreak at NTC was facilitated by overcrowding and failure to use facemasks. Enforcing face mask use and expanding shelter space could reduce the risk of future outbreaks. The collaborative efforts resulted in successful health sensitization and expanding the distribution of facemasks and shelter space.

Introduction

Coronavirus Disease 2019 (COVID-19), is a disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)(1). Refugee settings are especially susceptible to outbreaks of infectious diseases, including COVID-19 (2, 3). The susceptibility is linked to overcrowding, inadequate access to clean water and soap, and constraints on hand-washing facilities (3-5). In addition, early detection of the virus is often not possible because monitoring access to the camp is difficult and thus not easy to know whether people infected are camp residents or people from outside the camp (6).

COVID-19 outbreaks have been reported among refugees in Bangladesh (6, 7), Greece(6, 8, 9), and Brazil (10). The COVID-19 preventive measures among refugees are similar to those in the general population, including mass testing, vaccination, social distancing, use of face masks, hand washing, and other measures to improve personal hygiene (4, 7, 11-13). However, the implementation of these measures among refugees may be limited (4, 9, 10). Additional measures including refugee-led response in health education have been demonstrated to be beneficial (14).

Uganda hosts more than 1.4 million refugees and asylum seekers from neighboring countries, including South Sudan, the Democratic Republic of Congo, Burundi, and Somalia(15). Despite Uganda's open-door policy and provision of basic services, the large number of refugees has placed a significant strain on the country's resources and infrastructure, impacting both refugees and host communities. In early 2022, a new influx of more than 10,000 refugees fled to Uganda's southwestern Kisoro District due to violent clashes in DRC. Refugees entered through the Bunagana border and were relocated to Nyakabande Transit Centre (NTC) (16). In April 2022, the NTC registered its first case of COVID-19 through mandatory screening at entry and exit. By August 30, 2022, together with the Bubukwanga Transit Center in Bundibugyo District, the two registered a total of 1,365 COVID-19 cases(17).

Following the identification of the index COVID-19 case-patient on April 04 2022 in NTC, the cases cumulatively increased to 621 by June 30, 2022. We investigated the outbreak to establish its scope, identify factors associated with COVID-19 infection in NTC, and to recommend control and preventive measures for the future.

Methods

Outbreak area

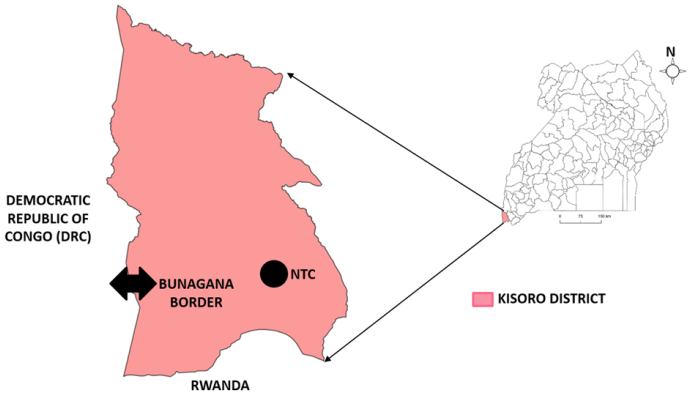


Figure 1: Nyakabande Transit Centre, Kisoro District, Southwestern Uganda

Nyakabande Transit Centre is located 5km from Kisoro Town and 18 Kilometers from Bunagana Border in Kisoro District, South West Uganda. Kisoro District shares boundary with Democratic Republic of Congo (DRC) in the West and the Republic of Rwanda in the South. It was opened in 1994 to cater for both returning and arriving refugees for Rwandans fleeing the genocide. In 2022, the capacity of NTC was 825 individuals. At the holding area, refugees are free to proceed to NTC

Continues to page 44

or return to their home country. Refugees are supposed to stay for a period of 2-5 days in the transit centre then transferred to settlement camps. However, due to the influx, this was not the case as some refugees stayed in the transit centre longer.

All refugees were mandated to be tested for COVID-19 at entry to NTC, and at the time of exit to the resettlement camp. Refugees were also mandated to be vaccinated against COVID-19 at the time of relocation to the resettlement camp. In early April 2022, NTC management designated one shelter for isolation of COVID-19 confirmed case patients.

Case definition and case finding
We defined a confirmed case as a positive COVID-19 antigen test (SD Biosensor, Inc., Republic of Korea) in a resident of NTC during March 1–June 30, 2022. We abstracted data from the COVID19 laboratory testing and isolation registers using a data abstraction tool to identify case-patients for the COVID-19 tests at entry and exit of NTC. Between March 28, 2022 and June 26, 2022, data was collected on the total number of refugees tested for COVID-19 at entry and exit, as well as the total number of positive test results at both entry and exit to determine when refugees were testing positive in relation to their stay at the transit Centre and to identify whether the COVID-19 cases were imported or contracted while at the Centre.

Descriptive epidemiology
We calculated mean age, and proportions by sex of the case-patients. We were not able to calculate attack rates by age or sex because there was no data on population by age and sex. We generated an epidemiological curve for the distribution of COVID-19 positive tests by date of testing among refugees in NTC between April to June 2022 and stratified the curve by the time of testing whether at time of relocation or at time of entry and the distribution of COVID-19 cases by symptom onset date among refugees in NTC between June to July 2022. We calculated the COVID-19 test positivity rate for tests done at entry and exit as the number of positive tests divided by number of total tests done

Environmental assessment
We assessed the NTC premises to understand the setting and the COVID-19 isolation unit. We observed sanitation and hygiene practices, availability of water, hand washing facilities, use of facemasks, crowding, the structure and status of shelters within the NTC.

Hypothesis generation
We conducted four hypothesis generating key informant interviews (KIIs) with the District Health Officer (DHO), Chairperson Kisoro District Local Government, District Surveillance Focal person (DSFP), NTC Camp commandant, and Medical Teams International (MTI)'s clinical lead officer. We also interviewed nineteen case-patients in the COVID-19 isolation unit. We explored factors related to non-adherence to preventive measures.

Unmatched case control study
We conducted an unmatched case control study with refugees after verbal informed consent. We defined a case as a person who had a negative COVID-19 test at entry and positive COVID-19 test at exit and had stayed ≥5 days at NTC between June 26 and July 16, 2022. A control was defined as person who had a negative COVID-19 test at both entry and exit and had stayed ≥5 days at NTC between June 26 and July 16, 2022. The outcome variable was COVID-19 positive at exit (for a case) and COVID-19 negative test at exit (for a control) given a negative COVID-19 test at entry. For each case and control, we collected data on: age, sex, education level, moving out of the centre, frequency of moving out of the centre, interaction with host community, having COVID-19 symptoms at time of COVID -19 test at exit, cigarette smoking, chronic medical illness, possession of face mask, hand washing, COVID-19 vaccination before entry to the center, date of last COVID-19 vaccination before entry to the center.

We collected data using an electronic tool in kobocollect. and exported to epi info version 7.2.5.0 for analysis. We used logistic regression to identify factors associated with COVID-19 infection. Variables that had a p-value <0.2 at bivariate analysis were included in the final model for multivariate analysis in a backward stepwise approach. Corresponding adjusted odds ratios (aORs) and 95% confidence intervals were reported. The final level of significance was considered at a p-value <0.05.

Continued from page 44

Ethical considerations and consent to participate
COVID-19 in Uganda was declared a public health emergency and the Uganda Ministry of Health (MoH) gave the directive to investigate the COVID-19 outbreak in NTC upon request from Kisoro District Local Government. We also sought administrative clearance to conduct the from Kisoro District Local Government and the NTC camp commandant. The Office of Science, U.S. Centers for Disease Control and Prevention, also determined that this activity was conducted in response to a public health emergency, with the primary intent of public health practice (epidemic disease control activity), hence it was determined not to be human subjects research. At the time of conducting this investigation, the MoH Standard Operating Procedures (SOPs) for COVID19 infection control discouraged the exchange of materials by hand. We therefore obtained verbal informed consent from eligible participants before data collection. During data collection, respondents were assigned unique identifiers instead of names to protect their confidentiality. Information was stored in password-protected computers and was not shared with anyone outside the investigation team.

Results

Descriptive epidemiology
We identified 380 confirmed case-persons and no death. Of these 206 (54.2%) were male. The mean age was 19.3 years (SD±12.6). The first positive test among new arrivals was registered on April 10, 2022 and among relocations on May 03, 2022 (Figure 2).

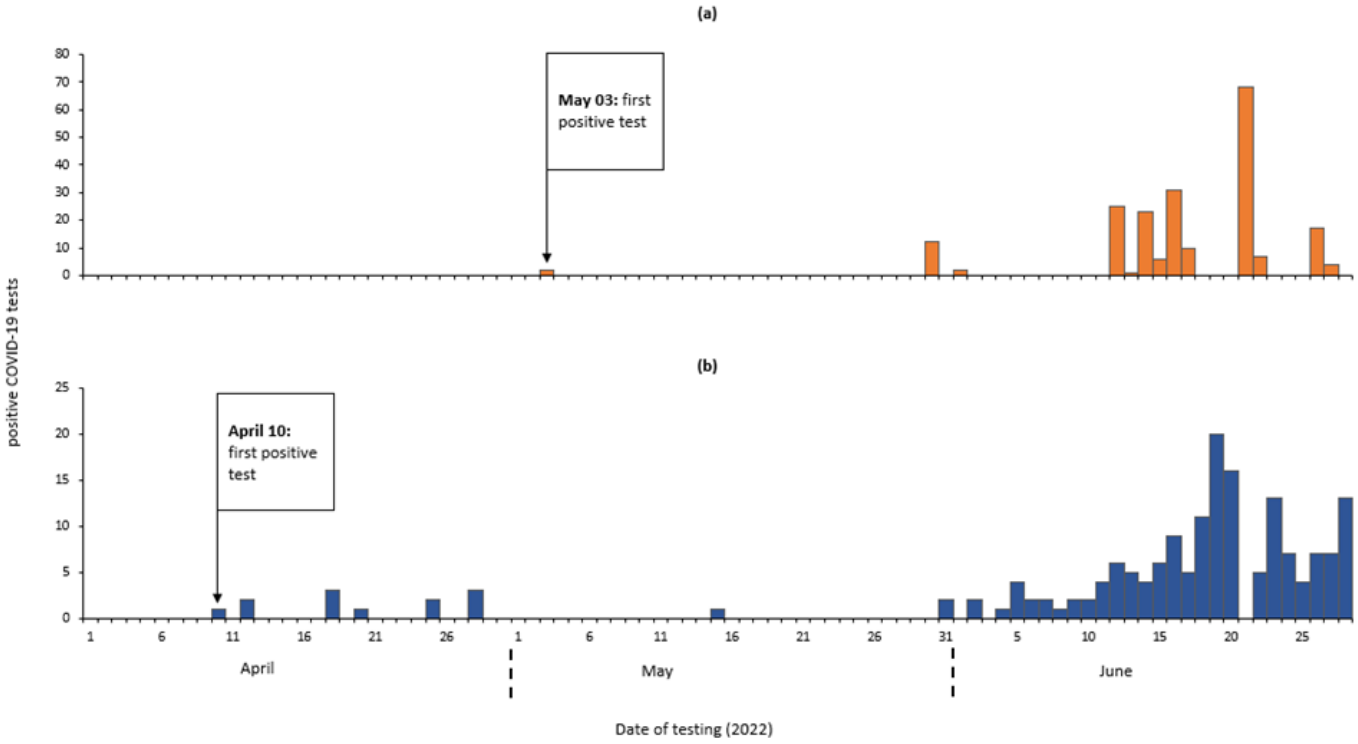


Figure 2: Distribution of COVID-19 positive tests by date of testing among refugees in Nyakabande Transit Centre, Kisoro District, Uganda, April-June 2022(a)-tests done at time of relocation (b)-tests done at time of entry

Out of 34,690 tests at entry, 209 (0.6%) tested positive. Out of 8,260 tests done at exit, 318 (3.8%) tested positive.

Continues to page 46

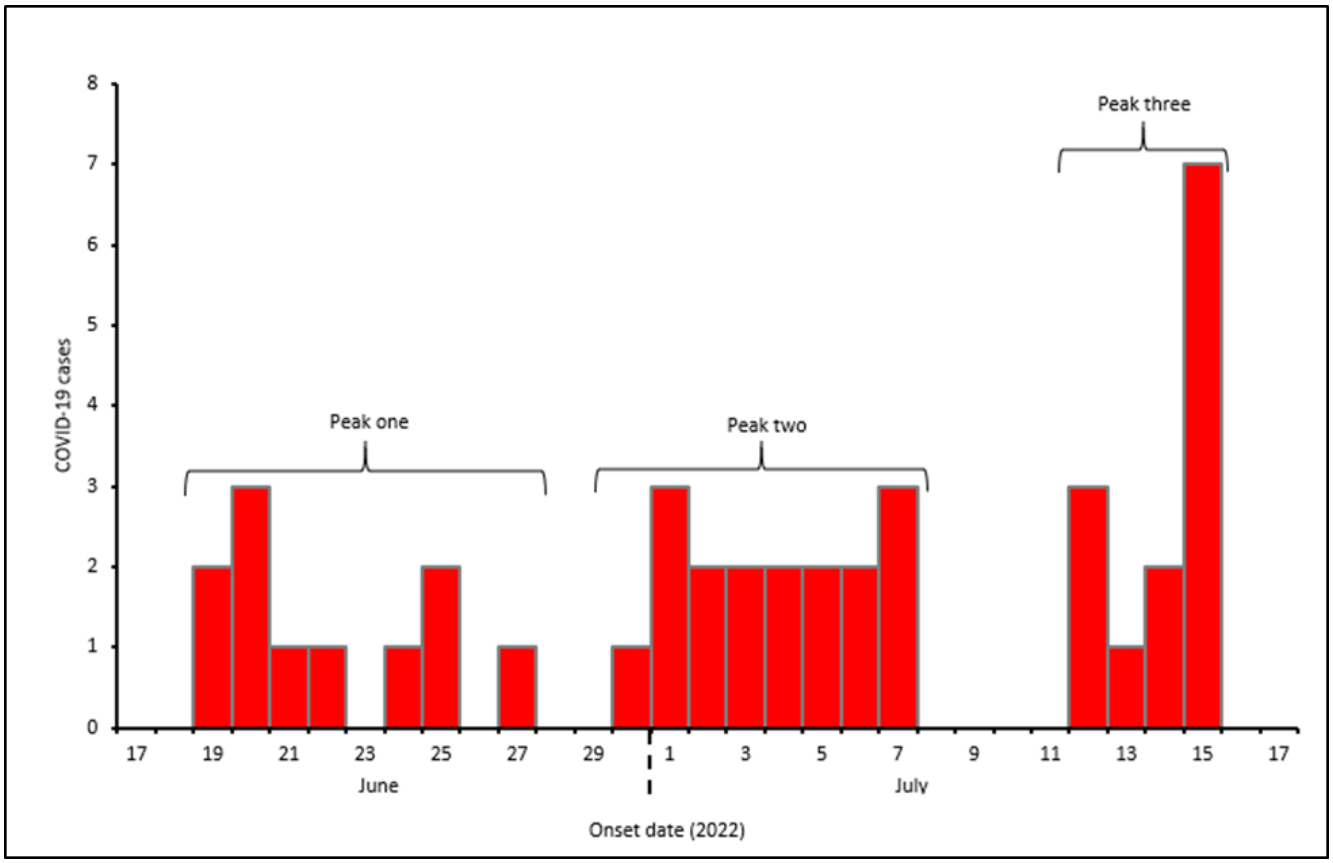


Figure 3: Distribution of COVID-19 cases by symptom onset date among refugees in Nyakabande Transit Centre, Kisoro District, Uganda, June-July 2022

Environmental assessment findings

We observed crowding among refugees, especially at the screening area on arrival, within the shelters, and during the lining up for food and relief items. This was similar to what was reported in the key informant interviews that revealed that shelters were at twice their capacity and the isolation unit was at three times its capacity.

Hypothesis generation interview findings

Key informant interviews

Key informant interviews revealed that the number of refugees were beyond the holding capacity of the NTC, most of refugees did not use face masks despite each being given a mask at entry, and that refugees had other bothering concerns like safety, family, food, among others than the concern of catching COVID-19 as highlighted in the following quotes……"This is overwhelming… as we speak now… the shelters have 1,600 individuals yet they have a total capacity of eight hundred twenty-five…the isolation unit that we set up for twenty-five patients…. sometimes can have sixty-five patients…" **Nyakabande transit centre commandant**

We also observed minimal use of facemasks among refugees in Nyakabande transit centre even among the case patients in COVID-19 isolation unit. Among those observed using facemasks, most of them used the facemasks incorrectly. Finding in the key informant interviews also agreed to our observations

"we give every refugee one cloth facemask… but most of them do not use their facemasks…"
Nyakabande transit centre clinical lead

It was also reported that most refugees were concerned about the safety of their lives, property, family and what to eat including the concern about their conjugal rights. It was thought that they could have been prioritizing these over the COVID-19 control measures.

Continued from page 46

"When refugees come here to the transit centre… they still think they are not safe… they think of danger any time… worry about their property and family… what to eat… I have heard many complaining that they can't have their conjugal rights…" **Chairperson Kisoro District Local Government**

Structured interviews with the COVID19 patients at the isolation units
Out of the 19 case-patients interviewed, 6(32%) did not wear face masks at all, 3(16%) reported close interaction with a symptomatic person before developing the illness.

Based on the descriptive epidemiology and the hypothesis generation interview findings, we hypothesized that crowding and non-compliance to personal protective measures was associated with an increased risk of contracting COVID-19 at NTC.

Case control findings
In a case control study, we enrolled 42 cases and 127 controls. The cases were comparable to controls across age, sex, and level of education. Thirty-three (78.6%) of the cases were aged between 5-29 years. Thirty-four (89.5%) of cases had neither attended school nor completed primary education (Table 1).

Table 1:Socio-demographic characteristics of cases and controls in Nyakabande Transit Centre, Kisoro District, Uganda, June-July 2022

Variable	Cases (N=42)		Controls (N=127)		P-value	
	n	%	n	%		
Sex						
Male	21	50.0	57	44.9	0.56	
Female	21	50.0	70	55.1		
Age [ð]						
5-29	33	78.6	94	74.0	0.69	
30-49	6	14.3	26	20.5		
≥50	3	7.1	7	5.5		
Education level						
None or Primary	34	89.5	62	77.5	0.14	
Secondary or Tertiary	4	10.5	18	22.5		

[Að] Median age is 24 (Range, 21-29) years for both cases and controls

In the multivariate analysis, using a facemask most of the time (aOR=0.06, 95% CI 0.02-0.16) reduced the odds of infection by 94%. The odds of contracting COVID-19 infection among refugees who had close contact with a COVID-19 symptomatic person were (aOR=10.34, 95%CI 3.29-32.55) (Table 2).

Continues to page 48

Table 2: Factors associated with COVID-19 infection among refugees in Nyakabande Transit Centre, Kisoro District, Southwestern Uganda, June-July 2022

Variable	cOR	(95% CI)	aOR	(95% CI)
Sex				
Male	Ref			
Female	1.23	(0.61-2.47)		
Age				
5-29	Ref.		Ref.	
30-49	0.66	(0.25-1.74)	0.94	(0.29-2.97)
≥50	1.22	(0.30-5.00)	3.38	(0.57-20.07)
Education level				
None or Primary	Ref.		Ref.	
Secondary or Tertiary	2.47	(0.73-10.8)	1.07	(0.28-4.07)
Shelter location				
Transit Centre	Ref.			
Holding Centre	0.95	(0.47-1.95)		
Moving out of the center				
Moves out	Ref.		Ref.	
Does not move out	0.51	(0.23-1.12)	2.49	(0.86-7.25)
Frequency of moving out in a week				
Once				
More than once	Ref.			
	0.56	(0.23-1.36)		
Interact with the host community				
No				
Yes	Ref.			
	1.2	(0.52-2.81)		
Cigarette smoking				
No	Ref.		Ref.	
Yes	4.28	(0.59- 87.28)	0.52	(0.05-4.91)
Close contact with a COVID-19 symptomatic person				
No	Ref.		Ref.	
Yes	0.27	(0.12-0.60)	10.34	(3.29-32.55)
Having a family member with COVID -19 in NTC seven days before the exit test				
No	Ref.			
Yes	1.90	(0.40-8.93)		
Using facemask				
No	Ref.		Ref.	
Yes	9.63	(4.36-21.25)	0.06	(0.02-0.16)
Frequency of use of a facemask				
Rarely or never	Ref.			
Specific occasions	0.11	(0.01-1.60)		
Most of the time	0.05	(0.004-0.59)		
COVID-19 vaccination before entry				
No				
Yes	Ref.			
	1.22	(0.23-6.53)		

cOR: Crude Odds Ratio; aOR: Adjusted Odds Ratio; CI: Confidence Interval; Ref: Reference category; NTC: Nyakabande Transit Centre

Continued from page 48

Discussion

The investigation showed that the COVID-19 positivity rate at the exit was six times higher than that at the entry to NTC suggesting COVID-19 transmission within NTC. The epidemic curve had three successive with one incubation period apart suggesting a propagated epidemic. Having close contact with a symptomatic person increased the odds of COVID-19 infection. Overcrowding and failure to use facemasks among refugees likely fueled the outbreak.

Close contact with a symptomatic person increased the odds of COVID-19 infection in this outbreak. COVID-19 virus is transmitted through droplets, and aerosols (1, 18). This especially happens when someone comes in close contact with an infected person (19-22). The crowding observed in the transit could have facilitated the close contact among refugees. Overcrowding has been reported as a risk factor for COVID-19 infection among refugees. A study conducted in refugee camps in Bangladesh found higher prevalence of COVID-19 in overcrowded camps(23). Another study in Jordan found that overcrowding was a risk factor for COVID-19 infection among Syrian refugees living in urban areas(24). Expanding shelter space and enforcing social distance especially at the time of distribution of food and other essential items to refugees could minimize close contact among refugees.

Facemasks protect against COVID-19 infection by limiting the movement of infectious droplets(1, 25). Because of this, during the COVID-19 pandemic, face masks were made mandatory for use in public (26-29). Our study results corroborate the notion that consistently wearing face masks significantly decreases the likelihood of COVID-19 infection among refugees, with odds reduction exceeding 90%. Most refugees did not wear the cloth masks they were given, even though this could have reduced their risk of COVID-19 infection. This was likely due to the challenging conditions they faced as refugees, which made them more worried about other problems, such as safety, food, and shelter. When they had to queue for essential items like food, the situation became even more difficult. A study conducted in a refugee camp in Bangladesh found that most refugees did not consistently use face masks even when provided with one, and this contributed to the higher prevalence of COVID-19 in the camp(30). Similarly, a study in Jordan identified overcrowding and lack of access to basic amenities as major risk factors for COVID-19 infection among Syrian refugees living in urban areas, and that the use of face masks significantly reduced the risk of transmission (24).

The investigation had the following limitations. Firstly, refugees who met the case definition and were transferred to resettlement camps were not followed up because of logistical limitations to reach the settlements they had been settled, potentially resulting in underestimation of the study outcomes. Secondly, incomplete records on sex, and age of refugees in the registers at the NTC may have resulted in an underestimation of disease burden. Lastly, the retrospective nature of the investigation is susceptible to recall and social desirability bias, as participants may have been inclined to provide answers that were considered appropriate. This could have resulted into an overestimation of the effect of the associated factors on the COVID-19 infection.

Conclusion

In conclusion, the COVID-19 outbreak at NTC was facilitated by overcrowding and failure to use personal protective measures. Enforcing face mask use and expanding shelter space at NTC could reduce the risk of future outbreaks.

Public health actions

Following the dissemination of our findings, a health sensitization program focused on educating refugees about the use of facemasks was organized in collaboration with the clinical lead at the NTC. The training emphasized the risks of COVID-19 infection, the correct way to wear a facemask, and the benefits of using facemasks to protect one's own health and that of others in the community. We observed a positive change in facemask usage behavior among refugees, and those who did not have facemasks before began to request for them. We recommend that this health talk on facemask usage be continued on a daily basis.

We organized advocacy meetings with the NTC camp management and Kisoro District Local Government to discuss the urgent need for expanding shelter space and increasing the procurement and distribution of facemasks. Our goal was to ensure that every refugee had access to at least two facemasks. The leadership was responsive to our proposal and mobilized implementing partners to procure more facemasks.

Continues to page 50

Furthermore, the NTC management prioritized the expansion of shelter space as an intermediate-term action to be taken.

Conflict of interest
The authors declare no conflict of interest.

Acknowledgments
We thank the Ministry of Health for permitting us to respond to this outbreak. We thank the Kisoro district local government and the management of NTC for granting permission and overall guidance to the team.

References
1. WHO. Coronavirus disease (COVID-19) 2022 [Available from: https://www.who.int/health-topics/coronavirus#tab=tab_1.
2. Orendain DJA, Djalante R. Ignored and invisible: internally displaced persons (IDPs) in the face of COVID-19 pandemic. Sustainability science. 2021;16(1):337-40.
3. Lau LS, Samari G, Moresky RT, Casey SE, Kachur SP, Roberts LF, et al. COVID-19 in humanitarian settings and lessons learned from past epidemics. Nature Medicine. 2020;26(5):647-8.
4. UNHCR TURA-A. 2021. [cited 2022]. Available from: https://www.unhcr.org/health-covid-19.html.
5. Hargreaves S, Kumar BN, McKee M, Jones L, Veizis A. Europe's migrant containment policies threaten the response to covid-19. British Medical Journal Publishing Group; 2020.
6. Malteser International OoMwr. Keeping refugee camps free from the coronavirus pandemic 2022 [cited 2022 11/12/2022]. Available from: https://www.malteser-international.org/en/current-issues/refugees-and-displacement/coronavirus-in-refugee-camps.html.
7. Zard M, Lau LS, Bowser DM, Fouad FM, Lucumí DI, Samari G, et al. Leave no one behind: ensuring access to COVID-19 vaccines for refugee and displaced populations. Nature Medicine. 2021;27(5):747-9.
8. Benos A, Kondilis E, Pantoularis I, Makridou E, Rotulo A, Seretis S. Critical Assessment of Preparedness and Policy Responses to SARS-CoV2 Pandemic: International and Greek Experience. CEHP-Centre for Research and Education in Public Health, Health Policy and …; 2020.
9. International M. Keeping refugee camps free from the coronavirus pandemic 2020 [Available from: https://www.malteser-international.org/en/current-issues/refugees-and-displacement/coronavirus-in-refugee-camps.html#:~:text=Millions%20of%20refugees%20and%20displaced,camps%20would%20have%20devastating%20consequences.
10. Martuscelli PN. How are forcibly displaced people affected by the COVID-19 pandemic outbreak? Evidence from Brazil. American Behavioral Scientist. 2021;65(10):1342-64.
11. Abbas Kigozi CG. Access to COVID-19 vaccines for refugees in Uganda 2022 [cited 2022 11/12/2022]. Available from: https://www.oxfam.org/en/research/access-covid-19-vaccines-refugees-uganda.
12. Control CfD, Prevention. Interim guidance on management of coronavirus disease 2019 (COVID-19) in correctional and detention facilities. 2021.
13. Malchrzak W, Babicki M, Pokorna-Kałwak D, Doniec Z, Mastalerz-Migas A. COVID-19 Vaccination and Ukrainian Refugees in Poland during Russian–Ukrainian War—Narrative Review. Vaccines. 2022;10(6):955.
14. Alio M, Alrihawi S, Milner J, Noor A, Wazefadost N, Zigashane P. By refugees, for refugees: Refugee leadership during COVID-19, and beyond. International Journal of Refugee Law. 2020;32(2):370-3.
15. UNHCR TURA. Global Trends Report 2021. 2021.
16. UNHCR TURA. Thousands flee into Uganda following clashes in DR Congo. 2022.
17. UNHCR TURA. Uganda Refugee Settlements: COVID-19 update 2022 [Available from: https://data.unhcr.org/es/dataviz/153.
18. Lotfi M, Hamblin MR, Rezaei N. COVID-19: Transmission, prevention, and potential therapeutic opportunities. Clinica chimica acta. 2020;508:254-66.

Continued from page 50

19. Xia W, Shao J, Guo Y, Peng X, Li Z, Hu D. Clinical and CT features in pediatric patients with COVID-19 infection: different points from adults. Pediatric pulmonology. 2020;55(5):1169-74.
20. Tian S, Hu N, Lou J, Chen K, Kang X, Xiang Z, et al. Characteristics of COVID-19 infection in Beijing. Journal of infection. 2020;80(4):401-6.
21. Spagnuolo G, De Vito D, Rengo S, Tatullo M. COVID-19 outbreak: an overview on dentistry. International journal of environmental research and public health. 2020;17 (6):2094.
22. Chen Y, Wang A, Yi B, Ding K, Wang H, Wang J, et al. Epidemiological characteristics of infection in COVID-19 close contacts in Ningbo city. Zhonghua liu xing bing xue za zhi= Zhonghua liuxingbingxue zazhi. 2020;41 (5):667-71.
23. Islam MS, Rahman KM, Sun Y, Qureshi MO, Abdi I, Chughtai AA, et al. Current knowledge of COVID-19 and infection prevention and control strategies in healthcare settings: A global analysis. Infection Control & Hospital Epidemiology. 2020;41(10):1196-206.
24. Doocy S, Lyles E, Akhu-Zaheya L, Burton A, Burnham G. Health service access and utilization among Syrian refugees in Jordan. Int J Equity Health. 2016;15(1):108.
25. CDC CoDCaP. COVID-19, What's New & Updated 2022 [Available from: https://www.cdc.gov/coronavirus/2019-ncov/whats-new-all.html.
26. Karmacharya M, Kumar S, Gulenko O, Cho Y-K. Advances in facemasks during the COVID-19 pandemic era. ACS Applied Bio Materials. 2021;4(5):3891-908.
27. Howard J, Huang A, Li Z, Tufekci Z, Zdimal V, van der Westhuizen H-M, et al. An evidence review of face masks against COVID-19. Proceedings of the National Academy of Sciences. 2021;118 (4):e2014564118.
28. Greenhalgh T, Schmid MB, Czypionka T, Bassler D, Gruer L. Face masks for the public during the covid-19 crisis. Bmj. 2020;369.
29. Garcia LP. Use of facemasks to limit COVID-19 transmission. Epidemiologia e Serviços de Saúde. 2020;29.
30. Ahmed F, Ahmed Ne, Pissarides C, Stiglitz J. Why inequality could spread COVID-19. The Lancet Public Health. 2020;5(5):e240.

UPCOMING EVENTS

Global Health Awareness and International Health Days, April – June 2023

Author: Innocent Ssemanda
Institutional affiliation: Uganda Public health fellowship program, Uganda National Institute of Public Health, Kampala, Uganda
Correspondence: Email: issemanda@uniph.go.ug, Tel: +256702353037

Background

International public health days offer great potential to raise awareness and understanding about health issues and mobilize support for action, from the local community to the international stage. Every year, the global community comes together to commemorate these days through global events at National, sub-national, and internal platform. There are many world days observed throughout the year related to specific health issues or conditions ranging from mental health to zoonoses.

The World No Tobacco Day

The detrimental bearing of the tobacco industry on the environment is immense, adding unnecessary pressure to our world's already scarce resources and fragile ecosystems. Tobacco kills over 8 million people every year and destroys the environment, further harming human health, through the cultivation, production, distribution, consumption, and post-consumer waste.

On 31 May 2023, the World Health Organization and public health champions around the world will come together to celebrate World No Tobacco Day. This year's theme is "We need food, not tobacco". The 2023 global campaign aims to raise awareness about alternative crop production and marketing opportunities for tobacco farmers and encourage them to grow sustainable, nutritious

Continues to page 52

crops. It will also aim to expose the tobacco industry's efforts to interfere with attempts to substitute tobacco growing with sustainable crops, thereby contributing to the global food crisis.

World Blood Donor Day

Blood is a necessary resource for planned treatments and the urgent interventions. It is helpful for patients who are suffering from life-threatening conditions for living longer and with a higher quality of life. It supports complex medical and surgical procedures

On 14th June every year, Nations around the world come together to celebrate the World Blood Donor Day, an event aimed at raising awareness of the need for safe blood and blood products and to honor the unpaid volunteers around the globe who donate the most precious gift of all – the gift of life.

For 2023, the World Blood Donor Day slogan will be "Give blood and keep the World beating".
It's a slogan that highlights the essential contribution that blood donors make to keep the world pulsating. That is by saving lives and improving other's health.

World Immunization Week

Today immunization can protect against 25 infectious diseases and the World Health Organization estimates that immunization currently averts 2 to 3 million deaths every year.

In the last week of April, the world, as it does every year, will come together to celebrate and raise awareness of the value of vaccines and immunization and how they protect people of all ages, giving us an opportunity to peruse a well lived life.

For 2023, the theme is '*Vaccines work for all*', it's a theme that suits the fact that for more than two centuries, vaccines have helped keep people healthy—from the very first vaccine developed to protect against smallpox to the newest vaccines used to prevent severe cases of COVID-19. Since then, families and communities have entrusted vaccines to protect their loved ones.

World Malaria Day

Malaria remains a global burden affecting millions of lives every day. Over 3.3 billion people in 106 countries are at risk of malaria. In 2021, malaria caused an estimated 619,000 deaths, mostly among African children.

Malaria affected countries continue to respond to a host of challenges including disruption arising from COVID19 pandemic. These challenges have been further compounded by the effectiveness of the primary malaria fighting tool. Rising resistance to insecticide treated nets and ant-malaria regiments remain a major concern particularly in Africa

Each year, on April 5th, the world commemorates the World Malaria Day, an occasion used to highlight the need for continued investment and sustained political commitment for malaria prevention and control by exposing the burden of this disease to the world. The theme for 2023 is 'Ready to Beat Malaria'. The overall aim of World Malaria Day is to spread awareness of the disease and to raise money for charities that are fighting to eradicate it.

Continued from page 52

UPDATES

8th National Field Epidemiology Conference, Africana Hotel, Kampala, Uganda, 12th January, 2023

Author: Mackline Ninsiima[1,2*]
Institution affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]Kampala Capital City Authority, Kampala, Uganda
Correspondence*: Email: mninsiima@uniph.go.ug, Tel: +256787819496

The Ministry of Health in collaboration with Uganda National Institute of Public Health hosted the 8th National Field Epidemiology Conference under the theme, "Sustaining Efforts to Build a Resilient Disease Surveillance and Response System" on January 12, 2023 at Africana Hotel, Kampala, Uganda. The conference opened with remarks by UNIPH Executive Director, Dr. Alex Ario Riolexus, UPHFP Resident Advisor, Dr. Julie R. Harris, and MoH representative, Mr. Atek Kagirita. The Field Epidemiologists were applauded for their outstanding contribution towards the detection and response to public health emergencies; most especially for having been instrumental during the 2022 Sudan Ebola Virus Disease outbreak in Uganda.

During this conference, 28 fellows of the Advanced Field Epidemiology Training Program (FETP), Cohorts 2021 and 2022 presented key findings ranging from analysis of surveillance data and outbreak investigations, which they had undertaken during their in-service training. This annual conference was physically attended by 177 participants from these institutions: Ministry of Health, Makerere University School of Public Health, Centers for Disease Control & Prevention, United States Agency for International Development (USAID), African Field Epidemiology Network (AFENET), Infectious Disease Institute (IDI), Kampala Capital City Authority, Joint Clinical Research Collaboration (JCRC), Medecins Sans Frontieres (MSF), Baylor College of Medicine Children's Foundation – Uganda, Regional Referral Hospitals, District Health Teams, and the media fraternity.

We acknowledge the highlighted institutions and all conference participants for their contribution towards the success of the conference.

Dr. Benon Kwesiga (PHFP Supervisor on the right) with some of the fellows (King Patrick, Rose Nampeera, Petranilla Nakamya, Stella Martha Migamba, Veronica Masanja, Mackline Ninsiima and Peter Chris Kawungezi) during the plenary session at the 8th National Field Epidemiology Conference

Training on incident management system for malaria epidemics in Uganda, Golf Course Hotel, Kampala, 7th-10th February, 2023

Author and institutional affiliations: Gorreti M. Zalwango*, Uganda Public Health Fellowship Program-Field Epidemiology Fellow Cohort 2022
Correspondence*: Email: mzalwango@musph.ac.ug, Tel: +256-752610802

From 2022 to date, the country has been experiencing malaria epidemics in a number of districts. Uganda took on the incident management system to manage malaria epidemics in the country being the first country in Sub-Sahara Africa to adopt this approach. The training was conducted by officials from the World Health Organisation. The training participants included members from the National Malaria Control Division, Uganda Public Health Fellowship Program field epidemiology fellows, and other national and international malaria stakeholders in the country. The 4-day training was closed by the Hon. Minister of Health, Dr. Jane Ruth Achieng who urged the teams to uphold good leadership and commitment during

Continues to page 54

management of malaria epidemics at all levels, emphasized behavioural change, and a need to rethink risk communication for better management of the epidemic and reduced malaria mortality.

Training participants and trainers posing with the Hon. Minister of health Dr. Jane Ruth Achieng, the WHO country representative Dr. Yonas Tegegn Woldemariam, and the Director General of health Services Dr. Henry Mwebesa

Excess mortality Survey, March, 2023

Authors: Job Morukileng[1*], Elizabeth Katana[1]
Institutional affiliation: [1]Uganda National Institute of Public Health, Kampala, Uganda
Correspondence*:Email: jmorukileng@uniph.go.ug,Tel:256782611585

Its reported that by April 2022, COVID19 had caused more than 6 million from confirmed cases across the globe. However, the actual number of deaths associated with the pandemic are projected to be much higher than reported. Some of these deaths are thought to be the unconfirmed Covid-19 cases but also the indirectly caused deaths due to the overwhelmed health systems, lockdowns, delayed access healthcare, closure of health facilities, economic downturn and others. To fully understand the impact of the pandemic on all-cause mortality, the objective approach it to estimate all-cause excess mortality. However, reliable data is required for this mortality estimate. In Uganda the national identification registration authority (NIRA) which is mandated to register deaths, currently captures about 7% of all expected deaths annually. Similarly, other mortality surveillance systems do not capture mortality data that is representative of the country.

Therefore, to obtain the necessary mortality data, the Uganda National Institute of Public health embarked on a household mortality survey to generate data to estimate the all-cause excess mortality in Uganda during Covid 19 pandemic and to evaluate the distribution of excess mortality by key factors including cause, age, sex, marital status, ethnicity, social economic status and others.

Following a success pilot in Jinja District in February 2023, the main survey took place during March 2023 in 14 districts across all the 14 regions in Uganda.

The 7th Graduation Ceremony of the Uganda Public Health Fellowship Program, Field Epidemiology Track

Author: Susan Waako*
Institutional affiliation: Uganda Public Health Fellowship Program, Field Epidemiology Track, Cohort 2023
Correspondence*: Email: swaako@uniph.go.ug, Tel: +256774835047

The Uganda Public Health Fellowship program has successfully graduated a total of 79 Advanced Field Epidemiology Training Program fellows since 2015. On 13th January 2023, 14 fellows were awarded for completing the two-year-in-service field epidemiology training program. This was the 8th cohort of fellows, who took on the course from 2021 to 2022. The fellows were of mixed backgrounds, including Medicine, Laboratory, Public Health, Nursing, Environmental Health, Community Health Science, Pharmacy, Wildlife Health and management. During their course, they supported the different Ministry of Health departments and were attached to the following host sites: Department of Integrated Epidemiology, Surveillance and Public Health Emergencies (IES&PHE), STI/AIDS Control Program, Public Health Emergency Operations Centre, Reproductive Health Department, National Tuberculosis and Leprosy Program, National Malaria Control Division (NMCD), Division of health information and Uganda Cancer Institute, and Uganda National Expanded Program on Immunization

They were engaged in various activities involving responding to disease emergencies, pro-

Continued from page 54

jects implementation, surveillance data analysis, and dissemination of findings through various means including abstract presentations at both national and international conferences and manuscript writing. Congratulation to the 14 fellows upon the completion of the program and wish them the best in their future career path.

Graduates of the 2021 cohort pose for a group photo with the chief-guest H.E Natalie Brown, the Ambassador of US to Uganda and other dignitaries from Ministry of Health and World Health Organization

2022 Sudan Ebola Virus Disease Outbreak, After Action Review, Speke Resort Munyonyo, Uganda, February 13th–16th, 2023

Authors: Mackline Ninsiima[1,2*], Jane Frances Zalwango[1,3], Hellen Nelly Naiga[1,4]
Institution affiliations: [1]Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda, [2]Kampala Capital City Authority, Kampala, Uganda; [3]National Malaria Control Division, Ministry of Health, Uganda; [4]Nutrition Division, Ministry of Health, Uganda
Correspondence*: Email: mninsiima@uniph.go.ug, Tel: +256787819496

The International Health Regulations (IHR) 2005, a legally binding agreement of countries to build the capability of detecting and reporting potential public health emergencies globally, require that all countries have the ability to detect, assess, report, and respond to public health events. Following a public health event, one of the recommended activities for countries to better prepare for and respond to these events is an After-Action Review (AAR). An AAR is a qualitative review of systems and processes in place prior to a public health event, what was done during the response and when, challenges encountered, and ways to mitigate these challenges in the future if another such event occurs. This can be accomplished through a variety of methods such as debriefing, working groups, key informant interviews, and mixed methods. This review should be conducted within three months after the response to a public health event, while events are still fresh and can be clearly recalled.

Uganda has always been praised for adhering to these guidelines, with this being her third AAR, following Marburg and Ebola Virus Disease (EVD) outbreaks in 2018 and 2019, respectively. This AAR was held a month after the end of the 2022 Sudan Ebola Virus Disease outbreak declaration on January 11, 2023, and organized by the Ministry of Health in collaboration with the World Health Organization. Uganda used the working group method for this review, which involved groups of people with expertise in specified operational pillars coming together to discuss and share opinions on key response areas in that pillar. A facilitator stirred these groups, and the group note taker took notes from the discussion using a pre-qualified note taking tool.

During the preparatory phase, eleven operational pillars in the EVD response were identified: 1) Coordination and Leadership; 2) Surveillance; 3) Laboratory; 4) Continuity of Essential Health Services; 5) Case Management; 6) Infection Prevention and Control; 7) Risk Communication; 8) Water, Sanitation and Hygiene (WASH); 9) Logistics; 10) Strategic Information, Research and Innovation (SIRI) and 11) Protection from Sexual Exploitation, Abuse, and Harassment (PSEAH); facilitators and note takers that included members from the Uganda National Institute of Public Health allocated to these pillars and trained on how to conduct an After Action Review by experts from WHO. The activities began on February 8, 2023, with a two-day review at the subnational level in selected districts with EVD cases: Kampala City, Mubende, and Kassanda, and then at the national level from February 13-16, 2023.

The AAR was a success on both levels and a valuable learning experience for many. It was attended by a number of stakeholders, including responders, government officials, partners, and in-country and foreign observers, who shared their objective experiences with the EVD outbreak response and recommended ways to improve. Participants included representatives from the Ministry of Health – Uganda, District Local Governments, Kampala Capital City Authority (KCCA), Ministry of Health – Kenya, World Health Organization (WHO), US Centers for Disease Control & Prevention (CDC), Uganda National Institute of

Continues to page 56

Public Health (UNIPH), United States Agency for International Development (USAID), African Field Epidemiology Network (AFENET), Infectious Disease Institute (IDI), Medecins Sans Frontieres (MSF), Baylor College of Medicine Children's Foundation – Uganda, Regional Referral Hospitals, United Nations Children's Fund (UNICEF), Uganda Virus Research Institute (UVRI), International Organization for Migration (IOM); and the media fraternity among others.

Several opinions were raised and discussed during the discussions, with 6 challenges and 3 priority areas for improvement identified per pillar based on their impact and level of difficulty for implementation. Among the key findings of this review was the underperformance with regard to the 7-1-7 approach to epidemic preparedness and response. The ideal time frame is 7 days to detect an outbreak, 1 day to notify public health authorities, and 7 days to mount an effective response. However, our evaluation was 46-1-9, with the very late detection of the outbreak, indicating the need for a more robust surveillance system for viral hemorrhagic fevers at both the facility and community levels.

All of this was compiled into a comprehensive report to aid in the preparation and response to a similar public health emergency in Uganda, as well as to provide guidance to other countries around the world.

We are grateful to the Rapid Response Teams, Implementing Partners, political leaders, communities from affected districts, and Ugandans in general for controlling this EVD outbreak in just 69 days following its declaration on September 20, 2022.

Coordination and Leadership pillar facilitated by Dr. Alex Ario Riolexus, Executive Director, Uganda National Institute of Public Health during the during the Sudan Ebola Virus Disease After Action Review, February 13–16, 2023, Speke Resort Munyonyo, Uganda

The Uganda Public Health Fellowship Program Commences its First Cohort of the Two-year Laboratory Leadership Track

Authors: Samuel Gidudu[1]*, Waako Susan[1], Daniel Kadobera[1], Susan Nabadda[2], Alex Ario Riolexus[1]

Institutional affiliations: [1] Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, [2]National Health Laboratory and Diagnostic Services

Correspondence*: Email: gidudusam@uniph.go.ug, Tel: +256704777931

The Uganda Public Health Fellowship Program (PHFP) started in 2015 with the field epidemiology track and now on board is the laboratory track. The PHFP-Laboratory Leadership Program (PHFP-LLP), is a 2-year in service field training fellowship where fellows focus on developing competency through providing laboratory leadership services in laboratory-based surveillance, laboratory quality management systems, policy and management, outbreak investigation and coordination. The aim of the PHFP-LLP is to develop laboratory leaders who will manage public health laboratory systems in the country. This is through building competencies in key areas of laboratory leadership among laboratory specialists through the two-year fellowship program.

The program provides opportunities for fellows to conduct daily mission-critical technical service to human and animal health on behalf of the Ministry of Health (MoH) and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). The PHFP-LLP also presents opportunity for developing laboratory management skills needed to assess, evaluate, and monitor the laboratory capacity to handle outbreak investigations and improve on the quality and integration of laboratory services alongside epidemiology services in human and animal sectors.

The PHFP-LLP includes seven didactic sessions which are two weeks in a quarter with mentorships in between the didactic sessions. These di-

Continued from page 56

dactic sessions are conducted at the Uganda national institute of public health while the mentorship sessions are conducted at the fellows' workplaces which also serves as the program's host site. The program is designed to link learning outcomes of the didactic sessions with real-world projects and experiences in laboratory leadership in both human and animal health domains.

The first cohort of fellows is comprised of six persons (three male and three female) with a masters' degrees in molecular biology and biotechnology (1), biomedical laboratory sciences and management (2), international infectious disease management (1), molecular biology (1) and immunology and clinical microbiology (1). Four of these have a bachelor's degree in biomedical laboratory technology while two have bachelor's degree in Science technology (Biology). These fellows are from five host sites and these include Central Public Health Laboratories (2), Uganda Virus Research Institute (1), National Animal Disease Diagnostics and Epidemiology Centre (1), Infectious Disease Institute (1) and Mildmay Uganda (1).

The pioneer PHFP-LLP fellows of cohort 2023 pose for a group photograph with some of their mentors during their orientation at the Uganda Public Health Fellowship Program

Suspected Cholera Alert, Luweero Island, Buvuma District, March 2023

Authors: [1]Shem Mwebaza* and [2]Saudah Kizito Namubiru
Institutional affiliations: [1]Uganda Public Health Fellowship Program-Laboratory Leadership Program, Uganda National Institute of Public Health, Kampala, Uganda
[2]Uganda Public Health Fellowship Program-Field Epidemiology Track, Uganda National Institute of Public Health, Kampala, Uganda
Correspondence*: Email: smwebaza@uniph.go.ug, Tel: +256702987664

On the 23rd of January 2023 an alert was received for suspected cholera; when five male residents from Luweero Island in Buvuma District developed severe rice water diarrhea. One of the patients died on the way to Katosi to seek medical care. A multi-disciplinary team was formed to investigate the incident. A total of ten samples were collected of which seven were stool (bloody diarrhea) from new suspected cases, two water samples and one passion fruit juice sample from a vendor. Rapid Diagnostic Testing (RDT) was done on the 7 stool samples onsite and these turned negative for cholera. All the collected samples were transported to Central Public Health Laboratories (CPHL) for further analysis.

The stool samples were tested for Ebola Virus at the Central Emergency Response and Surveillance Laboratory at Wandegeya with negative results. The microbiology report indicated that three of seven stool samples had *schistosoma mansoni*. The results from the water and passion fruit juice samples did not yield any significant results. The alert was likely schistosomiasis and the matter was forwarded to Vector Control Division, Ministry of Health.