ARTIFICIAL INTELLIGENCE IN INFECTIOUS DISEASE WORKSHOP 2024

ABSTRACT BOOK

Artificial Intelligence in Infectious Disease Workshop 2024
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ORAL ABSTRACT PRESENTATIONS

Artificial Intelligence in Infectious Disease Workshop 2024

Virtual Meeting

5 – 6 December

1

Finding the missing Tuberculosis cases: Lessons Learnt from using Artificial Intelligence enabled Chest X-ray system for active TB case search in communities in Lagos, Nigeria

Osatuyi T[1], Odume B[1], Obioha U[1], Sokoya D[2], Ogboye S[2], Agboolagorite R[2]

[1]Kncv Nigeria, Lagos, Nigeria, [2]Lagos State Ministry of Health, Lagos, Nigeria

Summary: Experience and lessons learnt using Computer-aided detection (CAD) attached to 21 Artificial intelligence enabled X-ray systems for screening and triage for TB. These were deployed to communities and 18 health facilities across 20 local government areas in Lagos, Nigeria and had helped to improve TB case finding in the state.

Background and challenges to implementation: About 32% of people with Tuberculosis (TB) are missed annually in Nigeria. Hard-to-Reach areas are characterized by vastness, inadequate infrastructure, and limited access to basic healthcare services. This highlighted the need for chest X-ray screening in communities and targeted outreaches are crucial to finding missing people with TB in these communities.

Intervention or response: The DCXR team worked with Lagos State TB control program, Damien foundation and Institute of Human Virology, Nigeria through Global Fund support, implemented CXR TB screening in rural areas. Hotspots were mapped using EPCON. We trained radiographers and TB screeners. Between January 2021 and December 2023, 1,469 outreaches were conducted in 721 rural communities. Focusing on cough categories: Not coughing, Coughing <2weeks and coughing > 2 weeks for screening of clients, symptomatic client's sputum sample were collected for investigation and those asymptomatic or could not produce a sputum were referred for CXR screening. CXR films were interpreted by hired radiologist and findings and reports were sent to Medical Officers for further evaluation.

Results/Impact: Over a 36-month period from January 2021 to December 2023, a total of 2,847,612 were verbally screened with 135,384 (5%) screened using the X-ray trucks with fixed DCXR attached with CAD4TB. 4,832 TB cases diagnosed were following verbal screening and 2,344 from CXR with CAD4TB AI screening and total of 7,176 TB cases were identified

Conclusions: The intervention conducted shows that 2,344 (33%) out of the total of 7,176 TB cases identified during the period, would have been missed without the integration of CXR since they presented with No cough or Cough of <2 weeks duration. Considering the NNS (58:561) & NNT (4:24), It is recommended that consistent use of Artificial Intelligence enabled CXR system attached with CAD4TB should be deployed for community TB screening as part of active TB case finding strategies.

2

Two-years assessment in comparing Tuberculosis symptom screening combined with Chest X-ray screening to symptom screening using Artificial Intelligence among general population in Lagos, Nigeria.

Osatuyi T[1], Odume B[1], Obioha U[1], Sokoya D[2], Agboolagorite R[2], Ogboye O[2], Labaran S[3]

[1]KNCV Nigeria, Ikeja, Nigeria, [2]Lagos State Ministry of Health, Ikeja, Nigeria, [3]National Tuberculosis Programme, Abuja, Nigeria

Summary: The presumptive yield speaks to the sensitivity of the combined screening algorithm in identification of true presumptive from comparison of WHO symptom screening combined with Chest X-ray screening to symptom screening alone using artificial intelligence software called CAD4TB which was implemented in Lagos metropolis through outreaches at various communities.

Background and challenges to implementation: Tuberculosis (TB) remains a major public health issue in Nigeria. Despite progress made in reducing the TB incidence, the TB burden is still very high. Digital Chest X-ray systems with artificial intelligence (AI) are increasingly used as screening tool for TB. We aimed to evaluate the performance of CXR with AI combined with WHO4SS and symptom screening for active case finding of TB among general populations.

Intervention or response: We organized screening camps in rural areas, ≥ 5 years were screened with WHO four- symptom screening (W4SS). EasyDR Interpreted by AI (CAD4TB V6). We collected sputum samples from individuals with a CAD4TB threshold score of ≥45 or if they reported any other TB symptoms. Samples were tested with Xpert MTB/RIF and bacteriologically negative results had their images and symptoms sent for radiologist review for clinical diagnosis.

Results: A total of 2,808,650 clients were screened from January 2022 - December 2023 at 1,499 camps with 122,576 presumptive TB was identified, 4,679 cases diagnosed (TB yield of 0.17%) with an average Number Needed to Test (NNT) of 26 and Number Needed to Screen (NNS) of 600. Disaggregating by screening method, a total of 2,712,228 clients, screened with W4SS, of those 116,823 identified presumptive TB, 3,714 TB cases diagnosed (0.14% TB yield). While 96,422 clients screened with combination of W4SS and CXR screening, 5,713 identified presumptive TB were evaluated, 965 TB were diagnosed (TB yield of 1%).

Conclusions: Screening for TB using CXR has a better TB yield at 1% compared to WHO4SS at 0.14%. The NNT (6:31) after screening using X-rays was lower (6) compared to symptom screening (31) and this shows X-ray with AI is 5 times more efficient in TB identification than WHO4SS. Combining symptom and CXR screening had a better presumptive yield which speaks to sensitivity of combined screening algorithm in identification of true presumptive.

3

Implementing Facility-based Artificial Intelligence enabled Chest X-ray screening as innovative strategy to improving TB case finding in Lagos, Nigeria.

Osatuyi T[1], Odume B[1], Sokoya D[2], Udunze O[1], Agbolagorite R[2], Ogboye O[2], Labaran S[3]

[1]KNCV Nigeria, Lagos, Nigeria, [2]Lagos State Ministry of Health, Ikeja, Nigeria, [3]National Tuberculosis Programme, Abuja, Nigeria

Background and challenges to implementation: Nigeria is first in Africa in Tuberculosis(TB) burden with a 32% gap in TB case notification. Lagos accounts for estimated 10% of Nigeria's TB burden. Lagos TB Programme placed on treatment:17,276 and 18,546 people affected by TB in 2022 and 2023 respectively. However, there has been different innovative approaches and strategies deployed to reduce this notification gap from Y2019-Y2023. The aim of this assessment is to increase TB case finding and close the gaps in TB case notification using facility-based Artificial Intelligence(AI) enabled Chest X-ray systems in Lagos, Nigeria.

Response/Intervention: We deployed Global Fund supported 18 facility-based AI enabled CXR Systems to 18 public and private facilities in Lagos based on OPD attendance, existing CXR Infrastructures and Human Resources from January, 2022-December,2023. Each CXR system on site has a radiographer, screening Officer and data officer. The radiologist reviews the digital radiographs remotely.

All clients screened using the WHO four symptoms screening and Computer-Aided Detection for TB(CAD4TB) score and threshold set at ≥45. All identified presumptive TB were evaluated with GeneXpert. The clients unable to produce sputum and bacteriological negative results had their digital Xray films sent to radiologists and medical officers for further review and evaluation. Data were collected using electronic TB registers.

Impact: A total of 95,770 clients were screened, 16,572(17%) were identified to be presumptive TB. Out of this, 16023(97%) presumptive TB were evaluated and 4,900 TB persons with TB were placed on treatment. Facility-based CXR intervention only account for 14%(4,900/35,822) of the overall TB case notification over the period under review.

Conclusion: Facility-based AI enabled CXR system Intervention being first of its kind in Nigeria and as demonstrated in the assessment(14%-yield) will significantly increase and improve the TB case finding and also reduce the TB case notification gap. We will recommend its scale up in other parts of the country.

4

The Use of Qure.ai to Intensify Tuberculosis Case Detection Among Coprisoners. The KNCV Nigeria Experience in Anambra State Nigeria.

Ekpen K[1], Chukwu E[1], Odume B[1], Ogbudebe C[1], chukwuogo O[1], MICHAEL S[1]

[1]KNCV NIGERIA, FCT, Nigeria, [2]NTBLCP, Abuja, Nigeria

Background: The Qure.ai Fiji mini-X-ray is an ultra-portable device used for active TB case finding in hard-to-reach, vulnerable populations. Traditional TB screenings focus on healthcare settings and rural areas. This study evaluates its use among prisoners in various correctional service centers in Anambra State, Nigeria, to improve TB detection in high-risk groups.

Methodology: Approval for TB screening is obtained from the Officer in Charge of the correctional facility, with collaboration from local health authorities such as the TBLS of the LGA. The team selects a safe location for screening, prioritizing health due to X-ray radiation. Inmates are brought in batches by clinic staff or the Cell Provost, with female inmates and staff screened separately. The National TB parallel algorithm is followed, with a presumptive TB score of 34 for high-risk correctional facilities. Presumptive cases are tested using the TB Lamp diagnostic tool, and TB-positive patients start treatment immediately. Negative samples are sent to radiologists via XMAP for further review. This 12-month study (Sept. 2022 – June 2024) covers four correctional centers in Anambra, Nigeria, using Qure.ai for enhanced TB case detection.

Results: A total of 3,906 individuals were screened during the TB case-finding initiative across correctional service centers in Anambra State, Nigeria. Of these, 562 individuals (14.4%) were identified as presumptive TB cases based on screening protocols. All presumptive cases were further evaluated, resulting in 81 confirmed TB diagnoses. This translates to a TB confirmation rate of 14.4% among presumptive cases and 2.1% of the total population screened.

Out of the 81 confirmed TB cases, 71 (87.7%) were bacteriologically confirmed, highlighting a strong reliance on accurate diagnostic tools. All 81 individuals diagnosed with TB were promptly placed on treatment, ensuring timely medical intervention and reducing the risk of transmission within the prison population.

Conclusions: The use of the Qure.ai X-ray machine to detect 81 TB cases among prisoners over a 12-month period demonstrates the effectiveness of AI-assisted diagnostic tools in high-risk environments. This outcome suggests that ab initio and finally the machine was able to identify 81 TB cases that might have otherwise gone unnoticed, especially in prisons where TB transmission risks are heightened due to overcrowding and poor ventilation.

5

Lesson Learnt from Using Computer-Aided TB Detection in Zanzibar

Omar R[1]

[1]Amref Tanzania, Zanzibar , Tanzania, United Republic of

Background: Tanzania is among 30 high tuberculosis (TB) burden countries. Despite the efforts, it is estimated that 36,000 people are missed. To reach these people, require strategies that will engage the broader community at risk. One effective strategy is systematic screening.
To implement systematic screening, the Ministry of Health (MoH) Tanzania procured Mobile TB clinics to provide one-stop-shop TB services. The clinics are equipped with digital X-ray machines installed with artificial intelligence computer-aided TB detection (CAD) system to facilitate rapid interpretation. Amref in collaboration with MoH Zanzibar utilized mobile TB clinic.

Approach: Participants underwent symptomatic TB screening. Those presumed to have TB (excluding children under 2 years) received chest x-ray (CXR) investigations and sputum molecular evaluations.
If the sputum results were inconclusive for TB, CXR was used in the algorithm to assist in clinical TB diagnosis.
The CXR images were initially read by a computer-aided detection (CAD) system and then reviewed by a radiologist. A CAD score of 40 or above was suggestive of TB.

Results: On September 2023, a total of 2326 clients (971F:1355M) underwent symptomatic screening and 645 were presumptive for TB.
Among those presumed, 132 CXR images were identified by CAD, as suggestive of TB, of which 38 (28.8%) were confirmed by a radiologist to have features of active TB disease.
Other features identified as active TB were non-active TB disease such as old TB disease, bronchitis, pneumonia, and conditions like cardiomegaly.
One image out of 513 non-suggestive by CAD was concluded to have active TB features by a radiologist.

Conclusion and Recommendation: The CAD system has significant potential in systematic TB screening, as it can effectively identify candidates for molecular evaluation, thereby minimizing costs.
The role of radiologists remains vital in settings without specific CAD calibration. Further operational studies are needed to explore the effectiveness of CAD in the Tanzanian context.

6

AI-Powered Decision Support for Effective STI PCR Testing: Enhancing Clinical Decision-Making in Infectious Disease Management

Chumpa N[1], Pipattaweepon T[2], Putcharoen O[1,2,3]

[1]Thai Red Cross Emerging Infectious Diseases Clinical Center, Bangkok, Thailand, [2]Thai Red Cross Anonymous Clinic, Bangkok, Thailand, [3]Division of Infectious Diseases, Department of Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

Background: Comprehensive STI PCR tests, capable of detecting multiple pathogens, have become increasingly available in clinical settings. These tests offer a more thorough analysis compared to conventional methods, but they also come with higher costs and the potential for detecting non-symptomatic infections that may not require immediate treatment. This presents a significant challenge for healthcare providers: making informed decisions about when to recommend these advanced tests to optimize treatment strategies. At the anonymous clinic of the Thai Red Cross in Bangkok, where the STI PCR 14-type test is currently utilized, we sought to develop a data-driven approach to guide clinicians in making treatment decisions that ensure patients receive appropriate care while avoiding unnecessary interventions.

Material and Methods: Data was collected from 420 patients at the anonymous clinic of the Thai Red Cross between March 2024 and June 2024, comprising 318 Thai nationals and 102 non-Thai individuals. The cohort included people with varying symptomatic presentations, sexual histories, and risk factors. To address the challenge of identifying which patients would benefit most from the STI PCR test, we developed a Logistic Regression model, enhanced by SMOTE (Synthetic Minority Over-sampling Technique) to mitigate class imbalance. The model was compared against various other machine learning approaches, including Neural Networks, Random Forest, Gradient Boosting, and Support Vector Machine (SVM), with Logistic Regression emerging as the most effective in guiding treatment decisions. Key features used in the model included demographic factors, symptomatic status, sexual history, and previous STI diagnoses.

Results: The model demonstrated an overall accuracy of 76%, with a recall of 70% for cases requiring treatment and a precision of 55%. By prioritizing recall, the model successfully minimized the number of false negatives, ensuring that people who required treatment were correctly identified. This approach was justified as it aligns with the clinical priority of reducing missed diagnoses and ensuring timely treatment, while also minimizing unnecessary treatments that could arise from overtesting. Importantly, the model identified the presence of symptoms, gender, and STI history as critical predictors in determining the necessity of PCR testing, directly influencing treatment strategies.

Conclusions: By integrating this machine learning model into clinical practice, healthcare providers can make more informed decisions about STI PCR testing, leading to improved treatment outcomes. The model's emphasis on recall ensures that patients in need of treatment are identified, while also reducing unnecessary treatments and associated costs. This approach aligns with the broader goals of effective treatment management in infectious disease care. Future work will focus on further refining the model, exploring its applicability across diverse clinical settings, and integrating it into routine clinical workflows to enhance treatment decision-making.

7

Identification of Koch Bacili Through Machine Learning

Raraz-Vidal J[1]

[1]UNHEVAL, Lima, Peru

Background: Tuberculosis is a disease with a great impact on public health, so it is important to have new tools to help diagnose, reduce exposure and be economical. So artificial intelligence is a useful tool to help in the process of reading bacilloscopies. Therefore, the aim of the study was to develop and evaluate the clinical efficacy of the automated method based on artificial intelligence to identify koch bacilli in Ziehl-Neelsen (ZN) stained sheets.

Methodology: Application study. A pilot study was carried out. An automated method (based on AI) for the identification of mycobacteria was developed. We prepared a training data set with 85 positive and 85 negative slides with the same size and color, from ZN-stained slides scanned and published on the internet. Which were confirmed by 2 clinical pathologists confirming positive and negative lamina. A neural network model based on machine learning algorithms was created to identify Koch's bacillus through its characteristics, in addition to training the neural network to improve identification. There was a sample of 44 slides (22 positives). Sensitivity, specificity, PPV, NPV, LR were estimated.

Results: The pilot study was performed with 44 images (22 images with Koch's bacilli and 22 images without Koch's bacilli). We compared the pathologists' results obtained by separately evaluating the images and the results obtained through the neural network. The test obtained a sensitivity of 90% and a specificity of 80% by the AI-assisted method, for the detection of AFB. The PPV 82%, NPV 89%, FP 20%, FN 10%. The positive Likelihood ratio (LR) obtained 4.5 and the negative LR 0.12.

Conclusion: The artificial intelligence program presented good sensitivity and specificity to identify koch bacilli.

8

The Use of AI (Electronic Sputum Dashboard) and Dispatch Riders in Mitigating Delay in Sputum Samples' Processing—Evidence from an Intervention in Lagos State, Nigeria.

Fadeyi M[1], Agbaje A[2], Asafa Y[1], Adetiba T[2], Ahmed B[1], Adekunle A[2]

[1]Damien Foundation Belgium (Nigeria Project), Ibadan, Nigeria,
[2]Institute of Human Virology Nigeria (IHVN) , Abuja, Nigeria

Introduction: The act of referring tuberculosis (TB) presumptive individuals after verbal screening to another health facility/diagnostic centers for testing often results in large loss to follow-up, owing to the many barriers people face in accessing care.
The transportation of sputum samples is an efficient method of increasing access to (TB) diagnostics in areas where testing is not currently available.
However, delay in transportation of sputum samples to diagnostic laboratories and non-accountability for such sputum samples are major reasons for the low yield of TB cases in the field. The usual practice of using the TB clinic staffs in transporting this samples contribute to low productivity of this staff thus contributing to sub optimal TB service delivery.

Methods: Damien Foundation Belgium (Nigeria Project) pilot the use of AI in form of electronic sputum dashboard and sputum riders' initiative. This unique method was used to transport and monitor the sample from presumptive TB patient in 20 LGAs of Lagos state between Q1 2019 and Q4-2019.
A total of 25 sputum dispatch riders were engaged for sputum logistics across the 20 LGAs in state. Their activities are monitored routinely on an AI electronic dashboard to provide real time feedback on the status of the samples at the diagnostics laboratory which may be accepted, processed or rejected. Also, prompt result of the samples is generated for decision to be taken by health workers in the clinic.

Results: Overall, 48,265 units of sputum samples were transported to the laboratory from the facilities during this period. This represent 60% increase of samples sent to diagnostic laboratories in the state compared to previous year (Q1 2018-Q4 2018). An unprecedented 99.9% results received from the laboratory by the dispatch riders were uploaded on the dashboard. The contribution of sputum riders to the overall TB case detection by the project progressively increased from 9% when the intervention began to 57% as at Q4 2020.

Conclusion: The use of AI electronic sputum dashboard with transportation of sputum samples by motorcycle dispatch riders is an efficient method of increasing access to TB diagnostic services in communities where testing is not currently available.
This initiative has since been scaled up to the entire 36+1 states in the country through Global Fund.

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Development and Evaluation of a Pre-Exposure Prophylaxis (PrEP) Eligibility Prediction Tool: Improving Public Health Outcomes through Accurate Risk Identification

Odhiambo C[1], Kubo E[1], Marima R[1]

[1]*Usaid Fahari Ya Jamii, Nairobi, Kenya*

Background: Pre-exposure prophylaxis (PrEP) has proven to be a highly effective strategy for preventing HIV transmission among individuals at high risk. Accurately identifying those eligible for PrEP is essential for optimizing resource allocation and improving public health outcomes. This study aimed to develop and evaluate a PrEP eligibility prediction tool using machine learning techniques to enhance risk identification and support decision-making in PrEP initiation and adherence. Furthermore, SHAP (SHapley Additive exPlanations) values were employed to interpret the model and identify the most significant predictors contributing to PrEP eligibility.

Objectives: The objective of this study was to create and evaluate a PrEP eligibility prediction tool aimed at accurately identifying individuals suitable for PrEP. The tool's performance was assessed using metrics such as accuracy and area under the curve (AUC), with SHAP values identifying key predictors. This approach aimed to enhance decision-making for PrEP initiation and adherence, thereby improving public health outcomes.

Methodology: A dataset of 19,894 individuals was utilized to develop and validate the PrEP eligibility prediction tool. The dataset included demographic, behavioral, and clinical variables associated with PrEP eligibility. Machine learning algorithms such as logistic regression, decision trees, and random forests were employed to build the models. SHAP values were used to determine the most significant predictors influencing eligibility decisions. The tool's performance was evaluated using accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and AUC.

Results: The PrEP eligibility prediction tool achieved an overall accuracy of 88.2%. It correctly predicted PrEP suitability in 16,256 instances (true positives) and incorrectly predicted suitability in 1,148 instances (false positives). Additionally, it incorrectly predicted unsuitability in 1,198 instances (false negatives) and correctly predicted unsuitability in 1,292 instances (true negatives). The model demonstrated an AUC of 0.82, indicating good discriminatory ability in identifying individuals suitable for PrEP. SHAP analysis revealed that key predictors, including age, sexual behavior, and HIV exposure risk factors, significantly influenced PrEP eligibility predictions.

Conclusion: The PrEP eligibility prediction tool, supported by SHAP analysis, shows strong potential in accurately identifying individuals suitable for PrEP, thereby contributing to improved public health outcomes. The high accuracy, sensitivity, specificity, and AUC values reflect its effectiveness in distinguishing those who may benefit from PrEP initiation and adherence support. The integration of SHAP to identify significant predictors enhances the interpretability of the tool, making it a valuable resource for clinical practice and public health interventions. Its application has the potential to optimize resource allocation and ensure that high-risk individuals receive appropriate preventive care.

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Predicting HIV Diagnosis Among Emerging Adults Using Electronic Health Records and Health Survey Data in All of Us Research Program

He Z[1], Liu Y[2], Prosperi M[2], MacDonell K[3], Naar S[3], He Z[1]

[1]School of Information, Florida State University, Tallahassee, United States, [2]Department of Epidemiology, University of Florida, Gainesville, United States, [3]College of Medicine, Florida State University, Tallahassee, United States

Background: Despite a global decline in HIV incidence, young adults aged 18-29 in the United States continue to represent a significant proportion of new HIV infections. This group is especially vulnerable due to high-risk behaviors, including unprotected sexual activity, and alcohol and substance use, which contribute to the persistent rates of infection. In this study, we leverage the All of Us Research Program's extensive electronic health records (EHR) and health survey data to build predictive models that can identify individuals at high risk of HIV. By predicting HIV diagnoses prior to clinical identification, the goal is to enable timely interventions, thereby reducing the HIV burden in this vulnerable population.

Materials and Methods: We developed several machine learning models using EHR and health survey data from the All of Us dataset, a large, diverse population database that includes health information from over one million participants, 45% of whom are from racial and ethnic minority groups. The case definition includes individuals aged 18-29 diagnosed with HIV ICD codes or a relevant personal medical history along with HIV-related lab tests or drug exposure, excluding those on pre-exposure prophylaxis (PrEP). Controls include 37,590 individuals aged 18-29 without HIV diagnosis but with diagnoses related to STIs (sexually transmitted infections), psychiatric conditions, or substance use disorders. Data were collected on demographics, diagnoses, lab results, medications, observations, procedures, and survey responses. Risky drinking behaviors were measured using the Alcohol Use Disorders Identification Test–Consumption (AUDIT-C) score, calculated from three survey questions on drinking frequency, quantity, and binge drinking.
The machine learning models utilized included Logistic Regression, Support Vector Machine, AdaBoost, Random Forest, and XGBoost. Model performance was assessed using metrics such as accuracy, F-score, and area under the receiver operating characteristic curve (AUROC). Feature importance was evaluated using Shapley values (SHAP) to interpret the contribution of each feature to the model's predictions.

Results: A balanced cohort consisting of 492 cases and 1,476 controls was used for training and evaluation to address class imbalance. Among the models tested, XGBoost performed best with an AUROC of 0.91, followed by SVM achieving an AUROC of 0.85. The SVM model was ultimately selected for further analysis due to its balanced performance across multiple metrics, along with high precision and recall. Risky drinking behaviors were among the most consistent predictors of HIV risk, along with lab tests. The SVM model performed similarly across sex categories, with an AUC of 0.84 for males and 0.80 for females, showing no evidence of gender bias despite a slightly higher male representation in the case group. The model also demonstrated high effectiveness in distinguishing between hazardous and non-hazardous drinkers, achieving an AUC of 0.85 for both groups.

Conclusions: By leveraging EHR and survey data, our SVM model provides valuable insights into HIV diagnoses among emerging adults. The identification of risky drinking behaviors and other key predictive features highlights the importance of incorporating Social Determinants of Health (SDoH) into targeted HIV prevention strategies to enhance public health interventions.

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Development of an AI Chatbot-Based Triage Solution to Support ART adherence for People with HIV

MA Y[1,2,3], Achiche S[1], Lessard D[2,3], Engler K[2], Vicente S[4], Tu G[5], Osmanlliu E[2,4], Lebouché B[2,3,4]

[1]Department of Biomedical Engineering, Polytechnique Montréal, Montreal, Canada, [2]Centre for Outcomes Research and Evaluation, Research Institute of the McGill University Health Centre, Montreal, Canada, [3]Chronic and Viral Illness Service, Division of Infectious Disease, Department of Medicine, McGill University Health Centre, Montreal, Canada, [4]Département des enseignements généraux, École de technologie supérieure, Montreal, Canada, [5]Faculty of Medicine and Health Sciences, McGill University, Montreal, Canada, [6]Faculty of Medicine, Laval University, Quebec, Canada

Introduction: Suboptimal adherence to antiretroviral therapies (ART) is a prevalent multifactorial problem associated with poorer health outcomes for people with HIV (PWH). The MARVIN chatbot provides ART-related information to help PWH self-manage HIV. However, effectively identifying ART adherence barriers to allow the chatbot to intervene with users proactively remains challenging. To address this, we developed a deep learning-based triage solution for MARVIN, enabling it to identify users facing such barriers to ART adherence and ensure they receive timely assistance.

Methods: We compiled a de-identified single-sentence corpus dataset from multiple sources. The dataset annotation process utilized a participatory design approach in which we formed a co-construction committee consisting of three healthcare professionals, three PWH, and two researchers. We conducted three 90-minute workshops to develop annotation guidelines iteratively. Between each workshop, two researchers followed these guidelines to manually annotate 10% of the entire dataset and validated their labeling reliability using the Cohen's Kappa Coefficient. One researcher completed all labeling after reliability was confirmed.

We defined two sentence-level classification tasks: I) classifying barrier domains by referencing the seven items of the I-Score, a patient-reported outcome measure of ART adherence barriers, namely 1) thoughts & feelings; 2) habits & activities; 3) social situation; 4) economic situation; 5) medication; 6) care; and 7) health; II) classifying three triage levels: low, medium, and high. With a 60%/20%/20% training/validation/testing dataset distribution, we fine-tuned several transformer-based models, including clinical language models (Bio-BERT & Bio-ClinicalBERT) and generic language models (RoBERTa-base & Flan-T5 (-small & -base)). Performance was assessed using the macro F1 average, a metric balancing precision and recall across all classes. The algorithm was then implemented into MARVIN, with relevant answers being edited by the co-construction committee.

Results: The final curated dataset contained 15597 sentences sourced from 1) raw MARVIN training data (n=3941); 2) MARVIN user conversations (n=4763); 3) qualitative data transcriptions from the "I-Score" development study (n=6328); and 4) anonymous daily health-related questions collected from the community-based organization Portail-VIH/SIDA du Quebec (n=565). The final Cohen's Kappa Coefficient was 0.83, indicating almost perfect agreement between the two annotators.

On the test sets for both tasks, both clinical language models performed less well than the generic models (macro-F1, for task I: Bio-BERT: 0.80, Bio-ClinicalBERT: 0.88, vs RoBERTa-base: 0.94, Flan-T5-small: 0.86, Flan-T5-base: 0.96; for task II: Bio-BERT: 0.89, Bio-ClinicalBERT: 0.89, vs RoBERTa-base: 0.92, Flan-T5-small: 0.91, Flan-T5-base: 0.94). The best-performing FLAN-T5-base model was integrated into MARVIN. In "high-risk" situations, all predictions prioritized recommendations to seek direct help from medical professionals. While in the "medium" and "low" risk scenarios, tailored informational interventions related to the detected barrier were provided, e.g., weekly questioning of the user about whether he/she had received medical help.

Conclusions: This triage algorithm will make our chatbot service more personalized, enhancing its proactivity to provide users with better advice and timely or even anticipatory interventions when it detects adherence barriers. This gives MARVIN the potential to better inform thousands of PWH, while actively referring more complex issues to healthcare professionals.

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HIV Case Identification through Machine Learning in Coastal Counties of Kenya

Ogolla E1, Barasa D1, Njuguna J1, Nzola J1, Lilian A1, Ahmed Z2, Masaulo P1, Simiyu T3, Obat E3 , Oyaro P1

1. USAID Stawisha Pwani 2. Department of Health Mombasa County 3. United States Agency for International Development-Health, Population and Nutrition office, Kenya and East Africa Mission

Background: The use of machine learning (ML) in risk stratification has emerged as a promising approach for efficiently enhancing HIV case identification and prevention, through increasing the precision of identifying those likely to be living with HIV and not aware of their HIV status, as well as those at high risk of acquiring HIV. This study evaluates the impact of ML-guided HIV screening on case identification in four coastal counties of Kenya through the support of USAID Stawisha Pwani project funded by USAID.

Methodology: The project employed electronic HTS (eHTS) and machine learning-based HIV risk assessments across 361 healthcare facilities in the four counties.
The ML-based screening tool used patient information, including demographic, clinical, and behavioral data, to assess HIV risk. Individuals were categorized into four risk groups: very high, high, moderate, and low risk. This stratification process was counselor-administered. The HTS counselors guided clients through the screening tool and made the final decision on the client's risk category.
Criteria for testing were based on the risk group into which an individual was categorized. All individuals in the high and very high-risk categories were prioritized for immediate HIV testing. Descriptive statistics were primarily used to analyze the data collected from October 2023 to August 2024. We analyzed the following key metrics; The number of individuals tested for HIV, Positivity rates by risk category, Initiation rates of pre-exposure prophylaxis (PrEP) among those testing HIV-Negative.

Results: Amongst the 9,938 clients screened, 3.776 (38%) were males while 6,162 (62%) were females. 34 (0.3%) were below 15 years while 9,904 (99%) were above 15 years. Upon screening for HIV risk using the ML tool and categorization into risk groups, 341 (3.4%) were identified as very high risk, 336 (98.5%) were tested and 46 (14%) tested positive for HIV. 1,423 (14%) were identified as high risk, 1,413 (99%) of them were tested and 56 (4%) tested positive for HIV. 4,658 (47%) identified as moderate-risk, 4,593 (99%) were tested and 77 (2%) tested positive for HIV. 3,516 (35%) identified as low risk, 3,383 (96%) were tested and 24 (1%) tested positive for HIV. For prevention purposes, amongst those who tested negative, 25/290 (9%), 82/1,357 (6%), 200/4,516 (4%) and 165/3,359 (5%) were screened as very high risk, high risk, moderate risk and low risk respectively and initiated on Pre-exposure Prophylaxis (PrEP).

Conclusion: Machine-guided HIV risk screening is concordant with the true risk of HIV infection of the clients served as shown by the results. The findings indicate that in resource limited settings, ML-based risk stratification can enhance the efficiency of HIV testing services, ensuring that resources are directed towards those most in need.

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Implementing AI-driven Solutions at National Scale for HIV and TB in Nigeria: Lessons from Multi-Sectoral Collaboration

Krugel A, Bhuhi P, Madubuko U, Tarhembah J, Vincent E, Adebayo O, Vincent E, Bello Raji H, Adekunle A, Daniel J, Atoi U, Nzeadibe K, Gowon J, Dickson-Nze R, Aimu R, Ochigbo C, Ugwuanyi K, Okwuonye L, Pillatar B, Daniel G, Tangkat H, Miri-Dashe T, Ezeanya C, Titus B, Murtala-Ibrahim F, Adetiba T, Okpokoro E, Olupitan O, Agbaje A, Mensah C, Dakum P

[1]*Institute Of Human Virology, Nigeria (ihvn), Abuja, Nigeria*

Background: In Nigeria, health programs addressing HIV and TB face significant challenges such as resource limitations and capacity constraints. To overcome these obstacles, digital and AI-driven solutions are being implemented to enhance program effectiveness, improving patient services and health outcomes. However, adopting these technologies at scale is often hindered by the complexity of systems, resistance to change, and a disconnect between available data and decision-making processes. This study explores the national-scale implementation of two AI-driven health solutions and their impact on program performance, drawing insights from implementers and technology partners.

Materials and Method: The study examines two core digital solutions: one focused on enhancing performance management at the individual level by providing tools for monitoring and managing staff performance, and another offering program leaders a bird's eye view of performance data with actionable insights. The implementation spanned 36+1 states, involving thousands of staff members across multiple implementing organizations. Key methods included performance data collection, AI analytics for decision support, and a structured change management approach to drive adoption. The study also integrated principles of diversity, equity, and inclusion (DEI) in the design of these solutions to ensure accessibility for all users.

Results: The implementation revealed critical success factors in achieving technology adoption, including the importance of user-friendly design, comprehensive training, and ongoing support. Despite initial challenges—such as fear of technology, change fatigue, and difficulty in aligning disparate systems—staff and managers were able to make better decisions, leading to improved health service delivery. The solutions provided key insights at both the individual and programmatic levels, helping to prioritize actions for greater impact. The adoption of the technology was further supported by a multi-sectoral approach, combining the expertise of national implementers, change managers, and technology partners.

Conclusion: When properly implemented and scaled, AI-driven solutions can significantly enhance health programs' performance in resource-limited settings like Nigeria. The study underscores the importance of viewing digital tools as enablers of decision-making rather than ends in themselves. Successful adoption requires effective technology, strong change management efforts, and a commitment to inclusivity. Lessons learned from this initiative can guide future implementations in similar contexts, highlighting the importance of collaboration and tailored solutions to overcome barriers to technology adoption in healthcare.

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Data Science Research to Predict Chronic Hepatitis B Disease Progression and Outcomes: A Pilot Study in the Gambia

Asare D[1,6], Kone I[2], Bangura R[3], Bojang L[4], Lemoine M[3,5], Bah B[1,2], Ndow G[3,5]

[1]African Institute for Mathematical Sciences, Muizenberg, South Africa, [2]Data Science Cluster, MRC Unit The Gambia at LSHTM, Fajara, The Gambia, [3]Disease Control & Elimination, MRC Unit The Gambia at LSHTM, Fajara, The Gambia, [4]Data Management & Architecture Department, MRC Unit The Gambia at LSHTM, Fajara, The Gambia, [5]Division of Digestive Diseases, Imperial College London , London, United Kingdom, [6]Division of Applied Mathematics, Stellenbosch University , Stellenbosch , South Africa

Background: Chronic hepatitis B (CHB) infection is a leading cause of morbidity and premature death in Africa. To date, there is very poor understanding on the predictors of disease outcome and mortality in Africa, and current treatment guidelines target patients who already have developed some degree of liver disease. Our study uses machine learning algorithms to test whether certain biomarkers or data patterns can predict disease outcomes using longitudinal data from the PROLIFICA program in The Gambia.

Methods: The PROLIFICA program enrolled adults with CHB infection screened from the general population. A baseline (2012-2014) and at follow-up (2018-2021), all patients had comprehensive clinical and virological assessment which included collection of epidemiological, demographic, clinical, virological (HBV), and treatment data. We grouped all patients by disease outcome at follow-up and used machine learning algorithms namely logistic regression (LR), decision trees (DT), random forest (RF), naive Bayes (NB), support vector machines (SVM), and K-nearest neighbors (KNN) to predict the mortality outcome of patients for each group, incorporating all meta-data collected.

Preliminary results: Between 2012-2014, 1,192 community-screen adults with CHB infection were enrolled in the PROLIFICA study in The Gambia. At follow-up in 2018-2021, after a median interval of 6.0 years (IQR 5.5-6.8), the overall mortality rate was 584/100,000 person-years (IQR:400-852), with baseline APRI ≥2 being a strong predictor of overall mortality (OR:7.2 (1.7-31.3), p=0.008) on epidemiological statistical analysis.
For the data science analysis, we used a different cross-validation approach to handle the large imbalanced target variable to produce optimum results. From the results, the F1-scores of LR, DT, RF, NB, SVM, and KNN, were 0.92, 0.94, 0.95,0.94, 0.90, and 0.92 respectively for predicting mortality outcome. Based on feature ranking derived from these results, the features at baseline considered significant for predicting mortality were high fibroscan score, space-occupying lesion, diagnosis of HCC, high albumin levels, high viral load, and high alanine transaminase (ALT) levels.

Conclusions: Known markers of advanced CHB and/or liver disease were identified as predictors for CHB-related mortality in this model, demonstrating model fitness. Further analysis to determine the prediction of CHB disease progression, future treatment eligibility, and outcome of treatment were also predicted.

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Leveraging AI for Preventive Strategies Against Stigma and Suicidal Ideation in HIV Self-Management

Villanueva Guzman D[1,2], Ma Y[1,2], Achiche S[1], Engler K[2], Lessard D[2], Lebouche B[2]

[1]Department of Biomedical Engineering of Polytechnique Montreal, Montreal, Canada, [2]Research Institute Of Mcgill's University Healthcare Center, Montreal, Canada

Introduction: Self-harm and suicidal ideation are significant health concerns among people with or vulnerable to HIV (PWH), who frequently experience stigma and related mental health challenges such as stress, anxiety, and depression. The AI-powered MARVIN chatbot provides HIV self-management-related knowledge and assists with medication adherence (antiretroviral therapy and pre-exposure prophylaxis). It also provides a safe space for PWH to ask sensitive questions which is amenable to mental health support. To enable MARVIN to manage high-risk messaging linked to stigma and mental health issues, we developed a preventive intervention module to address extreme user intentions.

Methods: Following the CO-STAR framework and using the one-shot learning method, ChatGPT was prompt-tuned to identify three types of message intent: self-harm, insult, and non-extreme (i.e., any other intent). To test its performance, we compiled three public hate speech databases from an online catalog (hatespeechdata.com) and combined them with MARVIN-user conversations and a synthetic dataset, resulting in 1000 sentences for each intent. We computed precision, recall, and F1 Score for each class, as well as overall accuracy. After integrating ChatGPT into MARVIN, three PWH, two engineers, and a doctor, participated in a two-hour test by performing 14 conversational scenarios and completing a two-item questionnaire on conversation clarity and user satisfaction.

Results: Through one-shot prompting, ChatGPT achieved recall rates of 97.00% for self-harm intent, 94.90% for insult intent, and 94.90% for non-extreme intent. This results in average rates for recall, precision and F1 score of 95.57%, 95.62% and 95.59% with an overall accuracy of 95.57%. The ChatGPT-MARVIN hybrid model then successfully generated appropriate responses containing 1) emergency contact information for self-harm intents; 2) messages guiding users to use stigma-free expressions for insult messages; and 3) a response reviewed by a medical expert for a non-extreme intent. All six testers found MARVIN's responses to be clear and concise and were satisfied with the overall experience. However, one patient participant suggested including links to additional resources.

Conclusion: Testing the anti-stigma preventive module integrated into MARVIN highlighted its robust ability to accurately identify extreme intents and generate clear, satisfactory responses. The results indicate that AI-driven chatbots can serve as valuable tools in creating safe spaces for users, fostering an environment conducive to open dialogue about mental health. Offering immediate assistance while encouraging healthy coping mechanisms position MARVIN as an essential component in HIV support and mental health care.

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Use of Machine Learning to Increase HIV Testing Yield Among Adolescents and Young People in Kenya

Wandina D[1]

[1]Gold Star Kenya, Karuri, Kenya

Introduction: Kenya has one of the largest HIV epidemics globally, with women constituting 62% of the 1.4 million people (15+ years) living with HIV. In 2023, Kenya had achieved 97% of the 1st 95 of the UNAIDS goals. However, the identification of HIV among adolescents and young people (AYP) remains low, at 80%. There's a need to adopt targeted testing approaches to close the AYP testing Gap, necessitating the use of artificial intelligence (AI).

Methods: A cross-sectional data review was done on outcomes of machine-aided HIV risk stratification in 95 health facilities supported by the USAID Tujenge Jamii project across 4 counties in Kenya. The program trained healthcare workers on the use of machine-aided HIV risk screening in health facilities using electronic medical records at the HIV testing points in the general population. This was done alongside the routine HTS counselors' HIV screening.

Results: Between October 2023 and August 2024 out of 93,655 clients tested for HIV 33,697(36%) were AYP aged 10-24 years, out of whom 62% were screened using machine learning with 16,867 (80%) being Adolescent Girls and Young women(AGYW) and 4,115 (20%) Adolescent Boys and Young Men(ABYM). Among the AGYW 421were classified as the highest risk with a 3% yield,2,803 were classified as high risk with a 1% yield,8,095 as a moderate risk with a 1% yield and 5,548 were low risks with a 0.4% yield. Among the ABYM, 36 were classified as very high risk with a 6% yield,482 as high risk with a 1.2% yield,1917 (0.8%) as medium risk, and 1,680(0.4%) as low risk. On average AGYW and ABYM recorded a positivity of 3% and 6% respectively. This was significantly higher than outcomes from manual screening where 23% AGYW and 12% ABYM were screened as with risk using the manual questionnaire screening with a 0.41% and 0.43% yield among AGYW and ABYM respectively.

Conclusion: The machine-aided HIV risk classification is a useful tool in improving access to HIV services. Need to scale up ML in facilities with electronic medical records.

POSTER ABSTRACT PRESENTATIONS

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Introduction of X-MAP system in bridging the evaluation gap in using AI enabled systems for active case search in Lagos, Nigeria

Osatuyi T[1], Odume B[1], Seshi M[1], Chukwu E[1], Udunze O[1], Sokoya D[2], Agboolagorite R[2], Ogboye O[2], Labaran S[3]

[1]KNCV Nigeria, Ikeja, Nigeria, [2]Lagos State Ministry of Health, Ikeja, Nigeria, [3]National Tuberculosis Programme, Abuja, Nigeria

Background and challenges to implementation: TB remains a major clinical and public health issue in Nigeria. Despite progress made in reducing the TB incidence in recent years, the TB burden is still very high. Digital Chest X-ray systems with artificial intelligence (AI) are increasingly used to screen for TB. There was a huge evaluation gap (88.9, Gap:11.1%) in Q4 2023 using only one hired radiologist for 21 AI enable systems for clinical diagnosis before the introduction of XMAP during GC7 implementation and to bridge this gap, KNCV Nigeria with funding from GF introduced the use of XMAP which is a real time application that links radiologists to radiographers for review of digital X-rays. We present a quarterly result of the field experience using DCXR (in Q4 2023) and XMAP (in Q1 2024) system in Lagos.

Intervention or response: Targeted community outreaches and facility-based screening were conducted using 3 mobile vans and 18 digital X-ray machines deployed across 20 LGAs in Lagos. Identified presumptive were tested using the GeneXpert machine, those that turned out negative and those presumptive that were unable to produce sputum were uploaded onto the XMAP platform for review by consultant radiologists. We present the results of the reviewed reports of the x-ray films uploaded between Q4 2023 and Q1 2024.

Results/Impact: Of the 2,310 films uploaded unto the XMAP platform a total of 2,309 suggestive of TB cases were evaluated and this gave a 99.9% evaluation rate (0.1% evaluation gap) compared to 88.9 evaluation rate with 11.1% evaluation gap in Q4 2023 as obtained across the 21 AI enabled systems. The XMAP platforms proves to be very efficient in TAT to review films for report to be given to clients has reduced drastically due to the number of radiologists linked to the XMAP, and this has eventually improved linkage to care (98.4% in Q1 2024, compared to 92.6% in Q4 2023).

Conclusion: Results from table A above has shown that XMAP real time reporting system is a game changer to improving clinical TB diagnosis in Nigeria and more importantly efficient in closing the evaluation gap to find the missed TB cases in Nigeria. We would also like to recommend the deployment of these new tools to KNCV supported and non DCXR states in country.

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Using New TB tools to Improve TB Diagnosis among PLHIV in Kenya

Achwoka D[1], Kabuoro S[2], Njuguna J[3], Kibera S[3], Oyaro P[3]

[1]USAID, Nairobi, Kenya, [2]Department of Health, Mombasa , Kenya, [3]USAID Stawisha Pwani, , Kenya

Background: Kenya, a high TB/HIV burden country, has made slow progress in Tuberculosis (TB) identification. Low diagnostic yields using conventional TB tools (smear microscopy, geneXpert) prompted adoption of highly sensitive Artificial Intelligence (AI) technology that included digital X-ray CAD and Truenat molecular technologies. We describe the effect and feasibility of introducing these technologies at a level three facility in Mombasa, Kenya on TB identification.
Materials and Methods
Patient-level records of People living with HIV (PLHIV) aged >15 years were extracted from National TB registers for a period of 12 months (July 2021 - December 2021 and July 2022 - December 2022) at Jomvu Model Hospital in Mombasa, Kenya. A pre-post analysis of TB outcomes that compared TB outcomes prior and post introduction of new TB tools (iNTP) in June 2022 was conducted. Descriptive analyses were included to show the characteristics of the clients served and changes in diagnostic yield.

Results: A total of 2671 patients were screened using all the 3 methods of X-ray CAD-1444 (54%), Truenat machines-1172 (44%) and smear microscopy- 55 (2%). 55 (2%) patients were screened pre iNTP (July - December 2021) and 2616 (98%) patients post iNTP (July - December 2022). (Post iNTP included outreach data). Bacteriologically confirmed (BC) TB was found in 8 (14.5%) patients pre iNTP compared with 135 (11.5 %) patients post iNTP. Majority clients in both periods were male (81%) and median age 37 years (IQR 31-43).

Conclusion: Introduction of new tools has led to increased TB identification and initiation of TB preventive therapy for PLHIV who test negative for TB. The Portable X-CAD machine has improved access for accurate TB diagnosis. With rapid test results and relatively low skill set required, scalability of iNTP could prove to be a gamechanger in the improved diagnosis and management of TB.

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Leveraging artificial intelligence in vaccine development

Olawade D[1], Teke J[1], Fapohunda O[2], Weerasinghe K[1], Usman S[3], Ige A[4], Clement David-Olawade A[5]

[1]Department of Research and Innovation, Medway NHS Foundation Trust, Gillingham, United Kingdom, [2]Department of Chemistry and Biochemistry, University of Arizona, Arizona, United States , [3]Department of Systems and Industrial Engineering, University of Arizona, Arizona, United States , [4]Department of Chemistry, Faculty of Science, University of Ibadan, Ibadan , Nigeria, [5]Endoscopy Department, University Hospitals of Leicester NHS Trust, Leicester, United Kingdom

Vaccine development stands as a cornerstone of public health efforts, pivotal in curbing infectious diseases and reducing global morbidity and mortality. However, traditional vaccine development methods are often time-consuming, costly, and inefficient.

The advent of artificial intelligence (AI) has ushered in a new era in vaccine design, offering unprecedented opportunities to expedite the process. This narrative review explores the role of AI in vaccine development, focusing on antigen selection, epitope prediction, adjuvant identification, and optimization strategies. AI algorithms, including machine learning and deep learning, leverage genomic data, protein structures, and immune system interactions to predict antigenic epitopes, assess immunogenicity, and prioritize antigens for experimentation. Furthermore, AI-driven approaches facilitate the rational design of immunogens and the identification of novel adjuvant candidates with optimal safety and efficacy profiles. Challenges such as data heterogeneity, model interpretability, and regulatory considerations must be addressed to realize the full potential of AI in vaccine development. Integrating emerging technologies, such as single-cell omics and synthetic biology, promises to enhance vaccine design precision and scalability.

This review underscores the transformative impact of AI on vaccine development and highlights the need for interdisciplinary collaborations and regulatory harmonization to accelerate the delivery of safe and effective vaccines against infectious diseases.

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Molecular Surveillance of Antimalarial Drug Resistance in a peri-urban sentinel site in Gabon from 2021 to 2023

Ndong Ngomo J[1,2,3], Niare [2], Ndong Muity [1,3], Mawili-Mboumba D[1,3], Bouyou-Akotet M[1,3], Bailey J[1,3]

[1]Département des Sciences fondamentales, service de Parasitologie-Mycologie et de Médecine Tropicale, Université Des Siences De La Santé, Owendo, Gabon, [2]Department of Pathology and Laboratory Medicine, Brown University, Providence, RI, USA, Providence, Brown, USA, [3]Centre de Recherche biomédicale en pathogènes Infectieux et Pathologies Associées, Libreville, Gabon

Malaria drug resistance is a global health concern and especially in endemic areas. The clonal expansion of resistant strains is an emergency situation for drug resistance surveillance in Gabon to inform the national malaria control program.

The objective was to estimate the prevalence of known molecular markers of drug resistance in a sentinel site and to investigate the genetic background and relatedness of K13 mutants.

Two spots of dried blood sample collected on whatmanTM from febrile children during epidemiological studies of malaria at CREIPA located in a peri-urban area of Libreville, Gabon. After DNA extraction from DBS with chelex, main drug resistance genes (k13, dhfr, dhps, crt, mdr1) and 305 SNP barcodes were captured using molecular inversion probe (MIP) and sequenced on Illumina platform Nextseq 550.Sequencing data was analyzed using the MIPTools package. We used the MIPlicorn R package to analyze drug resistance prevalence from filtered genotype data. A VCF file was generated from the barcode data to analyze identity-by-descent (IBD) and complexity of infection (COI).

On 767 blood samples, 468 (61%) were retained after quality control and exclusion of unique molecular index coverage < 5X. None validated or candidate K13 mutations associated with artemisinin resistance were detected. Nevertheless,16 samples with located in the propeller kelch domain non-synonymous mutation E433D, including 15 from 2023 and 1 from 2022 were found. The Q613H mutation was also detected in 5 isolates from 2023 and V637I in one from 2021. The mutations associated with pyremethamine resistance (C59R, N51I and S108N of the dhfr gene) appeared fixed and their proportion remained stable above 95% from 2021 to 2023. The A437G dhps mutation was also fixed but the proportion of samples homozygous for this marker fell from 92.1% in 2021 to 77.3% in 2022 and 82.8% in 2023.

The prevalence dhfr IRN haplotype by year ranged from 90.3% to 94.7%. The Quintuple mutations IRN+GE were rarely seen (5.3 - 9.7%). None sextuple mutations were found. The crt-K76T and mdr1-N86Y mutations were very rare (0.5-1.6%) as were homozygous K76T and N86Y carriers (0-1.6%). None Aamplifcaied copies of mdr1 gene were identified. Pairwise IBD analysis showed 3 independent clusters of k13 E433D mutants and only one cluster of the Q613H mutants. There, a gradual increase of the COI was observed from 2021 to 2023. COI in E433D mutants was significantly higher compared to WT ($P<0.001$).

The results of this work revealed a drastic decrease of mutations associated with resistance to quinoleine and the selection of new E433D mutations in the K13 gene in 2023. The structure analysis indicated the random appearance of the E433D and Q613H mutations in the K13 gene and higher recombination of strains carrying the E433D mutation in 2023, confirming the rebound in malaria prevalence described in Gabon.

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AI-Driven Strategies for Mpox Control: Enhancing Surveillance and Response in Africa

Olawade D[1], Ezeagu C[3], Alisi C[1], Clement David-Olawade A[4], Eniola D[5], Akingbala T[6], Wada O[7]

[1]Department of Allied and Public Health, School of Health, Sport and Bioscience, University Of East London, London, United Kingdom, [2]Department of Research and Innovation, Medway NHS Foundation Trust. , Gillingham , United Kingdom, [3]Department of Public Health, School of Health and Life Science, Teesside University, Middlebrough , United Kingdom, [4]Endoscopy Unit, Glenfield Hospital, University Hospitals of Leicester, Leicester, United Kingdom, [5]Department of Health Information Management, Rehoboth College of Health Technology, Akure, Nigeria, [6]Department of Public Health, University of Lagos, Lagos, Nigeria, [7]Division of Sustainable Development, College of Science and Engineering, Hamad Bin Khalifa University, Doha, Qatar

Mpox (Monkeypox), a zoonotic viral disease endemic to several African countries, has re-emerged as a significant public health concern, particularly in regions with limited healthcare resources. The management of Mpox outbreaks is challenged by factors such as inadequate surveillance, limited diagnostic capacity, and resource constraints.

This narrative review explores the potential of Artificial Intelligence (AI) to enhance the management and control of Mpox in Africa. AI technologies, including machine learning and predictive analytics, can significantly improve early detection, surveillance, contact tracing, case management, public health communication, and resource allocation. AI-driven tools can analyze large datasets to identify outbreak patterns, automate contact tracing through mobile data, optimize treatment plans, and tailor public health messages to specific communities. However, the successful implementation of AI faces challenges, including limited digital infrastructure, data quality issues, ethical concerns, and the need for capacity building. Furthermore, ongoing research is essential to refine AI algorithms and develop culturally sensitive applications.

This review emphasizes the need for investment in infrastructure, training, and ethical frameworks to fully integrate AI into public health systems in Africa.

By addressing these challenges, AI can play a pivotal role in mitigating the impact of Mpox and enhancing the resilience of healthcare systems against future infectious disease outbreaks. As AI technologies evolve, their role in public health will become increasingly critical, offering innovative solutions to manage emerging infectious diseases in resource-limited settings.

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Understanding Community Health and the Role of Artificial Intelligence in Infectious Disease Management: A Case Study of Chiundaponde Community in Muchinga Province, Zambia

Bwalya A[1]

[1]ministry of health, Lusaka , Zambia

Introduction: Measles is a highly contagious viral disease that poses a significant public health threat in Zambia, especially in rural areas. Despite efforts to increase vaccination coverage, measles outbreaks continue to occur, driven by factors such as low immunization rates, inadequate healthcare access, and misinformation about vaccines. In 2018, Zambia reported a resurgence of measles cases, with the under-five mortality rate at 61 deaths per 1,000 live births, highlighting the urgent need for effective disease management strategies.

Challenges in Rural Zambia: The Chiundaponde community faces numerous challenges in combating measles. Many residents live far from healthcare facilities, with only 50% of the rural population within five kilometers of a health center. This geographic barrier limits access to vaccinations and timely medical care. Additionally, Zambia suffers from a shortage of healthcare workers, particularly in rural areas, where the distribution of health professionals is inequitable. These factors contribute to the recurring nature of measles outbreaks, as many children remain unvaccinated or inadequately monitored for symptoms.

AI can play a transformative role in addressing these challenges by enhancing disease surveillance, outbreak prediction, and targeted interventions. AI models can forecast potential measles outbreaks by leveraging data from local health records, demographic information, and environmental factors. This predictive capability allows healthcare providers to allocate resources proactively, ensuring that vaccination campaigns and medical supplies are available when and where they are needed most.
AI-powered mobile health applications can facilitate early detection and monitoring of measles cases. These user-friendly tools can assist healthcare workers in diagnosing measles symptoms and tracking vaccination status within the community. For instance, an AI application could analyze symptoms reported by caregivers and suggest whether a child should be tested for measles, thereby streamlining the diagnostic process. Additionally, these applications can provide health education tailored to local languages and literacy levels, helping to dispel myths about vaccination and encourage community participation in health initiatives.
Integrating AI into local health systems also empowers healthcare workers by providing real-time data and insights. AI systems can analyze trends in disease incidence and vaccination coverage, enabling healthcare providers to make informed decisions about outreach efforts and resource allocation. Training local health workers in using AI tools can enhance their capacity to respond to outbreaks effectively, ultimately improving health outcomes in the community.

The integration of AI into health systems in rural Zambia holds immense potential for managing recurring infectious diseases like measles. By leveraging real-time data, predictive analytics, and mobile health applications, AI can enhance disease surveillance, improve vaccination rates, and empower local healthcare workers. This study underscores the need for continued investment in technology-driven health initiatives tailored to the unique challenges faced by rural communities. By addressing the barriers to healthcare access and utilizing AI effectively, Zambia can work toward reducing the burden of measles and improving overall community health outcomes. The successful implementation of AI in this context has the potential to transform public health in Zambia and serves as a model for other low-resource settings facing similar challenges.

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Adherence and retention on ART in Cross Boarder Counties. A case of Kuria East Sub county, Migori County, Kenya

Ochieng J[1], Okeyo I[2], Okeyo P[2]

[1]Ministry of health Migori County, Migori, Kenya, [2]Tukicheki Program, Migori, Kenya

Introduction: Adherence to and retention on ART are the key factors in improving treatment outcome by lowering the risk of transmission and disease progression. Kenya is near to epidemic control hence it is important to identify and address any risk factor that will reverse this gains. Sub-optimal treatment retention is one of such risks that has led to design of a campaign dubbed project "HIFADHI" i.e. HIV treatment continuity using full accountability of data, health information systems and program interventions. A strategy to help the PEPFAR program implement interventions towards preventing, detecting and addressing IIT (treatment interruption) with a goal of reducing overall IIT to less than 1% by end of FY24. Nevertheless, HIFADHI strategy has not worked optimally for cross-border areas.

A case of Migori bordering Tanzania republic where migration, intermarriage, trade, transnational sexual activities,unstable communication networks ,difference regimen guidelines and different education calender to implement OTZ are factors that can be attributed to sub optimal adherence to ART/retention .This is also replicated in Psycho-social groups with biased attendance from Kenya and inconsistent participants from Tanzania due to challenges of networks during invitations. The programmatic intervention of community ART distribution and physical defaulter tracing have not been successfully implemented for cross border clients due to diplomatic reasons.

Methodology: Desk review was conducted to analyze clients that have interrupted treatment during July 2023 to June 2024. Trends of EMR machine learning to predetermine probability of clients missing appointments. For returning clients back to treatment, we sought to use peers, expert clients and adherence counselors to trace clients.This was done by use of phone calls and physical tracing.

Result/Findings: The result revealed that as at June 2024, we had 100 patients who had interrupted treatment between July 2023 and June 2024, of which 30 were lost to follow up, 9 stopped treatment and 51 transfer out. Of the 100 IIT patients 12% had viral-load result of more than 1000 copies 16% of the clients are Tanzanian and 75% of the clients were female.Physical tracing and phone calls managed to return 32 clients to treatment. 22% of the clients returned to treatment cited that they missed treatment as a result of forgetting their appointment dates,of which 18% of them were from Tanzania. 4% of the missed appointment were due to lack of transport from Tanzania to Kenya. The result also highlighted that some clients 47% had drugs,19% had travelled and 8% were busy at work.21 clients phone calls attempt failed because of network.

Conclusion: Communication and lack of defined strategies in managing clients across boarders, Hinders optimal HIV client management

Recommendations: Cross-border management for HIV clients should be given special consideration in programming of HIV epidemic control.
Strengthen inter-country collaborations for efficient follow-up of HIV clients e.g through cross-border multi-sectorial approach and Technical Working Groups
Strengthen front-loading, profiling of clients based in risk categorizations for timely interventions in continuity of treatment
Harmonize guidelines based on equitable availability of ART commodities to enhance adherence through Transfer outs

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Development and Validation of a Machine Learning Model for prediction of Early Mortality Among HIV-Cryptococcal Meningitis patients in Uganda

Namombwe S[1], Kisakye D[1,2], Mugume A[1,2], Kakande P[2], Dai B[3], Nankoma G[2], Kintu T[2], Galiwango R[1,2], Boulware D[3], Meya D[1], Asiimwe I[6], Kiiza D[1]

[1]Infectious Diseases Institute, kampala, Uganda, [2]African Centre of Excellence in Bioinformatics and Data Intensive Sciences, kampala, Uganda, [3]Division of Infectious Diseases & International Medicine, Department of Medicine, University of Minnesota, , United States of America, [4]Department of Clinical Sciences, Biostatistics, Liverpool School of Tropical Medicine, , United Kingdom, [5]Department of Clinical Research, London School of Hygiene and Tropical Medicine, , United Kingdom, [6]The Wolfson Centre for Personalized Medicine and MRC Centre for Drug Safety Science, Department of Pharmacology and Therapeutics, Institute of Systems, Molecular and Integrative Biology, University of Liverpool, , United Kingdom

Background: Despite increased access to potent antiretroviral and antifungal therapies, Cryptococcal Meningitis (CM) remains a leading cause of HIV-related mortality in Africa. This study leveraged machine learning (ML) models to identify HIV-CM patients at risk of early mortality, facilitating early personalised management.

Methods: We utilised data from four clinical trials (NCT01075152, NCT01802385, ISRCTN72409687 and R01NS086312) of HIV-CM patients from Uganda to train and evaluate several ML algorithms including Logistic Regression Classifier, Random Forest Classifier and Catboost Classifier among others. Potential predictors were obtained from three sources 1) published predictors of early mortality in CM patients, 2) all baseline variables from the four clinical trials and 3) a small subset of routinely collected variables in resource-limited settings. To assess how the model predictions are influenced by the selection of input variables, three separate models were built, one for each predictor source. Patients were classified into two groups: "early mortality" if they died within 10 weeks of diagnosis or "survived" if they survived beyond 10 weeks. Model performance was evaluated using various metrics, including accuracy, precision, recall, F1-score, Area Under the Curve-Receiver Operating Characteristics (AUC-ROC) and Matthew's correlation coefficient (MCC).

Results: A total of 1,456 records of participants enrolled in the four clinical trials were used for model development. Among these, 729 and 727 were classified as early mortality or survived respectively. The model trained on the published predictors of early mortality in CM patients outperformed the rest of the models, achieving accuracy, precision, recall and F1scores of 0.79, 0.69, 0.85 and 0.76 for early mortality, respectively. The AUC-ROC was 0.82 and the MCC was 0.58. The top five predictors of early mortality were the Glasgow comma scale, serum sodium, weight, peripheral white blood cell count and days on ART.

Conclusion: The ML model developed using published predictors of mortality demonstrated good predictive capabilities for early mortality among HIV-associated CM patients. By providing reliable mortality risk assessments, this model could provide evidence for individualised CM management, guide post-discharge patient management, and ultimately reduce CM-related mortality. Future work will focus on deploying the model as a web-based application for use in clinical settings.

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Machine Learning Risk Stratification Compared to Manual Counselor Screening

Wandina D[1]

[1]Gold Star Kenya, Karuri, Kenya

Introduction: Kenya has one of the largest HIV epidemics globally, with women constituting 62% of the 1.4 million people (15+ years) living with HIV. In 2023, Kenya has achieved 97% in 1st 95 recording 17 681 new HIV infections. Identifying the last 3% of individuals is becoming increasingly difficult. There's a need to adopt targeted testing approaches hence growing interest in machine-aided artificial intelligence (AI). Studies have demonstrated that 4% of males and 11% of females are at high risk of infection using machine learning

Methods: A cross-sectional data review was done on outcomes of machine-aided HIV risk stratification in 95 health facilities supported by USAID Tujenge Jamii project across 4 counties in Kenya. The program trained healthcare workers on the use of machine-aided HIV risk screening in health facilities using electronic medical records at the HIV testing points in the general population. This was done alongside counselors' HIV screening, routinely comparing machine-lead outcomes and manual screening outcomes.

Results: Between April 2023 and June 2024 out of 100,000 clients tested for HIV 57,450 were screened using machine Learning where 2,374(4%) were classified as very high risk 10,683(19%) as high risk,26,455(46%) as moderate risk and 17,938(31%) low risk. From the very high risk, 217 (9%) tested HIV pos, 315 (3%) from the high risk,388 (1%) of the medium risk and 141(1%) from the low risk. The 9% and 3% positivity among the Very high risk and very risk categories were significantly higher compared to 14% client screened eligible with 530,431 clients tested by following a counselor manual guided screening tool where 5,649 (1.1%) tested HIV positive.

Conclusion: Machine-aided HIV risk classification scaleup provides an opportunity to improve HIV identification and efficiency, There is a need to scale up the use of ML in HIV testing.

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Digital Bridges: Harnessing social media to reach high risk men who have sex with men with HIV services in Ghana

Owusu S[1]

[1]*Maritime Life Precious Foundation, Takoradi , Ghana*

Issue/Background: Men-who-have-sex-with-men (MSM) in Ghana are at increased risk of HIV acquisition. However, access to essential HIV services remains a challenge. Due to barriers such as stigma, discrimination and violence, some MSM are “hidden” and engage in risky sexual behaviors but are not reached by HIV programs targeted at physical outreach locations. Knowing the disproportionate burden of HIV among this group calls for targeted interventions that align with the preferences and behaviors of MSM. Social media could be a powerful tool to bridge the gap in HIV service accessibility among high-risk MSM.

Description/Methods: Social media navigators were trained to engage hard-to-reach MSM through social networking platforms like Facebook, Badoo, Grindr and Instagram. Influencers within the MSM community also amplified health messages and fostered a sense of community engagement. IEC materials were developed and posted on selected digital platforms to raise awareness regarding HIV services among the hidden population. MSM who accessed these platforms were engaged through a one–on-one interaction and confidential online counselling. MSM recruited were given timed appointments and to access in-person services at community Drop-In-Centers.

Results: Data from September 2023 to March 2024 shows that social media reached out to more at-risk MSM than through in-person outreach. Among 178 new MSM recruited through social media, 119 had not been tested for HIV within the last six months. Physical outreach reached 446 new MSM; 142 had not been tested within the last six months. 58% of MSM recruited from social media engaged in inconsistent use of condoms for casual anal sex, compared to 41% identified at hotspots. Additionally, the HIV+ rate was higher among those tested through social media outreach compared to hotspot outreach. 130 MSM were tested through social media; 35 were diagnosed HIV+ (27% HIV+ yield). In contrast, 399 MSM were tested through physical outreach; 41 were diagnosed HIV+ (10.3% HIV+ yield).

Next Steps: Recognizing the evolving landscape of technology and communication preferences, public health initiatives must adapt to effectively engage and empower MSM communities by embracing innovative strategies, including social media outreach to bridge existing gaps in HIV services, reduce stigma, and ultimately contribute to the global goal of ending the HIV&AIDS epidemic.

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AI Youth Advocate Supporting Dagoretti Community in Nairobi, Kenya

Obuya G[1]

[1]youth advisory ccouncil, Nairobi, Kenya

Background: Digital technology has become an indispensable tool in healthcare, especially in the prevention and management of diseases. In recent years, AI has emerged as a powerful tool in disease prevention, diagnosis, and treatment. In this study, we investigated the effectiveness of using AI in disease prevention and creating awareness in the local community in dagoretti, Nairobi, Kenya.

Method: As a youth digital advocate, we conducted a literature review to gather information on the current trends and applications of AI in healthcare and how to awareness .we also conducted interviews with experts in the field to gain insights into the challenges and opportunities of using AI in disease prevention ,after that we formed 75 AI Advocate that will empower the community we conducted community dialogue with IT expert ,stakeholders, community elder ,youth and policy makers, health workers we saw is a good idea to place AI youth advocate and health worker in our local health facility to be taskforce and to help create correct information and prevention

Result: We have used AI to create targeted awareness campaigns our community, reaching a larger 4000 people with prevention information and referred to our local health facility 1500 people and increasing the impact of the message AI has help us to analyze social media and online platforms to track the spread of misinformation and rumors about diseases. By monitoring and debunking false information, AI has help prevent panic and misinformation within the community, ultimately promoting accurate health awareness and education.

Conclusion: AI has the potential to revolutionize disease prevention and awareness campaigns in the local community. However, there are still challenges to overcome, such as ensuring data privacy and security, and addressing biases in AI algorithms. As a youth digital advocate, I will continue to advocate for the ethical and responsible use of AI in healthcare to improve the health and well-being of our communities.
We need to have more AI Digital champion we our community and also national and county to adapt AI digital advocate

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Capacity Building and Regulatory Development for Artificial Intelligence in Clinical Trials in Uganda

Nanduudu A[1], Kityo C[1], Amuge P[1], Mugerwa H[1], Opolot H[2], Mutumba B[2]

[1]Joint Clinical Research Centre, Kampala, Uganda, [2]Uganda National Council Of Science and Technology (UNCST), Kampala, Uganda

Introduction: Artificial Intelligence (AI) has the potential to revolutionize clinical trials by enhancing efficiency, accuracy, and data management. While AI in clinical trials is well established in developed countries, its integration into clinical trials in Sub-Saharan Africa, particularly in Uganda, is expected soon; however, significant barriers exist, including a lack of regulatory guidelines and limited awareness among clinical trial investigators and communities regarding its applications and implications. This project aims to address these gaps through capacity-building initiatives and the development of regulatory guidelines, ensuring the safe and effective integration of AI technologies into clinical trials in Uganda while promoting acceptance.

Methods: The project comprises two stages of research, along with the implementation of capacity building and regulatory development. The first stage, a pre-implementation study titled "Assessment of Readiness and Barriers to the Integration of Artificial Intelligence in Clinical Trials: A Case Study of Uganda," will collect baseline data from key stakeholders, including investigators, patient-public involvement (PPIs), regulators, and ethics committees. The findings from this study will inform the design of targeted capacity-building and regulatory development interventions. The second stage, "Evaluating the Impact of Capacity Building and Regulatory Development for AI Integration in Clinical Trials in Uganda," will assess the project's overall effectiveness by evaluating stakeholders' preparedness and the impact of the newly established AI guidelines on clinical trial processes. The capacity-building and regulatory development activities will involve training investigators, regulators, and community representatives in the application of AI in clinical trials, while also supporting regulators in developing guidelines to govern the use of AI in clinical research.

Results: Preliminary findings from the first stage are expected to reveal key gaps in awareness and regulatory readiness, guiding targeted training programs for investigators, regulators, and community representatives. The second stage will assess the effectiveness of these interventions, measuring stakeholders' preparedness to implement and regulate AI-driven clinical trials. Anticipated outcomes from the project include:

- Improved Stakeholder Preparedness: Investigators, regulators, and community representatives will gain the knowledge and skills to effectively apply and oversee AI in clinical trials, enabling more efficient and ethical AI-driven research.
- Development of Regulatory Guidelines: Regulators will establish clear guidelines to govern AI use in clinical trials, ensuring safe, ethical, and effective application in Uganda's research landscape.
- Increased Awareness and Acceptance: Greater awareness of AI's benefits and implications will create a more supportive environment for AI integration in clinical research.
- Enhanced Capacity for Future AI Integration: The training and guidelines developed will equip Uganda to handle future advancements in AI-driven clinical trials, aligning with global standards.

Conclusion: This project aims to empower Ugandan clinical trial stakeholders by building their capacity to integrate AI technologies and develop robust regulatory frameworks, ultimately aligning Uganda's clinical research landscape with global AI standards and improving the quality, speed, and safety of clinical trials.

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Perspectives on gamification and digital platforms for enhanced training on HIV prevention strategies: a cross-sectional study among young pharmacists in Enugu, Nigeria

Ezenri G[1,2], Okibe N[1,2], Onyehalu J[1,2], Idabor C[1,2], Nwachuya C[1,2], Isah A[1,2]

[1]Person-Centered HIV Research Team, Nsukka, Nigeria,
[2]University of Nigeria, Nsukka, Nigeria

Background: Traditional interventional methods for HIV prevention strategies have often faced challenges that include effective engagement and attention retention among young people. There is a growing realization that introducing gamification and digital platforms as educational tools in HIV prevention campaigns will produce better outcomes. This study assessed the perspectives of young pharmacists in Enugu, Nigeria, on gamification and digital platforms for enhanced training on HIV prevention strategies.

Methods: This study adopted a cross-sectional design to obtain responses from 676 randomly sampled young Pharmacists in Enugu Metropolis, Nigeria, within the ages of 18–40 years in August 2023 using a validated 29-item questionnaire. Their understanding of HIV prevention strategies and the impact of gamification and digital platforms for enhanced training was assessed. Frequencies and percentages were used to summarize the study's findings. Ethical approval was obtained from the state hospital review board.

Results: A total of 532 young pharmacists responded to the questionnaire (78.7% response rate). The modal age was 18–24 years: 276 (51.9%). The majority of the young pharmacists had a bachelor's degree as their highest qualification, as expressed by 516 (97%). When asked about their understanding of HIV prevention strategies, 288 (54.1%) responded good and 120 (22.6%) responded very good. On the concept of gamification, 176 (33.1%) were familiar, and 448 (84.2%) believe that gamification can make learning about HIV prevention trainings more engaging. Almost half, 256 (48.1%) of respondents, think that a lack of modern resources is the biggest barrier for young pharmacists to taking HIV prevention training, and 312 (58.6%) of the respondents would prefer to receive HIV prevention training through gamified digital platforms.

Conclusions: The majority of young pharmacists believe gamification can make learning about HIV prevention strategies more engaging. Most young pharmacists would prefer to receive HIV prevention training through gamified digital platforms than traditional, existing methods. Stakeholders should ensure that gamification is implemented in designing future training programs on HIV prevention.

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Development and Impact of the YAhealth Digital Health Platform on Adolescents' SRHR and HIV Awareness in Rwanda

Ahishakiye A[1], Chuwa V[2]

[1]Community Health Boosters, Kigali, Rwanda, [2]UNICEF Rwanda, Kigali, Rwanda, [3]Rwanda Biomedical Center, Kigali, Rwanda

Background: Adolescents in Rwanda, comprising 24.5% of the population, face significant reproductive health challenges, including limited knowledge about HIV prevention and contraceptive use. The Rwanda DHS 2019-2020 report highlights that only 14% of young people (15-24 years) know the correct fertile period, and 5% of women aged 15-19 have childbearing experience. The COVID-19 pandemic has worsened these issues, increasing barriers to accessing SRHR and HIV information, exacerbated by stigma and judgment when seeking information and services.

Methodology: To address these challenges, Community Health Boosters (CHB), in collaboration with RBC and USAID-Ingobyi, developed YAhealth version 1.0 in 2020. YAhealth provides reliable health information across various channels, including mobile apps, an online web application, and USSD. The platform offers user-specific content on SRHR, mental health, HIV, and SGBV prevention. Initial pilot testing revealed low engagement with HIV content, indicating a need for improvement. Since 2023, Partnering with UNICEF Rwanda and the Government of Rwanda, the platform was redesigned using a Human-Centered Design approach. This involved co-designing workshops with adolescents to create engaging, youth-friendly, and non-judgmental content and app features.

Results: Following the pilot, user enrollment surged to over 24,000, validating the platform's effectiveness. The redesigned YAhealth platform, version 2.0, includes content developed and tested with adolescents and specialists from government agencies, UN agencies and partners, and validated by the Rwanda Health Communication Center. YAhealth has received recognition, winning the 2022 Innovation Hackathon and being ranked 3rd among the top eight apps promoting sexual and reproductive health in low- and middle-income countries by the National Health Institute.

Conclusions: Once finalized, YAhealth version 2.0 will fill a key gap by providing adolescents with accurate and engaging information on SRHR and HIV. By leveraging digital technology and focusing on adolescents' agency and leadership, YAhealth aims to improve access to critical health information, empower young people, and proactively manage their SRHR and HIV risks, thereby building a brighter future.

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Leveraging Digital Feedback Systems to Enhance Service Quality in HIV Care: A Pilot Study of Clientshot Across 40 Facilities in Nigeria

Vincent E, Adetola O, Ajayi O, Ekpere L, Victor N, Vincent E, Adebayo O, Bello Raji H, Adekunle A, Daniel J, Pillatar B, Adetiba T, Olupitan O, Okpokoro E, Agbaje A, Mensah C, Dakum P

[1]*Institute Of Human Virology, Nigeria (ihvn), Abuja, Nigeria*

Background: Client-centred HIV care is at the heart of quality healthcare service delivery with a focus on tailoring services to meet the unique needs of individuals, improving health outcomes, and fostering sustained retention in care. However, feedback mechanisms that can systematically capture routine clients' experiences and translate them into actionable improvements are often lacking. To address this gap, the Clientshot solution, which is one of the innovations of the Nigeria TB-HIV Reach Integration and Impact Project (N-THRIP) project funded by Global Fund, was developed and deployed across 40 healthcare facilities serving people living with HIV (PLHIV). The system allows clients to submit real-time complaints and commendations regarding their experiences, creating a dynamic feedback loop aimed at enhancing service delivery through a structured quality improvement process. This study provides the preliminary results from the pilot in 40 healthcare facilities across the four end-to-end comprehensive HIV implementation states in Nigeria.

Materials and Method: The Clientshot solution was integrated into the service framework of 40 high-volume healthcare facilities catering to people living with HIV (PLHIV). Facility managers received real-time client feedback through the platform, enabling them to assign each complaint or commendation to the relevant team members. A quality improvement (QI) framework guided the root cause identification and problem resolution processes. Key performance indicators, including the number of complaints resolved, time taken to resolve issues, and client feedback on the resolutions, were measured over a six-week period. Quantitative data regarding the level of satisfaction were exported from the backend and analyzed using descriptive statistics.

Results: In the pilot implementation of the Clientshot digital feedback system across 40 healthcare facilities serving people living with HIV, a total of 3,394 feedback entries were collected. Among these, 3,128 entries (92.2%) were classified as commendations, while 266 entries (7.8%) were classified as complaints.

The adherence counselling unit received the highest commendation rate, accounting for 843 entries (26.9%), followed by the pharmacy unit with 674 entries (21.6%). In contrast, the adherence counselling unit also had the highest number of complaints at 90 entries (33.8%), followed by the medical consultation unit with 57 entries (21.4%) and the pharmacy unit with 49 entries (18.4%). The laboratory had the least number of commendations, with 470 entries (15.0%) and 33 entries (12.4%) in complaints.

Out of the 266 complaints reported, 14 complaints (5.2%) were resolved, 4 complaints (1.5%) are currently in progress, while 248 complaints (93.2%) remain unresolved.

Conclusion: The results indicate a generally positive reception of HIV services, as evidenced by the high proportion of commendations (92.2%) compared to complaints (7.8%). However, the low-resolution rate of complaints (5.2%) highlights a significant area for improvement in addressing client concerns. The adherence counselling unit's dual role as both the highest-rated service and the highest source of complaints suggests inconsistencies in service delivery that require urgent attention.

Overall, while the Clientshot system facilitates positive client feedback, enhancing the complaint resolution mechanism is crucial for improving patient satisfaction and service quality.

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Drivers of Technology Adoption Among TB and HIV Program Implementers in Low and Middle-Income Countries: The AIM250 Experience in Nigeria

Adebayo O[1], Krugel A, Bhuhi P, Vincent E, Madubuko U, Tarhembah J, Bello Raji H, Adekunle A, Ugwoke U, Daniel J, Okwuonye L, Pillatar B, Murtala-Ibrahim F, Adetiba T, Okpokoro E, Olupitan O, Agbaje A, Mensah C, Dakum P

[1]Global Fund N-THRIP, Institute of Human Virology Nigeria, Abuja, Nigeria

Background: Low- and middle-income countries (LMICs) encounter challenges in managing TB and HIV programs, notably limited resources and infrastructure. The Accelerated Impact Methodology 250 (AIM250) initiative is one of the technological solutions approved by the Global Fund in Grant Cycle 7, Nigeria TB-HIV Reach Integration and Impact Project (N-THRIP) led by the Institute of Human Virology Nigeria (IHVN) aims to enhance individual performance management. This initiative provides tools for monitoring and managing staff performance against agreed standards, while also offering program leads an overview of performance data with actionable insights. This study explored the early adoption of AIM250 among TB and HIV program implementers in 10 pilot states in Nigeria.

Materials and Methods: A phased test approach was implemented to evaluate the adoption of AIM250 technology, focusing on data collection, performance review, and usability. State Technical Officers (STOs), sub-recipient (SR) representatives, and cluster coordinators were trained on February 27-28, 2024. The initial test phase was conducted between March and April 2024 across 10 states, each represented by one SR, without full technological integration. Manual data capture was employed, and "Test Phase Reports" were distributed to track individual and team performance. A live version was later integrated for full analytics, enabling program leads to assess implementation status and output for improved decision-making. Weekly and monthly assessments of performance standards were conducted, with performance conversations held between Cluster Coordinators/ESM Leads and STOs to identify areas for improvement. Regular review meetings captured feedback, escalations, and challenges. Monthly check-in sessions with SR Executive Sponsors and IHVN Leads facilitated discussions on compliance, and lessons learned, and ensured active involvement of SR Executives in reviewing test phase reports and supporting their teams. Evaluations measured contributions to program targets, execution of work plan activities, and adherence to supervision and training protocols, allowing for comprehensive testing of processes and identification of challenges before full-scale technology integration.

Results: The phased test approach demonstrated a significant improvement in capturing compliance. By the end of the test phase, compliance was 6% in February, 66% in March, 73% in April, and averaged 48% across all programs. This hit an all-time high of 94% in June, with a slight drop to 88% in July. Six out of the nine SRs maintained a 4-week average compliance rate above the target threshold of 80%. Performance review sessions enabled real-time feedback, leading to immediate adjustments in areas where performance standards were not met. Feedback indicated that while manual data capture posed initial challenges, it became manageable with structured performance conversations and regular check-ins. Early identification of bottlenecks, such as logistical delays in reporting and training gaps, allowed for timely interventions in preparation for full AIM250 technology implementation.

Conclusion: The phased test approach for AIM250 technology adoption significantly improved compliance and performance monitoring in TB and HIV programs across Nigeria. Regular feedback and structured evaluations identified key challenges and informed necessary adjustments, facilitating effective full-scale implementation. These positive outcomes highlight the importance of a systematic, collaborative framework for enhancing health service delivery in resource-limited settings.