Population Surveys: Measuring and Informing the HIV Response

July 1, 2021
We Welcome Your Participation

• Please use the Q&A box to submit any questions or comments you would like the speakers and panelists to address

• Please use the chat box (click ‘All panelists and attendees’) to share any thoughts or experiences you may have about the topic

• The webinar recording will be shared on the ICAP website
Population Surveys: Measuring and Informing the HIV Response

Dr. Jessica Justman, MD
Senior Technical Director, ICAP at Columbia University
July 1st, 2021
Acknowledgements

• All of the survey participants
• Ministries of health, national science authorities, national statistical bureaus, and national reference laboratories
• US Centers for Disease Control and Prevention
• US government agencies and multilateral organizations
• In-country and international partner organizations
• ICAP colleagues
• All JAIDS supplement authors
• Funding from PEPFAR
Acknowledgements

All local and international staff who worked tirelessly to conduct each survey
Origins of the Population-based HIV Impact Assessment (PHIA) Project

- Foundation of general health & HIV-focused surveys
- 2014: PEPFAR support for PHIA surveys to shape HIV responses and guide progress towards UNAIDS targets
- Each survey led by ministry of health, funded by PEPFAR through CDC, with technical support from CDC and ICAP
- PHIAs have been conducted in 15 countries
  - 5 countries have conducted multiple PHIA surveys
### Key Differences: General Health versus HIV-focused National Household Surveys

<table>
<thead>
<tr>
<th><strong>Wide range of health indicators across the general population to guide global health programs:</strong></th>
<th><strong>In-depth HIV indicators among people living with HIV recruited from general population:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maternal health and maternal and adult mortality</td>
<td>• HIV incidence and prevalence</td>
</tr>
<tr>
<td>• Child and adult nutrition</td>
<td>• Prevalence of viral load suppression</td>
</tr>
<tr>
<td>• Malaria</td>
<td>• Progress toward achievement of the UNAIDS 90-90-90 targets</td>
</tr>
<tr>
<td>• HIV prevalence, often without return of results</td>
<td>• Uptake of care, treatment and prevention services for HIV and other infectious diseases</td>
</tr>
<tr>
<td>• Domestic violence</td>
<td>• CD4 T-cell counts</td>
</tr>
<tr>
<td>• Orphans and vulnerable children</td>
<td>• Home-based HIV testing, with immediate return of results and counseling</td>
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</table>
The PHIA Project: Goal and Objectives

**Goal:** Conduct nationally representative, HIV-focused household surveys to assess the status of the HIV epidemic and the impact of national response programs

1º **objectives:**

- national HIV incidence, and
- national prevalence of viral load suppression (HIV RNA <1,000 c/mL)

2º **objectives:** subnational adult and pediatric HIV prevalence, HIV drug resistance, detectable ARVs, CD4 distribution, among others
**PHIA: By the Numbers**

- Fieldwork completed for 18 surveys
- 173,594 Households Interviewed*
- 421,572 Persons Tested for HIV*
- 12 Final Reports Released
- 65+ Conference Abstracts Accepted

*Data as of June 30th, not including MPHIA2/UPHIA2

Available now on the JAIDS website
https://journals.lww.com/jaids/pages/default.aspx

- Guest editors: Laura Porter, George Bello, Rejoice Nkambule, and Jessica Justman,
- Forward by Ambassador Deborah Birx and Irum Zaidi
- Methods: features sampling, field implementation, laboratory, and data architecture methodology
- Results:
  - HIV-1 recency testing
  - Population viral load and viremia
  - HIV incidence and male circumcision status
  - HIV awareness among men 15-59 years
Methods and Implementation

Population-Based HIV Impact Assessments Survey Methods, Response, and Quality in Zimbabwe, Malawi, and Zambia

A Comprehensive Approach to Assuring Quality of Laboratory Testing in HIV Surveys: Lessons Learned From the Population-Based HIV Impact Assessment Project

Data Architecture to Support Real-Time Data Analytics for the Population-Based HIV Impact Assessments

Improving Sampling Efficiency for Determining Pediatric HIV Prevalence in National Surveys: Evidence From 8 Sub-Saharan African Countries

Evaluating Nonresponse Weighting Adjustment for the Population-Based HIV Impact Assessment Surveys on Incorporating Survey Outcomes

Lessons From Rapid Field Implementation of an HIV Population-Based Survey in Nigeria, 2018
Methods and Implementation

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Lessons From Rapid Field Implementation of an HIV Population-Based Survey in Nigeria, 2018
Results


Population Viral Load, Viremia, and Recent HIV-1 Infections: Findings From Population-Based HIV Impact Assessments (PHIAs) in Zimbabwe, Malawi, and Zambia

HIV Incidence by Male Circumcision Status From the Population-Based HIV Impact Assessment Surveys—Eight Sub-Saharan African Countries, 2015–2017

Is Interview Length Associated With Blood Test Participation? Evidence From Three Population-Based HIV Impact Assessment Surveys Conducted From 2016 to 2017

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## HIV Population Surveys Webinar: Agenda

**9-10:30am ET**

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<th>Speaker(s)</th>
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<td>Introduction and Overview</td>
<td>Jessica Justman, ICAP</td>
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<td>Video</td>
<td>Ambassador Deborah Birx</td>
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<td>PHIA Methodology</td>
<td>Stephen Delgado, ICAP</td>
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<tr>
<td>Efficiency and Quality in Complex Surveys</td>
<td>Hetal Patel, CDC</td>
</tr>
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<td>Defining Quality in Laboratory Methods</td>
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<tr>
<td>Results</td>
<td>Christine West, CDC</td>
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<tr>
<td>Unawareness of HIV Infection Among Men</td>
<td>Mansoor Farahani, ICAP</td>
</tr>
<tr>
<td>Results</td>
<td></td>
</tr>
<tr>
<td>Population Viral Load, Viremia and Recent HIV-1</td>
<td>George Bello, Ministry of Health - Malawi</td>
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<tr>
<td>Infections</td>
<td>Rejoice Nkambule, Ministry of Health - Eswatini</td>
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<tr>
<td>Q&amp;A</td>
<td>Sabin Nsanzimana, Rwanda Biomedical Centre</td>
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<td>Panel Discussion</td>
<td>Bright Phiri, ICAP in South Africa</td>
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<tr>
<td>Closing Remarks</td>
<td>Drew Voetsch, CDC</td>
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<td>Moderator: Laura Porter, CDC</td>
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**Moderator:** Laura Porter, CDC
Thank You
Population-based HIV Impact Assessment (PHIA) Project

Survey Methods
Efficiency and Quality in Complex Surveys

1 July 2021
Overview

- Survey design and scope
- Survey response rates
- Survey methods
- Spotlight on:
  - Community mobilization
  - Survey planning and monitoring
- Survey implementation in the context of SARS-CoV-2
## PHIA Survey Design and Scope

<table>
<thead>
<tr>
<th>Sample design</th>
<th>Nationally representative, cross-sectional, multi-stage cluster sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>Powered to provide subnational-level estimates of VLS and national-level estimates of HIV incidence with prescribed precision</td>
</tr>
<tr>
<td>Eligibility criteria</td>
<td>De facto household population, variable age range across surveys</td>
</tr>
<tr>
<td>Questionnaire data</td>
<td>Computer-assisted personal interview (CAPI): household- and individual-level HIV-related indicators</td>
</tr>
<tr>
<td>Laboratory data</td>
<td>HIV rapid testing, supplemental HIV testing, viral load, CD4+, ARV, drug resistance genotyping and HIV subtyping, other biomarkers</td>
</tr>
<tr>
<td>Data analysis</td>
<td>Standardized tabulation plan with country-specific adaptation. Survey design, non-response, and non-coverage weighting.</td>
</tr>
</tbody>
</table>
Extensive Scope of PHIA Survey Data

- Data collection completed or ongoing in 15 countries
- 173,594 Household interviews
- 477,113 Individual interviews
- 421,572 Blood samples
- 12 Final Reports
- 10 Public Release Datasets
- 30+ Peer-reviewed publications
- 65+ Conference presentations and posters
## PHIA Survey Response Rates*

<table>
<thead>
<tr>
<th>Response rates (%)</th>
<th>Household interview</th>
<th>Individual interview</th>
<th>Blood collection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Average</td>
<td>90.4</td>
<td>94.1</td>
<td>87.7</td>
</tr>
<tr>
<td>Minimum</td>
<td>83.9</td>
<td>87.7</td>
<td>80.2</td>
</tr>
<tr>
<td>Maximum</td>
<td>98.9</td>
<td>99.3</td>
<td>98.5</td>
</tr>
</tbody>
</table>

*Unweighted response rates for participants ages 15-49 years in PHIA surveys conducted during 2015-2019 (except Haiti)
PHIA Survey Methods

- Community Mobilization
- Interviews
- Blood collection
- Home-based testing
- Laboratory-based testing
- Return of Results
Community Mobilization

- Essential element of high-quality surveys

- Stakeholder engagement at multiple levels:
  - National
  - Provincial/regional
  - District
  - Community
  - Household
Survey Methods, Response, and Quality

- Survey objectives
- Study design and sample size
- Eligibility, consent, recruitment
- Training
- Community mobilization
- Interviews
- Blood collection
- Biomarker testing
- Referral, return of results
- Data weighting, statistical analysis
Deployment Planning

- Selection of satellite lab sites
- Allocation and geographic distribution of field teams
- Routing and transportation logistics for samples, supplies, and staff
POPULATION SURVEYS: MEASURING AND INFORMING THE HIV RESPONSE

Near Real-time Monitoring

- Response rates
- Enrollment totals
- Sample quality
- Efficiency of data collection
- Geolocation of field teams
Data Architecture to Support Real-Time Data Analytics for the Population-Based HIV Impact Assessments

Melissa Metz, MS, Rebecca Smith, BBA, Rick Mitchell, MS, Yan T. Duong, PhD, Kristin Brown, MPH, Steve Kenchen, BS, Kiwon Lee, MPH, Francis M. Ogollah, MSc, Tafsadona Dramaneza, PhD, Yaseenul Malma, BS, Carole Moore, BS, Hetak Patel, MSc, Hannah Chung, MPH, Helecks Monga, and Stacie Saito, PhD, MIA, MSc

Background and Setting: Electronic data capture facilitates timely use of data. Population-based HIV impact assessment (PIHAs) are led by host governments, with funding from the President’s Emergency Plan for AIDS Relief, technical assistance from the Centers for Disease Control, and implementation support from ICAP at Columbia University. We described data architectures, code-based processes, and resulting data volume and quality for 14 national PIHA surveys with concurrent timelines and varied country-level data governance (2015-2020).

Methods: PIHA project teams were collected through tablets, point-of-care and laboratory testing instruments, and inventory management systems, using open-source software, vendor solutions, and custom-built software. Data were securely uploaded to the PIHA database weekly or monthly and then used to populate survey-retrieving dashboards and return timely laboratory-based test results on an ongoing basis. Automated data processing allowed timely reporting of survey results.

Results: Fourteen data architectures were successfully established, and data from more than 450,000 participants in 30,000 files across 13 countries with compiled PIHAs, and blood data producing approximately 6,000 aliquots each week per country, were securely collected, transmitted, and processed by 17 kilobyte equivalent staff. More than 25,600 viral load results were returned to clinics of participants’ choice. Data cleaning was scaled up for 98.5% of household and 99.2% of individual questionnaires.

Conclusion: The PIHA data architecture permitted secure, simultaneous collection and transmission of high-quality survey and biomarker data across multiple countries, quick turnaround time of laboratory-based biomarker results, and rapid dissemination of survey outcomes to guide President’s Emergency Plan for AIDS Relief epidemic control.

Key Words: HIV, population-based surveys, electronic data collection, data management, data architecture, PIHA

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**INTRODUCTION**

The population-based HIV impact assessment (PIHA) project, led by host governments with technical assistance from the Centers for Disease Control and implementation support from ICAP at Columbia University, in assessing the status of HIV epidemics and the impact of response efforts in select countries. Each cross-sectional, household-based survey used a 2-stage cluster design. Interviews collected demographic, behavioral, and clinical information from eligible household participants. Blood draws were conducted for home-based HIV testing and counseling and point-of-care CD4 T-cell enumeration, with results immediately returned to the participants. Blood samples that were positive for HIV underwent laboratory-based confirmatory testing. HIV incidence testing, RNA polymerase chain reaction (PCR) viral load (VLs), DNA PCR (early infant diagnoses), and serum antiretroviral drug detection. Data were weighted for survey design, and the x̄*y* interaction automatic detection methods were used to adjust for nonresponse. Additional details are available elsewhere.1,2 As of this writing, 13 surveys have been completed, and one is currently being weighed (2019-2020; Table 1).

Many studies 3,4 have discussed the advantages of electronic data collection, which was a guiding principle in designing the PIHA data architecture. The main challenge for the PIHA project was to establish a data architecture that could ensure the timely return of laboratory-based test...
Implementation of Population-based Surveys in the Context of SARS-CoV-2

- Guidelines and standard operating procedures (SOPs) for safely conducting the full spectrum of survey activities
  - Recommendations for Implementing Population-based HIV Impact Assessment (PHIA) Surveys during the COVID-19 Global Pandemic—and other documents
- Mobile phone-based staff symptom screening app
- DHIS2-based data management system for staff SARS-CoV-2-related data
Thank you!
PHIA Surveys
Defining Quality Laboratory Methods
Guiding Principles for PHIA Surveys

1. Ensuring participants receive accurate HIV test results
   - Competent staff – Rigorous and focused training
   - Quality assurance – Re-testing
   - Discrepancy resolution
   - Realtime data review

2. Arm to freezer within 24 hours
   - Tiered structure for specimen management
   - Specimen integrity – molecular testing required 24 hours
   - Quality testing
Laboratory Process

**BLOOD COLLECTION**

- Venous Blood Collection: ~4 and 10 mL (Ages 2+ years)
- Finger-prick Collection: ~1 mL (Ages < 2 years and failed venous collection)

**PROCESSING**

- Plasma aliquoting
- DBS preparation

**TESTING**

- HIV Rapid testing
- QA re-testing
- Confirmation (Geenius RT)
- CD4 testing
- Viral Load (VL)
- Early Infant Diagnosis (EID)
- LAg-Avidity
- Antiretroviral (ARV) detection
- Drug resistance

**RETURN OF RESULTS**

- HIV Rapid Testing
- CD4 Testing
- Viral load
- EID
- Drug resistance
• Tiered structure of the survey allowed maintaining of ideal specimen conditions
• Specimen collection and testing was conducted at the household level
• Daily, specimen were transported from household to satellite/mobile laboratories
• Weekly, specimens were transferred and stored at central laboratory
Laboratory Selection

**Satellite Lab:**
- 2 to 3 hours of driving distance from selected enumeration area (EA)
- Space – specimen processing, testing and storage of supplies
- Electricity and waste management

**Central Lab:**
- Capacity to perform VL and EID testing
- Long-term storage for 8 to 10 freezers (-70°C)
## Overall Specimen Quality

<table>
<thead>
<tr>
<th>Specimen Quality</th>
<th>Total (13 countries)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # of Specimens processed and stored</td>
<td>370,843</td>
</tr>
<tr>
<td>Arm to Freezer within 24 hours</td>
<td>365,759 (98.6%)</td>
</tr>
<tr>
<td>No Hemolysis/Clotting</td>
<td>370,093 (99.8%)</td>
</tr>
<tr>
<td><strong>QA Re-testing (1st 50 samples)</strong></td>
<td></td>
</tr>
<tr>
<td>Concordant results</td>
<td>99.4%</td>
</tr>
</tbody>
</table>

Bio-repository – Remaining specimens for future use (~116 freezers)
A Comprehensive Approach to Assuring Quality of Laboratory Testing in HIV Surveys: Lessons Learned From the Population-Based HIV Impact Assessment Project

Hetaf K. Patel, MSc, a, b, c, Yen T. Duong, PhD, d Sechin Barkaha, BS, MT, e Trudy Dobin, BS, f Michael Lappe, MPH, g Carole Moore, BE, MT, h Merid Dunan, MT, i Kathrine Ekman, PhD, j Julius Mangwana, MPH, k MBBS, l Bethess Way-Gordon, MD, m David Yew, Msc, n Kenisha Jackson, BS, o Robert A. Domanski, PhD, p Eric U. Yeruymi, PhD, q Shaminanigui Vudapati, PhD, r Chawnt B. Nalagmu, PhD, s MPH, t AMIUS, u Francis M. Oguttu, MSc, v Taffadouw Dooramvua, PhD, w Paul Rabindra, MPH, x MBBS, y Karampessat, Szechan, PhD, z Melissa Hett, MD, a,b,c Howard Leung, PhD, o Sarvo Sihan, PhD, a,b,c,d, x Kristal Brown, MPH, y Andrew C. Veesch, PhD, z Bhaskar S. Pradhan, PhD

Background: Conducting HIV surveys in resource-limited settings is challenging because of logistical, limited availability of trained personnel, and competency of testing. We described the processes and systems deemed critical to ensure high-quality laboratory data in the population-based HIV impact assessment and large-scale household surveys.

Methods: Laboratory professionals were engaged in every stage of the surveys, including protocol development, site evaluations, specimen acquisition, processing, collection, on-site quality assessments, microbiological testing, monitoring, analysis, and reporting. A third network of laboratories, satellite laboratories, and central laboratories, accompanied with trainings, optimized process for blood specimen collection, storage, transport, and timelines monitoring of specimen quality, and flow sheets of each testing procedure ensuring chain of custody, measurement accuracy, and high-quality testing. A plausibility review of aggregate derived data was conducted to validate associations between key variables as a final quality check to identify laboratory errors.

Results: Overall, we conducted a hands-on training for 3355 survey testers trained on various lab procedures, with 166-167 personnel trained per survey on microbiological processes, 55 training and monitoring demands, around 75% of which had adequate volume and 98.8% had on-site laboratories, indicating high quality. We implemented quality control and proficiency testing for testing, revised dispersions, validated 7000 PanC lari instruments, and monitored ward

INTRODUCTION

National, population-based HIV-mortality and sentinel surveys are designed to provide critical information about the health of a country and disease burden at national and subnational levels. HIV surveys play an important role in understanding the impact of HIV on populations and help identify target areas for prevention programs. The UNAIDS Global Targets of 95-95-95, 2020-2022, and 2025-2030 for all people living with HIV and related conditions reveal the importance of monitoring and evaluating progression and outcomes. Many countries have reported significant progress toward epidemic control, although some countries continue to see increases in some subregions and communities. Since 2004, the US President's Emergency Plan for AIDS Relief has played a major role in expanding access to HIV testing and treating antiretroviral treatment (ART) to millions of people living with HIV in more than 110 countries in Africa, Asia, and the Americas. The population-based HIV impact assessments (PHIAs) were designed to measure the global, US, and national communities and identify subnational countries. The major objectives of the PHIAs were training 3355 testers trained on various lab procedures.

~3355 testers trained on various lab procedures

*From the Division of Global HIV/AIDS Centers for Disease Control and Prevention, Atlanta, GA and CDC of Global Lab, New York, NY.
*The authors have no conflicts of interest to declare.
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### Article Title

**HIV-1 Recent Infection Testing Algorithm With Antiretroviral Drug Detection to Improve Accuracy of Incidence Estimates**

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and 
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### Background

HIV incidence calculation currently includes seroconversion data as HIV-1 incidence assay and seroconversion test results (OD. > 0.045) to a recent infection testing algorithm (RITA2). However, persons with recent infection not identified by such methods may be missed.

### Methods

Serum samples were tested for antibody using the HIV-1 Limia test (Anasys-Agility system) and the HIV-1 viral load, ARV test in each country, and ARV drug resistance. Log-linear models were used as a non-parametric density function of each age. We compared HIV-1 incidence estimates using three different RITA2 algorithms: (1) using OD. > 0.045 and RITA2 = non-convertible ARV; (2) using OD. > 0.045 and RITA2 = non-convertible ARV; and (3) using OD. > 0.045 and RITA2 = non-convertible ARV.

### Results

Of the 359 adult HIV-positive participants, 142 were diagnosed with rapid HIV testing and 217 were diagnosed with rapid HIV testing and 217 were diagnosed with rapid HIV testing. Those with detectable ARV were significantly more likely to be exposed to prior HIV-positive status (10.1% vs. 10.1%) and had higher levels of detectable ARV (17.1% vs. 17.1%) than those without detectable ARV. RITA2 viral load was lower than HIV-1 incidence. For the 19% of patients, resulting in different estimates for viral load across the 15 countries. Incidence estimates were similar using detectable or non-detectable ARV (13 vs. 14). The RITA2 algorithm provided a better estimate of recent infection than the standard incidence algorithm.

### Key Words

HIV incidence, RITA2, viral load, seroconversion.
Successful Use of Near Point-of-Care Early Infant Diagnosis in NAMPHIA to Improve Turnaround Times in a National Household Survey

Robert A. Donnadieu, PhD,1* Katrina Sicemman, PhD,2* Selvamani Savandani, MSc,2* Tajulzamor Dinamar, PhD,3* Ndaeta Fana, MSc,4* Suyaha P. Shama, MSc,4* Ligawenna N. Kudum, Lihane LC,5* Lerika K. Shathaba, RN, MPH,6* Macomela D. Dukumzi, BSc, MSc,7* Solly Stephens, MPH,7* Lydia Niesie, RN7* Melissa Metz, MS,8 Sache Sako, PhD,8 Daniel B. Williams, MSc,8 Andrew C. Fawcett, PhD,9* Hotel E. Pield, MSc,9* Bhavna S. Patel, PhD,8 and Vo T. Duong, PhD8

Background: In the population-based HIV impact assessment survey, early infant diagnosis (EID) was provided to infants <18 months without a prior diagnosis. For the Namibia Population-based HIV Impact Assessment (NAMPHIA), the CapriCORN platform was assessed for the feasibility of near point-of-care (PAC) EID testing compared with the standard Roche COBAS® HIV-1 COBAS® Test (CAPTAIN) platform. Quality assurance measures and turnaround times were compared to assess EID results reporting.

Methods: NAMPHIA participants were screened for HIV using screening tests. Determined HIV-1/2 reactive tests were retested with the CapriCORN or the standard Roche COBAS® HIV-1 COBAS® Test (CAPTAIN) platforms. Quality assurance measures and turnaround times were compared to assess EID results reporting.

Results: Of the 623 neonatal infants (68% 0-6 months), 60% were positive and 40% were negative across the two platforms included in the study. Of the 152 positive infants, 61 were found to be HIV-infected, yielding 24% sensitivity, 56% specificity, 30% positive predictive value, and 72% negative predictive value. Average measured time was 3.5 days for the Aptima test and 1.5 days for the CapriCORN compared with the standard Roche COBAS® HIV-1 COBAS® Test (CAPTAIN) platform. These results demonstrated the feasibility of near point-of-care (PAC) EID testing compared with the standard Roche COBAS® HIV-1 COBAS® Test (CAPTAIN) platform.

Conclusions: The results of the study indicate that it is feasible to implement near point-of-care EID testing in large-scale population-based HIV impact assessments.

INTRODUCTION

Of the 3 million people living with HIV in 2019, 1.8 million were children (aged 0-14 years). Access to early infant diagnosis (EID) and timely treatment leads to an increase in survival of HIV-infected children. EID criteria include a testing cutoff of infant maturity and mortality in Namibia, which continues to have one of the highest HIV-prevalence rates in the world at 22.4% (95% confidence interval: 11.1–33.7) in 2019. There has been an increasing trend in the adoption of EID criteria in Namibia. The National HIV Guidelines in Namibia recommend a routine and test the all higher risk infants defined as HIV positive to have an HIV test at 6 months minimum less than 4 months of antiretroviral treatment (ART) at the time of diagnosis, as children born to women with HIV infection with viral load (< 400 copies/mL) in the 3 months before delivery of ≤ 1:2,000; and children born to women with HIV infection diagnosed during labor and delivery, postpartum, or in the preterm maternal period. The national EID testing guidelines are based on an intensive and robust approach to infant and newborn screening and the sampling for molecular testing in a centralized laboratory, the National Institute of Pathology (NIP), in Windhoek, Namibia. This protocol requires an

Flowchart of EID Testing Process for NAMPHIA survey

1. Determine HIV-1/2 RT

   - Reactive, N=62
   - Non-reactive, N=701
   - Not exposed (Negative)

2. Satellite Lab Testing (EID Point-of-Care (PAC) Testing)
   - Xpert® HIV-1 Qual EID POC Test

3. Preliminary Interpretation (Results returned to family)

4. Central Lab Testing (EID Confirmation)

5. Final Interpretation

   - Positive Confirmed
   - Negative Confirmed
Innovations

• Improved overall PPV for diagnostic HIV testing
• CD4 testing at HH level using point-of-care PIMA instrument
• EID POC testing using GeneXpert
• Data discrepancy resolution
• Established a nationally-representative bio-repository of matching plasma and DBS specimen
• Building regional capacity via lab fellowship program
Challenges Driving Innovations

**LARGE TRAININGS**
- Increased focused training

**BLOOD COLLECTION**
- Introduced re-fresher training
- Improved messaging on amount of blood collected

**LOGISTICS AND SAFETY**
- Reviewed procurement list 6 months prior to survey start
- Local police escort

**BIO-HAZARD WASTE MANAGEMENT**
- Waste directed to nearby facilities
- Secured waste until it was discarded
Summary

Engagement of laboratory personnel and adherence to various laboratory quality measures during *all phases of survey* implementation will provide accurate and reliable data

- Planning
- Training
- Logistics (procurement, field deployment, etc)
- SOP development and review (version control)
- Monitoring
- Review of quality control for all testing methods
- Final QC check and aggregate lab data review
THANK YOU
Unawareness of HIV Infection Among Men Aged 15-59 Years in 13 Sub-Saharan African Countries: Findings from the PHIAs, 2015-2019

Christine West, PhD, MSN/MPH
Epidemiologist
CDC – Atlanta, GA
July 1, 2021
Despite higher disease burden in women, HIV outcomes are worse in men than women reflective of gaps in testing and treatment coverage.
Emphasis of HIV programs to identify men living with HIV (MLHIV)

- Men lack universal entry points for HIV testing
- Programs focus on never tested and younger MLHIV
- More strategies needed to reach MLHIV who tested negative but remain at risk for infection
Objectives

• Describe men aged 15-59 years who were unaware of their HIV+ status across 13 countries
• Identify risk factors of unawareness among MLHIV who ever tested

• The goal of the findings is to inform testing strategies to reach MLHIV who are unaware of their HIV+ status
Availability of interview and biomarker data provide opportunity to examine unawareness and testing behaviors.

Cross-sectional Household Survey

Interviews: Demographics Testing and Sexual behaviors

Rapid Diagnostic Test and ARV testing

Unawareness defined as having a self-reported negative or unknown HIV status and ARVs were not detected in the blood but tested positive during the survey.
Our analysis used data from PHIA completed in 13 countries during 2015-2019

- Nationally representative*, cross-sectional, population-based household surveys
- Two-stage, stratified cluster sampling design
- Weighted analysis using pooled data from all countries accounting for the survey design
- Frequency tables comparing HIV+ unaware, aware, and HIV negative men
- Log-binomial regression examining unawareness among HIV + unaware and HIV negative men

*Urban population only
Nationally representative
Study population:

114,776 men aged 15-59 with valid interview/biomarker data

7,430 (4.4%) HIV positive

2,052 (33.7%) Unaware of HIV + status

1,289 (63.0%) Ever Tested

107,346 (95.6%) HIV negative

5,375 (66.3%) Aware of HIV+ status*

759 (37.0%) Never tested

*Adjusted for ARVs, 390 (14%) HIV-positive men self-reported as unaware of their positive status were reclassified as being aware after ARVs were detected in their blood
While southern African countries had higher HIV prevalence in men, western African countries and Tanzania had high male unawareness.
Almost half (48%) of the men unaware of their status had a CD4 count less than 350 cells/μl*

*Data not available for Rwanda and Kenya
Most unaware men ever tested were age >25 years, reported primary education, and being married or living together.
Most men ever tested did not use a condom at last sex in the last 12 months. More unaware men than HIV negative men reported partners of positive or unknown status and two or more sexual partners in the last 12 months.
Most unaware men ever tested had not tested in the last 12 months and were uncircumcised. Unaware men ever tested were more likely to report a TB diagnosis compared to HIV negative men.
In adjusted analysis, unawareness was associated with age > 25 years, living in southern/southeastern Africa, no education, married, divorced/separated, widowed, partners of positive or unknown status, TB diagnosis, not being circumcised, and testing more than 12 months from interview.
Limitations

• Self-report of testing and behavioral factors
• Some previously diagnosed participants who were not on treatment may not have disclosed their HIV+ status
• Certain variables of interest were not available across all countries
• Application of findings may not apply in all settings due to contextual/programmatic differences between countries
• Lower response rates for men compared to women
Conclusion

• Men unaware of their HIV+ status at increased risk of poor health outcomes and need earlier engagement of HIV services.

• Identifying characteristics of unaware men who previously tested negative could improve yield of testing programs.

• Increased frequency of testing, outreach and educational strategies, improving partner testing, and availability of HIV testing during health service utilization.

• Importance of basic prevention measures, such as condom use and VMMC.
Acknowledgements

Co-authors

PHIA field teams

PHIA study participants

Ministries of Health

ICAP HQ and ICAP Malawi

CDC HQ and CDC Country offices

WESTAT

Other PI/collaborating institutions

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Link to manuscript: https://journals.lww.com/jaids/Fulltext/2021/08011/Unawareness_of_HIV_Infection_Among_Men_Aged_15_59.14.aspx
Population Viral Measures and a Recent HIV Case at Enumeration Area Level

Farahani¹, M., Radin¹, E., Saito¹, S., Sachathep¹, K., Manjengwa¹, J., Balachandra², S., Low¹, A., Duong¹, Y., Jonnalagadda², S., Patel², H., Voetsch², A., Hladik², W., Hakim², A., Ahmed¹, N., Musuka¹, G., Tippet Barr², B., Wadonda-Kabondo², N. W., Auld², A., Jahn², A., Williams², D., Barradas², D., Payne², D., Bello³, G., Mugurungi⁴, O., Parekh², B., Hoos¹, D., Justman¹, J.

1: ICAP at Columbia University; 2: U.S. Centers for Disease Control and Prevention (CDC); 3: ITECH-Malawi; 4: Zimbabwe Ministry of Health and Child Care

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UNAIDS Goal and Targets

Goal: To end the AIDS epidemic by 2030

Targets:

- 90% diagnosed
- 90% on treatment
- 90% virally suppressed by 2020

More PLHIV on ART
Lower plasma VL
Lower HIV incidence
• Encouraging findings from the first round of Population-based HIV Impact Assessment (PHIA) surveys.

• VLS among those on ART range from 73.7% in Cote d’Ivoire to 91.4% in Eswatini.
Concerns for Internal Validity in Early Studies

• Many studies used different measures of aggregate VL to evaluate the ART programs and as a proxy for HIV incidence since 2009

• Limitations and biases in previous studies:
  
  Ecological fallacy
  Sampling bias
  Missing data
  Not including HIV prevalence in the model
  Only those with a known HIV status were included

Concerns for External Validity in Recent Studies

• Recent studies showed population VL and prevalence of viremia are correlated with HIV incidence

• Hard to extrapolate to the general population:
  
  Certain locations (rural KwaZulu-Natal, South Africa; 22 cities in India)

  Populations (PWID and MSM)


Research Question

Is there an association between population viral load and viral load suppression and the probability of at least one recent HIV-1 infection in the surveys’ smallest geographic sampling unit (an enumeration area)?
Methods

Nationally representative, cross-sectional data from PHIA surveys in Zimbabwe, Malawi, and Zambia.

Two-stage stratified cluster sample:

1\textsuperscript{st} : EAs from the latest census

2\textsuperscript{nd} : randomly selected a sample of households in each EA
Enumeration Area Sample Size

- **Total data collected**: 1,510 EAs across the three surveys

- **Included in this study**: 1,374 EAs (91%) with at least one HIV+ adult who consented to an interview and blood draw.

- Average household per EA: 28

- Total of 58,366 adults aged 15-59 years, 58.6% female.
<table>
<thead>
<tr>
<th>Number of recent HIV cases at EAs</th>
<th>Malawi</th>
<th>Zambia</th>
<th>Zimbabwe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>405 (94%)</td>
<td>406 (91%)</td>
<td>463 (94%)</td>
<td>1,274 (93%)</td>
</tr>
<tr>
<td>1</td>
<td>27 (6%)</td>
<td>40 (9%)</td>
<td>27 (5%)</td>
<td>94 (7%)</td>
</tr>
<tr>
<td>2</td>
<td>1 (0.2%)</td>
<td>2 (0.5%)</td>
<td>2 (0.4%)</td>
<td>5 (0.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>433</td>
<td>448</td>
<td>492</td>
<td>1,373</td>
</tr>
</tbody>
</table>
Definitions of Viral Load Aggregate Measures

- **Population VL**: the arithmetic mean of $\log_{10} VL$ in all PLHIV in the EA, irrespective of whether they were aware of HIV status

- **Unaware VL**: the arithmetic mean of $\log_{10} VL$ in individuals with HIV in an EA unaware of their HIV status

- **In-care VL**: the arithmetic mean of $\log_{10} VL$ of all HIV-positive persons in-care

- **Prevalence of viremia**: the prevalence of individuals with HIV in the EA with HIV RNA $>1000$ c/mL.
## Summary Statistics

<table>
<thead>
<tr>
<th>Measures</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age of the female population in the EA</td>
<td>31  (29-33)</td>
</tr>
<tr>
<td>Median age of the male population in the EA</td>
<td>31  (29-33)</td>
</tr>
<tr>
<td>Proportion of people ever tested HIV in the EA</td>
<td>77% (71-82)</td>
</tr>
<tr>
<td>HIV prevalence at EA-level</td>
<td>14% (9-20)</td>
</tr>
<tr>
<td>Prevalence of awareness of HIV status among PLHIV</td>
<td>75% (57-91)</td>
</tr>
<tr>
<td>ART coverage among PLHIV</td>
<td>67% (50-72)</td>
</tr>
<tr>
<td>Prevalence of VLS among PLHIV</td>
<td>67% (50-83)</td>
</tr>
</tbody>
</table>
## Viral Load Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>[95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean log10 VL of those on ART</td>
<td>0.7</td>
<td>0.03</td>
<td>0.6 – 0.7</td>
</tr>
<tr>
<td>Mean log10 VL of those unaware of HIV status</td>
<td>2.7</td>
<td>0.06</td>
<td>2.4 – 2.7</td>
</tr>
<tr>
<td>Mean log10 Population VL</td>
<td>1.9</td>
<td>0.04</td>
<td>1.8 – 2.0</td>
</tr>
<tr>
<td>Prevalence of viremia &gt; 1000 c/mL</td>
<td>36%</td>
<td>0.06</td>
<td>35 – 37</td>
</tr>
</tbody>
</table>
Correlation Between PVL/Unaware VL and a Recent HIV Case

Adjusted predicted probability of a recent HIV case at EA

Mean log10 of VL
Correlation Between 90-90-90 Indicators and a Recent HIV Case

Adjusted predicted probability of a recent HIV case at EA

Probability of a recent HIV case at EA

- Awareness of HIV status
- ART coverage
- VL suppression

Prevalence at the EA(%)
Correlation between Different levels of Viremia and A Recent HIV Case

- Prevalence of Viremia with ≥VL 1000 copies/ML: Adjusted Odds Ratio = 5.3
- Prevalence of Viremia with ≥VL 400 copies/ML: Adjusted Odds Ratio = 4.3
- Prevalence of Viremia with ≥VL 40 copies/ML: Adjusted Odds Ratio = 3.4
Interpretation

• Half a log higher in the mean log of PVL increases the predicted probability of having a new HIV case by 13%

• When prevalence of VLS rises from 40% to 60%, the predicted probability of new HIV infection at enumeration area level drops by 26%.
Conclusion

• We found a strong association between PVL and VLS prevalence with recent HIV-1 infection at the EA level in three southern African countries with similar generalized HIV epidemics.

• These results suggest expanding and maintaining high levels of VLS may be key to HIV epidemic control in these three countries.
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- Lauren Williams

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- Desmond Maminimini
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- Mathews Kagoli
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- Sheila Bandazi
- D. Kabambe
- R. Mwenda

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## Q&A Log

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am interested to know if PHIAs include any question on STIs. Thanks</td>
<td>Yes, we included question on STI symptoms. In addition, we tested for Syphilis (Zimbabwe, Zambia, Uganda, Tanzania, Ethiopia, Kenya); HBV (Zambia, Uganda, Tanzania, Cameroon, Ethiopia, Kenya, Rwanda, Nigeria); and HCV (Tanzania, Rwanda)</td>
</tr>
<tr>
<td>I have failed to understand why the PHIA’s sample from regions proportional to their size rather than at a set sample size, as the DHS does. I believe it’s because national level estimates of incidence will be self weighting if we sample from regions proportional to size, but are we not compromising the subnational estimates of HIV prevalence if we sample this way? That’s what seemed to happen in the 2016 Tanzania PHIA. TZ has ~30 regions, but only 10 had samples large enough to yield robust HIV prevalence estimates. Seems like we are prioritizing national-level incidence over subnational prevalence estimates. Would others agree? If so, it seems to me that the subnational prevalence estimates are actually more useful at country level, when designing programs</td>
<td>Answered live during Q&amp;A</td>
</tr>
<tr>
<td>“Questions on implementation of PHIA surveys in the context of COVID-19. 1. About daily symptom screening - How is the effectiveness and efficiency of the daily symptom screening? - Was this supplemented by COVID-19 testing? How frequently? 2. Managing training and field work - Any reported cases of COVID-19 among the field team? - How the training and fieldwork have been managed in situations where field team gets sick? - Any reported deaths of COVID-19 among the field team? 3. Managing households/participants - How you have approached a participant who is in isolation/quarantine?”</td>
<td>Mitigation such as social distancing, masking, disinfection and pre-training/pre-fieldwork COVID-19 testing is implemented throughout all parts of the survey including training and field works. Our field teams and lab staff work in bubbles, meaning they don’t have contact with other teams or other lab shifts. This reduces the risk that multiple teams or shifts will be impacted. All PHIA field, lab, and survey management staff submit daily COVID-19 symptom screening through an app on their phone. When a person screens positive for COVID-19 symptoms, they are immediately isolated and their team/lab shift/close contacts quarantined while the person is tested. This allows us to prevent further spread. And in countries where vaccination is available, we have worked with the government to get staff vaccinated. We do not screen individuals or households for COVID-19 but instead assume any household we enter could have a member who is infected. If the household tells us they are in isolation/quarantine, we will not proceed at that time, but we assume all households may be a source of asymptomatic spread and focus on maintaining a high level of precautionary measures at all times.</td>
</tr>
</tbody>
</table>
Q&A Log, cont’d

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) With regards to universal entry points for men as strategy to optimize testing for HIV, any recommendation?</td>
<td>Self-testing, men’s clinics, community-based testing, and partner testing have shown promising results for men to increase yield</td>
</tr>
<tr>
<td>Unawareness among males is still a problem, I have noticed that most of countries are busy on Covid19 but HIV infection is emerging following lockdowns. What are you doing as ICAP to support small initiatives (especially in LMICs) to tackle the new HIV infection?</td>
<td>Addressed live during Q&amp;A and more details will be shared in next webinar on conducting population-based surveys during COVID-19</td>
</tr>
<tr>
<td>2) Can say Pop based survey is successful and can COVID-19 testing and vaccination benefit from this approach?</td>
<td>Addressed live during Q&amp;A and more details will be shared in next webinar on conducting population-based surveys during COVID-19</td>
</tr>
<tr>
<td>How to put in place strategies to involve men in HIV prevention knowing that they are the economic supports of the family in limited in Africa for example</td>
<td>Thanks for the question. Prevention efforts that countries can take to involve men in planning/education in male friendly settings is key as well as access to these services in different communities and in places that men frequent and work. Especially men who may migrate away from the home for work, workplaces also have a role to play (mining, trucking, fisheries, etc.) to provide these services (condom access, education)</td>
</tr>
<tr>
<td>Great endertaking! The 90% analysis for VL suppression is at the 1,000 copies/ml treshold. Have you done the analysis at the treshold of 20 copies/ml or 50 copies/ml? Thank you.</td>
<td>Our lowest detection level at that time was 40 copies. We did not analyze the data at 20 or 50 copies/ml, but I guess the results would be similar to what we found at 40 copies/ml.</td>
</tr>
<tr>
<td>Can you tell us how many individuals who SELFREPORTED HIV were actually NEGATIVES? This is important to support (or not) the new WHO recommendation of 3 HIV consecutive positive tests for confirm HIV status</td>
<td>Yes. The number of these across multiple surveys is small. In most countries it was less than 2%</td>
</tr>
<tr>
<td>Thanks to our great presentation and PHIA initiative across the content on how far we are towards HIV epidemic control. Acknowledging that HIV testing as any other disease control program is the entry point to effective treatment and since PHIA surveys managed to integrate national HIV testing algorithms and Genenius to confirm all positives, please comment on what is the level of quality of HIV testing from the PHIAS and what needs to be improved if any or best practices observed from countries. Thanks again</td>
<td>Thank you Richard for the feedback. The overall PPV of all national testing algorithm is pretty high. In most cases, this was greater than &gt;98%. The quality issues were minor and resolved via discrepancy resolution.</td>
</tr>
</tbody>
</table>
August 2021 JAIDS Supplement
Available Now

‘HIV Population Surveys: Shaping the Global Response’

https://journals.lww.com/jaids/toc/2021/08011

The webinar recording will be shared on the ICAP website