NHLS Data Strategy

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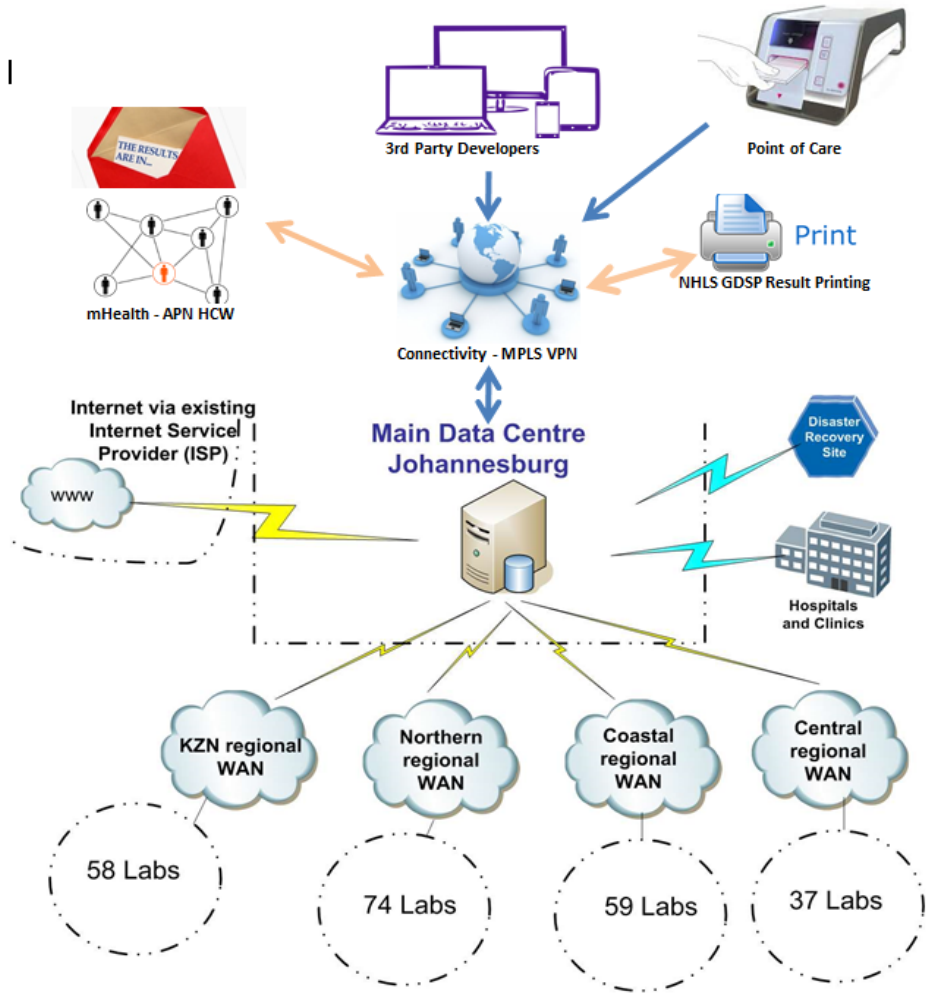
NATIONAL HEALTH LABORATORY SERVICE

Introduction

- NHLS has a unique repository of laboratory information
  - The data is representative of pathology information for +/- 80% of the South African population
- 270+ sites across South Africa
- Single Laboratory System
- Single Data Warehouse



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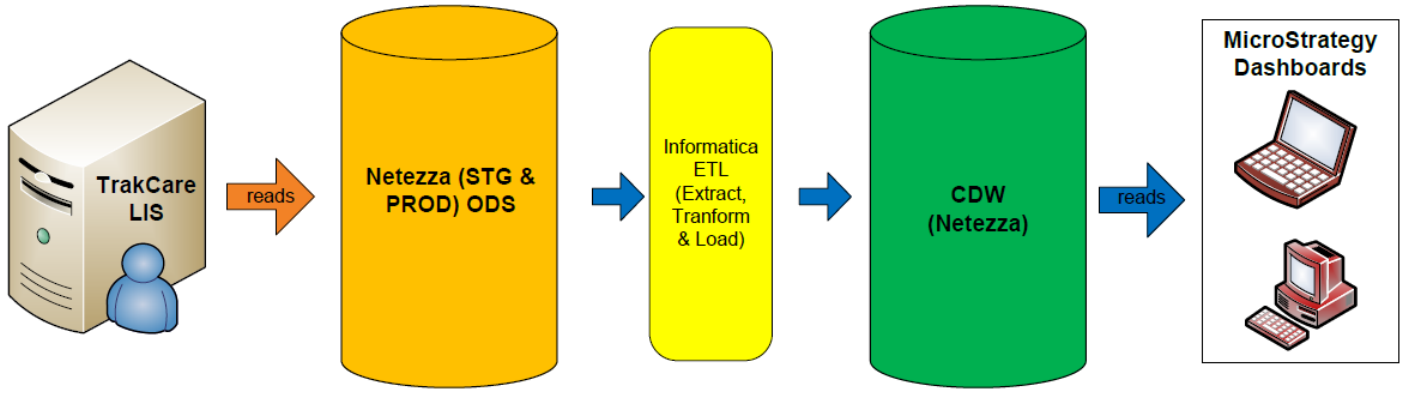
Laboratory Information Systems



- TrakCare Lab
  - used in all labs in NHLS, NICD and NIOH
- Country-wide since Oct 2015
- Technical
  - Application hosted on Citrix Application servers
  - Supported by Caché Database
  - Uses Ensemble Integration engine
- Network
  - To all sites
  - MPLS implementation
  - SITA CAP connection

- All instruments are interfaced through a LIS (4 regional centers and connected through wide area network)
- CDW raw data is aggregated
- A disaster recovery site is based within 20km.
- Hospital information systems (HIS) use HL7 protocol and interface to the data center.
- All patient laboratory results are made available to HCW via an internet service provider (ISP) such as www.labresults.nhls.ac.za.
- Virtual private networks (MPLS VPN) and other network traffic are routed for mHealth, point of care, SMS printer devices, etc

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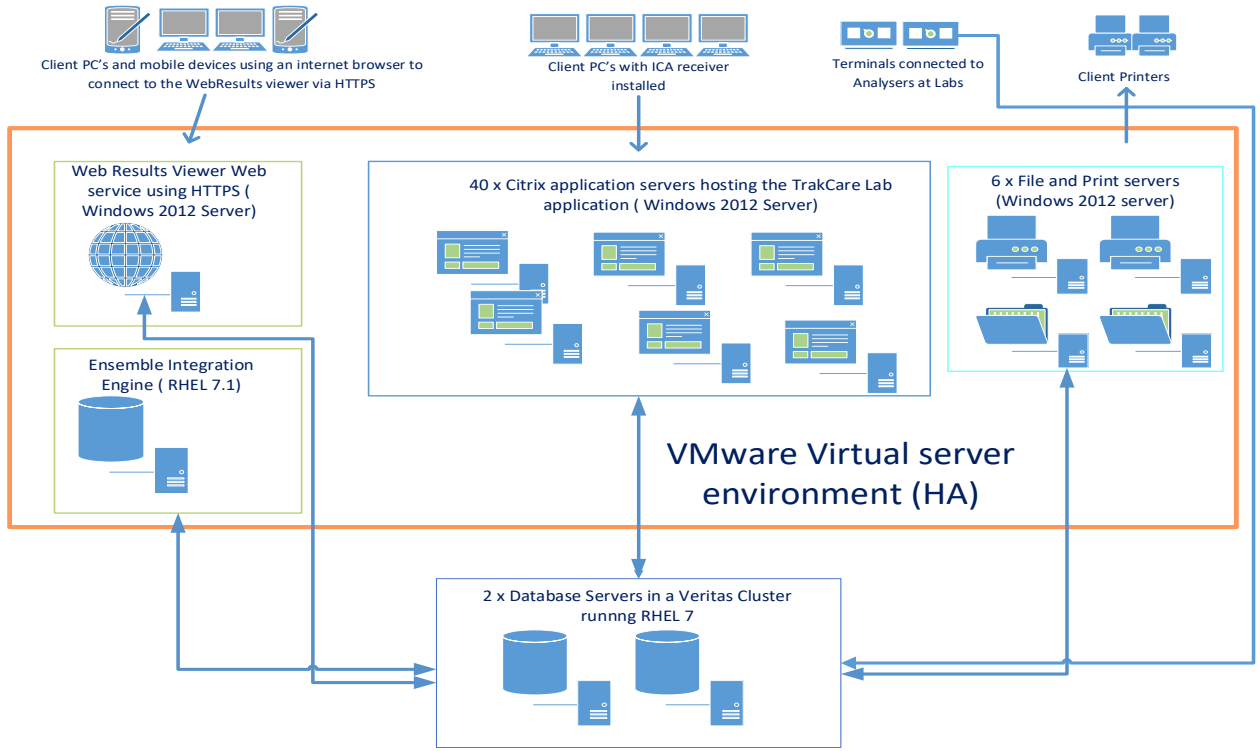
Information held in CDW

- Laboratory information:
  - Disa*Lab – legacy laboratory information system
  - TrakCare Lab – new laboratory information system
  - Information from private laboratories
- Business Information
  - Financial information
  - Lab staffing information
- National statistics
  - Population statistics
  - Prevalence surveys (e.g. antenatal HIV)
  - DHIS information



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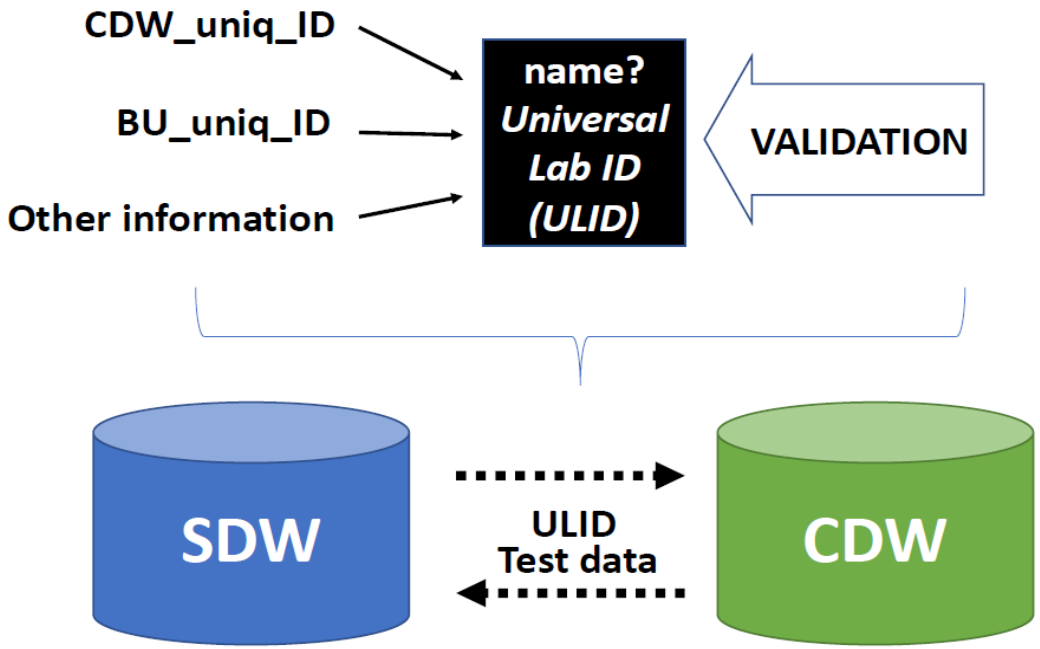
Surveillance and Corporate data warehouse

In future: Algorithm integration into SDW and CDW



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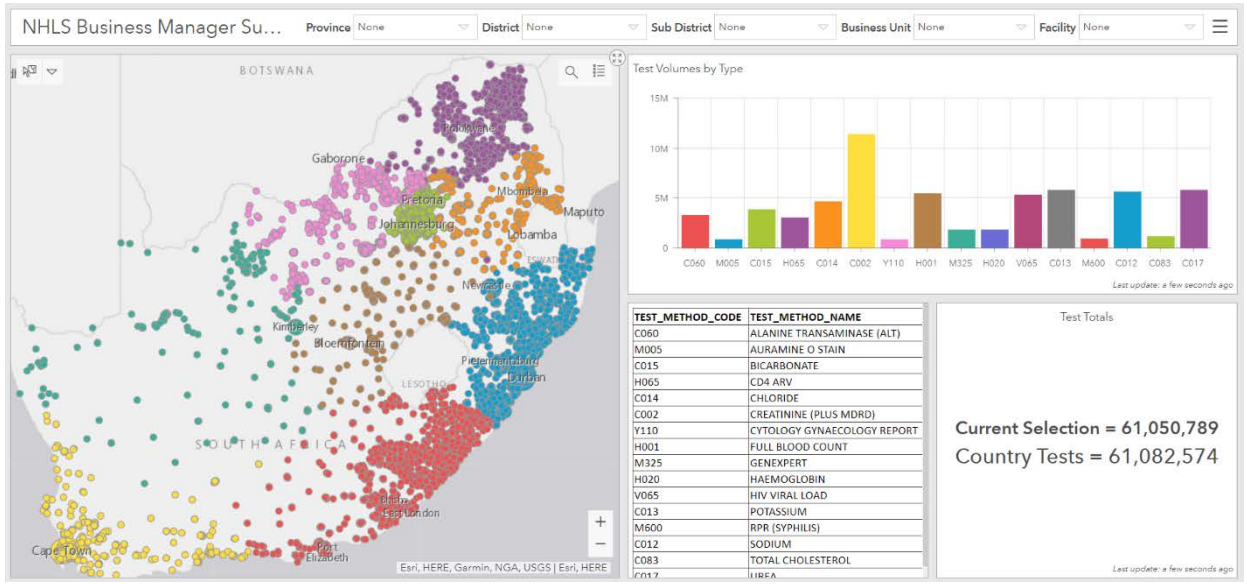
Data Capabilities

- Process +/- 300 million raw data records per month
- Perform extensive data cleansing and transformation
- Record linking – Laboratory information systems are specimen-centric and therefore need to build a patient or case view of the data
  - Implemented data linking program
  - Uses fuzzy logic to evaluate demographic attributes and assign a probabilistic % match
  - Automatically allocates a patient identifier to all matches scoring above a given threshold
- Reporting - analytical, formatted, integrated spatial & dashboard reporting is available



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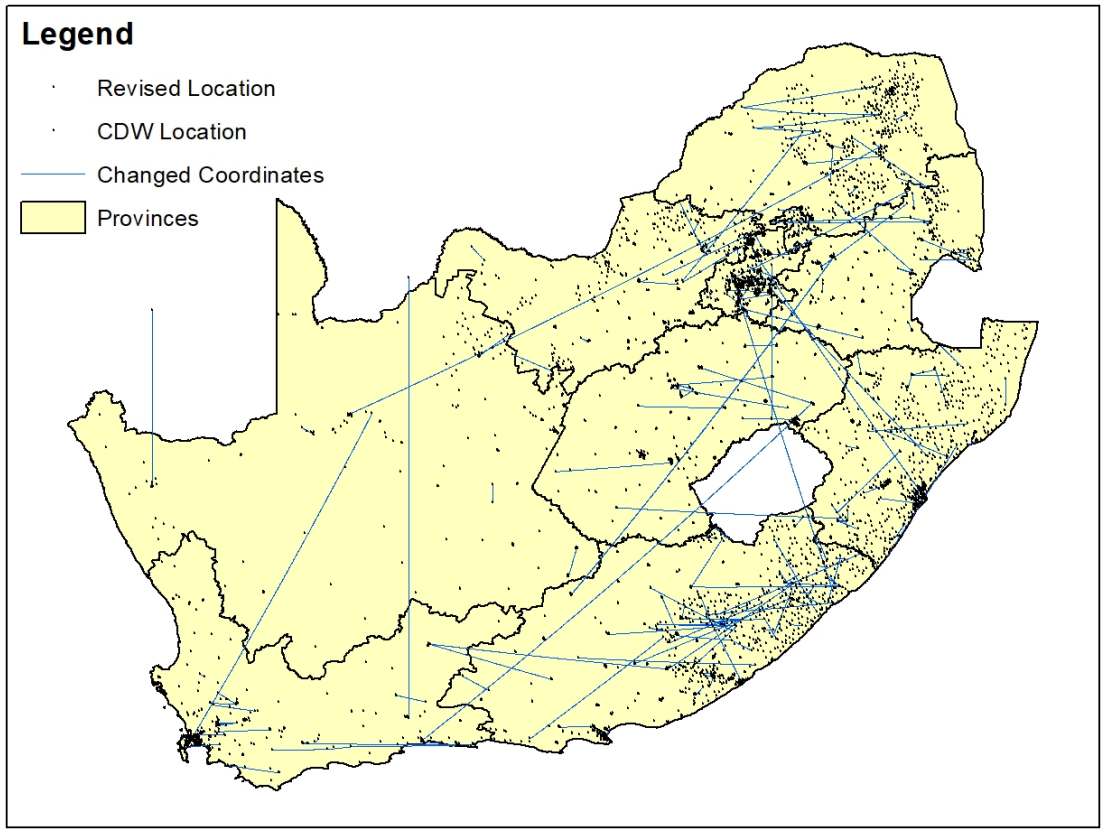
Facility coordinate cleaning



- **Process in constant Evolution**
- **Simple exercise of mapping**: clinics, laboratories, drive time, volumes, results, TAT, analyzer volumes
- **Service Mapping Network**: logistics: route selection, physical location, GIS
- Mapping all this into an **LIS/LIMS**
- Mapping **instruments, tests and test codes** to LIS
- Mapping demographics and result to location **(LIMS)**
- **Added layer of Sophistication**
- Mapping to a **Central Data Warehouse** (CDW)
- "**Geospatial mapping**": fixed and now mobile

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Across the National Priority Program

80% population, networked, instruments interfaced -1 LIS

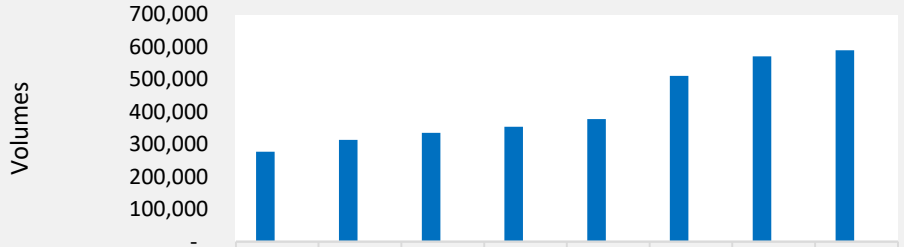
HIV Viral Load

	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18
FY_Volumes	1,219,1	1,655,4	2,047,7	2,599,5	3,018,3	3,782,0	4,508,6	5,048,2
FY_Volumes_Increase		35.79%	23.69%	26.95%	16.11%	25.30%	19.21%	11.97%

Total Volumes to date: 23,879,266

Financial Year

HIV PCR

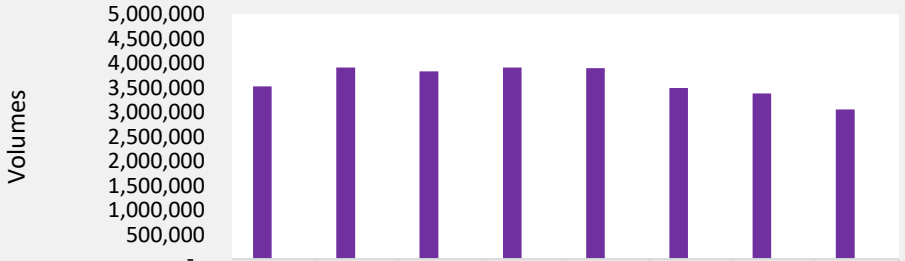


	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18
FY_Volumes	277,092	314,393	335,597	353,976	378,037	510,791	571,812	590,301
FY_Volumes_Increase		13.46%	6.74%	5.48%	6.80%	35.12%	11.95%	3.23%

Total volumes to date: 3,331,999

Financial Year

CD4 Count

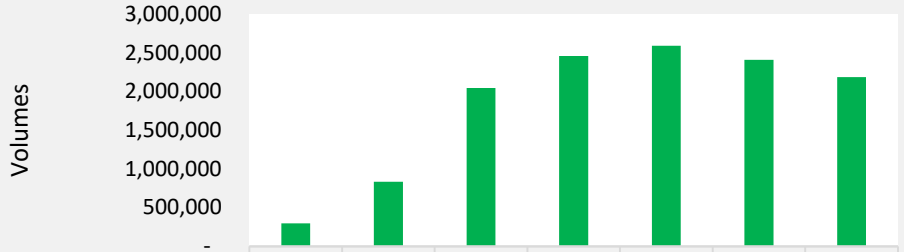


	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18
FY_Volumes	3,533,0	3,914,6	3,838,5	3,915,2	3,904,7	3,497,0	3,389,4	3,058,2
FY_Volumes_Increase		10.80%	-1.94%	2.00%	-0.27%	-10.44%	-3.08%	-9.77%

Total Volumes to date: 29,051,003

Financial Year

Xpert MTB/RIF

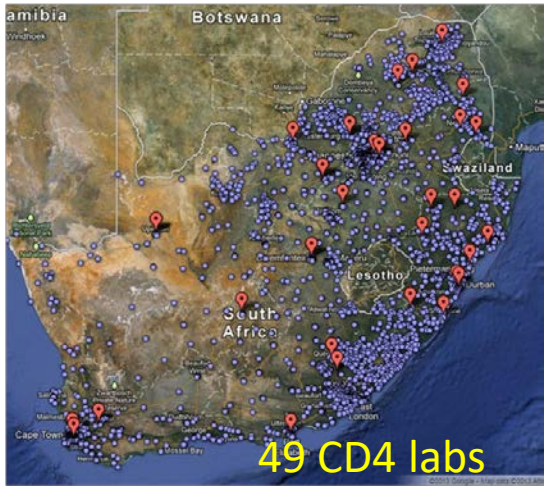


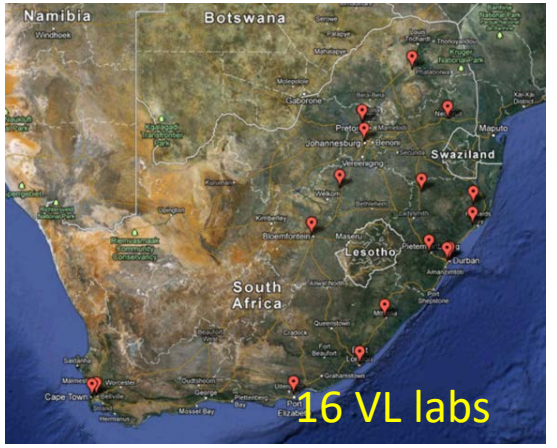
	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18
FY_Volumes	296,501	835,164	2,048,7	2,463,9	2,593,5	2,412,2	2,188,8
FY Volumes Increase		181.67%	145.31%	20.26%	5.26%	-6.99%	-9.26%

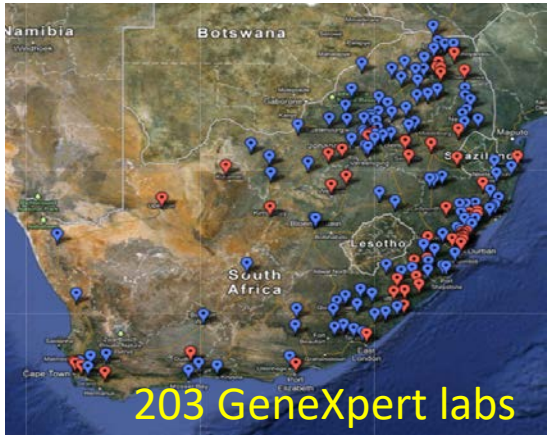
Total Volumes todate: 12,838,921

Financial Year

NATIONAL HEALTH LABORATORY SERVICE
National Priority Programmes

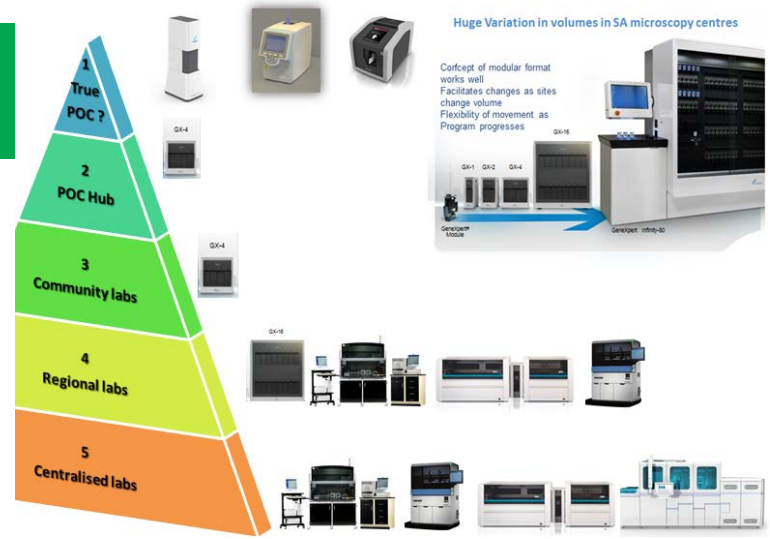


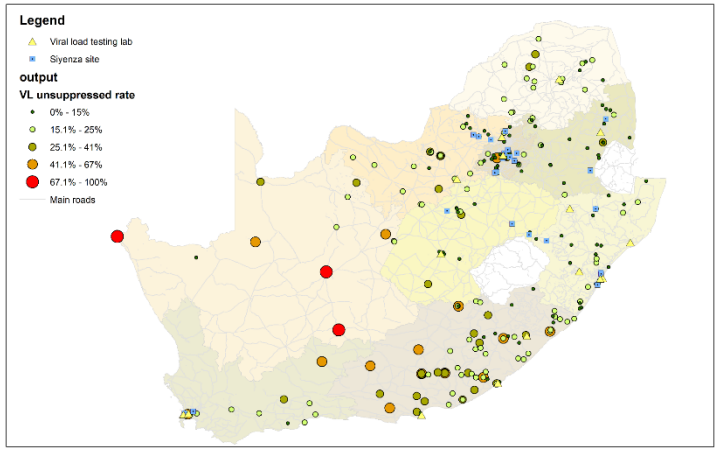


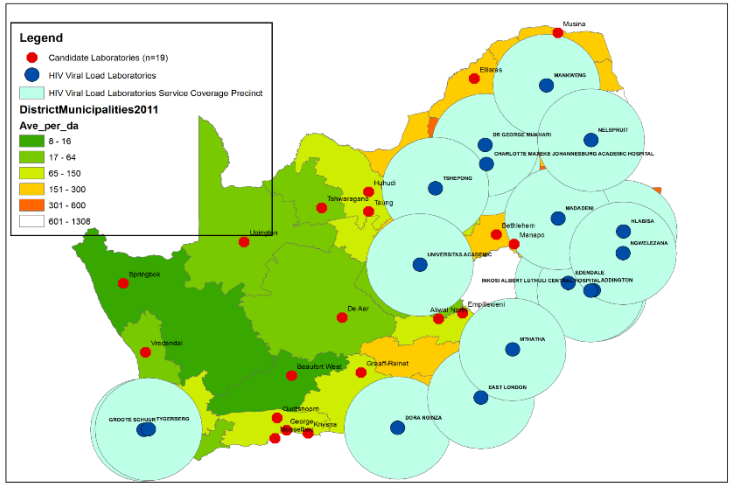


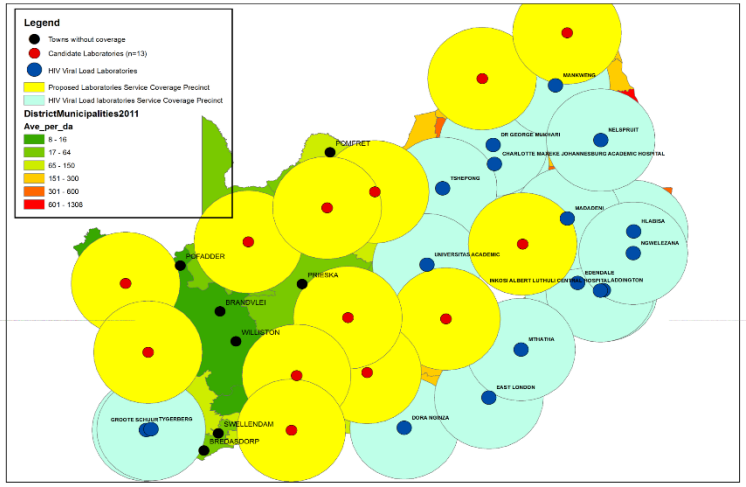
Data applications beyond result reporting

- Operational dashboards
- Surveillance
- Gaps in services (coverage)
- GIS mapping for route optimization
- Placement of instruments within the tiered laboratory framework
- Placement of POC
- HIV Longitudinal cohort development (program success)
- Integrate HIV/TB cohort
- Molecular granularity for TB control









Program value

NATIONAL HEALTH LABORATORY SERVICE

M&E Geographic Distribution (All Ages)

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES

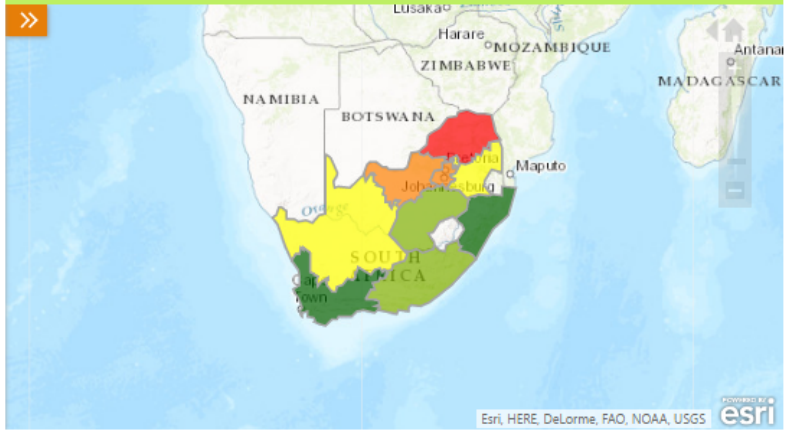
Year: 2016 | Quarter: Q2 2016 | Month: Apr 2016 | Age Range: All Ages

National | Provincial | NHI

CD4

CD4 <= 100 | CD4 <= 200 | CD4 <= 350 | CD4 <= 500

Add data | Tools | Map | Bar Graph

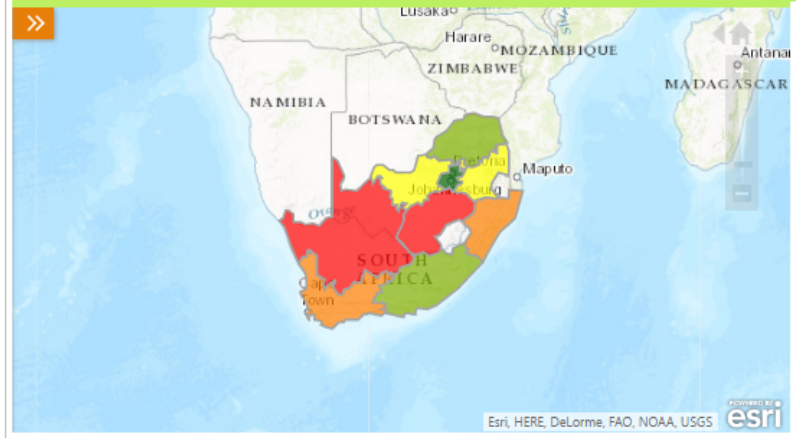


		Total		<= 100					
Province		Current	LY	Current	LY	Delta	%	% LY	
Eastern Cape	EC	33,008	29,327	3,142	2,934	208	9.5	10.0	⇧
Free State	FS	15,946	14,922	1,579	1,364	215	9.9	9.1	⇧
Gauteng	GP	63,182	55,424	6,896	6,606	290	10.9	11.9	⇧
KwaZulu-Natal	KZN	94,082	88,504	6,755	6,043	712	7.2	6.8	⇧
Limpopo	LP	21,075	19,909	2,695	2,403	292	12.8	12.1	⇧
Mpumalanga	MP	27,618	27,555	2,808	2,469	339	10.2	9.0	⇧
North West	NW	19,109	18,556	2,028	1,897	131	10.6	10.2	⇧
Northern Cape	NC	5,400	5,242	538	465	73	10.0	8.9	⇧
Western Cape	WC	20,298	21,195	1,820	1,537	283	9.0	7.3	⇧
Total		299,718	280,634	28,261	25,718	2,543	9.4	9.2	

VL

VL <= 1000 | VL > 1000

Add data | Tools | Map | Bar Graph

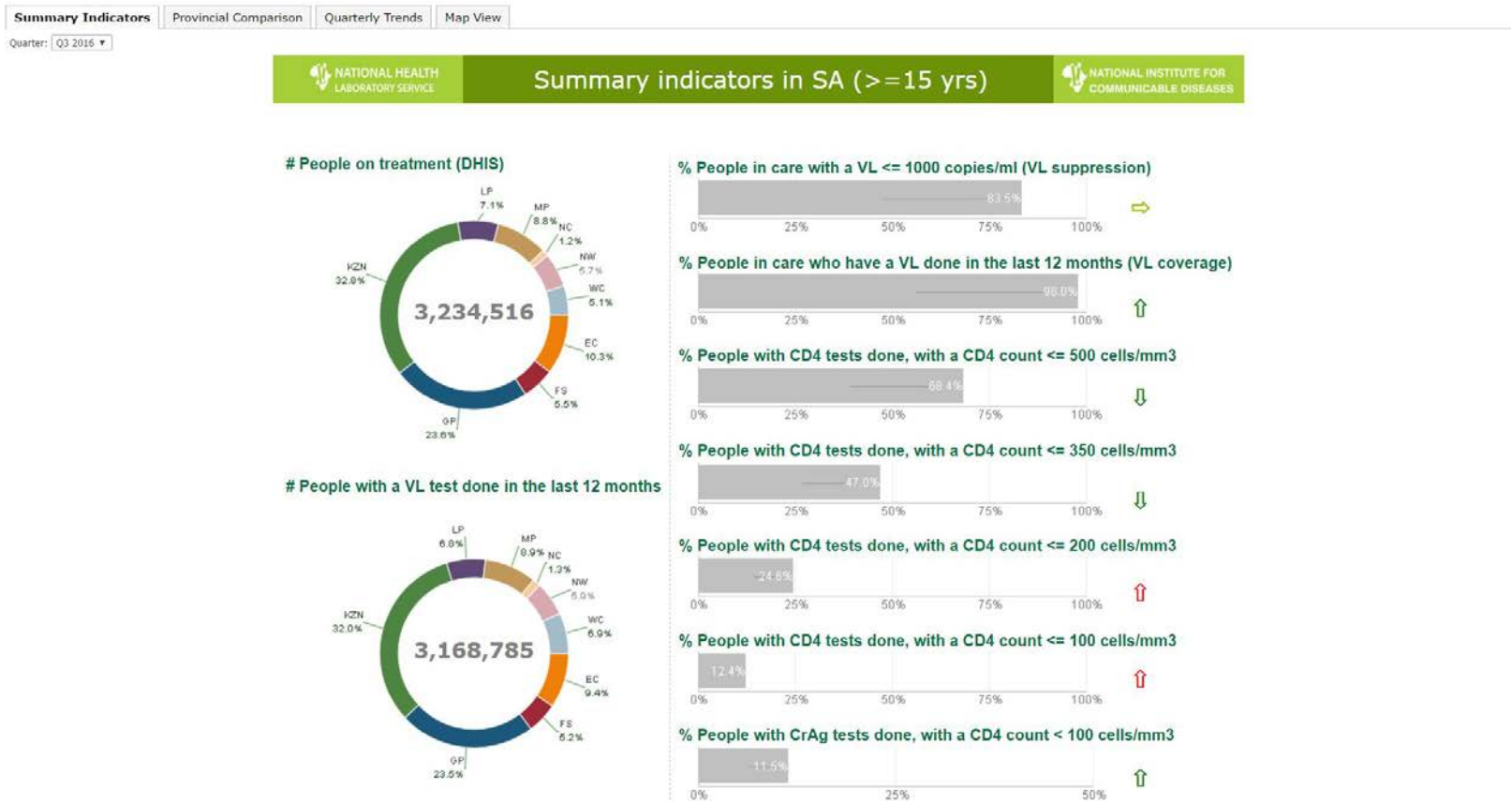


		Total		<= 1000					
Province		Current	LY	Current	LY	Delta	%	% LY	
Eastern Cape	EC	37,979	27,090	11,927	5,767	6,160	31.4	21.3	⇧
Free State	FS	21,279	15,077	1,832	1,235	597	8.6	8.2	⇧
Gauteng	GP	86,094	54,409	32,121	11,772	20,349	37.3	21.6	⇧
KwaZulu-Natal	KZN	104,101	83,979	17,454	12,686	4,768	16.8	15.1	⇧
Limpopo	LP	31,383	20,788	8,144	4,958	3,186	26.0	23.9	⇧
Mpumalanga	MP	33,517	28,652	7,684	7,733	(49)	22.9	27.0	⇩
North West	NW	21,361	15,838	4,463	3,307	1,156	20.9	20.9	⇧
Northern Cape	NC	5,013	4,201	460	626	(166)	9.2	14.9	⇩
Western Cape	WC	24,568	17,922	4,663	10,233	(5,570)	19.0	57.1	⇩
Total		365,275	267,956	88,748	58,317	30,431	24.3	21.8	

CD4/VL MONITORING DASHBOARD launch 2016

health Department: Health REPUBLIC OF SOUTH AFRICA | USAID FROM THE AMERICAN PEOPLE | PEPFAR | Right to care Treating Health Seriously | NATIONAL HEALTH LABORATORY SERVICE | NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES Division of the National Health Laboratory Service | BOSTON UNIVERSITY

Program value



CD4/VL Monitoring Dashboard launch 2016

health Department: Health REPUBLIC OF SOUTH AFRICA

USAID FROM THE AMERICAN PEOPLE

PEPFAR

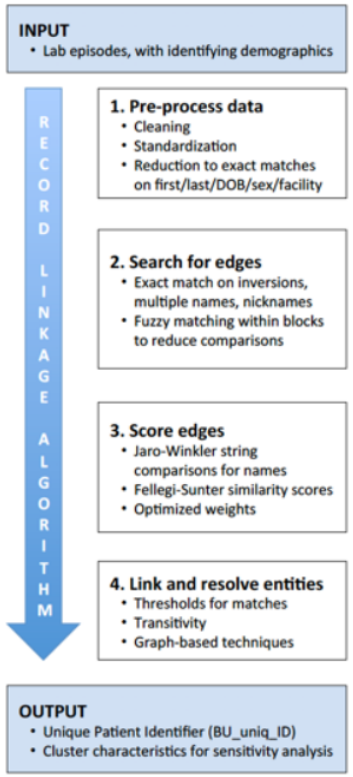
Right to care Treating Health Seriously

NATIONAL HEALTH LABORATORY SERVICE

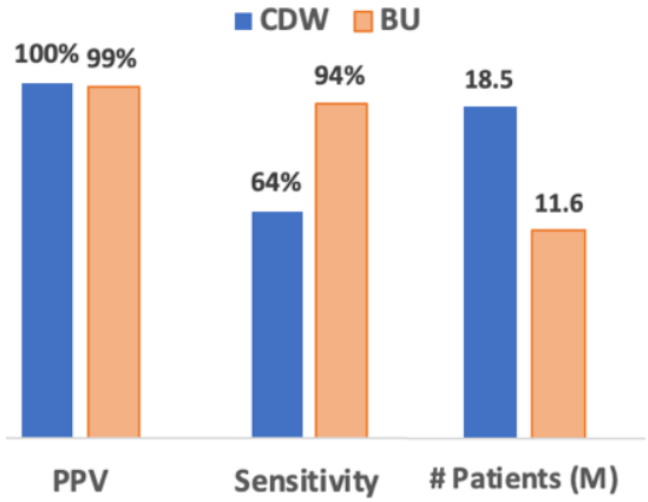
NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES Division of the National Health Laboratory Service

BOSTON UNIVERSITY

Building the NHLS National HIV Cohort



National HIV Cohort	
# Lab Tests	98 M
# Specimens	71 M
# Patients	11.6 M
# on ART	4.2 M



Building a National HIV Cohort from Routine Laboratory Data: Probabilistic Record-Linkage with Graphs

bioRxiv

Jacob Bor, William MacLeod, Katia Oleinik, James Potter, Alana T. Brennan, Sue Candy, Mhairi Maskew, Matthew P. Fox, Ian Sanne, Wendy S. Stevens, Sergio Carmona

doi: https://doi.org/10.1101/450304

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Research using the cohort (example 1)

Clinical Infectious Diseases

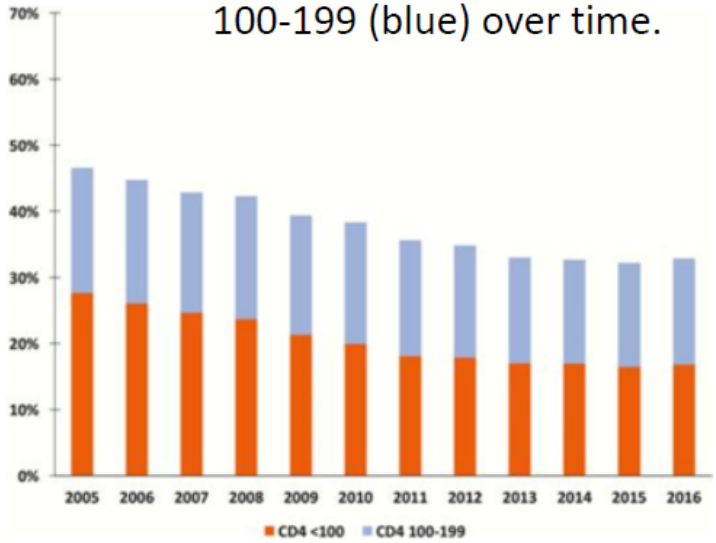
Persistent High Burden of Advanced HIV Disease Among Patients Seeking Care in South Africa's National HIV Program: Data From a Nationwide Laboratory Cohort

Sergio Carmona ✉, Jacob Bor, Cornelius Nattey, Brendan Maughan-Brown, Mhairi Maskew, Matthew P Fox, Deborah K Glencross, Nathan Ford, William B MacLeod

Clinical Infectious Diseases, Volume 66, Issue suppl_2, 1 April 2018, Pages S111–S117, https://doi.org/10.1093/cid/ciy045

Published: 04 March 2018

Figure shows the share of patients presenting with CD4<100 (red) and CD4 100-199 (blue) over time.



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Research using the cohort (example 2)

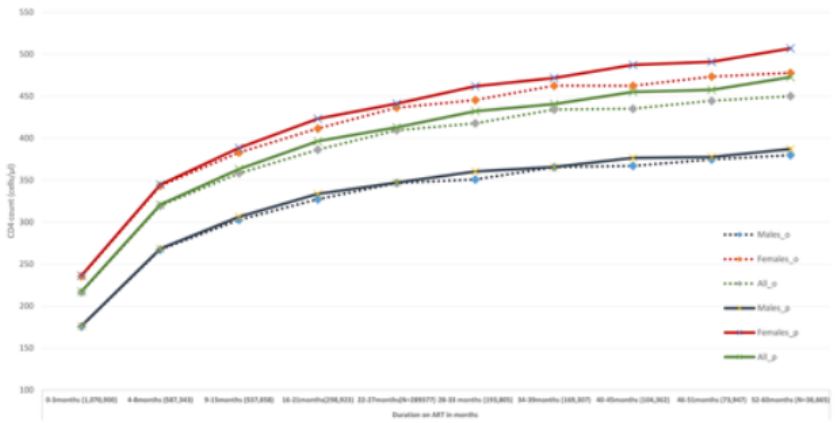
PLOS ONE

RESEARCH ARTICLE

CD4 count recovery and associated factors among individuals enrolled in the South African antiretroviral therapy programme: An analysis of national laboratory based data

Tendesayi Kufa[1,2*], Zara Shubber[3], William MacLeod[4,5], Simbarashe Takuva[6], Sergio Carmona[7], Jacob Bor[4], Marelize Gorgens[3], Yogan Pillay[8], Adrian Puren[1,9], Jeffrey W. Eaton[10], Nicole Fraser-Hurt[3]

Figure shows CD4 trajectories among men (bottom), women (top), and both (middle) on ART



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Research using the cohort (example 3)

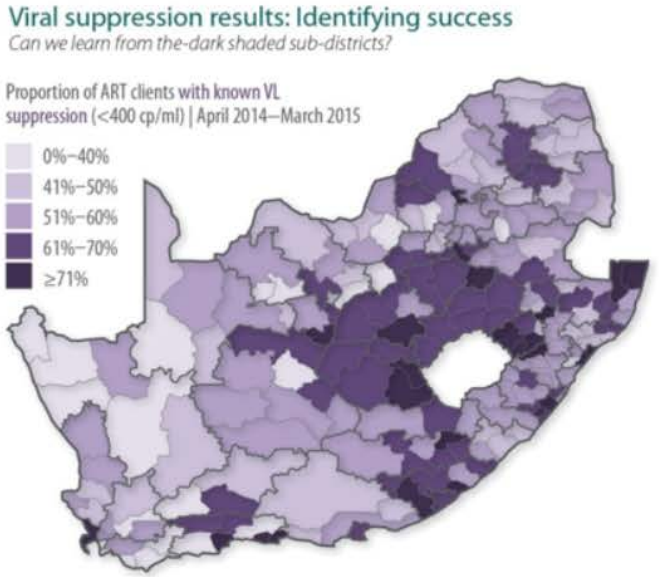
Analysis of Big Data for better targeting of ART Adherence Strategies

Spatial clustering analysis of viral load suppression by South African province, district, sub-district and facility (April 2014 – March 2015)

November 2015

health
Department:
Health
REPUBLIC OF SOUTH AFRICA

WORLD BANK GROUP
Health, Nutrition & Population



William MacLeod, Jacob Bor, Kathryn Crawford, and Sergio Carmona
with NDOH and World Bank collaborators

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Research using the cohort (example 4)

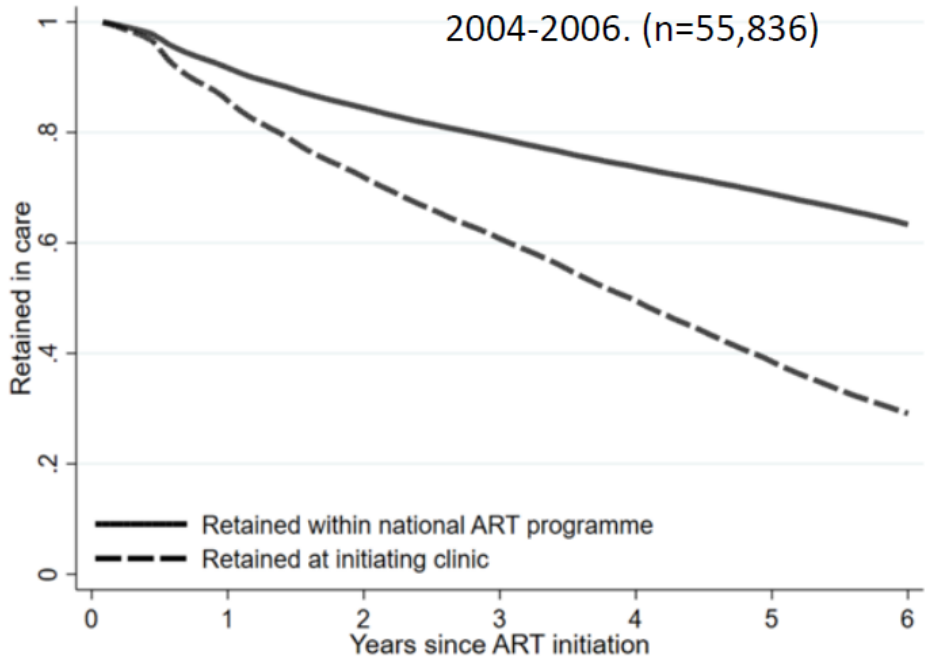
PLOS | MEDICINE

RESEARCH ARTICLE

Estimating retention in HIV care accounting for patient transfers: A national laboratory cohort study in South Africa

Matthew P. Fox[1,2,3]*, Jacob Bor[2], Alana T. Brennan[2,3], William B. MacLeod[2,3], Mhairi Maskew[3], Wendy S. Stevens[4,5], Sergio Carmona[4]

Figure shows effect of patient transfer on retention estimates in South Africa among patients starting ART in 2004-2006. (n=55,836)



IONAL HEALTH
RATORY SERVICE

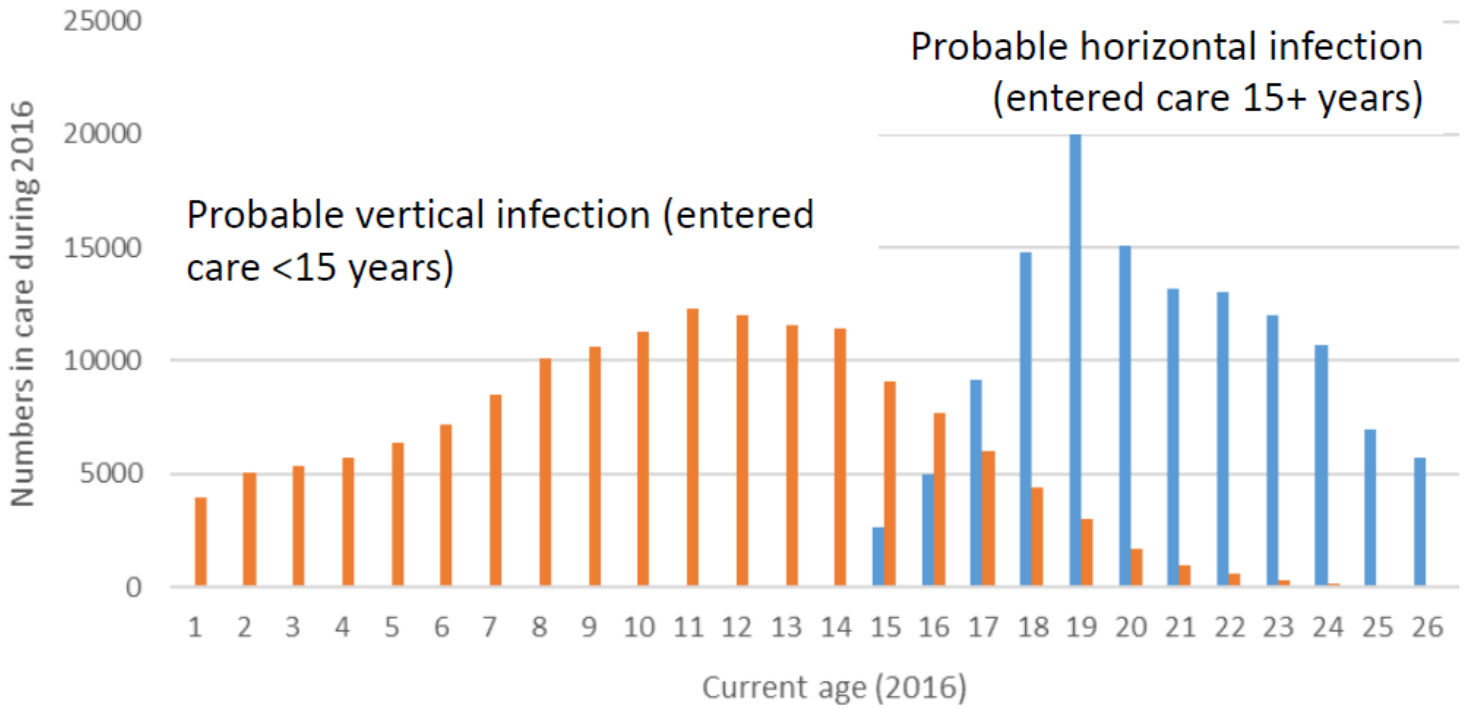
Research using the cohort (example 5)

The Adolescent HIV Treatment Bulge in South Africa's National HIV Program: a Retrospective National Cohort Study

Mhairi Maskew, Jacob Bor, William MacLeod, Sergio Carmona, Gayle G. Sherman, Matthew P. Fox

In press

THE LANCET HIV



Extensions of the HIV cohort linkage

1. How does the algorithm perform for other conditions?
   - Ongoing work with the NPP and NICD TB groups to link and validate for TB (BU/WITS R01 under review)
   - Recently funded work with Jaya George and Nigel Crowther to look at NCDs (Alana Brennan K01)
   - Research opportunities to look at HIV/TB/NCD multi-morbidity
2. Can performance be improved for infant and paediatric cases?
   - Ongoing work with Gayle Sherman
3. Can the algorithm be integrated into real-time linkage in the data warehouse, and how does it perform when scaled to all conditions?
   - Ongoing work with NICD
   - For pragmatic reasons, pilot at SDW, then move to CDW if successful

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Potential future opportunities

- Can NHLS National HIV Cohort be linked to TIER and other data sources to build integrated cohort to improve surveillance/research?
  - We have proposed some pilot work
- Can algorithm be leveraged to improve delivery of patient care?

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Lots of Potential for Collaborative Research

- Here are some focus areas: (Are these the right ones? Are there others?)

1. VL monitoring and treatment outcomes
2. Paediatric HIV and pregnancy cohort
3. HIV drug resistance
4. HIV advanced disease
5. TB and HIV/TB co-infection
6. Non-communicable diseases
7. Data linkages and technical

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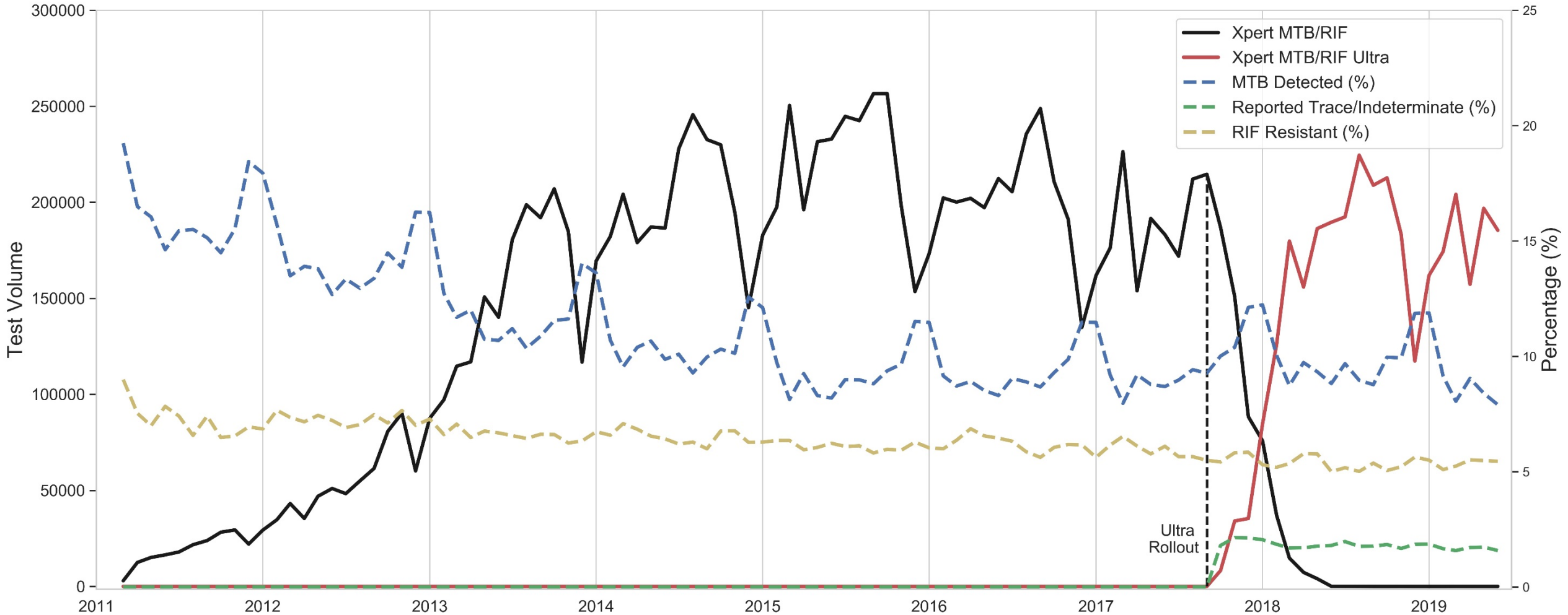
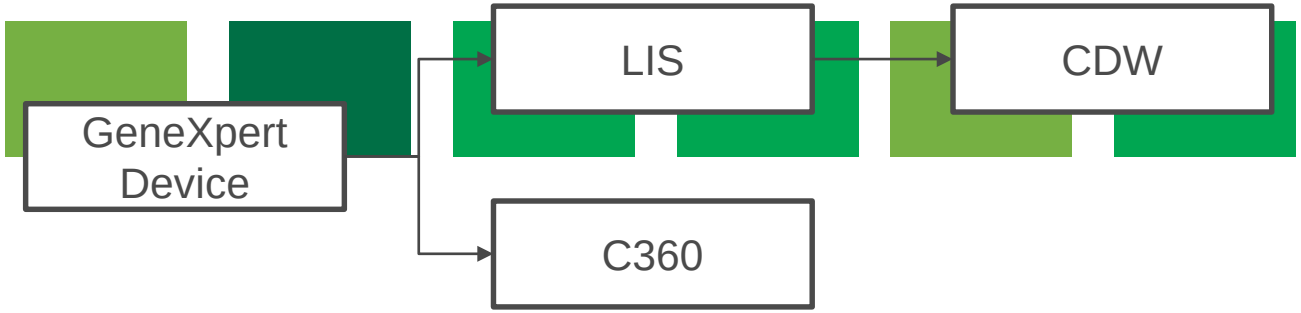
- CDW (March 2011 – June 2019)
  - > 12.3 million Xpert MTB/RIF tests
  - > 3.2 million Xpert MTB/RIF Ultra tests

- C360 (June 2016 – July 2019)
  - >1.8 million Xpert MTB/RIF tests
  - >2.4 million Xpert MTB/RIF Ultra Tests



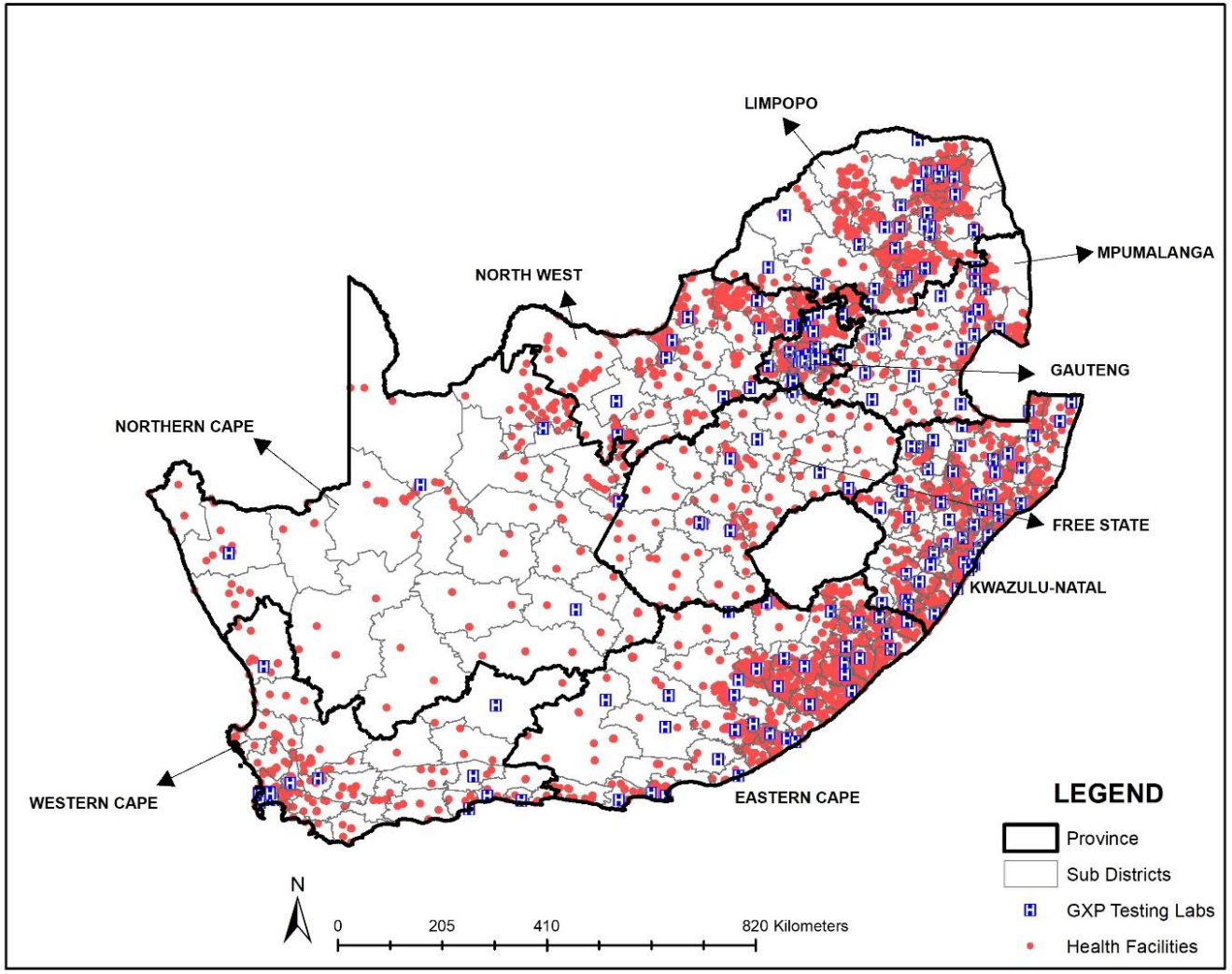


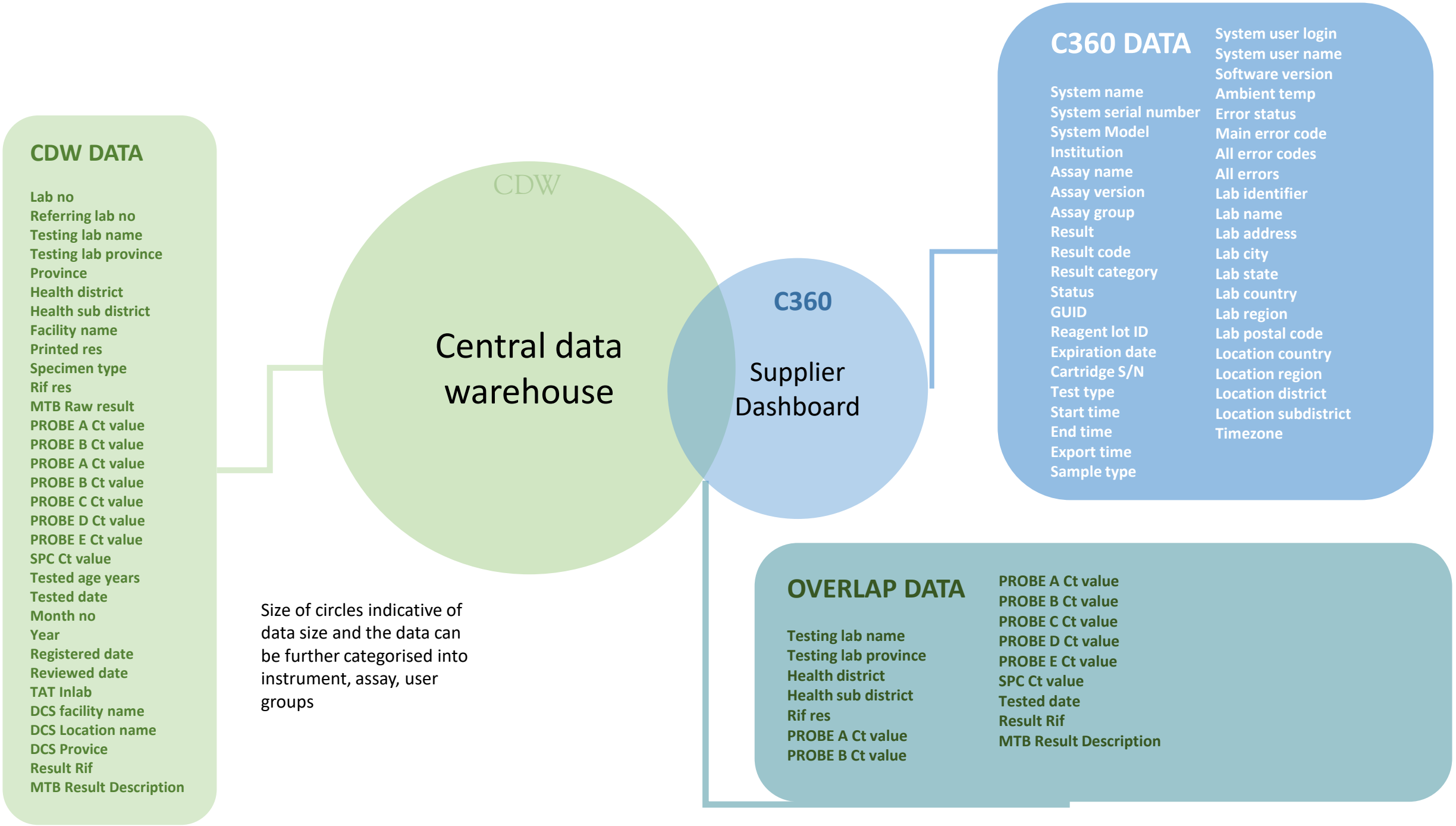
Data Architecture

- Data is transferred in two pathways:
  1. TrakCare, Laboratory Information System (LIS), Central Data Warehouse (CDW)
  2. C360 – Cepheid's platform.

- The data from CDW is comprehensive

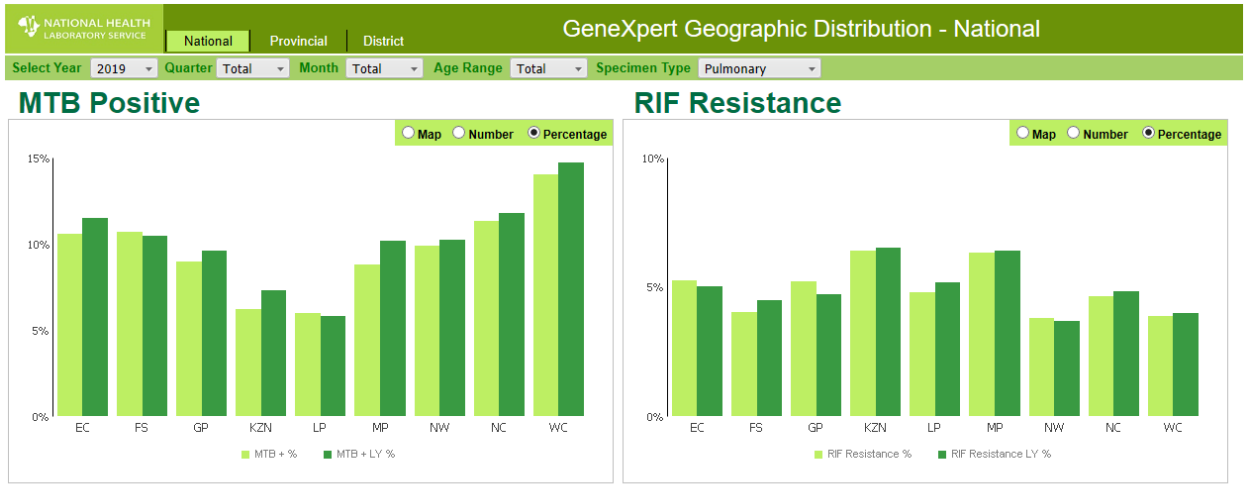
- The data from C360 is at the laboratory level




CDW DATA
Lab no
Referring lab no
Testing lab name
Testing lab province
Province
Health district
Health sub district
Facility name
Printed res
Specimen type
Rif res
MTB Raw result
PROBE A Ct value
PROBE B Ct value
PROBE A Ct value
PROBE B Ct value
PROBE C Ct value
PROBE D Ct value
PROBE E Ct value
SPC Ct value
Tested age years
Tested date
Month no
Year
Registered date
Reviewed date
TAT Inlab
DCS facility name
DCS Location name
DCS Provice
Result Rif
MTB Result Description
CDW
Central data warehouse
C360
Supplier Dashboard
C360 DATA
System name
System serial number
System Model
Institution
Assay name
Assay version
Assay group
Result
Result code
Result category
Status
GUID
Reagent lot ID
Expiration date
Cartridge S/N
Test type
Start time
End time
Export time
Sample type
System user login
System user name
Software version
Ambient temp
Error status
Main error code
All error codes
All errors
Lab identifier
Lab name
Lab address
Lab city
Lab state
Lab country
Lab region
Lab postal code
Location country
Location region
Location district
Location subdistrict
Timezone
Size of circles indicative of data size and the data can be further categorised into instrument, assay, user groups
OVERLAP DATA
Testing lab name
Testing lab province
Health district
Health sub district
Rif res
PROBE A Ct value
PROBE B Ct value
PROBE A Ct value
PROBE B Ct value
PROBE C Ct value
PROBE D Ct value
PROBE E Ct value
SPC Ct value
Tested date
Result Rif
MTB Result Description

How is the data used and potential future

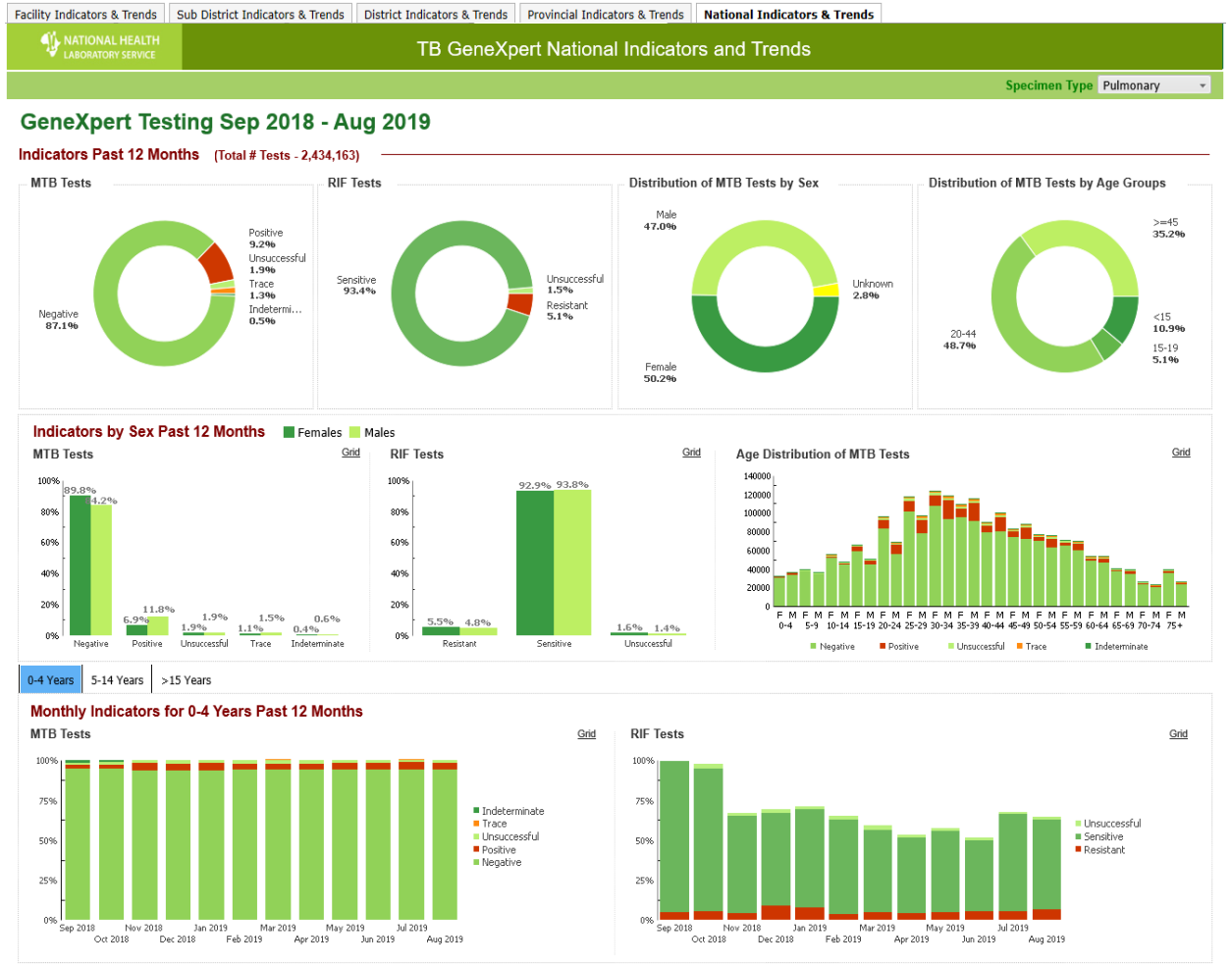
- TB Dashboards for the NDoH



* LP - The Same Period Last Year; CP - Current Period

Xpert MTB/RIF Ultra implementation for routine use began in October 2017. The laboratory reporting algorithm for Trace was modified in October 2018.

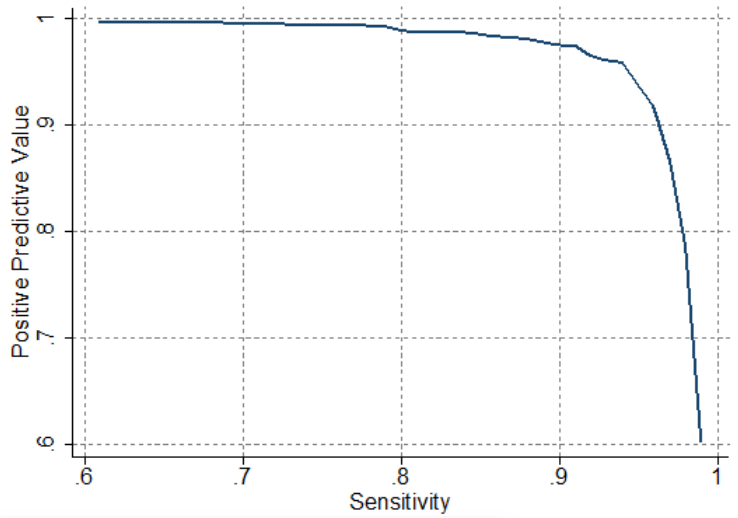
	Tests Total		MTB Positive				Trace				Indeterminate				Test Unsuccessful				RIF Resistant				RIF Unsuccessful			
Province	CP	LP	CP	LP	% CP	% LP	CP	LP	% CP	% LP	CP	LP	% CP	% LP	CP	LP	% CP	% LP	CP	LP	% CP	% LP	CP	LP	% CP	% LP
EC	260,868	375,989	27,519	43,098	10.5%	11.5%	5,325	1,096	2.0%	0.3%	0	7,048	0.0%	1.9%	6,297	8,309	2.4%	2.2%	1,441	2,153	5.2%	5.0%	501	393	1.8%	0.9%
FS	56,001	93,370	5,977	9,753	10.7%	10.4%	1,332	286	2.4%	0.3%	0	1,642	0.0%	1.8%	462	610	0.8%	0.7%	241	436	4.0%	4.5%	89	53	1.5%	0.5%
GP	187,182	295,896	16,776	28,269	9.0%	9.6%	2,711	686	1.4%	0.2%	0	4,343	0.0%	1.5%	2,858	3,883	1.5%	1.3%	873	1,326	5.2%	4.7%	441	260	2.6%	0.9%
KZN	441,758	605,087	27,464	44,239	6.2%	7.3%	5,582	1,234	1.3%	0.2%	10	6,947	0.0%	1.1%	8,363	9,476	1.9%	1.6%	1,754	2,873	6.4%	6.5%	337	426	1.2%	1.0%
LP	95,734	156,898	5,734	9,087	6.0%	5.8%	934	190	1.0%	0.1%	0	1,512	0.0%	1.0%	2,052	3,071	2.1%	2.0%	273	468	4.8%	5.2%	88	110	1.5%	1.2%
MP	66,873	96,405	5,863	9,782	8.8%	10.1%	1,605	433	2.4%	0.4%	0	1,539	0.0%	1.6%	1,959	2,004	2.9%	2.1%	370	624	6.3%	6.4%	128	83	2.2%	0.8%
NW	71,007	119,979	7,025	12,245	9.9%	10.2%	1,460	287	2.1%	0.2%	0	2,051	0.0%	1.7%	2,229	2,837	3.1%	2.4%	266	449	3.8%	3.7%	161	109	2.3%	0.9%
NC	42,554	63,914	4,800	7,505	11.3%	11.7%	765	162	1.8%	0.3%	0	987	0.0%	1.5%	677	877	1.6%	1.4%	222	361	4.6%	4.8%	112	35	2.3%	0.5%
WC	158,550	232,582	22,198	34,124	14.0%	14.7%	3,414	756	2.2%	0.3%	0	4,255	0.0%	1.8%	2,710	4,053	1.7%	1.7%	857	1,350	3.9%	4.0%	338	189	1.5%	0.6%
Total	1,380,527	2,040,120	123,356	198,102	8.9%	9.7%	23,128	5,130	1.7%	0.3%	10	30,324	0.0%	1.5%	27,607	35,120	2.0%	1.7%	6,297	10,040	5.1%	5.1%	2,195	1,658	1.8%	0.8%



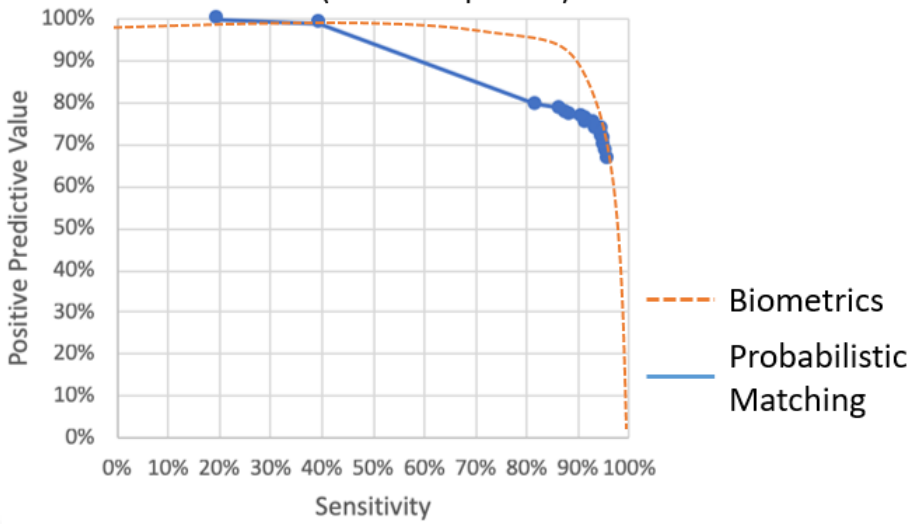
In the absence of a unique ID?

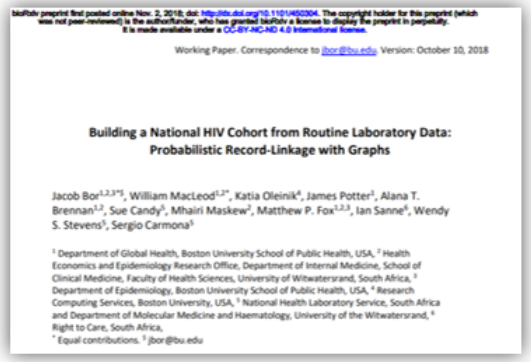
The (Potential) Promise of Biometrics

HIV Cohort



TB Cohort (in development)





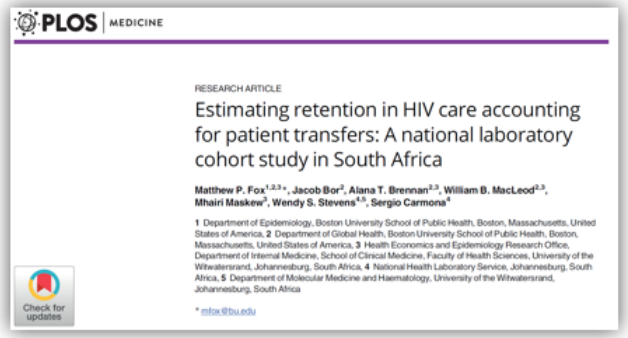
Working Paper. Correspondence to jbor@bu.edu. Version: October 10, 2018

Building a National HIV Cohort from Routine Laboratory Data: Probabilistic Record-Linkage with Graphs

Jacob Bor[1,2,3*§], William MacLeod[1,2*], Katia Oleinik[4], James Potter[1], Alana T. Brennan[1,2], Sue Candy[5], Mhairi Maskew[2], Matthew P. Fox[1,2,3], Ian Sanne[6], Wendy S. Stevens[5], Sergio Carmona[5]

[1] Department of Global Health, Boston University School of Public Health, USA, [2] Health Economics and Epidemiology Research Office, Department of Internal Medicine, School of Clinical Medicine, Faculty of Health Sciences, University of Witwatersrand, South Africa, [3] Department of Epidemiology, Boston University School of Public Health, USA, [4] Research Computing Services, Boston University, USA, [5] National Health Laboratory Service, South Africa and Department of Molecular Medicine and Haematology, University of the Witwatersrand, [6] Right to Care, South Africa,

* Equal contributions. § jbor@bu.edu



PLOS MEDICINE

RESEARCH ARTICLE

Estimating retention in HIV care accounting for patient transfers: A national laboratory cohort study in South Africa

Matthew P. Fox[1,2,3]*, Jacob Bor[2], Alana T. Brennan[2,3], William B. MacLeod[2,3], Mhairi Maskew[2], Wendy S. Stevens[4,5], Sergio Carmona[4]

1 Department of Epidemiology, Boston University School of Public Health, Boston, Massachusetts, United States of America, 2 Department of Global Health, Boston University School of Public Health, Boston, Massachusetts, United States of America, 3 Health Economics and Epidemiology Research Office, Department of Internal Medicine, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa, 4 National Health Laboratory Service, Johannesburg, South Africa, 5 Department of Molecular Medicine and Haematology, University of the Witwatersrand, Johannesburg, South Africa

* mfox@bu.edu

Check for updates

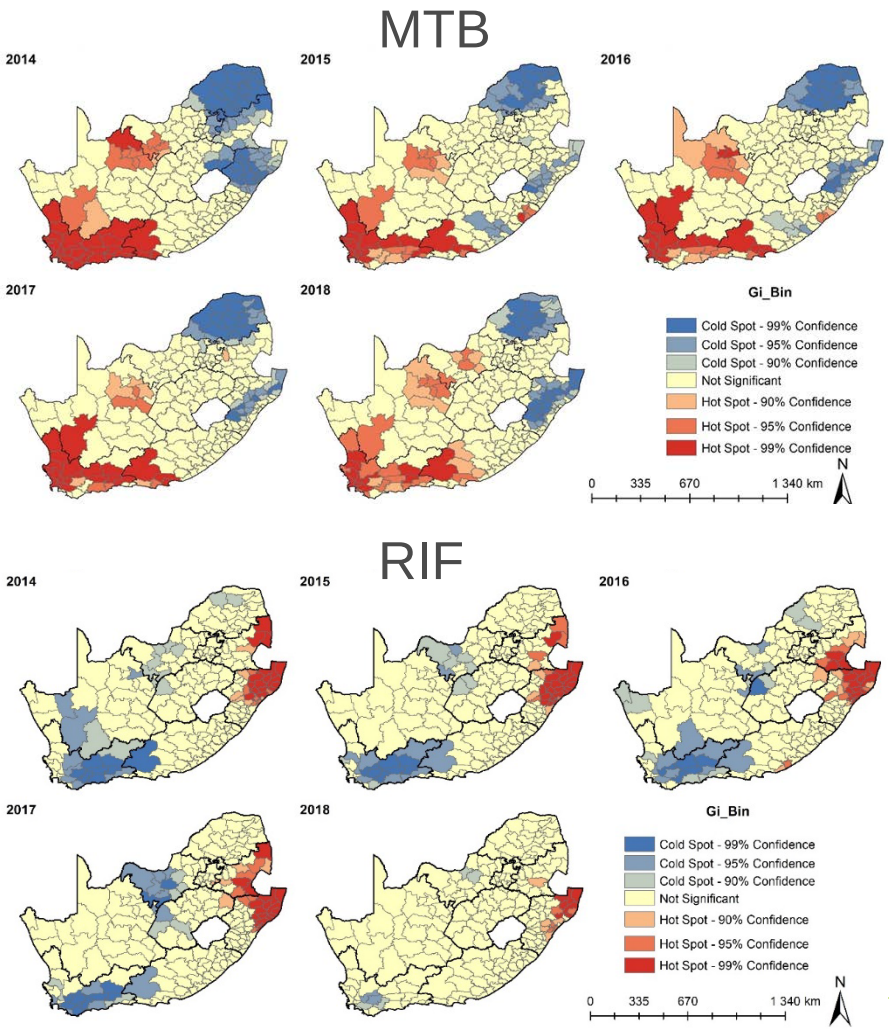
Biometrics Considerations:

- Database infrastructure (speed of queries)
- Data ownership (security)
- Identification vs Verification Models
- Mobility

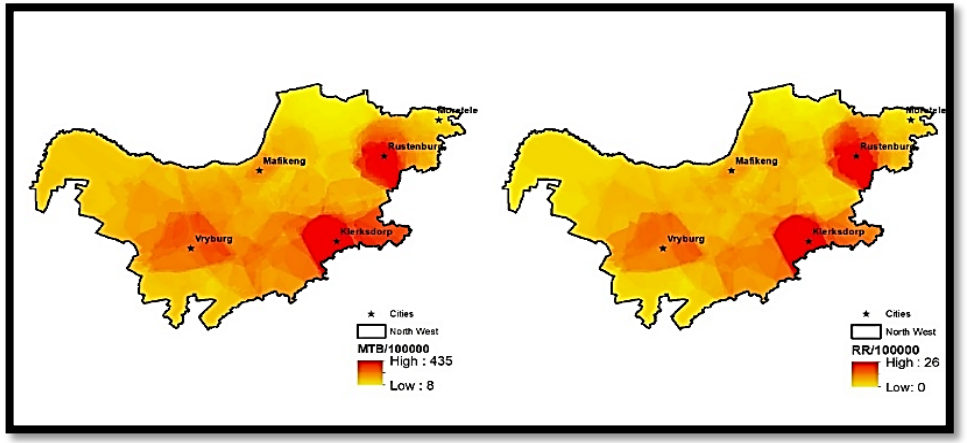
NATIONAL HEALTH LABORATORY SERVICE

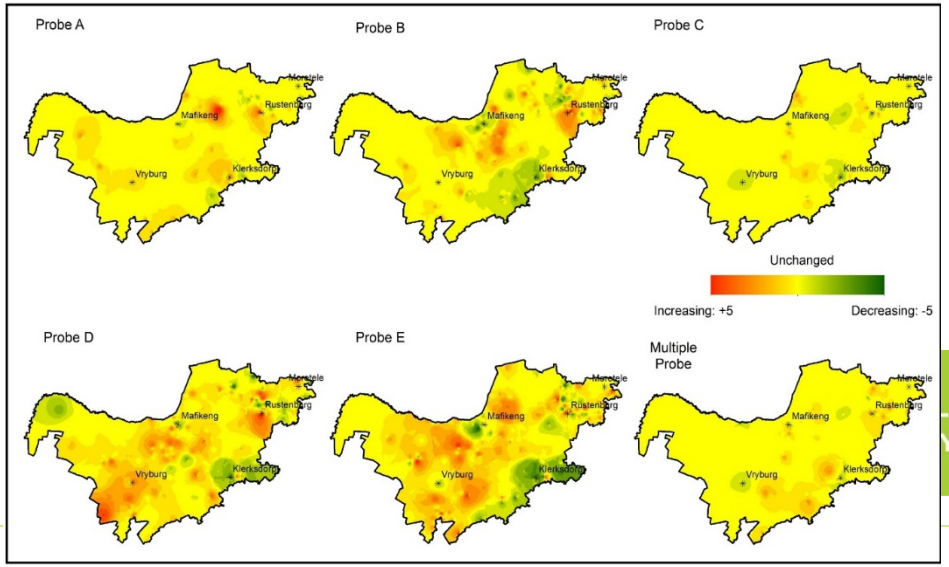
How is the data used and potential future

Monitoring of the TB Cascade at a National level: Xpert MTB/RIF 2011-2018



Monitoring of the TB Cascade at a Provincial level: Xpert MTB/RIF 2013-2015 in the North West





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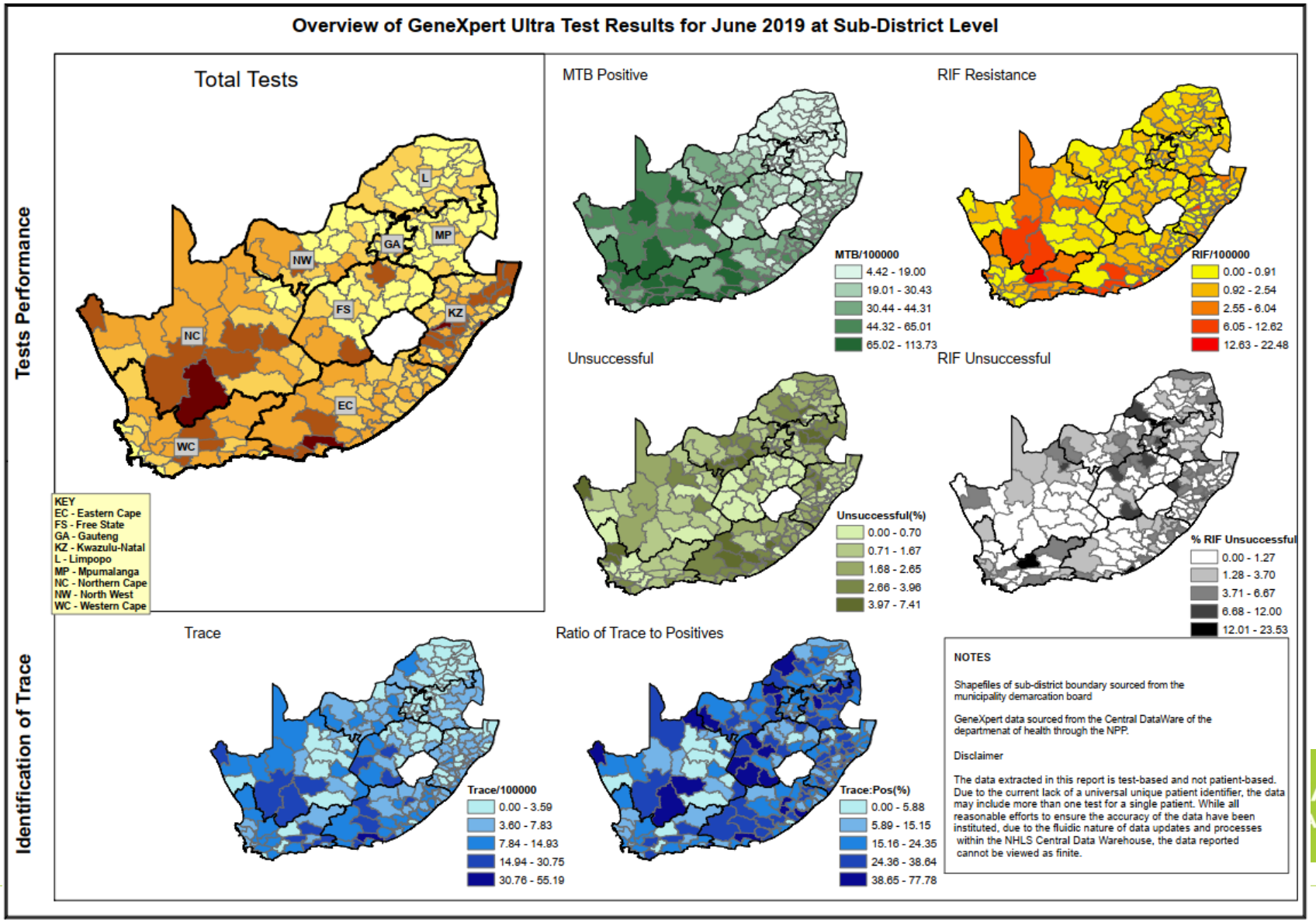
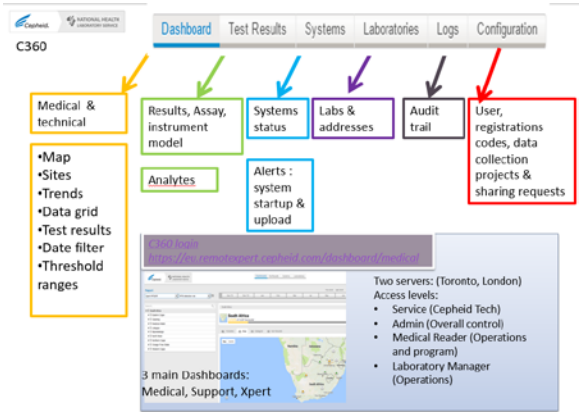
How is the data used and potential future

- Operations

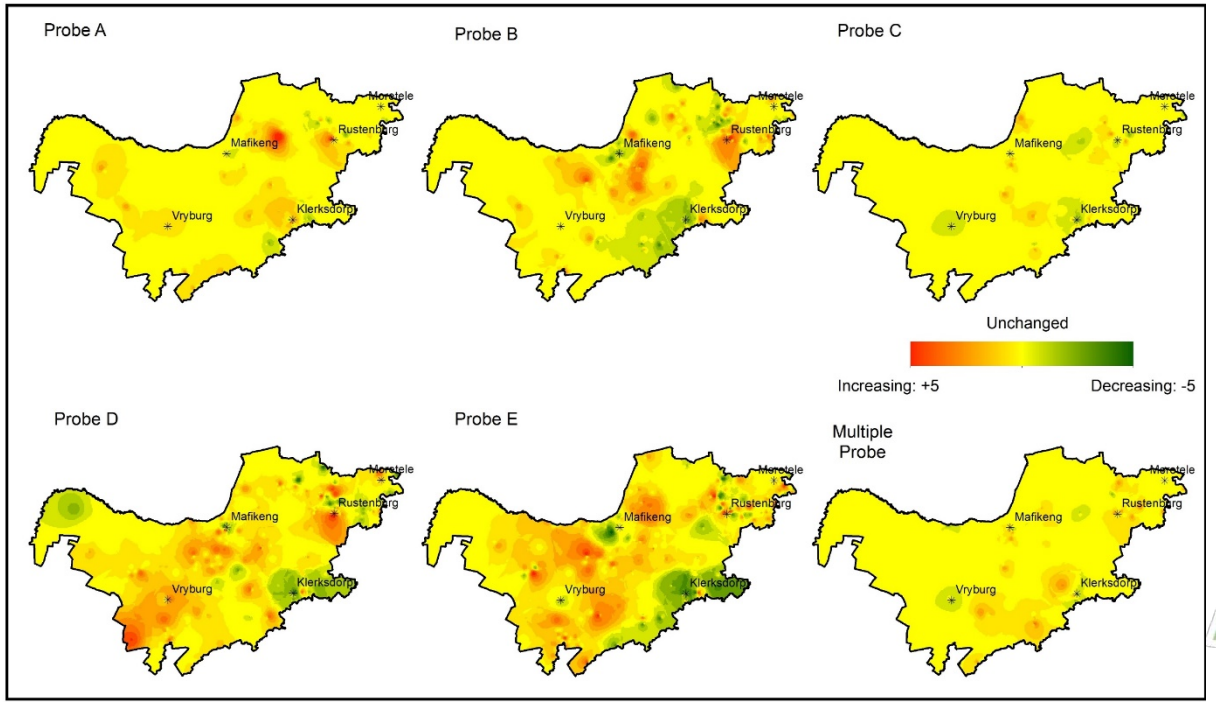


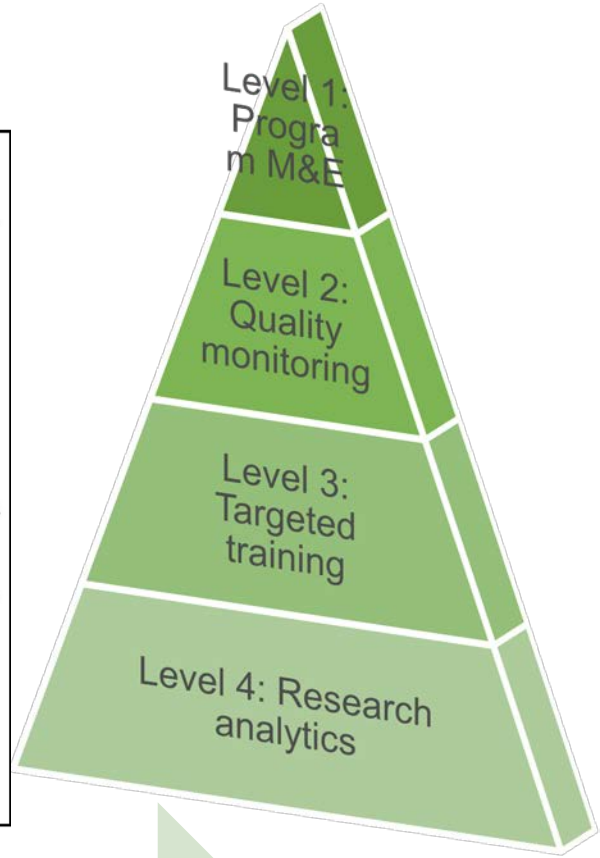
Continuous quality monitoring

Dashboards



Molecular granularity





Data curator, storage infrastructure, interfacing, maintenance, hosting, backup

Research concept and design and partnerships

Data access approval and ethics (security) process

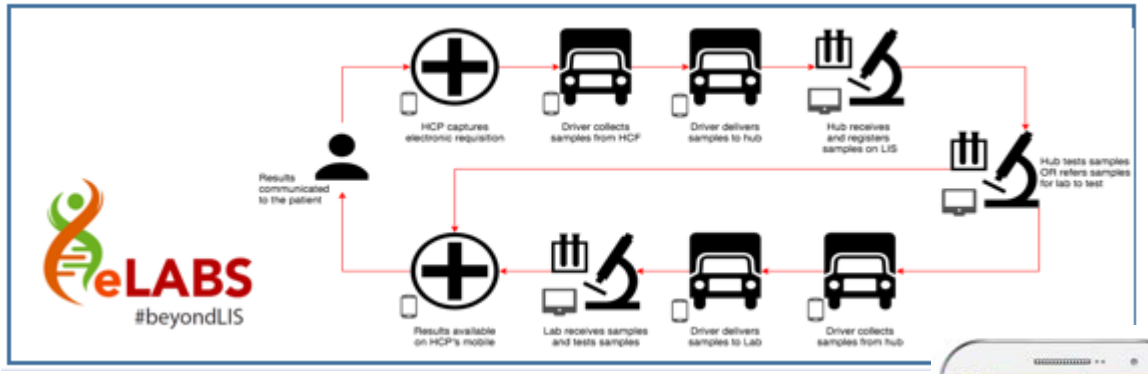
Data dictionary, analytics and visualization, tools

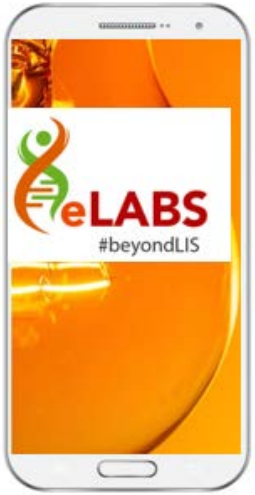
Stakeholder engagement and communications, dashboard access (download speed)

Expanding the laboratory data backbone

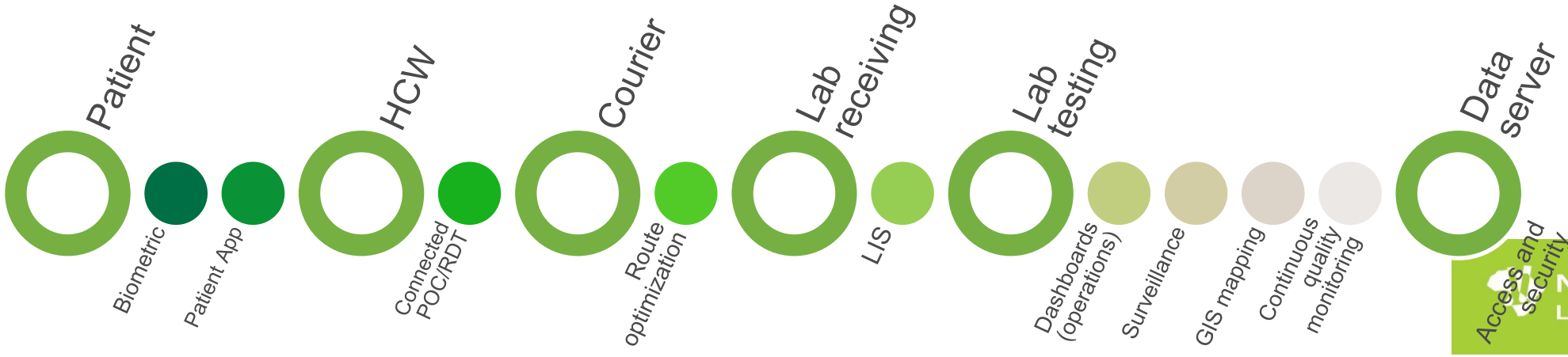
NATIONAL HEALTH LABORATORY SERVICE
National Priority Programmes

- The “information chain” – poor communication between referring clinics and central labs, increases TAT and decreases quality of care.
- Barriers must be addressed
  - Quick and efficient test requests
  - Efficient transport of specimens to central testing labs
  - Standardise communication systems to rapidly transmit results back to clinics (HCW and patients)
  - Workflow automation and monitoring

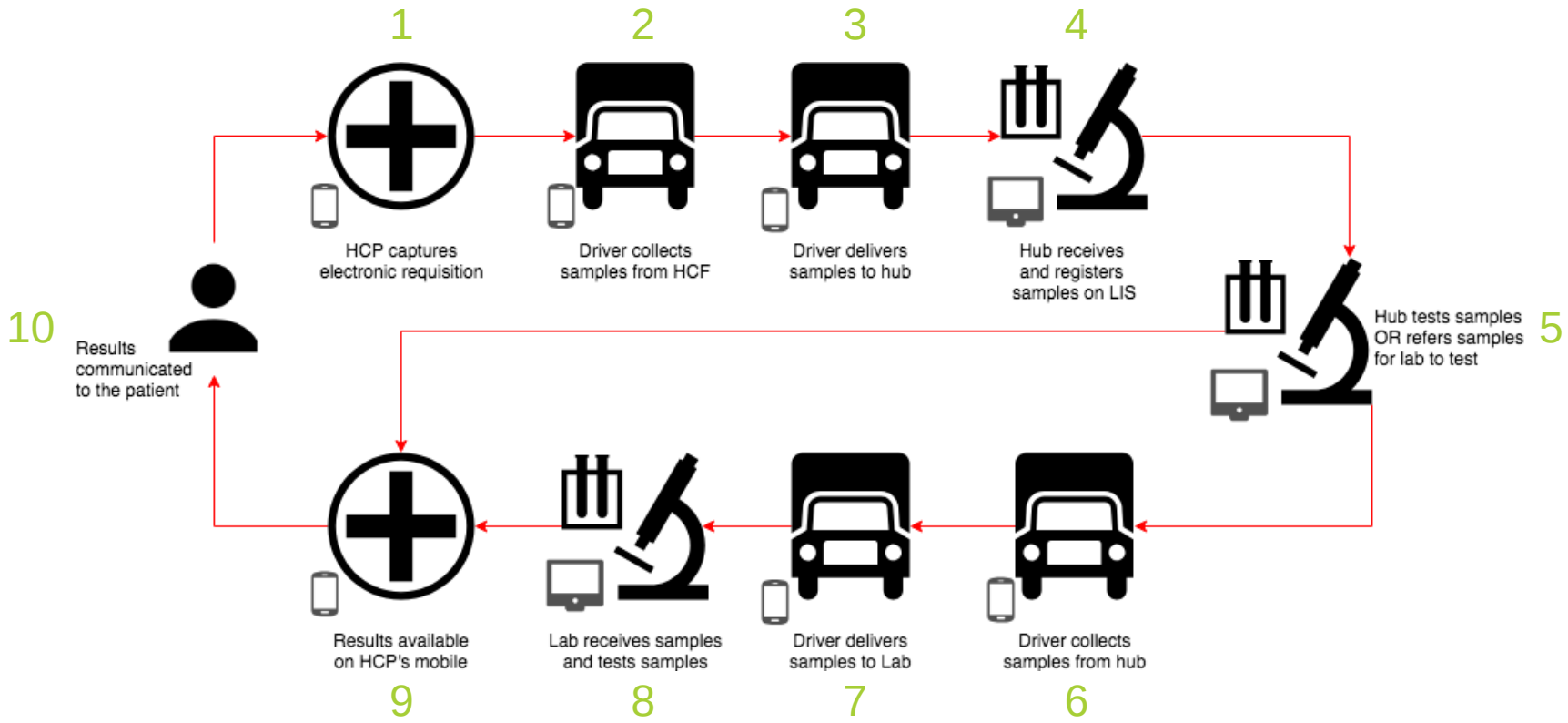




eLABS – backbone to a connected laboratory



NATIONAL HEALTH LABORATORY SERVICE



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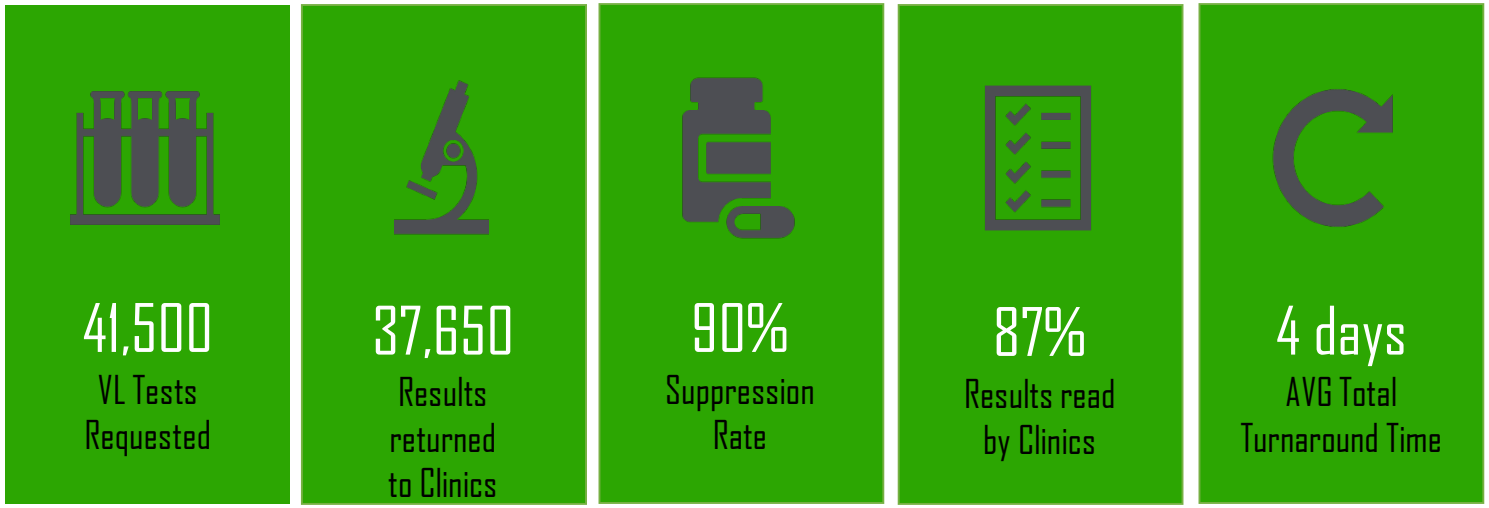
Adoption Statistics: South Africa



Project Start Date: October 2018

Reduction in TAT at facility by 62%
Registration decrease of 57%
Reduction in LSS by 50%
Specimen rejection reduced by 1% (2%)%

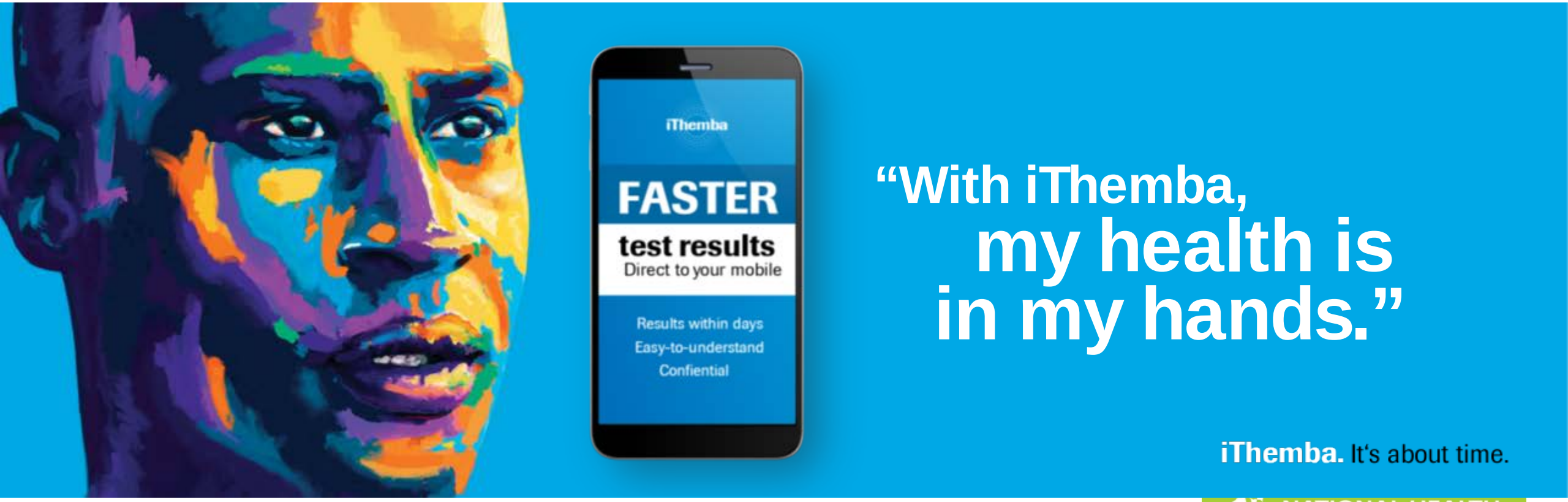
Data Updated: 17 July 2019

NATIONAL HEALTH LABORATORY SERVICE

iTher

NHLS-IT, NHLS-NPP update

September 2019



NATIONAL HEALTH LABORATORY SERVICE

iThemba pilot data (as of June 24th 2019) *Enrollments in April, May and June*

1*. *The Power of Mobile*

Harnessing growth of smart mobile access to transform healthcare delivery

Enrolled / Screened*

Overall
501 / 706 (70.9%)

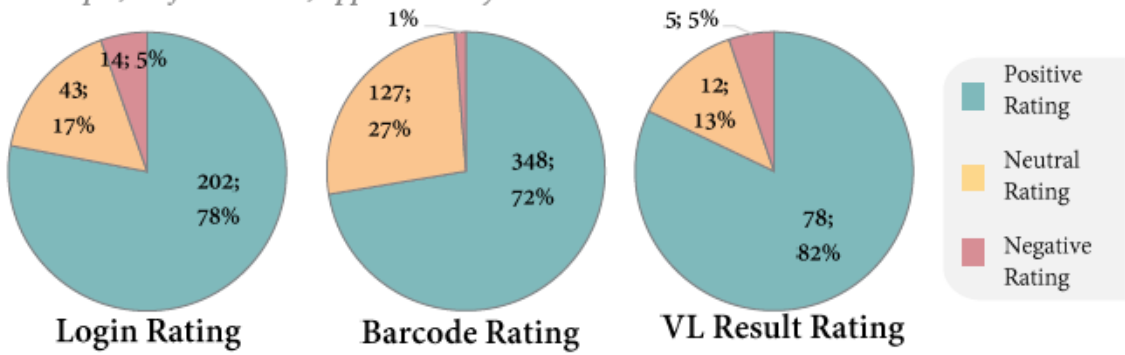
Hillbrow
238 / 360(66.1%)

Yeoville
263 / 346 (76.0%)

*Some patients are not accounted for in the count due to various IE criteria, only criteria (5 – 10) are counted in this bucket.

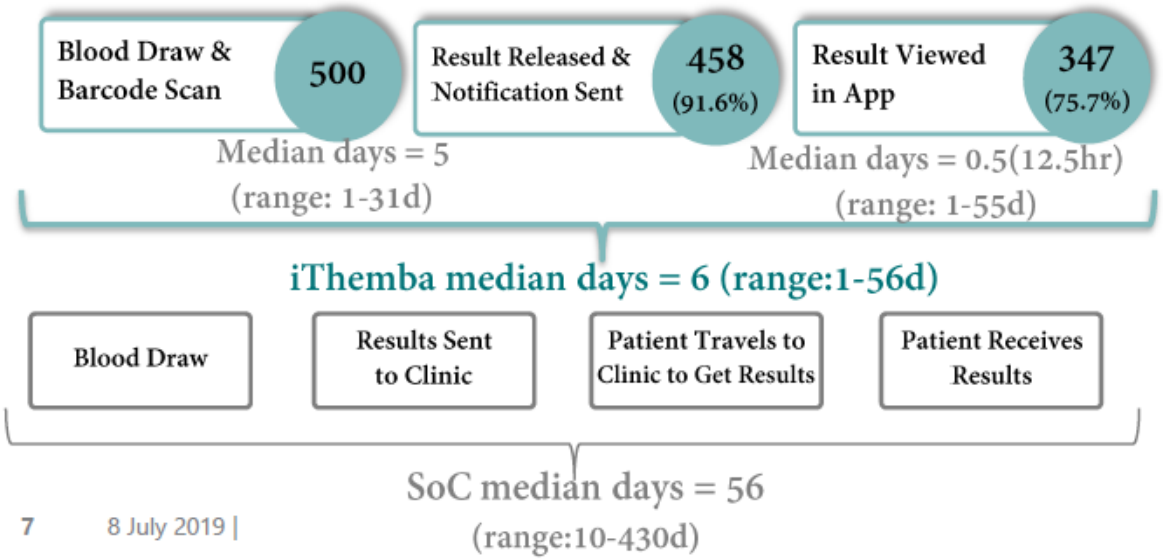
2. *The Power of Simplicity*

Simple, useful solution, appreciated by users



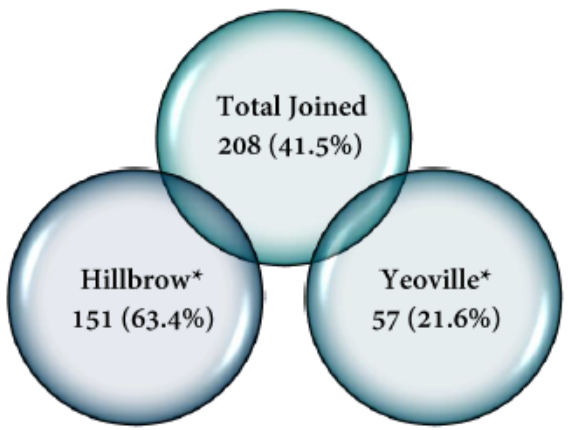
3. *The Power of Knowledge*

Closing the gap in knowledge of HIV viral load status



4. *The Power of Community*

Engaging users with virtual communities to provide support



*Denominator for percent calculation is based on each site's virtual community enrollment

iThemba

Empowering patients to remain adherent to treatment and engaged in care

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

iLEAD

Ezintsha

University of the Witwatersrand WITS RHI

NATIONAL HEALTH LABORATORY SERVICE

Roche

Laboratory as the command centre

- Bi-directional Push and Pull of information
- Continuous real-time monitoring
- Clinical relevancy and footprint expanded by clinical partners
- Priorities to be determined by stakeholders and partner consultations
- Complexity will increase beyond the proof of concepts
- Platform for innovation and social entrepreneurship
- Significant investment required for maintenance

NATIONAL HEALTH LABORATORY SERVICE

Considerations

- The CDW storing all public sector laboratory results is indeed a national treasure and needs to be resourced
- The value of the laboratory for **individual patient management** has always been relatively clear.
- **New roles**:
  - The value of **aggregated laboratory data** has been demonstrated in the projects presented today: **programmatic value**
  - The role of the laboratory in proactive enhancement of **linkage to care** via solutions such as mHealth, webview etc is in its infancy requires investment
  - Facilitates a platform to support **POCT initiatives**
  - Monitoring of **analyzer performance** from a distance

NATIONAL HEALTH LABORATORY SERVICE

Acknowledgements

- National Department of Health (HIV and TB cluster)
- NHLS National Priority Program
- Department of Molecular Medicine and Haematology, Wits University R&D team
- NHLS, National Priority Program, TB/HIV Expert working groups
- Funders (specifically CDC, Bill and Melinda Gates foundation, NIH/ACTG, USAID, MRC/Newton)
- Clinical partners Right to care, Aurum, TB/HIV care, WRHI, PHRU
- Research collaborators: HERO (BU),
- Commercial collaborators (Cepheid, Abbott, Roche, Hain, BD)
- Innovators

NATIONAL HEALTH LABORATORY SERVICE