NATIONAL HEALTH LABORATORY SERVICE

GeneXpert MTB/RIF

Progress Report

July 2015

NATIONAL HEALTH LABORATORY SERVICE

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Disclaimer: This is a dynamic specimen dataset requiring regular update and it should be noted that figures may change as linkages to individuals tested are updated.

1. Background to Project

This project was initiated at the request of the Honorable Minister of Health, Dr Aaron Motsoaledi, in early 2011, following the World Health Organization's strong recommendation published in December 2010 which stated that "the new automated DNA test for TB be used as the initial diagnostic test in individuals suspected of MDR-TB or HIV/TB". In essence this comprises the majority of TB suspects in South Africa. A pilot study was proposed by the TB Cluster within the National Department of Health (NDoH) while a project feasibility study was being performed with due diligence.

The pilot study was initiated in microscopy centres. The NDoH requested that at least 1 instrument be placed in each province, preferably in high burden districts. Selections were made by the TB cluster, with twenty-five microscopy centres being selected and a total of 30 instruments placed.

The NDoH funded 9 GX16 and 14 GX4 instruments for the project. FIND (The Foundation for Innovative New Diagnostics) donated 6 GX4 analysers and the Infinity or GX48 was supported by PEPFAR Right to Care funds. All instruments were placed by World TB day March 242011. This placement represented about 10% of national coverage. The basis for the calculations was an assumption that 2 smears at diagnosis would be replaced by 1 Xpert® MTB/RIF assay. All instruments were interfaced to the NHLS Laboratory Information System (LIS) allowing for troubleshooting and data collection.

Since then, 309 GeneXpert instruments of varying sizes (GX4: 110; GX16:190; GX48: 1; GX80:8) have been placed in 221 sites – both urban and rural settings, by the National Priority Programmes of the NHLS and the NDoH, the progress of which is described in point 6 below.

The programme was further expanded to directly support the annual screening for TB and HIV of a quarter of a million people in special risk populations in correctional centres and in peri-mining communities.

1.1. Correctional Services

In order to improve TB control in all 242 correctional facilities in South Africa, the NHLS is working in partnership with the Department of Correctional Services (DCS), NDoH, Aurum Institute, TB/HIV Care Association and Right to Care to ensure access to regular HIV- and TB-related screening, testing and treatment of up to 150,000 offenders through the Global Fund programme. Xpert MTB/Rif testing is being provided either on-site, or at the nearest referral laboratory. During 2014, Xpert MTB/RIF testing facilities have been established on-site at the following Correctional Facilities:

- KgošiMampuru Management Area II
- Barberton Management Area
- Johannesburg Management Area
- Groenpunt Management Area
- Pollsmoor Management Area
- St Albans Management Area
- Durban-Westville Management Area

1.2. Peri-Mining Communities

NHLS, together with the Aurum Institute, has been appointed by NDoH (under the Global Fund grant) to provide services to implement interventions aimed at improving TB and HIV/AIDS management for vulnerable peri-mining communities (estimated at around 600,000 people) in 6 main mining districts. Six staffed and GeneXpert-equipped mobile TB units will be provided within the communities to undertake Xpert MTB/RIF testing for TB. In addition, persons newly identified as HIV-infected through the clinical partner will be staged for HIV-treatment using CD4 tests provided by the closest NHLS lab in the district. The 6 districts with a high proportion of mines in South Africa that have been identified for focused attention are:

- Lejweleputswa (Free State),
- Dr K K Kaunda & Bojanala Districts (North West),
- West Rand (Gauteng)
- Waterberg & Sekhukhune (Limpopo)

2. Assays performed to date

In summary, a total of 6 538 967 specimens have been processed to date (31 July 2015). In July 245 078 specimens were processed. The total % of *Mycobacterium tuberculosis* complex (MTBC) detected in this cohort was 9.03% (22 119). As a reflection of Xpert MTB/RIF's superior sensitivity over microscopy, the average national TB positivity rate among suspects was found to be 8% using microscopy but up to 16-18% in the first year and 13-14% in the second year, 10-11% in the third and fourth years and has reduced to 9% in the 5th year, after introduction of Xpert® MTB/RIF assay. To date Kwa-Zulu Natal (KZN) has performed the greatest number of tests which is probably as a result of the number of instruments placed (refer to tables 1 & 2). Average Rifampicin resistance detection rates have remained around 7% since project inception (Refer to tables 3 & 4).

Table 1: GeneXpert MTB Results by province (cumulative)

Province	Year	MTB Detected	MTB Not Detected	Test Unsuccessful	Total	% MTB Detected
EASTERN CAPE	2011	3 252	15 235	549	**19 036**	**17,08**
EASTERN CAPE	2012	15 880	84 755	2 862	**103 497**	**15,34**
EASTERN CAPE	2013	45 469	320 022	10 046	**375 537**	**12,11**
EASTERN CAPE	2014	48 900	382 950	11 369	**443 219**	**11,03**
EASTERN CAPE	2015	29 221	272 852	6 985	**309 058**	**9,45**
FREE STATE	2011	2 811	14 532	35	**17 378**	**16,18**
FREE STATE	2012	11 660	76 863	288	**88 811**	**13,13**
FREE STATE	2013	14 758	139 299	1 020	**155 077**	**9,52**
FREE STATE	2014	14 030	125 554	997	**140 581**	**9,98**
FREE STATE	2015	7 392	70 111	679	**78 182**	**9,45**
GAUTENG	2011	3 094	18 881	443	**22 418**	**13,80**
GAUTENG	2012	11 120	72 979	2 305	**86 404**	**12,87**
GAUTENG	2013	31 432	215 064	7 690	**254 186**	**12,37**
GAUTENG	2014	38 537	303 844	7 423	**349 804**	**11,02**
GAUTENG	2015	21 703	218 281	5 014	**244 998**	**8,86**
KWAZULU-NATAL	2011	7 546	30 575	896	**39 017**	**19,34**
KWAZULU-NATAL	2012	23 963	135 973	5 915	**165 851**	**14,45**
KWAZULU-NATAL	2013	42 294	293 200	15 003	**350 497**	**12,07**
KWAZULU-NATAL	2014	57 323	519 674	18 683	**595 680**	**9,62**
KWAZULU-NATAL	2015	33 076	354 744	11 028	**398 848**	**8,29**
LIMPOPO	2011	1 973	17 253	173	**19 399**	**10,17**
LIMPOPO	2012	4 004	30 924	689	**35 617**	**11,24**

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LIMPOPO	2013	13 927	188 932	6 086	**208 945**	**6,67**
LIMPOPO	2014	14 376	211 956	7 688	**234 020**	**6,14**
LIMPOPO	2015	7 402	130 598	3 875	**141 875**	**5,22**
MPUMALANGA	2011	2 629	12 683	1 100	**16 412**	**16,02**
MPUMALANGA	2012	4 035	22 226	1 133	**27 394**	**14,73**
MPUMALANGA	2013	10 406	63 030	2 210	**75 646**	**13,76**
MPUMALANGA	2014	14 650	112 752	4 210	**131 612**	**11,13**
MPUMALANGA	2015	7 741	70 879	2 574	**81 194**	**9,53**
NORTH WEST	2011	3 429	14 557	644	**18 630**	**18,41**
NORTH WEST	2012	5 499	29 977	2 052	**37 528**	**14,65**
NORTH WEST	2013	13 301	100 512	4 926	**118 739**	**11,20**
NORTH WEST	2014	17 001	150 584	6 638	**174 223**	**9,76**
NORTH WEST	2015	9 147	97 923	3 171	**110 241**	**8,30**
NORTHERN CAPE	2011	2 727	15 527	712	**18 966**	**14,38**
NORTHERN CAPE	2012	3 830	21 728	1 038	**26 596**	**14,40**
NORTHERN CAPE	2013	7 912	53 728	2 529	**64 169**	**12,33**
NORTHERN CAPE	2014	8 685	63 062	2 891	**74 638**	**11,64**
NORTHERN CAPE	2015	4 979	39 941	1 392	**46 312**	**10,75**
WESTERN CAPE	2011	2 173	9 897	47	**12 117**	**17,93**
WESTERN CAPE	2012	13 206	68 045	689	**81 940**	**16,12**
WESTERN CAPE	2013	28 653	155 003	2 343	**185 999**	**15,40**
WESTERN CAPE	2014	33 717	180 294	1 992	**216 003**	**15,61**
WESTERN CAPE	2015	20 759	120 733	1 181	**142 673**	**14,55**
TOTAL		**719 622**	**5 648 132**	**171 213**	**6 538 967**	**11,01**

Table 2: GeneXpert MTB Results by province (01-31 July 2015)

Province	MTB Detected	MTB Not Detected	Test Unsuccessful	Grand Total	% MTB Detected
Eastern Cape	4 330	41 835	933	47 098	9,19
Free State	1 207	11 879	114	13 200	9,14
Gauteng	3 519	37 326	872	41 717	8,44
Kwa-Zulu Natal	5 195	54 595	1 176	60 966	8,52
Limpopo	1 157	20 309	518	21 984	5,26
Mpumalanga	1 213	10 974	285	12 472	9,73
North West	1 400	15 412	410	17 222	8,13
Northern Cape	789	6 734	223	7 746	10,19
Western Cape	3 309	19 167	197	22 673	14,59
Grand Total	**22 119**	**218 231**	**4 728**	**245 078**	**9,03**

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Table 3: Provincial GeneXpert RIF Results in MTB detected cases (01-31 July 2015)

Province	Inconclusive	Resistant	Sensitive	No Rif Results	Grand Total	% Rif Resistant
Eastern Cape	106	228	3 975	21	4 330	5,27
Free State	13	64	1 130		1 207	5,30
Gauteng	66	190	3 262	1	3 519	5,40
Kwa-Zulu Natal	97	441	4 643	14	5 195	8,49
Limpopo	33	82	1 032	10	1 157	7,09
Mpumalanga	21	69	1 114	9	1 213	5,69
North West	65	67	1 268		1 400	4,79
Northern Cape	20	38	731		789	4,82
Western Cape	35	173	3 092	9	3 309	5,23
Grand Total	**456**	**1 352**	**20 247**	**64**	**22 119**	**6,11**

Table 4: Provincial GeneXpert RIF Results in MTB detected cases (cumulative)

Province	Year	Inconclusive	Resistant	Sensitive	No RIF Result	Total	% RIF Resistant
EASTERN CAPE	2011	33	248	2 919	52	**3 252**	**7,63**
EASTERN CAPE	2012	213	1 077	14 456	134	**15 880**	**6,78**
EASTERN CAPE	2013	1 274	2 969	41 073	153	**45 469**	**6,53**
EASTERN CAPE	2014	1 248	2 983	44 620	49	**48 900**	**6,10**
EASTERN CAPE	2015	415	1713	27040	53	**29 221**	**5,86**
FREE STATE	2011	28	155	2 626	2	**2 811**	**5,51**
FREE STATE	2012	162	755	10 717	26	**11 660**	**6,48**
FREE STATE	2013	372	800	13 564	22	**14 758**	**5,42**
FREE STATE	2014	367	816	12 843	4	**14 030**	**5,82**
FREE STATE	2015	84	399	6905	4	**7 392**	**5,40**
GAUTENG	2011	25	179	2 889	1	**3 094**	**5,79**
GAUTENG	2012	136	766	10 142	76	**11 120**	**6,89**
GAUTENG	2013	921	2 008	28 433	70	**31 432**	**6,39**
GAUTENG	2014	818	2 293	35 399	27	**38 537**	**5,95**
GAUTENG	2015	283	1233	20178	9	**21 703**	**5,68**
KWAZULU-NATAL	2011	64	592	6 875	15	**7 546**	**7,85**
KWAZULU-NATAL	2012	417	2 166	21 128	252	**23 963**	**9,04**
KWAZULU-NATAL	2013	1 076	3 704	37 079	435	**42 294**	**8,76**
KWAZULU-NATAL	2014	1 512	4 962	50 646	203	**57 323**	**8,66**
KWAZULU-NATAL	2015	535	2612	29871	58	**33 076**	**7,90**
LIMPOPO	2011	25	148	1 775	25	**1 973**	**7,50**
LIMPOPO	2012	52	268	3 609	75	**4 004**	**6,69**
LIMPOPO	2013	299	715	12 803	110	**13 927**	**5,13**

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LIMPOPO	2014	328	706	13 294	48	**14 376**	**4,91**
LIMPOPO	2015	101	421	6847	33	**7 402**	**5,69**
MPUMALANGA	2011	30	207	2 386	6	**2 629**	**7,87**
MPUMALANGA	2012	57	401	3 501	76	**4 035**	**9,94**
MPUMALANGA	2013	238	1 024	9 116	28	**10 406**	**9,84**
MPUMALANGA	2014	380	1 281	12 969	20	**14 650**	**8,74**
MPUMALANGA	2015	108	597	7019	17	**7 741**	**7,71**
NORTH WEST	2011	39	303	3 083	4	**3 429**	**8,84**
NORTH WEST	2012	75	414	5 000	10	**5 499**	**7,53**
NORTH WEST	2013	325	730	12 219	27	**13 301**	**5,49**
NORTH WEST	2014	504	909	15 579	9	**17 001**	**5,35**
NORTH WEST	2015	180	459	8503	5	**9 147**	**5,02**
NORTHERN CAPE	2011	28	186	2 511	2	**2 727**	**6,82**
NORTHERN CAPE	2012	50	236	3 536	8	**3 830**	**6,16**
NORTHERN CAPE	2013	175	422	7 025	290	**7 912**	**5,33**
NORTHERN CAPE	2014	200	448	8 022	15	**8 685**	**5,16**
NORTHERN CAPE	2015	58	256	4663	2	**4 979**	**5,14**
WESTERN CAPE	2011	15	107	2 050	1	**2 173**	**4,92**
WESTERN CAPE	2012	153	653	12 397	3	**13 206**	**4,94**
WESTERN CAPE	2013	636	1 409	26 606	2	**28 653**	**4,92**
WESTERN CAPE	2014	678	1 766	31 272	1	**33 717**	**5,24**
WESTERN CAPE	2015	206	1047	19495	11	**20 759**	**5,04**
Total		**14 923**	**47 543**	**654 683**	**2 473**	**719 622**	**6,61**

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3. Rif Concordance

Rifampicin concordance is good for both LPA and culture. The data is skewed by reporting the GeneXpert immediately, but still have to wait for MGIT and LPA results.

Table 5: Rif Concordance by LPA or DST

Province	Rif Resistant Cases	GeneXpert Confirmation & Rif Concordance									
		DST					LPA				
		Confirmed		Rif Concordance		Pre-analytical/ No result	Confirmed		Rif Concordance		Indeterminate
		#	%	#	%		#	%	#	%	
EC	7 914	310	3,9%	209	67,4%	3	2 386	30,1%	2 209	92,6%	7
FS	2 501	203	8,1%	112	55,2%	0	943	37,7%	805	85,4%	179
GP	5 668	207	3,7%	135	65,2%	4	1 428	25,2%	1 279	89,6%	26
KZN	12 664	3 129	24,7%	2 914	93,1%	0	3 100	24,5%	2 773	89,5%	119
LP	1 907	94	4,9%	70	74,5%	2	456	23,9%	364	79,8%	15
MP	3 090	660	21,4%	651	98,6%	0	1 132	36,6%	974	86,0%	3
NW	2 230	171	7,7%	113	66,1%	0	730	32,7%	604	82,7%	47
NC	1 243	268	21,6%	201	75,0%	3	527	42,4%	407	77,2%	34
WC	4 305	166	3,9%	57	0,0%	0	3 328	77,3%	3 081	92,6%	2
National	**41 522**	**5 208**	**12,5%**	**4 462**	**85,7%**	**12**	**14 030**	**33,8%**	**12 496**	**89,1%**	**432**

4. Errors

Average error rate has ranged consistently below 3% in the month of July. Details of the invalid results, which likely represent sample issues remains below 1%. These are being monitored regularly and corrective action implemented where necessary.

Table 6: Number of Unsuccessful Tests and Reasons (1-31 July 2015)

Province	Errors	Invalids	No Results	MTB Results	Grand Total	% Error
Eastern Cape	708	125	101	46 170	47 104	1,50
Free State	59	48	8	13 088	13 203	0,45
Gauteng	667	113	93	40 845	41 718	1,60
Kwa-Zulu Natal	878	198	101	59 812	60 989	1,44
Limpopo	398	90	30	21 471	21 989	1,81
Mpumalanga	200	45	40	12 188	12 473	1,60
North West	280	54	78	16 811	17 223	1,63
Northern Cape	133	85	5	7 523	7 746	1,72
Western Cape	124	33	57	20 780	20 994	0,59
Grand Total	**3 447**	**791**	**513**	**238 688**	**243 439**	**1,42**

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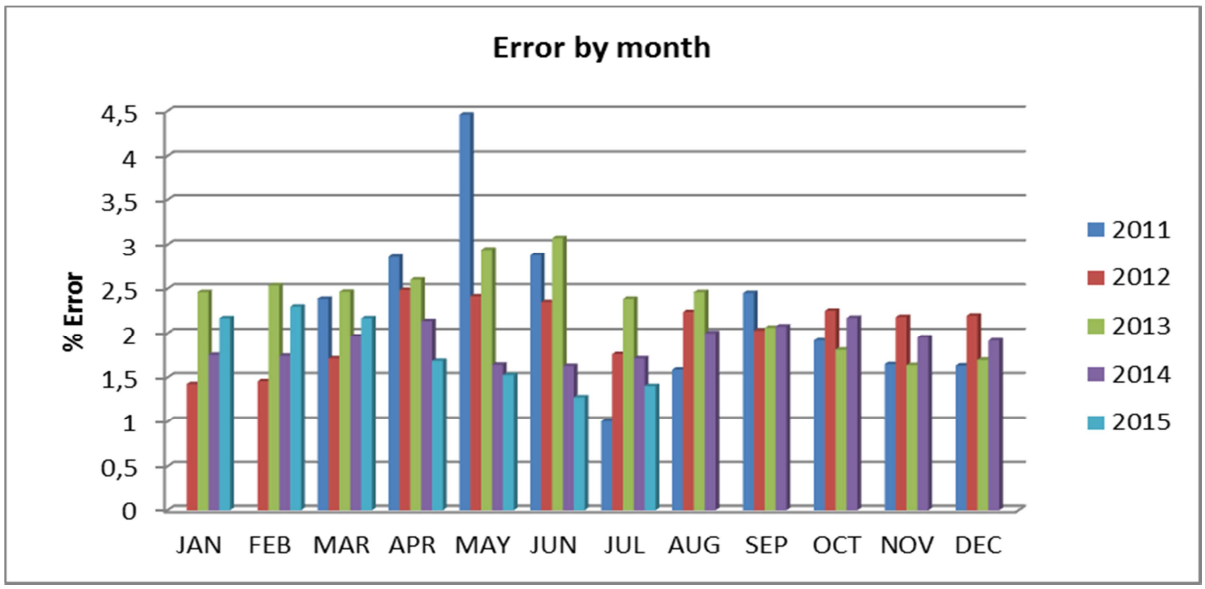
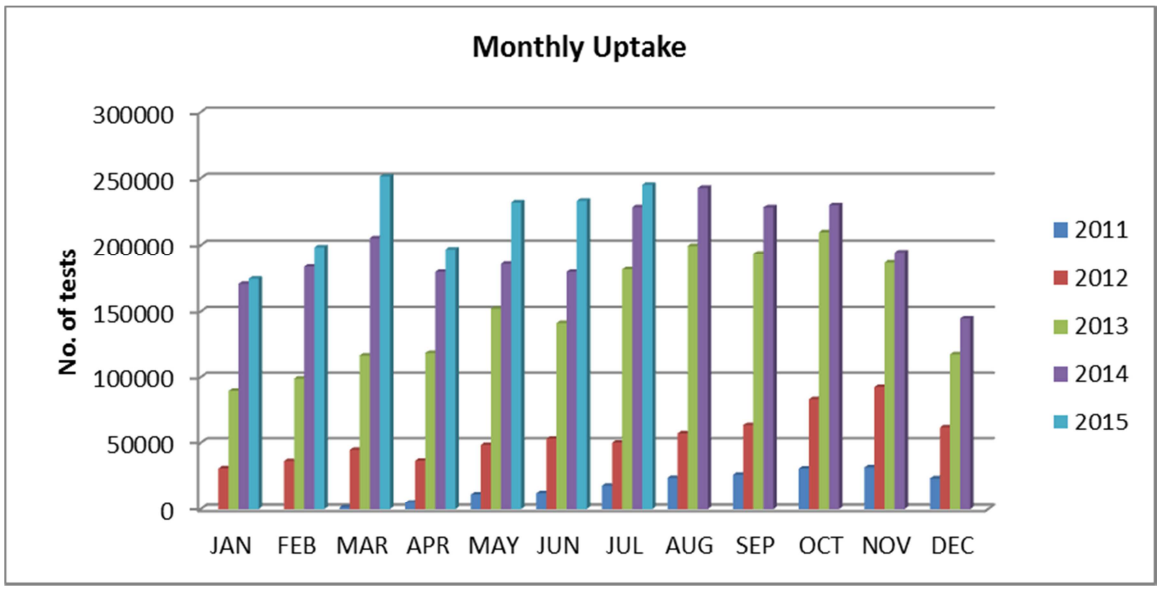
Figure 1: GeneXpert Error by Month



5. Monthly uptake since implementation started

Figure 2: GeneXpert Monthly Uptake



Monthly uptake increased steadily since program inception. The main reason for interruptions is due to the variation in work practices which is expected during the December period.

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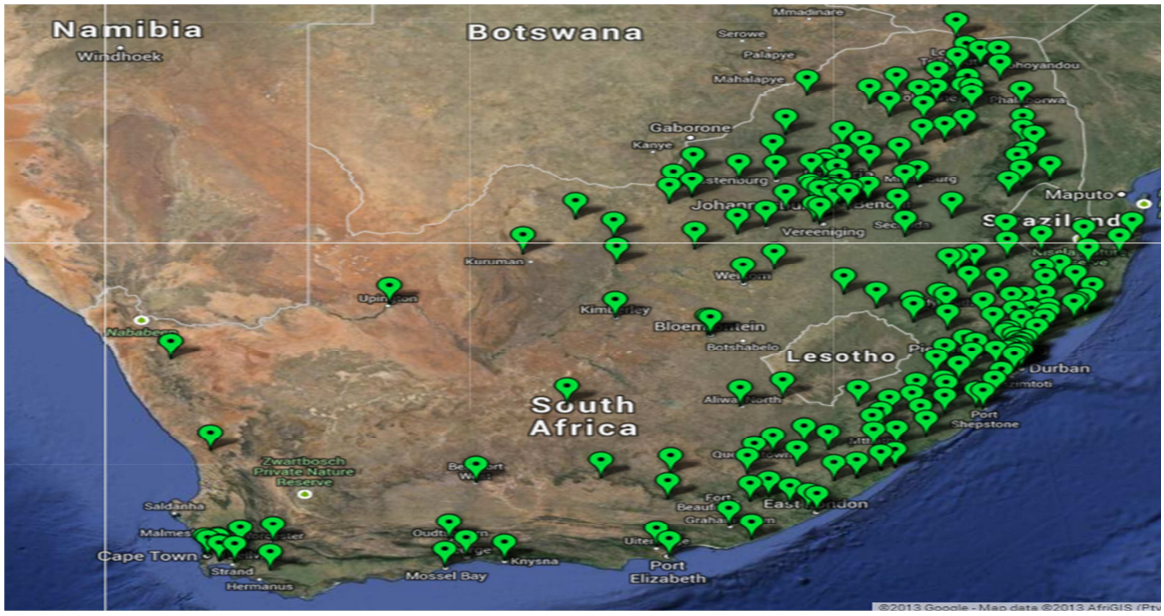
6. Phased Implementation Progress

Figure 3: Current GeneXpert Placement (221 testing centers, 309 **analysers, Gx4:** 110; Gx16-8: 1**; Gx16:** 189; GX48:1; GX80-80: 8) *20 clinic placements *7 Correctional Facilities *6 Mobile Vans



7. Training: Laboratory and Clinical

A total of 1,785 laboratory staff and 9,043 health care workers have been trained since December 2011. This will be an ongoing process to support NDoH training on clinical algorithm. Laboratory staff received both clinical and technical training

8. Challenges identified during the course of the project to date

- Rollout of EGK to avoid duplications
- Implementing WHO recommended guidelines for Xpert testing on EPTB and paediatric samples: being addressed
- EPTB training to be expanded to correctional facilities to ensure compliance
- Hospital staff not complying to the GXP testing algorithm because trainings has not been conducted in most of the hospitals- being addressed
- Staff rotation in hospital wards posing a challenge in the implementation and compliance to the TB algorithms resulting in delay to initiating patients on TB Treatment

9. Funding

Table 9: Total and Percentage Contribution to date by Donor

Donor	% Contribution
NDoH	24.04
Bill & Melinda Gates Foundation	7.20
TB Reach	1.42
MSF	0.90
FIND	0.45
USAID	2.45
CDC NHLS 2010/11	14.78
CDC NDoH	0.72
CDC NHLS 2011/12	1.39
Dr. Niebauer	0.20
Gobal Fund NDOH	40.91
Global Fund RTC	2.78
CDC NDoH	2.77
Subtotal	**100**

CDC has contributed 19, 65% towards the program to date.

10. Recent Campaigns

None in June