COST AND OUTCOMES OF ART SCALE-UP IN ZAMBIA:

MODELLED ESTIMATES FOR TEST AND TREAT & COMMUNITY BASED SERVICE DELIVERY MODELS

POLICY BRIEF, SEPTEMBER 2016

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BACKGROUND

Zambia is exploring the resources needed to offer antiretroviral therapy (ART) to any person who tests HIV-positive, rather than limiting eligibility to patients with CD4 counts below 500 cells/µl, under the "Test and Treat" (T&T) strategy. The Ministry of Health (MoH), National AIDS Council, PEPFAR and other partners have worked with USAID's EQUIP Project to model the costs and impact of introducing T&T, and to estimate the costs of different community models of ART delivery, that are expected to be essential to increase system capacity and efficiency. This information will support budgeting, planning and strategic use of key service delivery options for Zambia under its new National AIDS Strategic Framework (NASF), and inform government's MTEF planning and budget submissions in the context of competing demands for scarce resources for health care.

This brief presents preliminary results for the cost and expected impact of an ART T&T strategy in Zambia and the estimated costs associated with community-based ART models. It does not reflect all other HIV or health program changes that will be considered in the new NASF. An assessment of available funding, fiscal space and financial gaps, as well as potential effects of exchange rates and macroeconomic trends, was also outside the scope of this analysis. They would warrant further examination by the Government of Zambia in planning and resource mobilisation.

METHODS

The cost and expected impact of an HIV test and treat strategy were modelled on the basis of Zambia's previous projections of the epidemic, made with the Spectrum AIM and Goals models.[1] For the current analysis, Goals was updated to reflect actual coverage for all HIV programs at the end of 2015, the new ART T&T targets, updated antiretroviral (ARV) and laboratory costs, and other program unit costs with the most recently available costs. Three testing and treatment scenarios were modelled (Table 1), with assumptions agreed upon in stakeholder workshops.

Table 1. T&T scenarios modelled in Zambia

Scenario Parameters	Business as Usual (BAU) - Baseline scenario -	Fast Track 90-90-90	Ambitious
ART eligibility	CD4 count < 500 cells/µl*	T&T	T&T
By 2020			
% of HIV+ plus who know their status	65%	90%	95%
% of all HIV+ on ART	70%	81%	90%
By 2030, % of all HIV+ on ART	82%	90%	95%

*Plus T&T for pregnant women, children, and TB co-infected

[1] National HIV/AIDS/STI & TB Council (2013) and updated "AIM projection Zambia 2016_NATIONAL Final" (13 July 2016).

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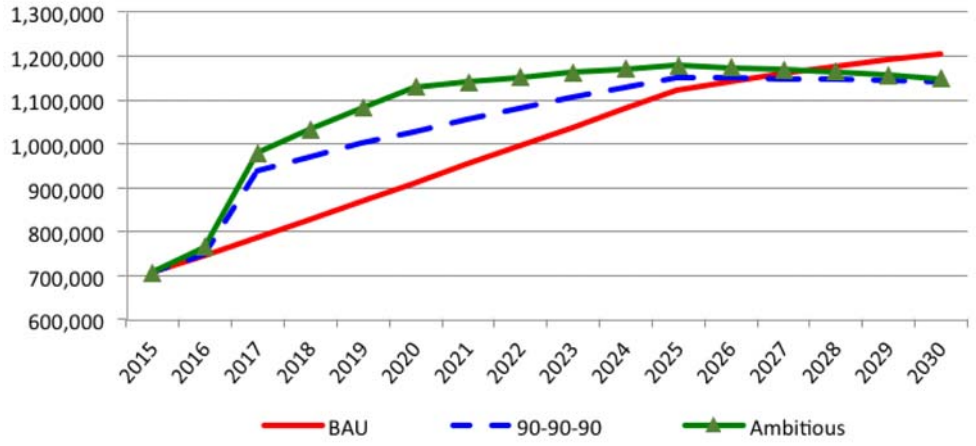
Targets for all other programs (e.g. condoms, circumcision) were modelled based on Zambia's NASF Extension 2014-16 (NAC 2013) and kept the same for all the scenarios.[2] Costs of differentiated community ART models were estimated using an ingredients-based approach based on interviews with implementers and on implementers' budgetary data. No primary data were collected for this analysis.[3] Costs and impact were not discounted, and costs are reported in 2015 US$.[4]

RESULTS

Projected impact of Test & Treat on the Zambian HIV epidemic

Under both T&T scenarios, the numbers of **adults on ART** will increase rapidly, from 706,000 in 2016 to 1,027,000 by 2029 in the Fast Track 90-90-90 scenario, and 1,131,000 under the Ambitious scenario as early as 2020 (Figure 1). The rate of increase will then slow in the Ambitious scenario, leading to similar numbers of adults on ART for all three scenarios by 2025. By 2030, fewer people are projected to require treatment due to the HIV infections prevented by high levels of ART coverage under the Fast Track and Ambitious scenarios. The numbers under the Business as Usual (BAU) scenario could however continue to increase.

Figure 1: Number of adults receiving ART under different treatment scale-up scenarios in Zambia



The numbers of **children on ART,** after initially increasing from 51,900 in 2015, are projected to start falling within a few years. This decline is because PMTCT has hugely reduced the number of newly infected children, and older HIV positive children are graduating to adult ART. The timing and scale of the reduction are uncertain, however, as there is limited information on numbers of infected children who can still be reached with ART.

Earlier HIV testing and ART initiation can **prevent large numbers of HIV infections**, by reducing people's viral loads and thus their risk of infecting others. Scaling up T&T can thus have a preventative effect that will eventually lead to reduced numbers of people needing treatment. Between 2016 and 2030 the Fast Track 90-90-90 scenario and the Ambitious scenario will avert 262,000 and 355,000 infections, respectively, when compared to the baseline BAU scenario (figure 2). Nevertheless, a large number of new infections will continue, even in the Ambitious scenario.

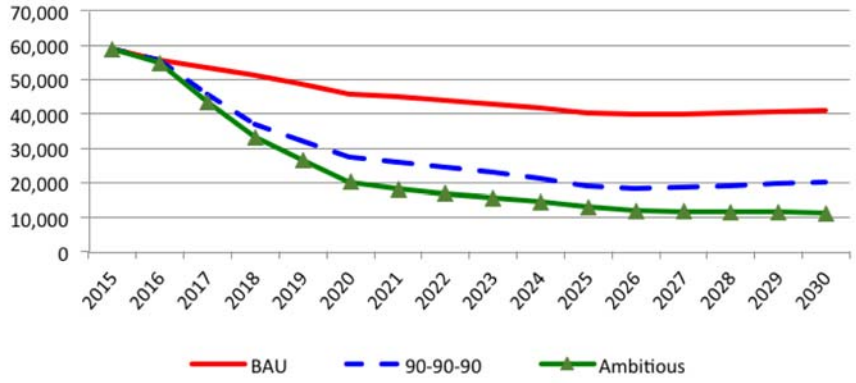
[2] For other interventions, the following targets were modeled for every scenario, to be reached by 2020: community mobilization: 40%, mass media: 40%, HCT: 45%, condom promotion: 35%, school-based education: 90%. Further details of the methodology and assumptions can be found in the accompanying Spectrum files and costing sheets, and refer to Stover et al, 2014.

[3] Primary data cost and impact data will be collected during the planned cost-effectiveness study (MoH).

[4] Applying an average annual exchange rate of 9.014 (Oanda, 2016).

Another prominent benefit of T&T is a **reduction in AIDS deaths**. The Fast-Track 90-90-90 scenario averts 48,000 more deaths than the baseline BAU scenario by 2030, while the Ambitious scenario averts 80,500 more deaths, equivalent to a reduction of more than 25%.[5]

Figure 2: Numbers of new HIV infections in Zambia per year, under various treatment scenarios

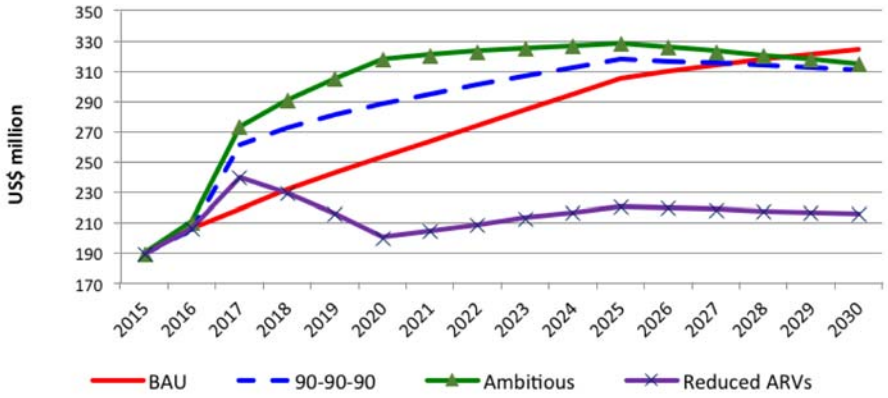


Costs of introducing Test & Treat in Zambia

The *average cost per person per year on ART* was estimated to range from US $265 to $270 per annum over the period 2016-2020. Personnel and facility overhead costs are were based on Zambia's MATCH 2.0 study (CHAI 2014) and combined with the most recent ARV prices and changing laboratory costs as viral load (VL) tests replace CD4 counts in the national ART monitoring protocol. Of the total per patient-year, ARV drugs cost around $150 (56% of the total); staff (22%) and laboratory tests (12%) are the other large components.

Under both T&T scenarios, the **cost of the ART program** initially increases dramatically (Figure 3). From a baseline of approximately $206 million in 2016, the cost of the Fast Track 90-90-90 scenario would reach $300 million in 2022 and peak at $318 million in 2025. It would thereafter decline, to $311 million in 2030. In the Ambitious scenario the cost would rise to $290 million by 2017, peak at around $328 million in 2025, and then decline to $314 million by 2030.

Figure 3: ART Program Test & Treat Estimated Resources Needed (US$ million; 2016 prices)



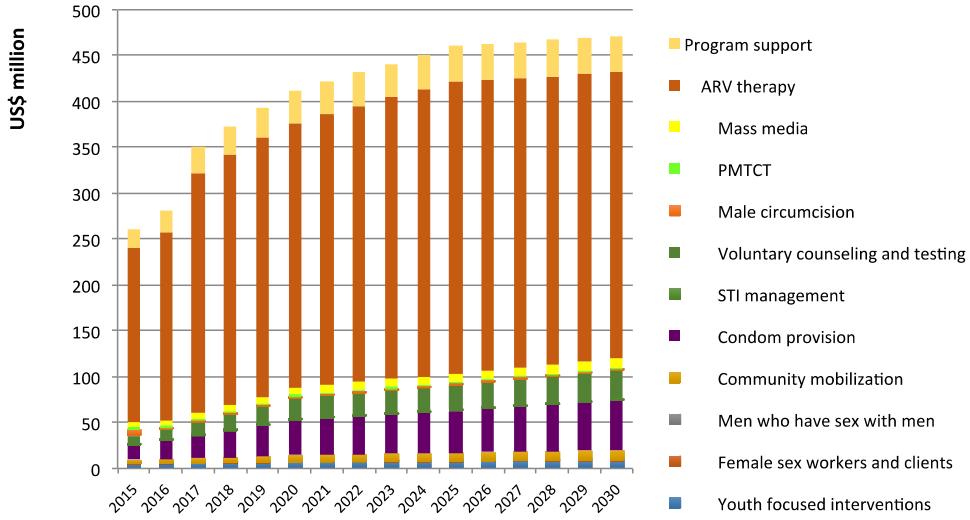
In both T&T scenarios, costs begin to plateau around 2025, when the numbers of persons needing treatment begin to stabilise. Costs continue climbing in the BAU scenario. As a result, while both the T&T scenarios initially cost more in total than the BAU scenario, eventually the T&T annual costs would fall below those of the BAU scenario. Figure 3 also shows an illustrative, adapted 90-90-90

[5] A reduction in mortality, in addition to its intrinsic benefits, has implications for increased productivity and reduced hospitalization costs; these were not estimated but may be substantial.

scenario labelled "Reduced ARVs," which assumes a 55% reduction in ARV drug prices by 2020 and indicates the potential for a major reduction in overall program costs if drug prices fall.

The estimated total HIV program costs in the Fast Track 90-90-90 scenario are shown in Figure 4 below. The ART program will initially consume about 75% of the projected total resources allocated to the full national HIV response if other program components are scaled-up as per the NASF targets. However, they then decrease slightly to around 66% as the preventative effect is realised.

Figure 4 - The total national costs for the Fast Track 90-90-90 scenario in Zambia, by program area (US$ million)



* Refer to appendix for the table of figures.

In Table 2, incremental program costs per death and infection averted are presented for each T&T scenario, as compared to the baseline Business as Usual scenario. The figures do not reflect the total possible future savings in terms of other health care costs averted.

Table 2. Incremental costs of T&T scenarios per death and infection averted 2016-2030

Outcome	Fast Track 90-90-90	Ambitious
Incremental ART cost per death averted	$5,436	$5,761
Incremental ART cost per infection averted	$990	$1,307

* T&T incremental effect as compared to BAU baseline scenario.

Community based models of ART delivery

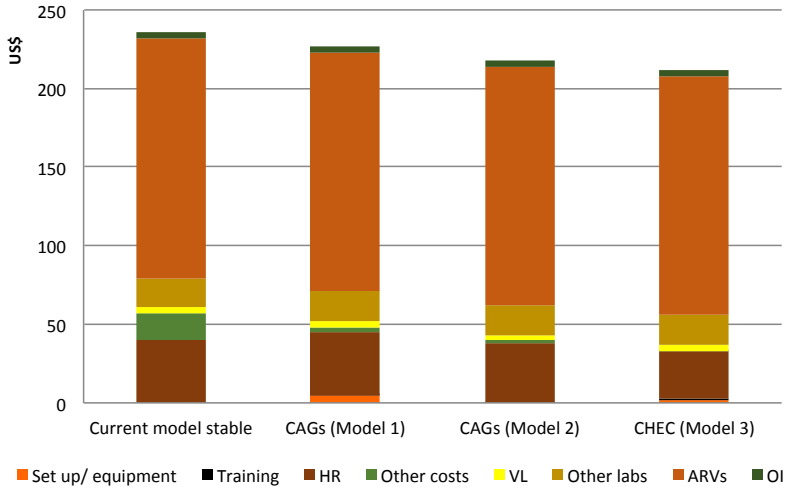
Differentiated models of community-based delivery of ART aim to reduce the need for adult patients who have been stable on ART for more than 6 months to collect their ARVs from health centers. They are intended to decongest crowded clinics, limit demands on scarce staff, and reduce ART program costs. At the same time they should decrease patients' travel costs and waiting time, and improve adherence. They could thus be important to achieve T&T scale-up targets.

In the models being piloted in Zambia, various routine tasks of collecting medication and providing adherence support are given to patients' peers or community health workers (CHWs). Different models and community contexts involve different training, equipment and allowances. They also vary in staffing, supervision models and workloads. For example, in the Community Adherence Group (CAG) model, a CHW or peer volunteer typically supervises up to 10 CAGs, each of which has six people on ART. Every CAG member has only one routine visit to the clinic 6-monthly for a check-up and to pick up ARVs for the whole CAG. Models such as the Community HIV Epidemic Control's

(CHEC) use CHWs for outreach to distribute ARVs and provide adherence support for up to 200 clients each.

Although the pilots are at an early stage of development, a preliminary costing of three models was done to assess their potential to reduce program costs. The estimated costs of ART per person per year are shown in Figure 5 below. The piloted community models are estimated to reduce health service costs per stable patient on ART by between 4% and 10%. Cost reductions are limited mainly by the dominance of the ARV drug costs, challenges in further reducing health centre visits below 6-monthly, and the relatively small patient loads of CHWs and CAGs in some models. No information on costs to patients, or the effects of decongestion of facilities or ART outcomes, is available yet.

Figure 5: Estimated cost per patient per year for community ART models (US$, 2016)*



* Costs that are not expected to be influenced by the model of care are the same across all models.
** "Other" Includes e.g. utilities, building space, stationery, transport.
*** Refer to appendix for the table of figures.

A scale-up scenario was developed to illustrate the potential cost and capacity impact of community models if they are rolled out to cover 25% of stable patients by 2020. This target is much more ambitious than the current pilot projects' capacity. Because unstable and paediatric patients will continue to be treated at facilities, the 25% of stable patients amounts to only 19% of *all* ART patients being on community models by 2020. Similarly, the overall ART program cost savings from introducing the proposed models could be limited to between 1-2% of total ART program costs until 2020, depending on start-up costs and rates at which the CHWs can increase their support to PLHIV. In summary, accelerated scale up will be required if community models are to take on a substantial proportion of the ART patients, and the program financial savings could still likely be modest.

CONCLUSIONS AND RECOMMENDATIONS

In summary, this analysis found that:

- Implementation of Test & Treat is expected to put **between 540,000 (Fast Track 90-90-90 scenario) and 837,000 (Ambitious scenario) more adults and children on ART** by 2020 than the current Business as Usual scenario. Rapid increases in capacity will be required for the anticipated large increases in ART enrolment particularly in 2017, with more gradual increases thereafter.
- Over the 15 years from 2016 to 2030 **an *additional* $260 million (Fast-track 90-90-90 scenario) or $464 million (Ambitious scenario)** will be required for ART under the T&T policy.

- The **Fast Track 90-90-90 and Ambitious scenarios could avert up to 262,000 and 355,000 more new HIV infections**, respectively, and avert up to 48,000 and 80,500 more deaths than the BAU scenario. Importantly, the reduced number of persons who become infected in the T&T scenarios is projected to bring treatment costs down, around 2026.
- Relative to the baseline, business-as-usual scenario, **moving to T&T will require front-loading of expenditures and implementation capacity** to achieve the longer-term preventative impact of universal treatment. A key question is which T&T scenario could be realistically achieved in terms of speed of implementation.
- Community models of ART delivery for stable adults could potentially decongest health facilities, reduce costs to the ART program and to clients, and enhance adherence. Health system **cost savings are expected to be modest**, however, and rapid scale-up will be required of the community models to absorb more stable adults.
- As might be expected, the ARV drugs already comprise more than half of total costs, hence the limited potential savings from greater efficiencies in service delivery. Therefore the largest potential to reduce costs substantially is through **reducing the prices of the ARV drugs**.

The following main recommendations arise from this modeling exercise:

Rapid scale up of Test and Treat

1. Address with urgency any obstacles limiting the scale-up of testing and treatment initiation, as both of the modelled T&T scenarios will require dramatically increasing numbers of patients on treatment in the first few years.
2. Explore strategies and differentiated models of delivery which could address the bottlenecks and reduce program costs, such as:
   - ✓ Health systems development to sustain T&T e.g. strategic information, supply chain, infrastructure, laboratory capacity;
   - ✓ Efficient targeted HCT approaches to reach positive people for T&T enrolment;
   - ✓ Strategic T&T scenario selection to improve the allocation of constrained resources, and;
   - ✓ Strategies to reduce ARV drug costs, including pooled procurements, longer-lasting drugs, reduced resistance drugs, or improved stock management to reduce wastage.
3. While scaling up the treatment programme, expand other effective prevention interventions to ensure fewer people become infected.
4. Improve program monitoring to generate timely, national-level indicators of coverage.
5. Ascertain the available funding and fiscal space, calculate the funding gap, and explore innovative resource mobilisation options for sustaining the T&T programme.
6. Ensure continued commitment and coordination by the Government, PEPFAR and the Global Fund to provide adequate and long-term resources.

Community models for ART delivery

7. Rapidly review and share the experiences in Zambia and the region with evolving community models of delivery.
8. Refine the practical guidance to implementing partners on how to plan and implement new models efficiently, reduce costs where possible, and to scale them up with adequate quality.
9. Map priority target populations for various models and guide resource allocation to them.
10. Undertake more detailed and longer-term empirical analyses of patient and service costs, savings and benefits, facility decongestion, and treatment outcomes of community models.
11. Develop robust systems for the routine monitoring of patient outcomes, resource use and provider and patient costs for each model, with warning indicators to identify challenges early.

ACKNOWLEDGEMENTS

This rapid assessment was made possible by the extensive advice and inputs from many colleagues in the Zambian National HIV/AIDS/STI/TB Council (NAC), Ministry of Health, USAID, CDC, UNAIDS, CIDRZ, JSI, University of Maryland, Boston University, the Health Economics and Epidemiology Research Office (HE^{2}RO), Right to Care, and FHI360. Thanks specifically to **CHAI** for their valuable assistance in collecting and reviewing recent costing literature and in updating their ART unit costs, and to **Avenir Health** for updating their Goals models based on the new AIM projections, and the scenarios developed by the stakeholders.

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Further references used to source calibration data for the T&T projections and differentiated ART models can be found obtained from the authors.

APPENDICES

Appendix 1: Total estimated resources needed to achieve the 90-90-90 scenario, by programme

Intervention Cost (US$ millions)	2016	2017	2018	2019	2020	2025	2030
Youth focused interventions	5.52	5.81	6.11	6.42	6.74	7.65	8.68
Female sex workers and clients	0.46	0.48	0.50	0.52	0.53	0.63	0.74
Men who have sex with men	0.02	0.02	0.03	0.03	0.03	0.03	0.04
Community mobilization	4.14	4.90	5.72	6.58	7.51	8.88	10.40
Condom provision	20.71	24.81	29.14	33.71	38.54	46.09	54.58
STI management	0.43	0.50	0.57	0.64	0.72	0.86	1.01
Voluntary counselling & testing	12.04	14.51	17.14	19.95	22.93	27.13	31.76
Male circumcision	0.97	0.98	1.00	1.02	1.04	1.49	1.88
PMTCT	2.39	2.51	2.62	2.65	2.65	2.10	1.50
Mass media	5.73	6.14	6.57	7.03	7.51	8.88	10.40
ART	205.91	261.15	272.46	281.59	288.80	318.06	310.92
Enabling environment	2.10	2.63	2.83	3.01	3.19	3.59	3.71
Program management	6.84	8.55	9.20	9.78	10.38	11.66	12.06
Research	1.84	2.30	2.48	2.63	2.79	3.14	3.25
Monitoring and evaluation	2.63	3.29	3.54	3.76	3.99	4.48	4.64
Strategic information	6.05	7.57	8.13	8.65	9.18	10.31	10.67
Logistics	3.16	3.95	4.24	4.52	4.79	5.38	5.57
Total Estimated Costs	**280.94**	**350.10**	**372.27**	**392.50**	**411.33**	**460.38**	**471.79**

Appendix 2: Total estimated resources needed for each scenario (US$ millions)

Total HIV Resource Need (US$m)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Baseline	281	321	347	373	398	414	430	445	461	477	487	496	505	514	523
Fast-track 90-90-90	281	350	372	393	411	422	432	441	451	460	463	465	467	469	472
Ambitious	286	363	392	418	443	449	455	460	466	471	472	473	474	475	476
Additional investment from Baseline to 90-90-90	-	29	25	20	13	8	2	- 4	- 10	- 17	- 24	- 31	- 38	- 45	- 51

Appendix 3: Estimated numbers of HIV-infected children (0-14yrs) and numbers on ART

	HIV-infected children (0-14yrs)			Children (0-14yrs) on ART		
	Business as Usual	90-90-90	Ambitious	Business as Usual	90-90-90	Ambitious
2015	78 274	78 274	78 274	51 903	51 903	51 903
2016	76 848	76 848	76 824	58 822	58 822	58 799
2017	74 506	74 503	74 364	57 031	58 300	58 179
2018	71 268	71 188	70 887	54 327	56 958	56 673
2019	66 800	66 863	66 341	50 899	54 584	54 095
2020	61 693	61 869	61 091	46 891	51 490	50 760
2021	56 813	56 885	56 136	43 142	47 793	47 662
2022	52 013	51 854	51 080	39 518	44 024	44 308
2023	47 644	47 150	46 368	36 207	40 434	41 034
2024	43 456	42 530	41 768	33 049	36 861	37 709
2025	38 928	37 553	36 851	29 646	32 862	33 881
2026	34 384	32 652	31 967	26 257	28 880	29 374
2027	29 145	27 200	26 451	22 358	24 311	24 312
2028	24 315	22 168	21 244	18 655	19 972	19 520
2029	21 206	18 872	17 724	16 273	17 160	16 285
2030	18 932	16 432	15 038	14 538	15 100	13 827
Total (2016-30)	**796 225**	**782 841**	**772 408**			

Appendix 4: Estimated numbers of HIV-infected adults (15+yrs) and numbers on ART

	HIV-infected adults (15+ years)			Adults (15+ yrs) on ART		
	Business as Usual	90-90-90	Ambitious	Business as Usual	90-90-90	Ambitious
2015	1 195 970	1 195 970	1 195 970	706 743	706 743	706 743
2016	1 220 159	1 220 160	1 219 850	746 166	746 167	766 516
2017	1 244 260	1 239 195	1 237 597	788 489	936 474	980 995
2018	1 267 132	1 252 767	1 248 877	830 620	969 456	1 034 675
2019	1 288 531	1 262 573	1 255 369	872 335	999 888	1 084 968
2020	1 308 260	1 268 433	1 256 809	913 554	1 027 430	1 131 128
2021	1 327 691	1 272 942	1 256 389	955 494	1 053 996	1 143 315
2022	1 346 570	1 276 239	1 254 922	997 670	1 079 698	1 154 528
2023	1 364 449	1 278 006	1 252 147	1 039 813	1 104 197	1 164 496
2024	1 381 448	1 278 425	1 248 302	1 082 151	1 127 571	1 173 403
2025	1 398 022	1 277 916	1 243 872	1 124 881	1 150 124	1 181 678
2026	1 414 168	1 276 449	1 238 552	1 143 445	1 148 804	1 176 625
2027	1 430 822	1 275 634	1 233 539	1 161 655	1 148 070	1 171 862
2028	1 447 053	1 274 664	1 227 952	1 178 786	1 147 198	1 166 554
2029	1 461 519	1 272 186	1 220 425	1 193 645	1 144 967	1 159 403
2030	1 475 020	1 268 909	1 211 776	1 207 031	1 142 018	1 151 186
Total (2016-30)	**20 375 104**	**18 994 498**	**18 606 378**			

Appendix 5: Breakdown of estimated ART costs by ingredient (90-90-90 scenario) (US$million)

Total ART T&T Costs (US$m)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
VL costs	3	13	19	24	29	30	30	31	31	32	32	32	31	31	31
ARV costs	118	150	155	159	162	166	169	172	176	179	178	177	176	175	175
Other labs	22	19	15	12	10	10	11	11	11	11	11	11	11	11	11
OI screening & treatment	3	4	4	4	4	4	4	5	5	5	5	5	5	5	5
Personnel	45	57	59	60	62	63	65	66	67	68	68	68	67	67	67
Nutrition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Equipment	10	13	13	14	14	14	15	15	15	15	15	15	15	15	15
Building maintenance	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Training	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Running & other facility costs	3	4	4	4	4	4	4	5	5	5	5	5	5	5	5
Total ART costs (US$)	**206**	**261**	**272**	**282**	**289**	**295**	**301**	**307**	**313**	**318**	**317**	**315**	**314**	**312**	**311**
Estimated ART Unit cost (US$)	265	267	269	270	270	270	270	270	270	270	270	270	270	270	270

Appendix 6: Estimated cost per patient per year for community ART models (US$, 2016)

Model	Set up/ equipment	Training	Staff costs	Other costs*	Viral load tests	Other lab incl. CD4	ARVs	OI mgmt	**Total**
Current model stable			39.53	17.8	3.37	18.91	151	4	**235.51**
CAGs (Model 1)	4.54	0.10	40.77	2.92	3.37	18.91	151	4	**226.51**
CAGs (Model 2)	-	0.04	37.88	1.91	3.37	18.91	151	4	**217.55**
CHEC CHW	1.71	0.79	30.49	0.29	3.37	18.91	151	4	**211.00**
Current adult unstable			107.4	17.8	3.37	27.95	151	4	**312.37**

** "Other" Includes e.g. utilities, building space, stationery, transport.