Total cost and potential cost savings of the national antiretroviral treatment (ART) programme in South Africa 2010 to 2017

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Background: **Situation in 2008/9**

- South Africa has the largest ART programme worldwide
  - 919,923 patients in November 2009
- Initiation rates of >300,000 patients/ year put pressure on funding and capacity
- Discussion about changes to guidelines
  - Increased eligibility
  - Better drugs
  - Changes to drug procurement
  - Changes to staffing levels and tasks
- Department of Health convened Costing Task Team in April 2009

Scenarios: Eligibility criteria

Scenario	Adults	Children
Scenario 1: **Old South African guidelines**	CD4 < 200 cells/mm^3 or WHO stage 4	CD4 15% to 20% or WHO stage 3 or 4
Scenario 2: **New South African guidelines**	**CD4 < 350** cells/mm^3 for TB/HIV co-infected or pregnant pts **CD4 < 200** cells/mm^3 or WHO stage 4 for all others	After positive PCR (**Early Paediatric Treatment**)
Scenario 3: **Full WHO guidelines**	**CD4 < 350** cells/mm^3 or WHO stage 4	

Scenarios: Adult drug regimens

Scenario		Regimen
Scenario 1: **Old South African guidelines**	First line	**d4T** + 3TC + EFV or NVP
	Second line	AZT + ddI + LPV/r
Scenario 2: **New South African guidelines** *and* Scenario 3: **Full WHO guidelines**	First line	**TDF** + 3TC + EFV or NVP for new initiates or if d4T toxicity; d4T + 3TC + EFV or NVP for all others
	Second line	**TDF + 3TC** + LPV/r if failing d4T- or AZT-containing regimens; **AZT + 3TC** + LPV/r if failing TDF-containing regimens

Scenarios: Paediatric drug regimens

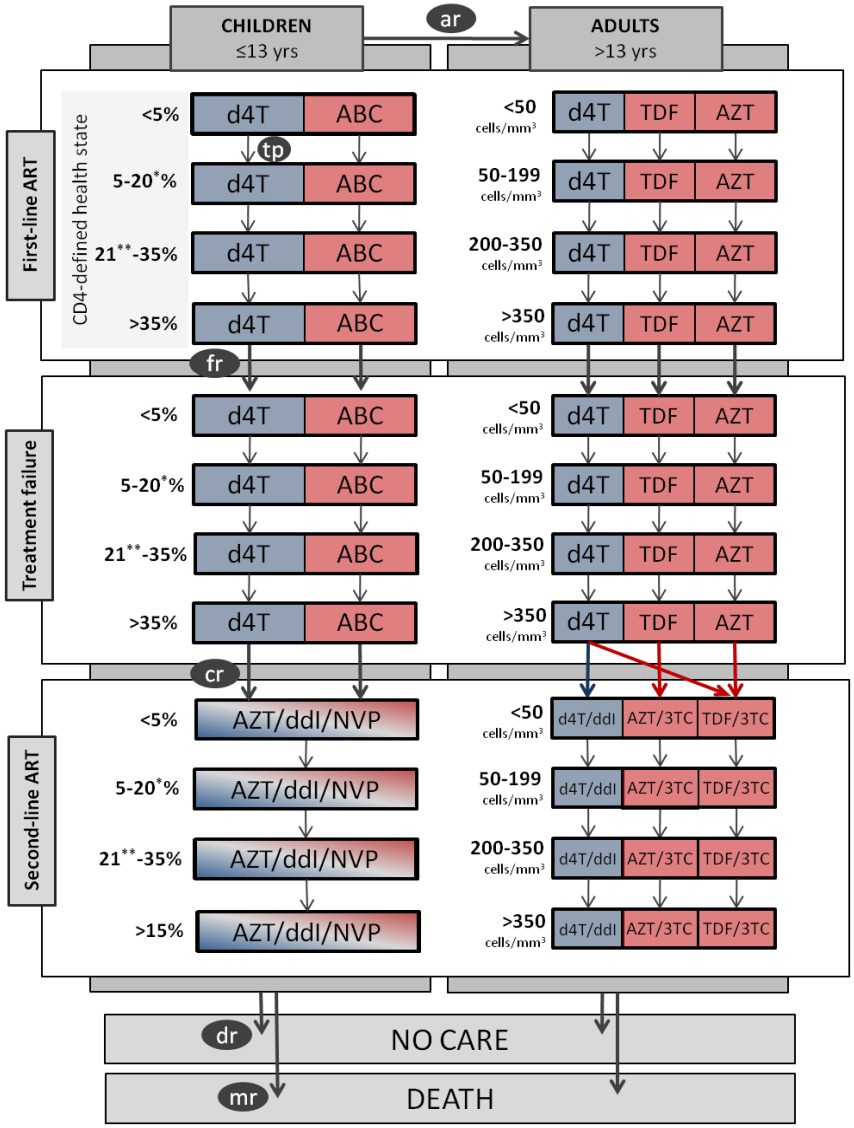
Scenario		Children < 3 years	Children > 3 years
Scenario 1: **Old South African guidelines**	First line	d4T + 3TC + LPV/r	d4T + 3TC + EFV or NVP
	Second line	AZT + ddI + NVP	AZT + ddI + LPV/r
Scenario 2: **New South African guidelines** *and* Scenario 3: **Full WHO guidelines**	First line	**ABC** + 3TC + LPV/r	**ABC** + 3TC + EFV or NVP
	Second line	AZT + ddI + NVP	AZT + ddI + LPV/r

Additional conditions

- **New drug purchasing system (RL/FDC):**
  - ARV drugs at prices set in reference list (modelled on CHAI/ GPRM/ SCMS prices)
  - Fixed-dose combination where possible

- **Task shifting (TS):**
  - ARV initiation and management by nurses under physician supervision
  - ARV dispensing by pharmacy assistants under pharmacist supervision

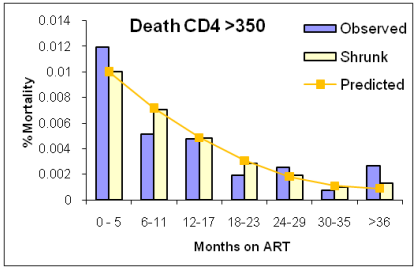
Health-state transition model
National ART Cost Model (**NACM**)



- 6-monthly transitions between types of care and CD4-defined health states
- Number of patients initiating ART from ASSA2003 model
- Initiation rate (coverage of newly eligible pts)
  - 80% in pts with <200 CD4 cells/mm^3
  - 24% in pts with 200-350 CD4 cells/mm^3
- Model is evaluated for 2010/11 to 2016/17, with a run-in between 2003/4 and 2009/10

Transitions

- Transition probabilites and rates of mortality, loss to follow-up, and first-line treatment failure based on 2 large Johannesburg cohorts:
  - Themba Lethu Clinic Cohort (n= 9,502)
  - Harriet Shezi Children's Clinic (n= 3,748)
- Transition probabilities and rates depend on CD4 cell count/ percentage and, for adult first-line treatment, also on time on treatment
- Mortality and loss rates shrunk towards their values predicted in a linear regression model as a function of the estimate's variance, using an Empirical-Bayes shrinkage estimator (Greenland *Epid* 1991)



Months on ART	Probability of		Probability of transition to CD4 cell count stratum:			
	Death	Loss to follow-up	<50 cells/µl	50-199 cells/µl	200-350 cells/µl	>350 cells/µl
if CD4 cell count >350 cells/µl						
0 - 5	1.0%	5.4%	0%	2.9%	10.7%	86.4%
6-11	0.7%	4.2%	0%	1.9%	17.7%	80.4%
12-17	0.5%	3.2%	0.2%	0.9%	10.4%	88.5%
18-23	0.3%	2.0%	0.07%	0.5%	9.6%	89.8%
24-29	0.2%	1.6%	0.07%	1.3%	9.5%	89.2%
30-35	0.1%	1.2%	0%	0.7%	8.0%	91.3%
>35	0.1%	0.6%	0.2%	0.5%	9.2%	90.1%
if CD4 cell count 200 - 350 cells/µl						
0 – 5	1.4%	5.1%	0.7%	8.4%	57%	33.8%
6-11	1.0%	3.6%	0.3%	7.8%	62%	29.7%
12-17	0.4%	2.9%	0.2%	5.4%	57%	37.3%
18-23	0.5%	2.3%	0.07%	5.2%	63%	31.5%
24-29	0.3%	1.9%	0.09%	5.8%	64%	30.3%
30-35	0.3%	1.6%	0%	4.5%	64%	31.6%
>35	0.0%	1.3%	0%	5.1%	61.3%	33.6%
if CD4 cell count 50 -199 cells/µl						
0 - 5	2.6%	6.5%	1.0%	39.9%	45.3%	13.8%
6-11	1.7%	4.7%	0.9%	56.0%	39.0%	4.2%
12-17	1.1%	4.0%	1.7%	52.7%	41.8%	3.8%
18-23	1.1%	3.3%	0.9%	52.9%	42.9%	3.4%
24-29	0.7%	3.1%	1.2%	55.2%	41.3%	2.3%
30-35	0.5%	2.5%	0.5%	54.8%	38.6%	6.1%
>35	0.2%	2.6%	0%	54.3%	38.8%	6.9%
if CD4 cell count <50 cells/µl						
0 - 5	8.0%	9.7%	11.6%	71.2%	15.0%	2.2%
6-11	5.9%	7.5%	23.6%	65.2%	9.4%	1.7%
12-17	5.8%	6.0%	31.4%	45.1%	19.6%	3.9%
18-23	5.4%	4.8%	29.4%	50.0%	11.8%	8.8%
24-29	0.0%	4.1%	25.0%	58.3%	8.3%	8.3%
30-35	0.0%	0.0%	25.0%	50.0%	25.0%	0%
>35	3.6%	6.4%	0%	33.3%	33.3%	33.3%

Cost input [2009 USD]

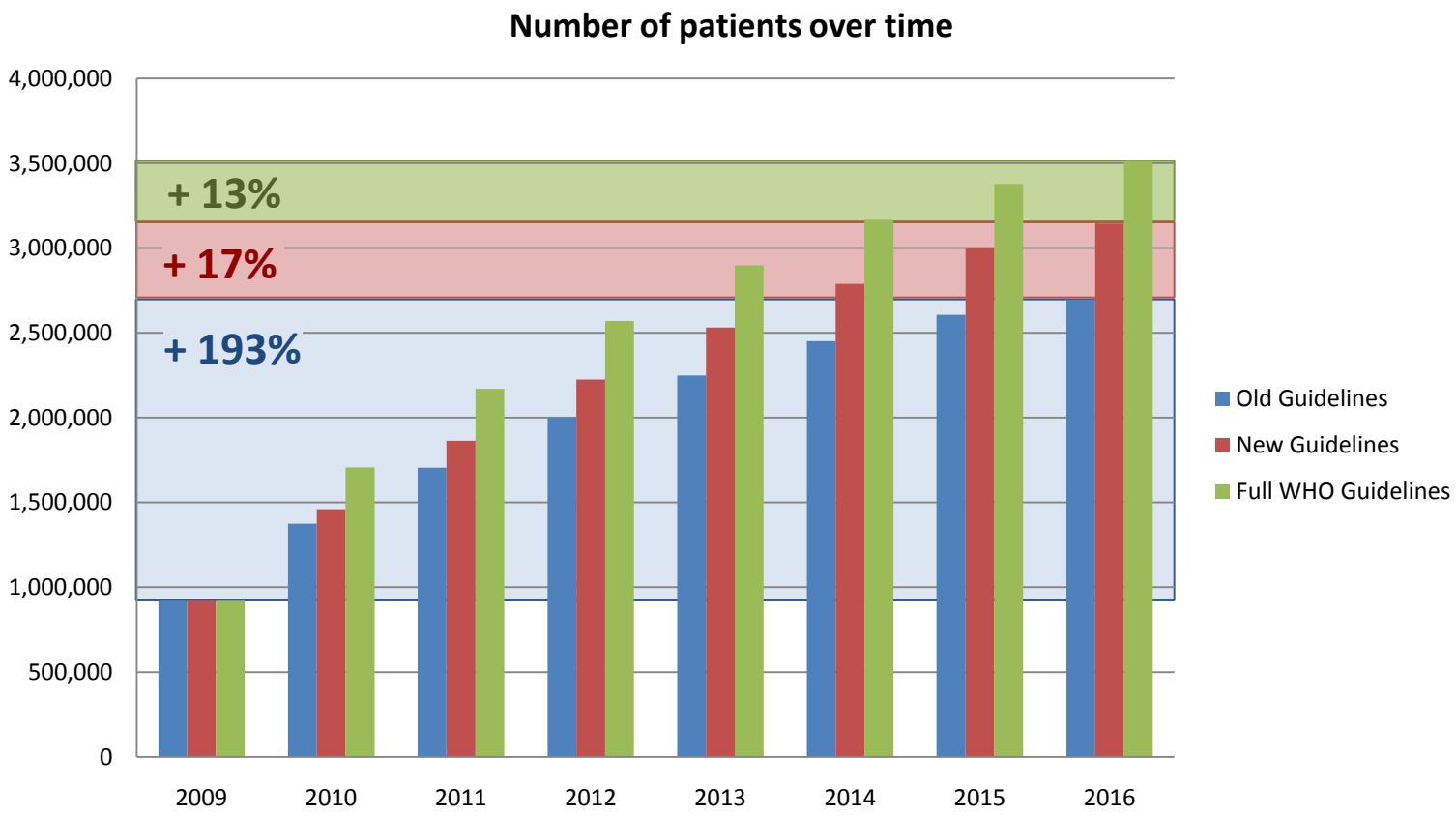
Cost data from bottom-up cost analysis at Themba Lethu clinic in 2007-2009 (n=350); ARV cost for children adjusted by age and weight; ARV costs updated to last g'vt tenders

Cost per patient year (*half-year)	**Old guidelines**			**New guidelines + Full WHO guidelines**		
Adults	**d4T** regimens			**TDF** regimens		**AZT** regimens
First line < 6 mts*	448			552		420
First line > 6 mts	672			799		703
First line failure	662			801		694
Second line	1,531			1,235		1,140
Children	**d4T** regimens			**ABC** regimens		
Age [years]	*<1*	*1-5*	*6-13*	*<1*	*1-5*	*6-13*
First line < 6 mts*	408	466	478	729	794	812
First line > 6 mts	507	607	628	515	625	657
First line failure	542	644	664	550	662	694
Second line	582	889	880	582	889	880

Results:
Total number of patients

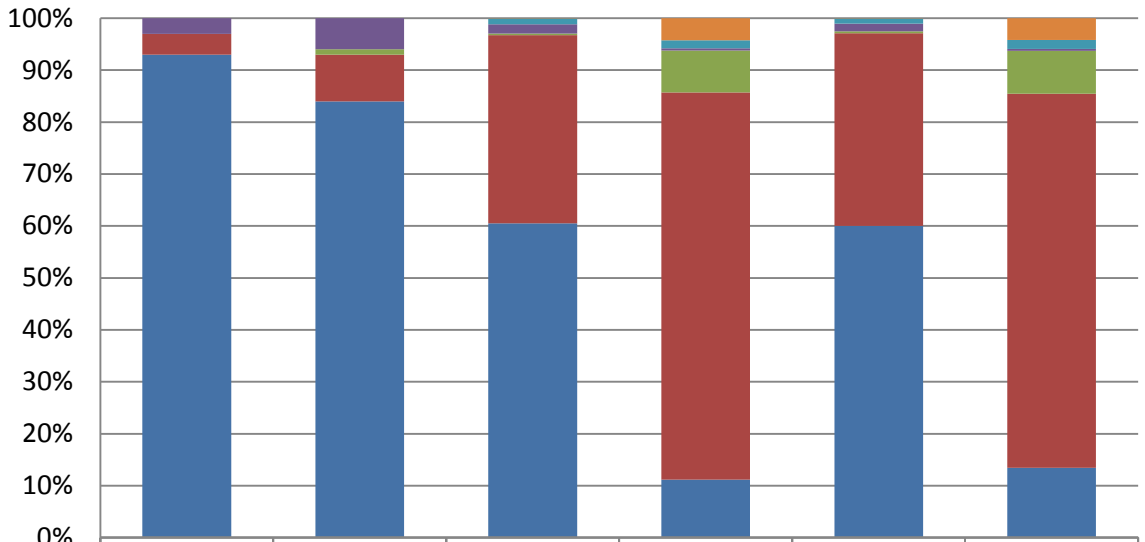
Scenario	Total patients initiated	Total patients on ART by year		*% increase on 2009*
	2010/11 to 2016/17	2009/10	2016/17	
Old Guidelines	2,932,000	1,028,000	2,693,000	*193%*
New Guidelines	3,331,000	1,028,000	2,949,000	*242%*
% increase on old GL	*14%*	-	*17%*	-
Full WHO Guidelines	3,592,000	1,028,000	3,513,000	*282%*
% increase on old GL	*23%*	-	*30%*	-

Results:
Total number of patients



→Growth in number of patients on ART over time as a result of prevalence (+193% for Old Guidelines)
is higher than growth in patients as a result of increase in eligibility (+17-30%)

Results:
Regimen distribution (Adults)



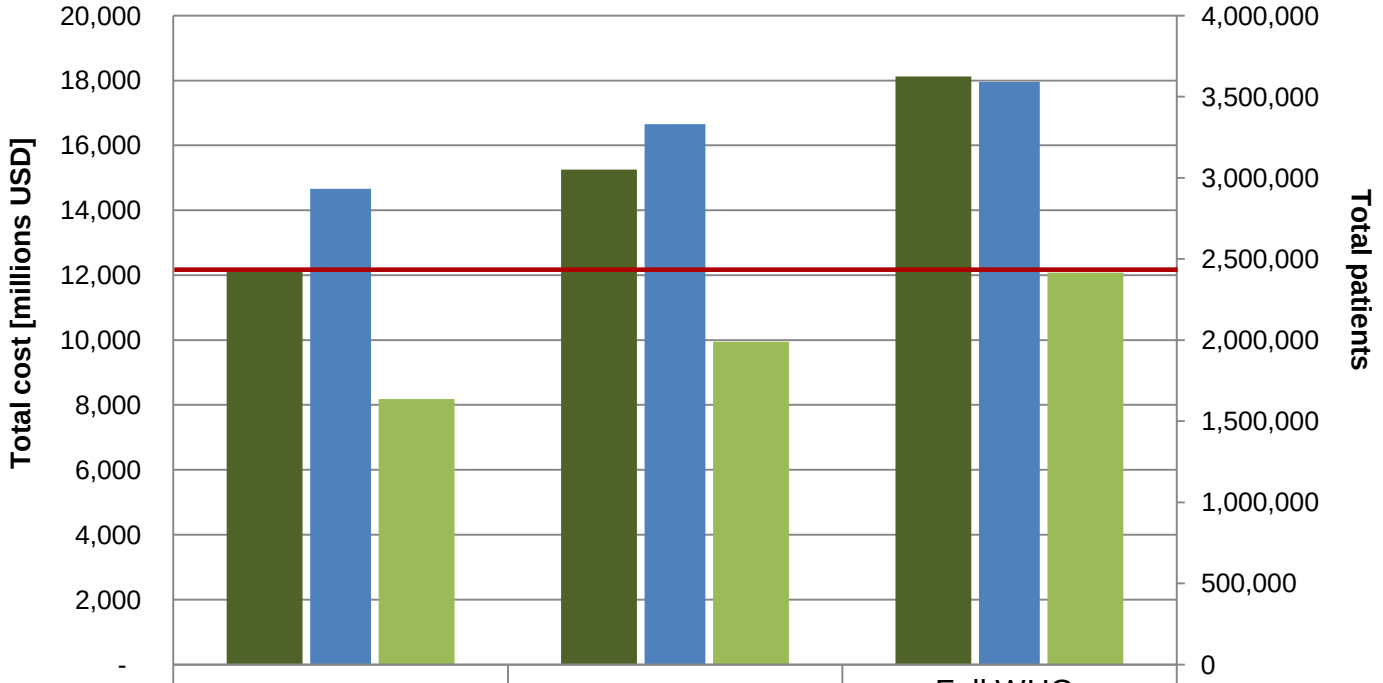
	2010/11	2016/17	2010/11	2016/17	2010/11	2016/17
	Old Guidelines		New Guidelines		Full WHO Guidelines	
AZT+3TC+LPV/r	0%	0%	0.1%	4%	0.1%	4%
TDF+3TC+LPV/r	0%	0%	1%	2%	1%	2%
AZT+ddI+LPV/r	3%	6%	2%	0.4%	2%	0.4%
AZT+3TC+EFV/ NVP	0%	1%	0.3%	8%	0.3%	8%
TDF+3TC+EFV/ NVP	4%	9%	36%	75%	37%	72%
d4T+3TC+EFV/ NVP	93%	84%	61%	11%	60%	13%

Results:
Total cost [million 2009 USD]

Scenario	Full cost (Staffing and drug cost as current)			Reduced cost (With task-shifting and cheaper fixed-dose combinations)			
	2010/11	2016/17	Total	2010/11	2016/17	Total	% change on full cost
Old Guidelines	1,055	2,245	**12,200**	711	1,504	8,180	*-33%*
New Guidelines	1,161	2,994	15,251	754	1,969	9,946	*-35%*
increase on old GL	*10%*	*33%*	*25%*	*6%*	*31%*	*22%*	-
Full WHO Guidelines	1,415	3,494	18,125	934	2,345	12,077	*-33%*
increase on old GL	*34%*	*56%*	*49%*	*31%*	*56%*	*48%*	-

→**The total cost of the programme increases by 25% and 49%, resp., for the New GL and WHO GL scenarios, as a result of both higher numbers of patients and higher drug cost for TDF-containing regimens.**

Summary



	Old Guidelines	New Guidelines	Full WHO Guidelines
Total cost (Full cost)	12,200	15,251	18,125
Total cost (Reduced cost)	8,180	9,946	12,077
Total patients initiated on ART	2,932,000	3,331,000	3,592,000

→**If new drug purchasing mechanisms and task-shifting are implemented, the cost of the New Guidelines is below, and the cost of the Full WHO Guidelines the same as the cost of the Old Guidelines.**

Budget impact

[Budget Review 2010, National Treasury]

	2010/11	2011/12	2012/13
Total public health budget	13.9 billion	15.0 billion	16.0 billion
Percentage of budget at full cost			
Old Guidelines	8%	9%	10%
New Guidelines	8%	10%	12%
Full WHO Guidelines	10%	13%	15%
Percentage of budget at reduced cost (TS and RL/FDC)			
Old Guidelines	5%	6%	7%
New Guidelines	5%	7%	8%
Full WHO Guidelines	7%	8%	10%

Limitations

- Assumption that the rate of initiation between 200 and 350 CD4 cells/mm^3 is 30% of that < 200 CD4 cells/mm^3 might be an over- or underestimation
- Cost does not differ between CD4 cell counts, and inpatient cost is excluded
- Effectiveness assumed to be the same for d4T-, TDF- and ABC-containing regimens
- Task shifting only affects staff and administration cost, not effectiveness
- Impact on transmission not included

Conclusions

- Under both new sets of guidelines, the increase in cost as a result of increased eligibility and better drugs is dwarfed by the increase in cost resulting from the growth in the population in need of ART, regardless of eligibility criteria
- HIV prevalence will continue to be a stronger driver of treatment costs than eligibility thresholds or drug choices
- Our model indicates that the projected increases in treatment cost under both new guidelines could be offset by the introduction of new drug purchasing mechanisms and task-shifting

Implementation

- In April 2010, new South African national ART guidelines were implemented, recommending the changes in eligibility and regimens in the New Guidelines scenario
- Task-shifting has been agreed on, and new reference list mechanism has been issued for 2010 tender
- In February 2010, the national ART budget was increased by 96%, providing care for up to 2.3 million patients by the end of 2012/13
- In order to increase coverage, a HCT campaign was started in April 2010, aiming at testing 15 million South Africans by June 2011

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