

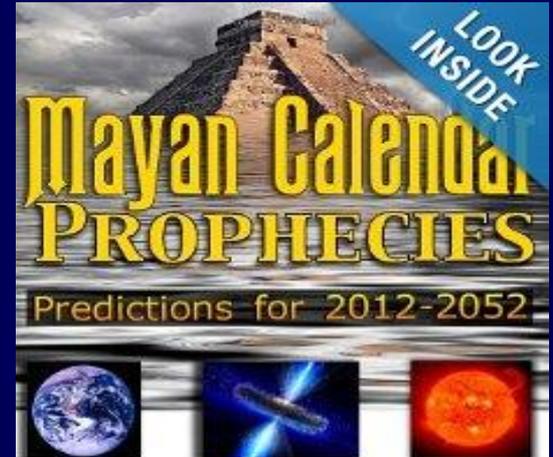
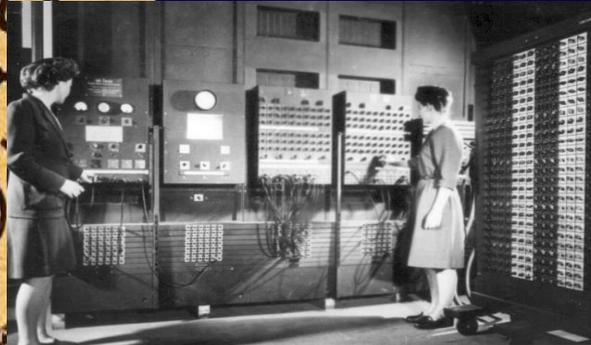
Epidemiology and economics: *modelling the scenarios for the end of AIDS*

Controlling the HIV Epidemic with Antiretrovirals:
from consensus to implementations

London, England
September 22, 2013

Reuben Granich, MD, MPH
Senior Advisor, Care and Treatment
UNAIDS

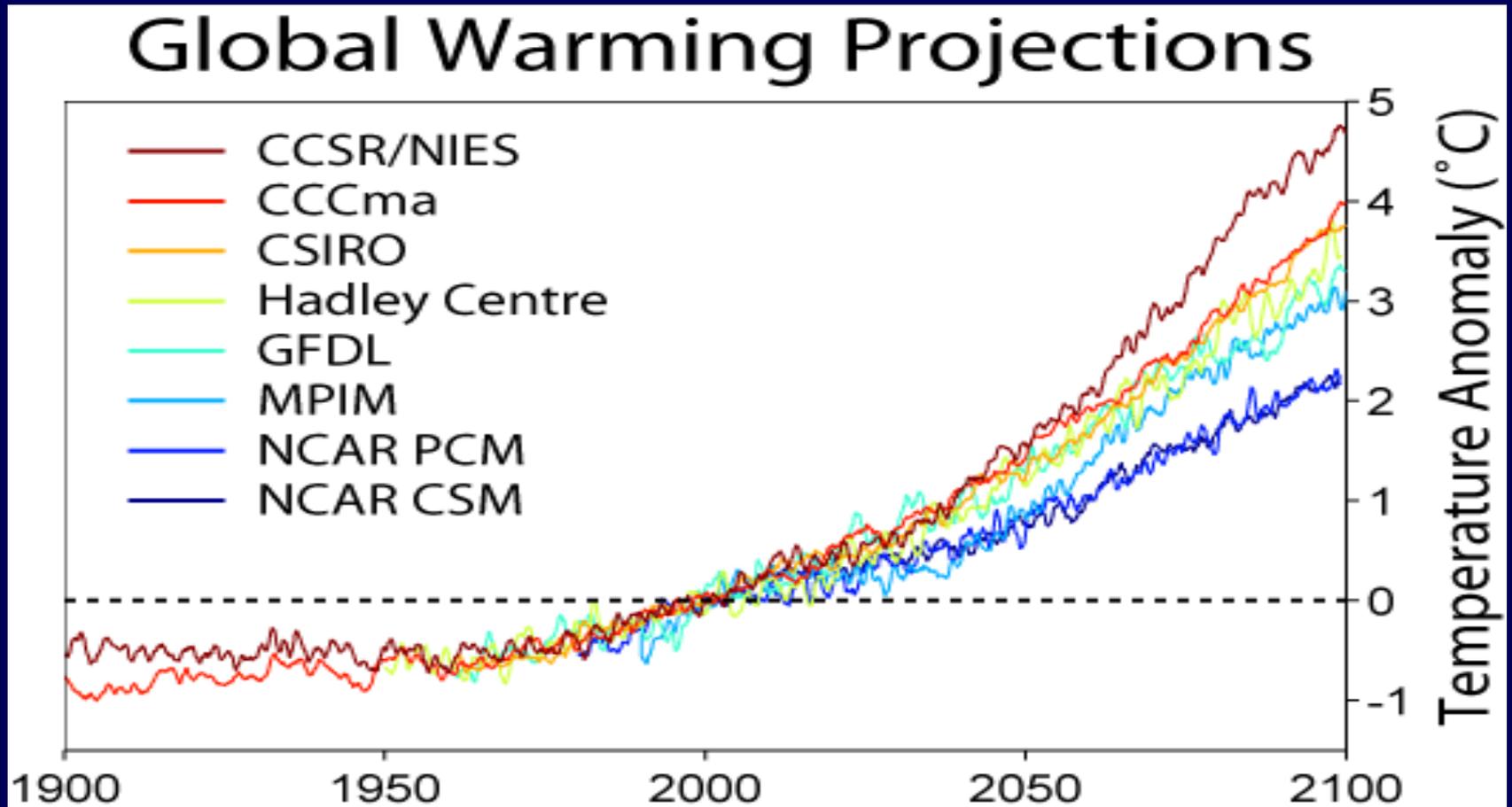
Predicting the future is easier than we think



Discussing modelling,
economics and the end of AIDS
in 15 minutes is more of a challenge



Climate change modelling has provided us with options



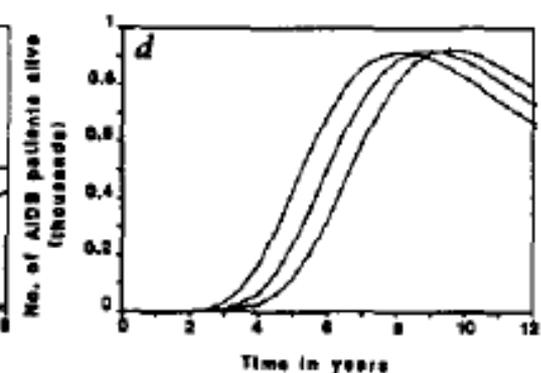
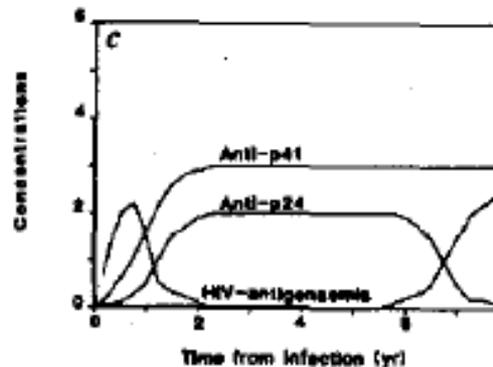
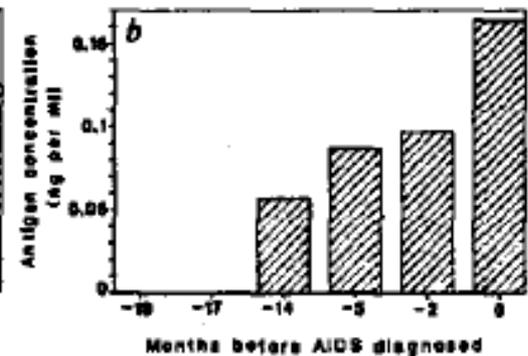
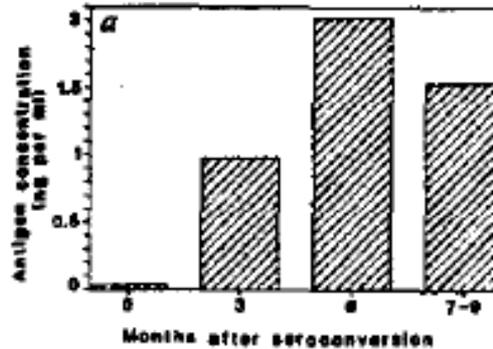
Anderson and May 1988

Epidemiological parameters of HIV transmission

Roy M. Anderson* & Robert M. May†

* Parasite Epidemiology Research Group, Department of Pure and Applied Biology, Imperial College, London University, London SW7 2BB, UK
 † Biology Department, Princeton University, Princeton, New Jersey 08540, USA

Epidemiological data on the main determinants of the transmission accumulating, but many uncertainties remain.



Handwritten notes on a blackboard:

$$X_{t+1} = \lambda X_t e^{-X_t}$$

pop'n with discrete, non overlapping generations = (1 week? / 1 day?)

FIXED PTS of period 2^c

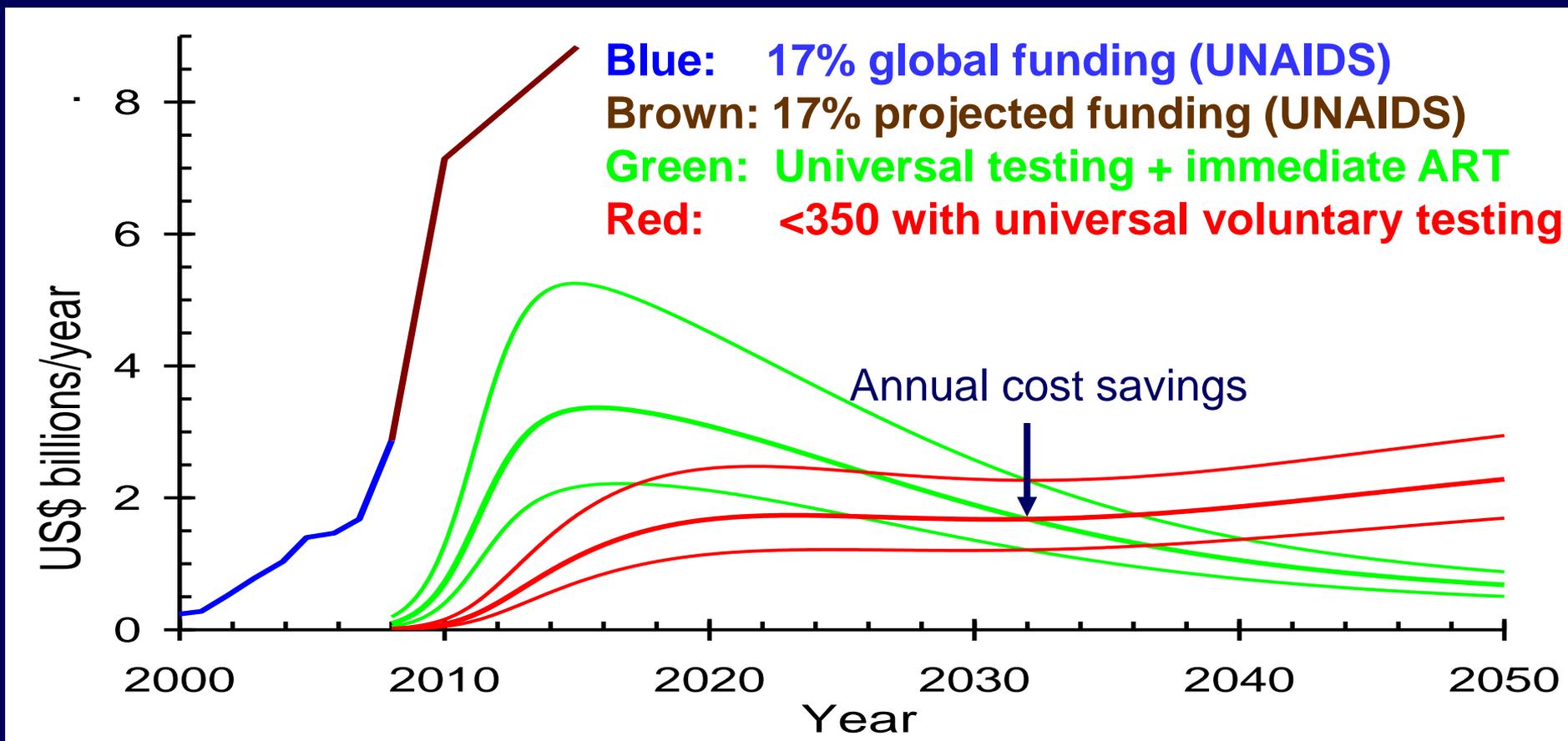
$c = 7.37$ 16.77

CASCADE OF PERIOD DOUBLING FOR $\lambda > 2^c$

Q: WHAT HAPPENS FOR $\lambda > 16.77$ (Point of accum of e^{2^c})
 LOOKS LIKE A MESS!

\$10 reward for answer!!

Estimated and projected funding and costs: We appear to be in the right ball park....



Cohen J. HIV/AIDS. The great funding surge. *Science* 2008 Jul 25;321(5888):512-9.

UNAIDS. Financial resources required to achieve universal access to HIV prevention, treatment, care and support.

UNAIDS Report (2007). http://data.unaids.org/pub/Report/2007/20070925_advocacy_grne2_en.pdf.

Granich *Lancet* 2008



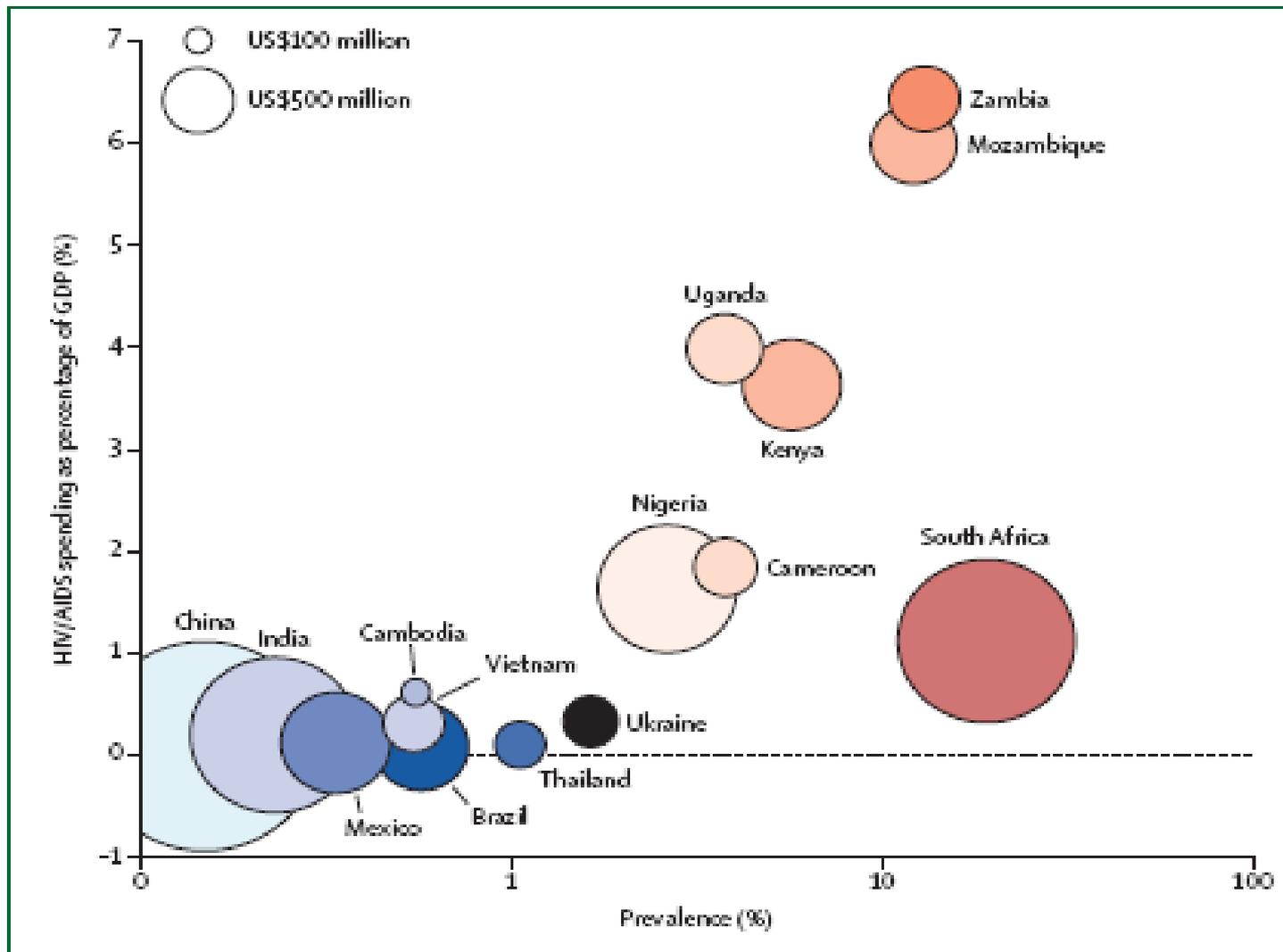
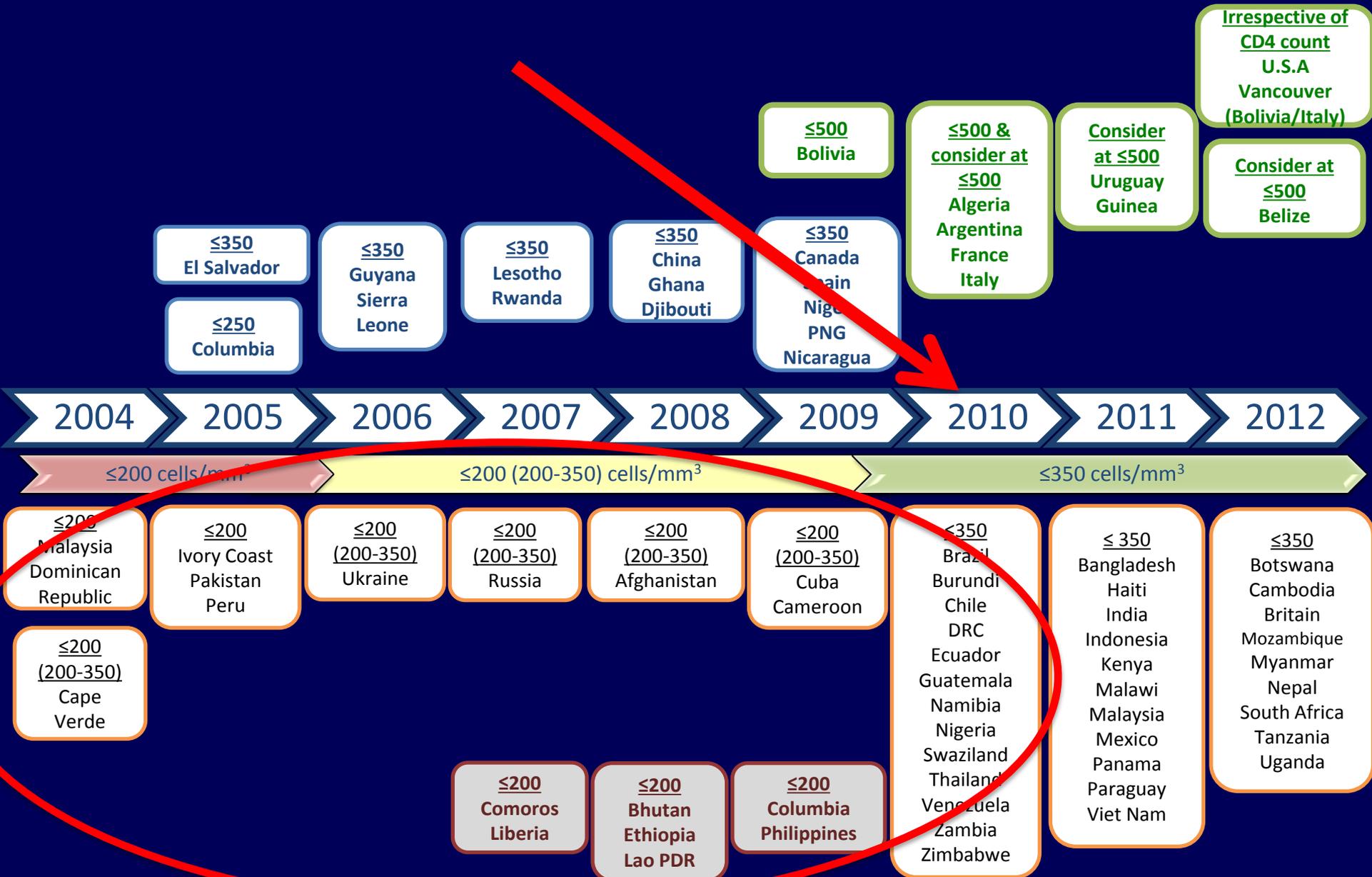


Figure: AIDS spending requirements in 2015 for selected low-income and middle-income countries²⁵
 Circle size is proportional to a country's total projected AIDS spending needs in 2015, calculated on the basis of the rapid scale-up scenario.

When to start policy by date



Towards an improved investment approach for an effective response to HIV/AIDS



Bernhard Schwartlander, John Stover, Timothy Hallatt, Rifat Atun, Carlos Avila, Eleanor Gausws, Michael Bartos, Petar D Ghys, Marjorie Opuni, David Barr, Ramzi Alsalqa, Lori Ballinger, Marcelo de Freitas, Geoffrey Garnett, Charles Holmes, Ken Legins, Yogan Pillay, Anderson Eduardo Stanciole, Craig McClure, Gottfried Hirschall, Marie-Laga, Nancy Padian, on behalf of the Investment Framework Study Group*

Schwartlander Lancet 2011 2nd generation economics

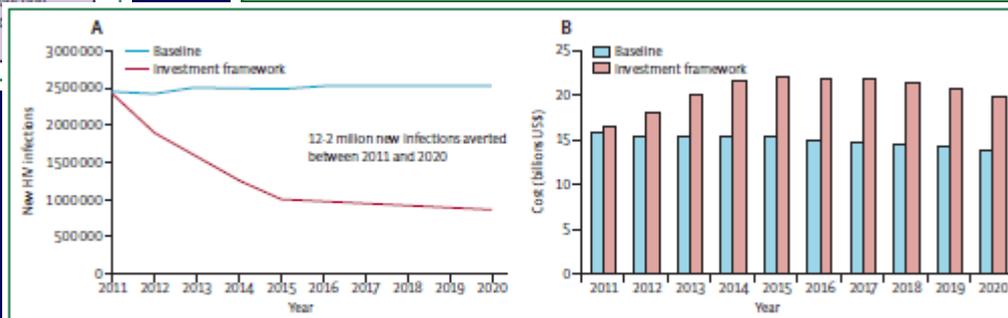
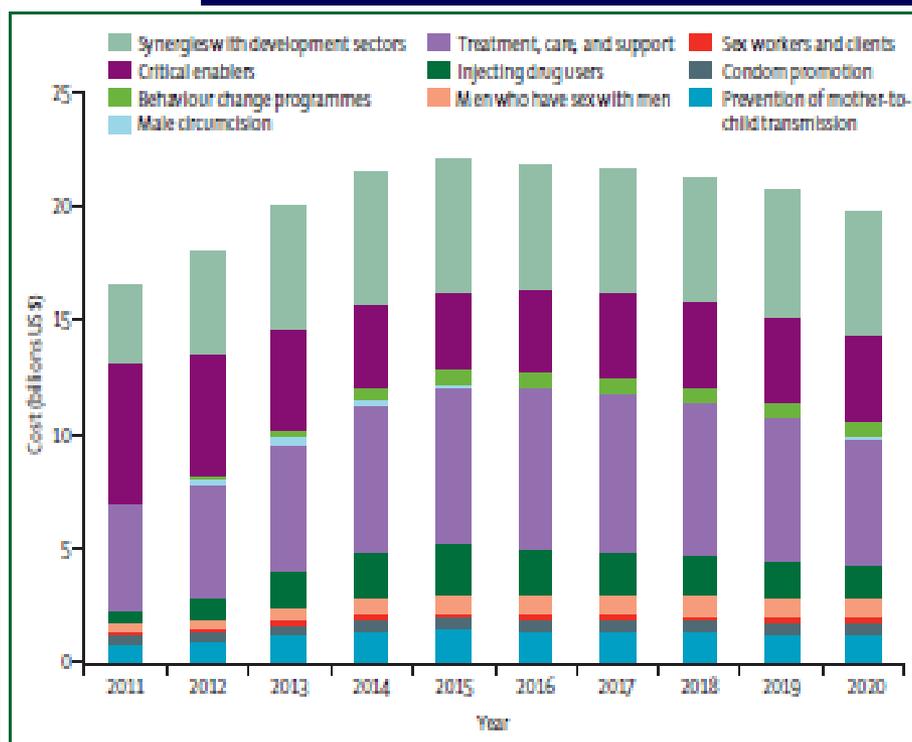
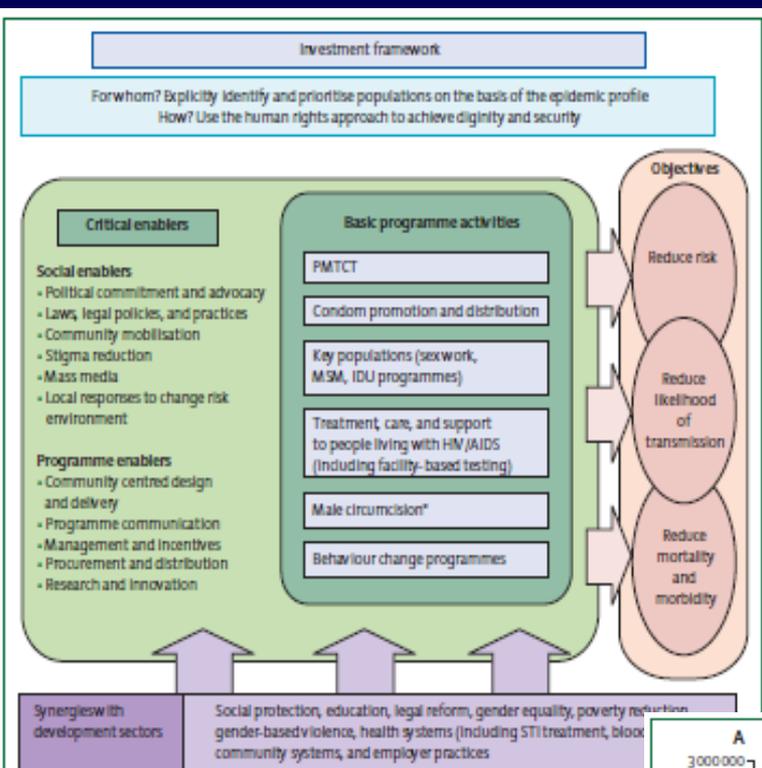
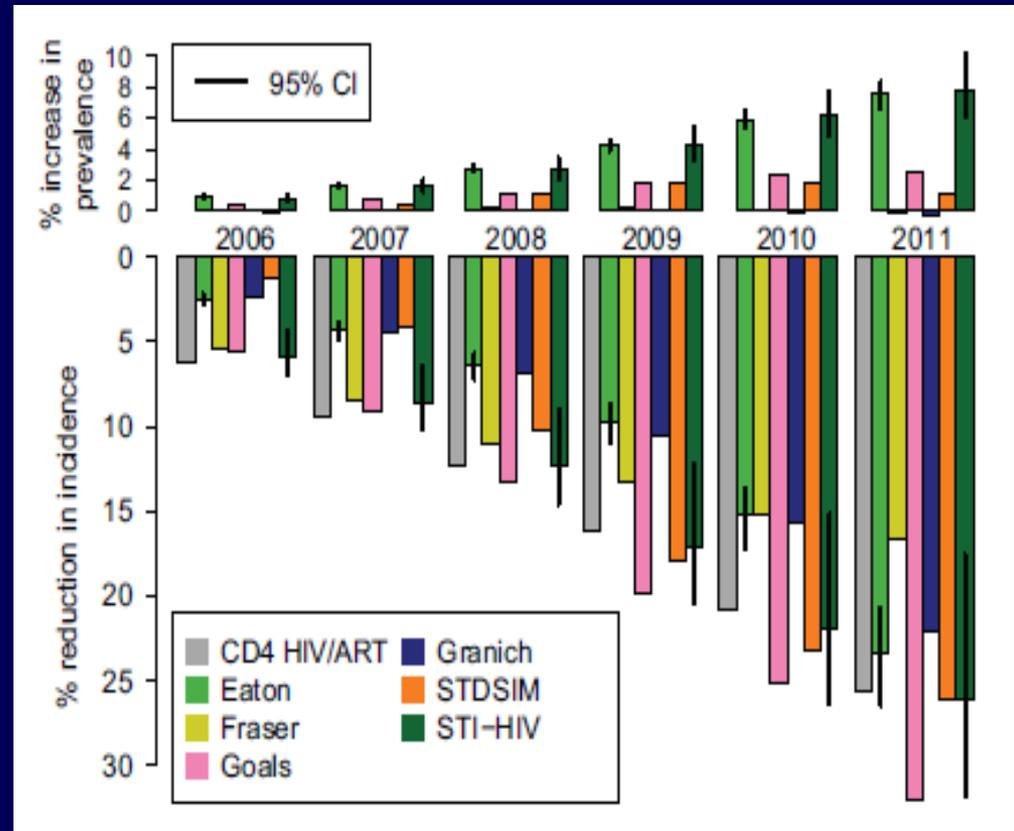
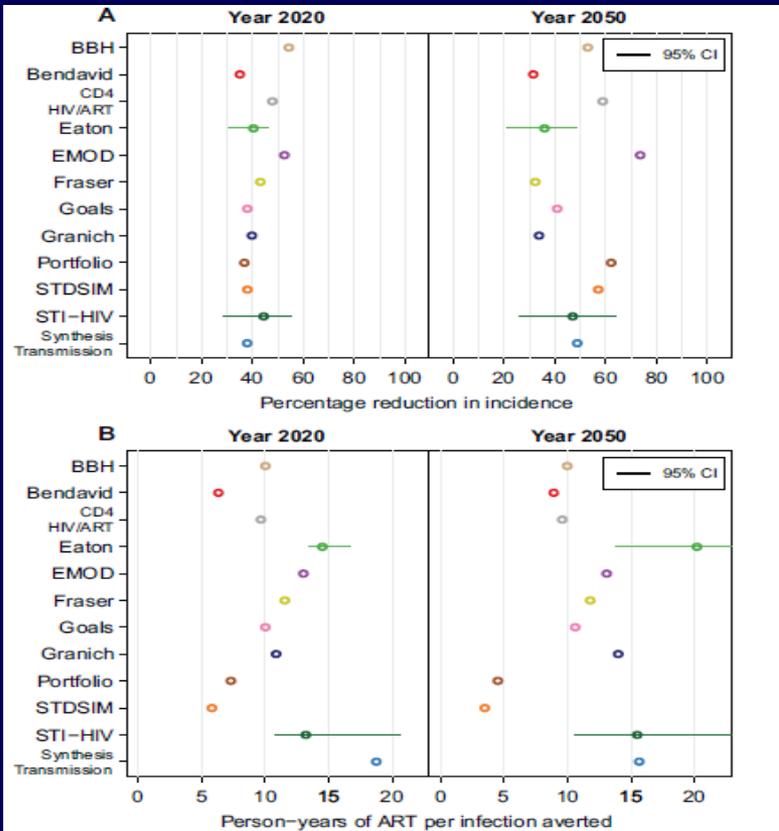


Figure 4: Number of new HIV infections per year (A) and cost in low-income and middle-income countries (B) between 2011 and 2020 expected under the new investment approach compared with a baseline scenario assuming constant coverage at around present funding rates and approaches

HIV Treatment as Prevention: Systematic Comparison of Mathematical Models of the Potential Impact of Antiretroviral Therapy on HIV Incidence in South Africa

Jeffrey W. Eaton^{1*}, Leigh F. Johnson², Joshua A. Salomon³, Till Bärnighausen^{3,4}, Eran Bendavid⁵, Anna Bershteyn⁶, David E. Bloom³, Valentina Cambiano⁷, Christophe Fraser⁸, Jan A. C. Hontelez^{4,9,10}, Salal Humair^{3,11}, Daniel J. Klein⁶, Elisa F. Long¹², Andrew N. Phillips⁷, Carel Pretorius¹³, John Stover¹³, Edward A. Wenger⁶, Brian G. Williams¹⁴, Timothy B. Hallett¹

Eaton PlosMed 2013



Third generation economics: significantly higher employment at CD4 \geq 500 among adults

- Compared to CD4<200, CD4 \geq 500 associated with
 - 5.8 more days/month
 - 2.2 more hours/day (40% more than ref. mean of 5.5)

Regression model coefficients		
	(1)	(2)
Outcome:	Days worked in the past month	Hours worked on usual day in past
CD4<200	Reference	Reference
CD4 200-349	2.7	1.8
CD4 350-499	4.8	0.9
CD4 \geq 500	5.8**	2.2*
Observations	107	107

- Linear regression model with age, age-squared, and sex included as controls
- ** p<0.05, * p<0.10
- Reference group has CD4<200

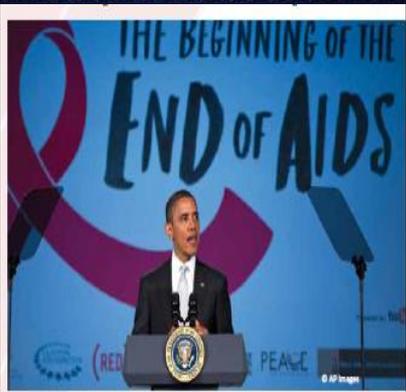
Those with CD4 \geq 500 worked nearly 1 week/month more than those with CD4<200, and as much as HIV-uninfected adults

How do we spend the money?





PEPFAR BLUEPRINT: CREATING AN AIDS-free GENERATION



November 29, 2012

As a nation, we are firmly committed to turning the tide on the 30-year-old fight against AIDS. That's why I proudly announced last year that creating an AIDS-free generation is a new policy imperative for the United States.

To be clear, we still face enormous challenges. Far too many people are dying from this disease. We need to reach more people with both prevention and treatment services. But today, thanks to remarkable scientific discovery and the work of countless individuals, organizations and governments, an AIDS-free generation is not just a rallying cry—it is a goal that is within our reach.

At the International AIDS Conference this past July, I asked our Global AIDS Coordinator, Ambassador Eric Goody, to prepare this blueprint outlining our path to helping create an AIDS-free generation. I want the next Congress, the next Secretary of State, and all of our partners here at home and around the world to understand everything we've learned and to have a road map for how the United States will contribute to an AIDS-free generation.

This blueprint should make one thing clear: the United States is and will continue doing our part. But creating an AIDS-free generation is too big a task for one government or one country. It requires the world to share in the responsibility. We call on partner countries, other donor nations, civil society, faith-based organizations, the private sector, foundations, multilateral institutions and people living with HIV to join us as we each do our part.

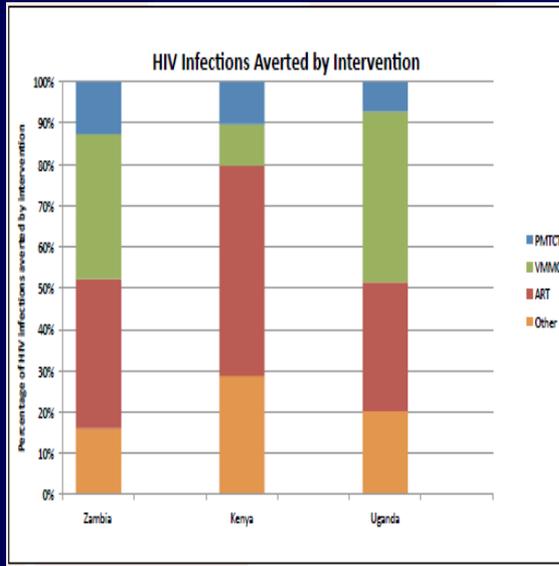
Together, we can deliver a better future to millions across the globe. A future where children are not born with HIV... where teenagers and adults are at far lower risk of contracting the virus... where those who do have the virus get life-saving treatment. A future where every child has the chance to live up to his or her God-given potential.

That's a future worth fighting for, together.

Sincerely,

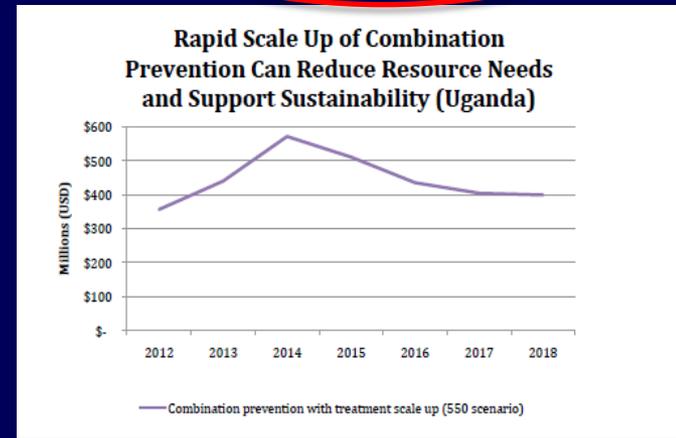
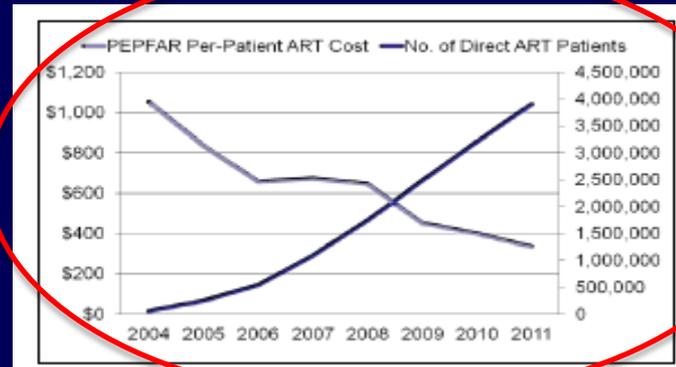
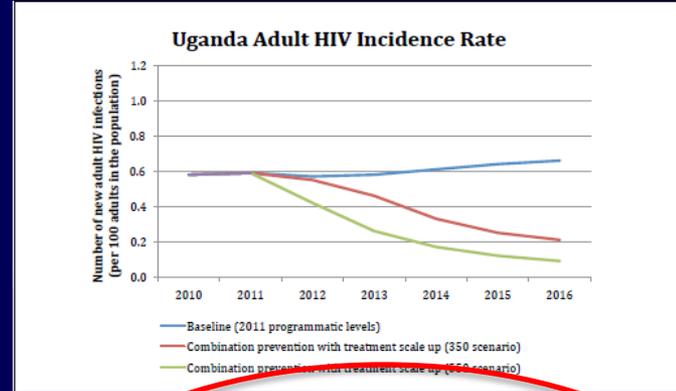
Hillary Rodham Clinton
Hillary Rodham Clinton
Secretary of State

PEPFAR Blue Print



Country	2011 New HIV Infections	2011 Increase in New Patients on Treatment	Ratio of New HIV Infections to Increase in New Patients on Treatment
Botswana	8,300	17,811	0.3
Cote d'Ivoire	13,000	6,844	1.9
DRC	46,000*	9,373	4.9
Ethiopia	11,000	40,507	0.3
Kenya	91,000	93,912	1.0
Lesotho	22,000	5,845	3.8
Mozambique	100,000	48,912	2.0
Namibia	80,000	14,539	0.6
Nigeria	270,000	56,789	4.8
Rwanda	8,400	4,083	2.1
South Africa	370,000	276,017	1.3
Swaziland	12,000	11,731	1.0
Tanzania	120,000	31,700**	3.8
Uganda	120,000	60,014	2.0
Zambia	42,000	66,479	0.6
Zimbabwe	60,000	142,155	0.4

* Official data not available for new HIV infections; data generated through internal PEPFAR modeling.
 ** Due to concerns about data validity, the ratio shown for Tanzania was calculated using the increase in new patients on ART directly supported by PEPFAR in 2011.
 Source: UNAIDS 2012 World AIDS Day Report

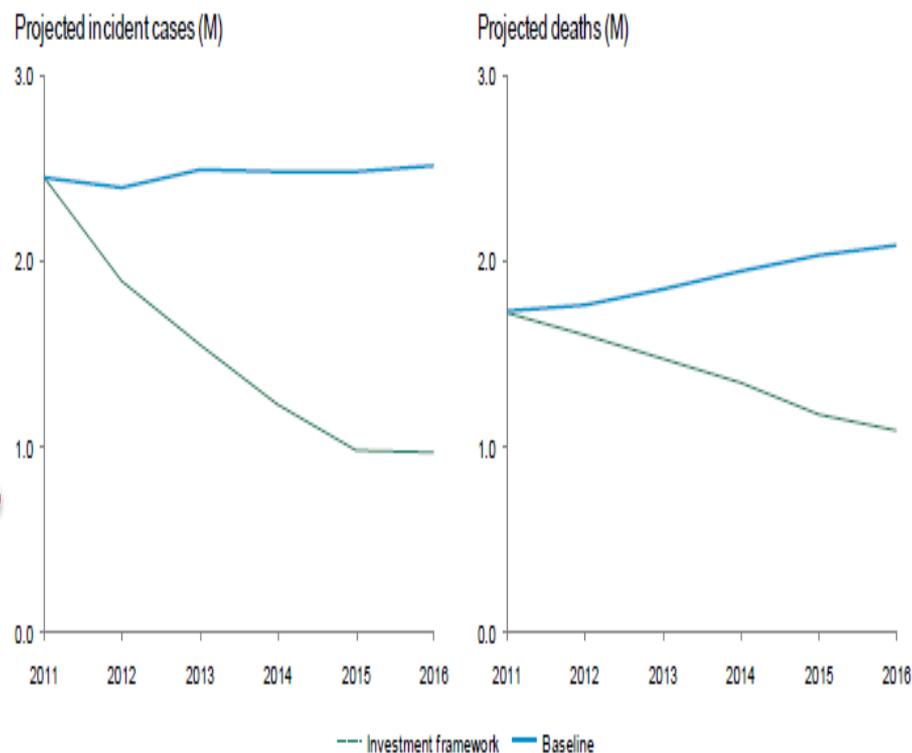


**REVIEW OF HIV/AIDS, TUBERCULOSIS AND MALARIA LANDSCAPE
FOR THE GLOBAL FUND STRATEGY 2012-2016**

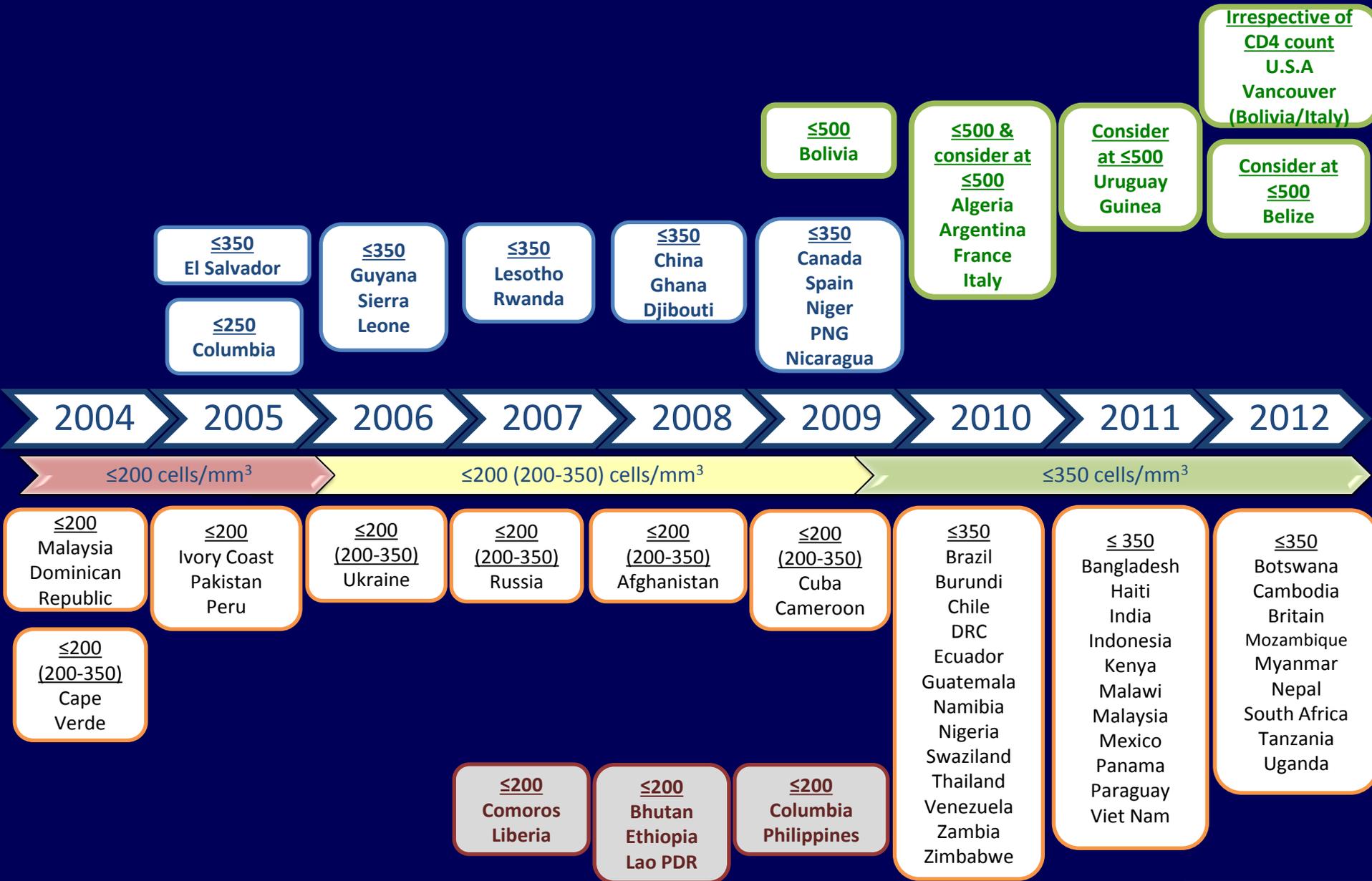
Exhibit 5: HIV/AIDS – Likelihood and impact of new interventions¹²

Type	Existing	Anticipated	Timing	Likelihood	Impact
Vaccine	N/A	RV144, HVTN 505	2020+	○	◐
Prevention	Condoms, Male Circumcision	Treatment as Prevention (discordant couples)	2011	●	◐
		Oral PrEP (for MSMs)	2011	◐	◐
		Male circumcision devices	2012	◐	◐
Treatments	ARV	Treatment 2.0	2011	◐	◐
Diagnostics	CD4, viral load	Point of care	2011	●	◐
		Couples testing	2011	●	◐

Exhibit 3: HIV/AIDS – Projected incidence and deaths (2011-2016)⁶



When to start policy varies by country



One size does not fit all....

Rapid transitioning to Option B+

Early 2013

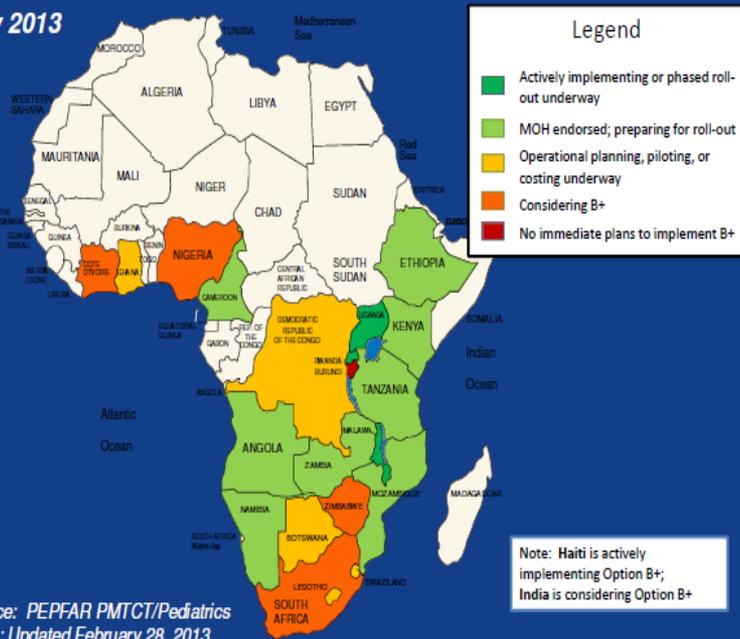
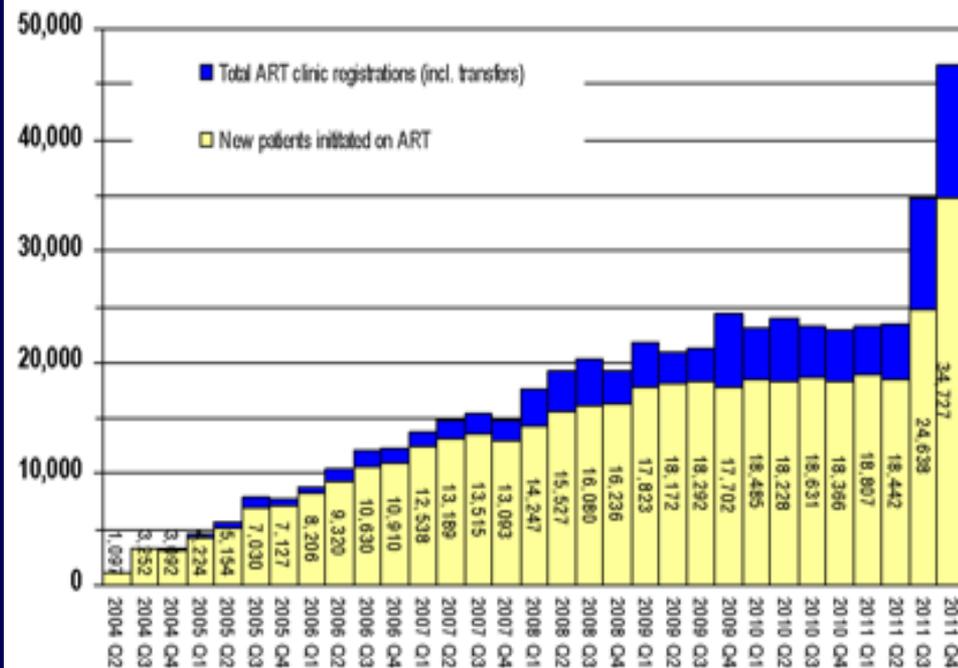


Figure 1: Patients newly initiated on ART and total ART clinic registrations per quarter

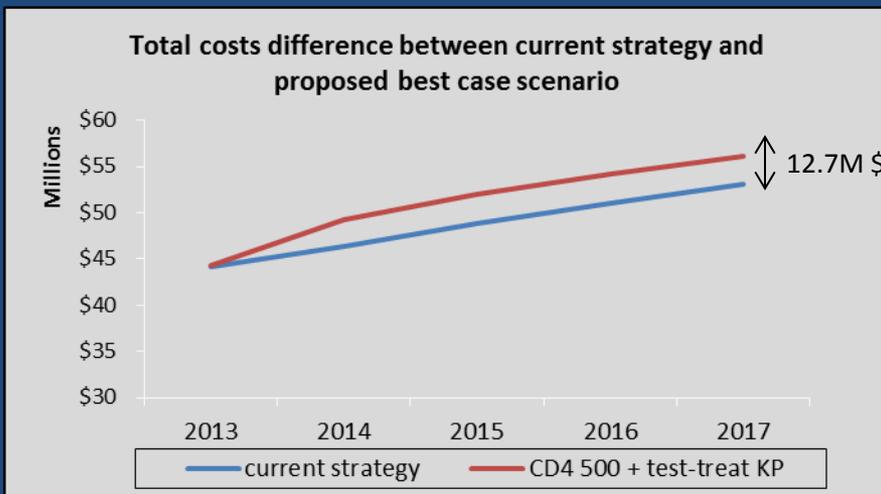
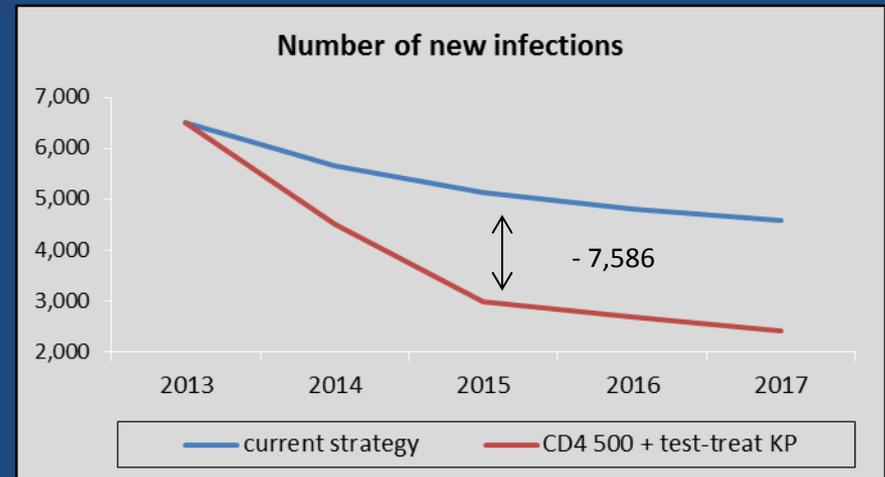
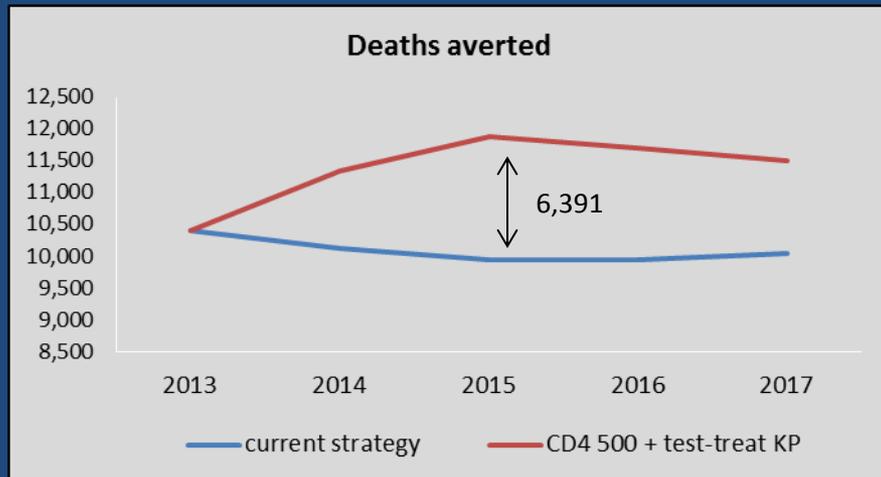
Total ART clinic registrations include patients who transferred between sites. This results in double counting of patients at the national level. For 'patients newly initiated on ART' every patient is only counted once.



Option B+: early 2013

Comparison between the current situation and proposed strategy of ART initiation at < 500 CD4 and test-to-treat for MSM and CSW

Over a 5 year period, a 5.2% increase in costs* would result in 12.7% additional deaths averted and a 28.4% decrease in new infections**



Investing an additional 12.7M \$ would result in
6,391 deaths averted and
7,586 fewer new infections

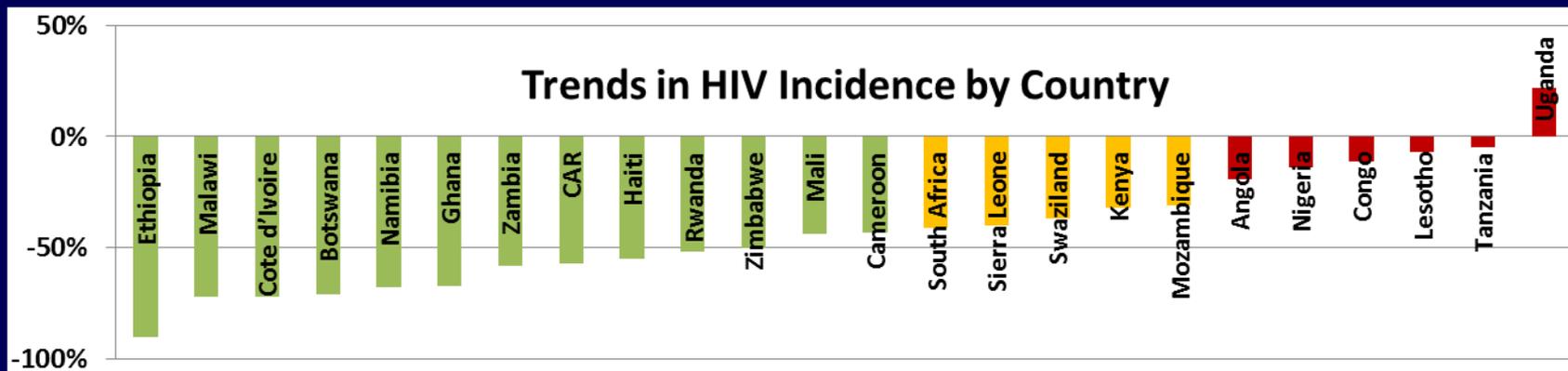
* Additional costs may be underestimated as current resources were assumed to be able to absorb the new ART and pre-ART patients. ** EPI impact calculated with Spectrum, with conservative assumptions

However beautiful the strategy, you should occasionally
look at the results

--Winston Churchill

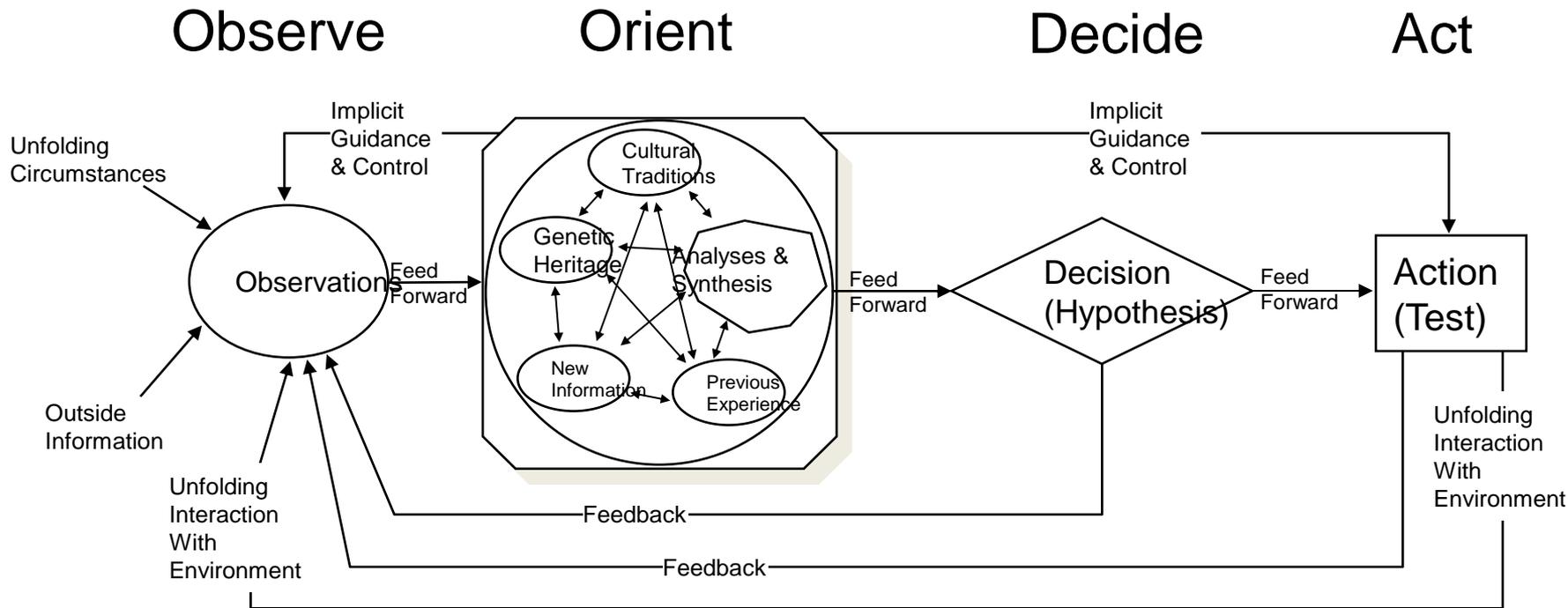


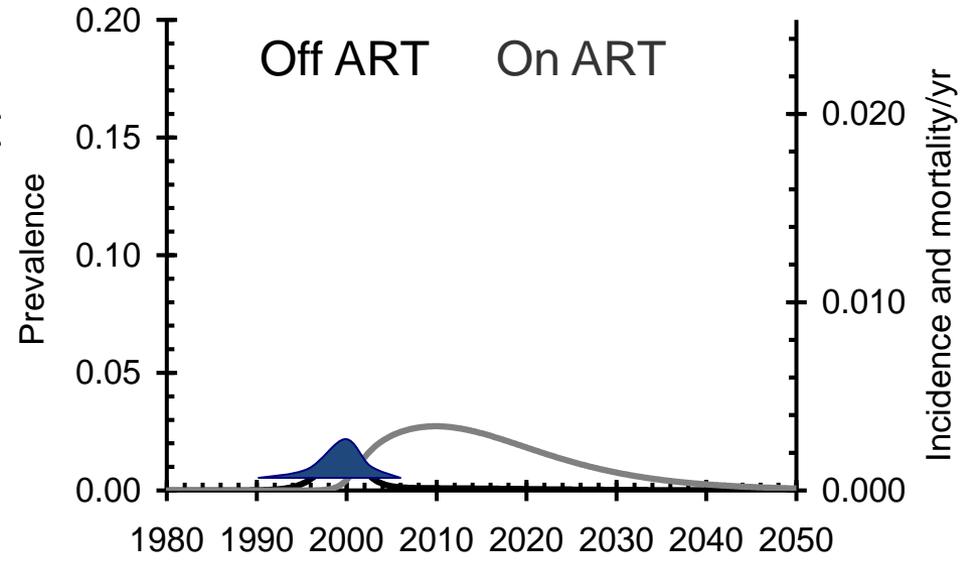
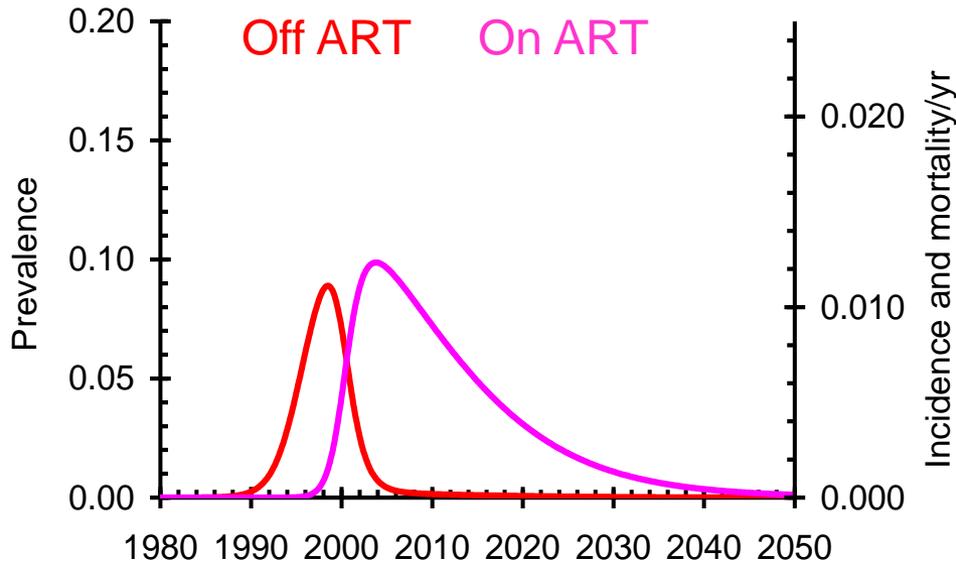
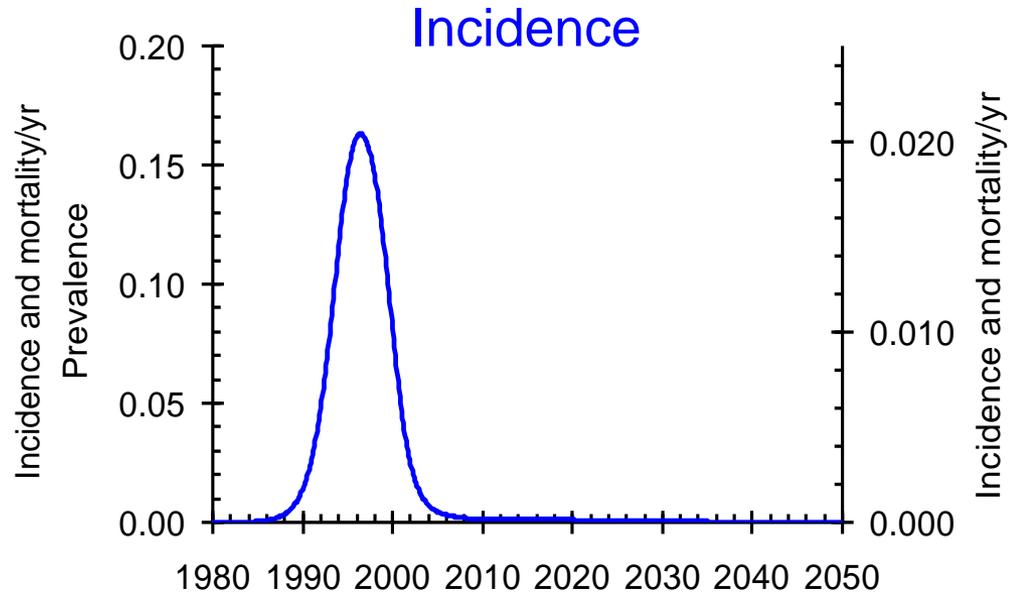
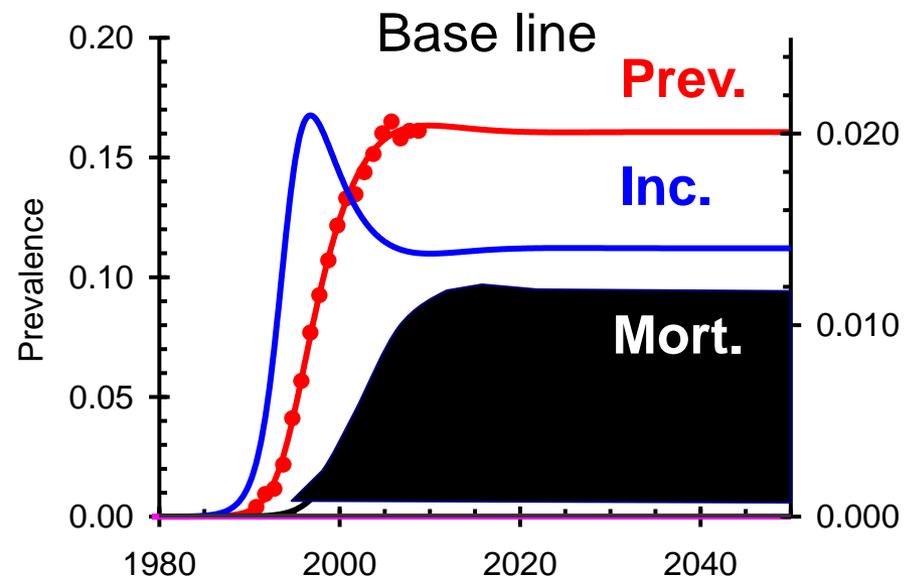
High level political support for TasP (Vancouver 2013)



Transition from “does it work” to “how do we expand”

The OODA Loop: speed matters...and we are very slow





HIV in South Africa: test and treat starting in 1995

Conclusion

- Models are very useful but are not sufficient to change policy—science, politics, and finance and leadership are essential
- Better data, better clarity when framing questions
- Better feedback loops—OODA loop is weak and slow
- Improve and accelerate policy making AND implementation to end AIDS

Public health is purchasable. Within a few natural and important limitations any community can determine its own health.

--Hermann M. Biggs

(29 Sep 1859 - 28 Jun 1923)

New York City's Public Health Officer and public health pioneer



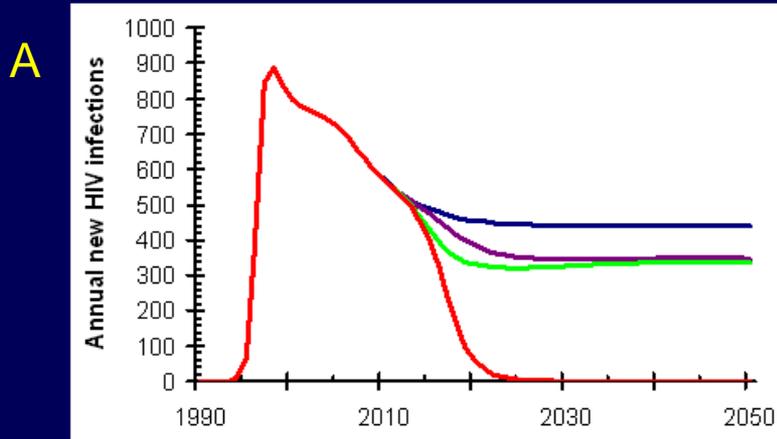
Thank You

- Brian Williams
- Julio Montaner
- Badara Samb
- Brad Hersh
- Debbi Birx
- Somya Gupta
- Amitabh Suthar
- Swarup Sarkar
- Mona Sfeir

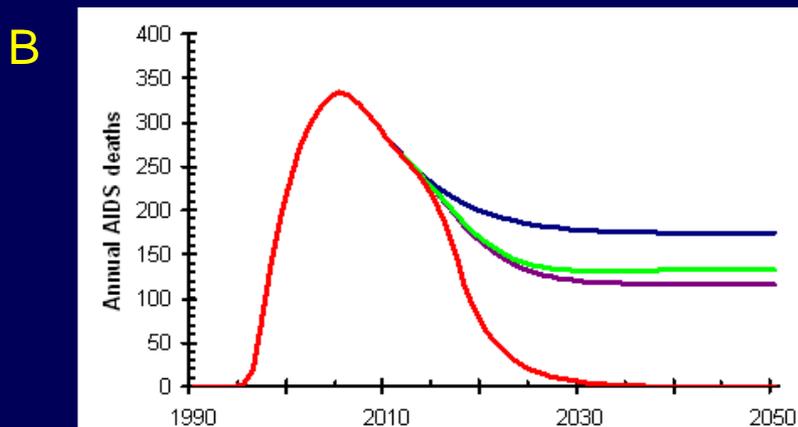
Views expressed in this presentation are those of the author and do not necessarily represent the views of the Joint United Nations Programme on HIV/AIDS (UNAIDS).

Periodic testing & immediate ART significantly reduces new HIV infections and AIDS deaths in the context of Vietnam's HIV epidemic

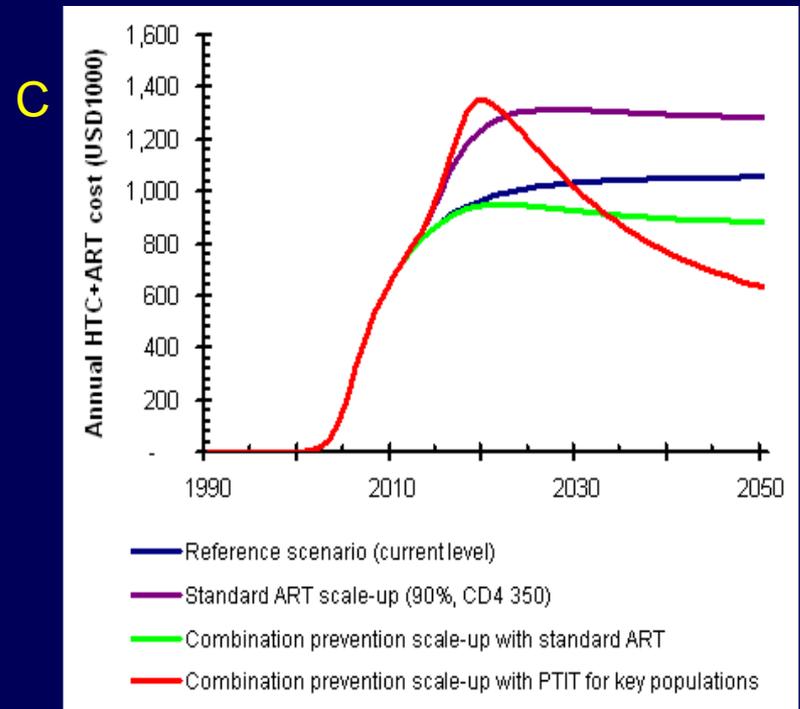
Annual new HIV infection



Annual AIDS death



ART and HTC cost



Periodic testing and immediate treatment (PTIT)

