The cost-effectiveness of early detection and adequate monitoring of HIV/AIDS patients in Mexico

Bautista-Arredondo S[1], Sánchez-González G[1]., **Colchero MA.**[1], Caro-Vega Y[2]., Valencia-Mendoza A.[1], Sierra J.[2]

1 **Instituto Nacional de Salud Pública**

2 **Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán**

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Introduction

Mexican ART program

- ART coverage largely increased in Mexico since 2001
- High ART prices
- Heterogeneous clinical care
  - Suboptimal monitoring and prescription
  - Late initiation (late testers, late presenters)
- An expensive and inefficient program

Aim

- To build a mathematical model to estimate the cost effectiveness of different strategies to optimize HIV/AIDS treatment and care program

Strategies modeled

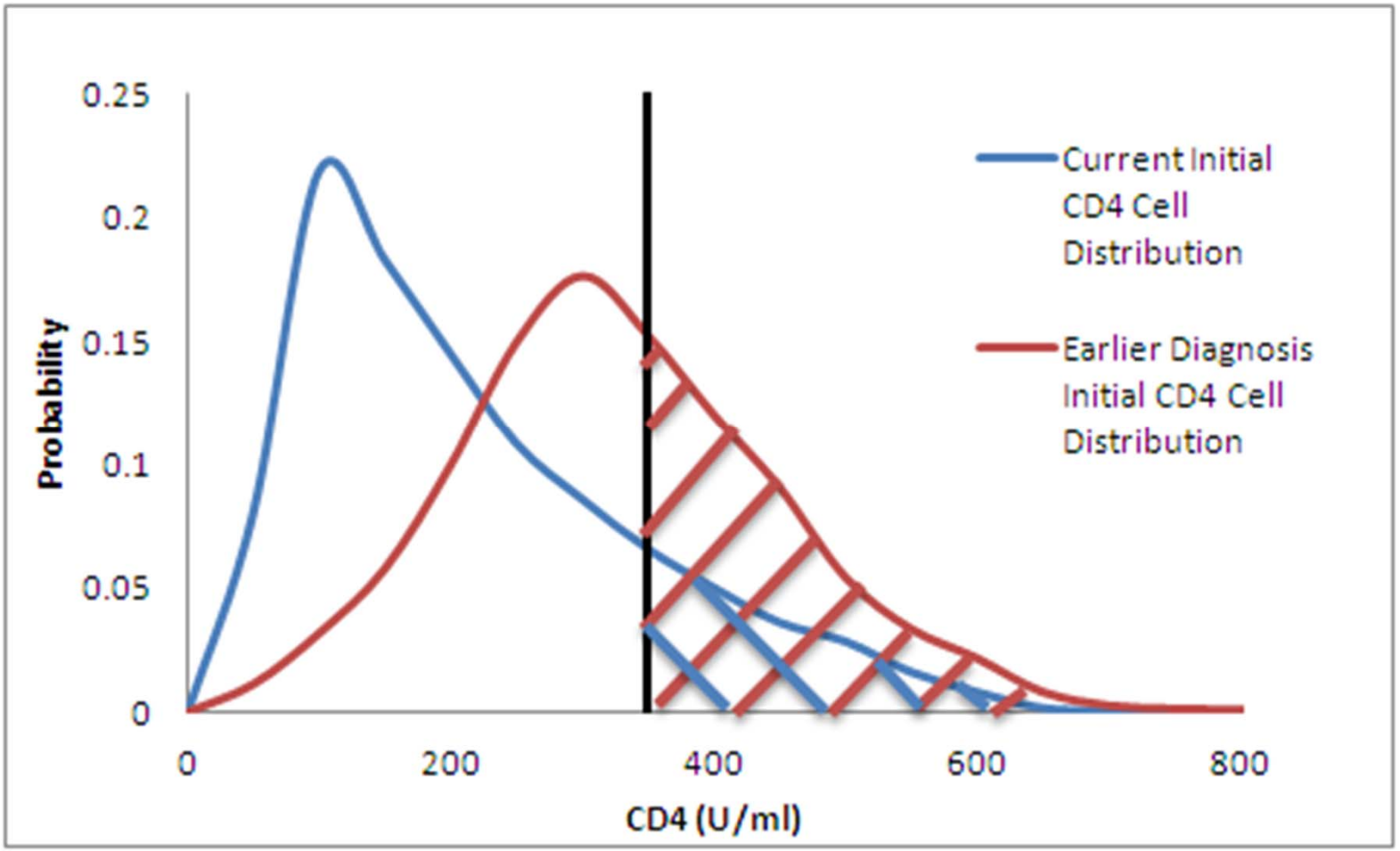
- Estimated the gap in survival and attention cost
  - Status quo
  - Optimal monitoring
  - Early detection
  - Early detection + optimal monitoring

Efficiency analysis

Procedure	Status quo	Optimal monitoring	Early Detection	Optimal Monitoring + early detection
Viral Load	54%**	6 months*	54%**	6 months*
CD4		4 months*		4 months*
Diagnosis	20% > 350**	20% > 350	50% > 350	50% > 350

**HIV/AIDS Guidelines, Mexico 2009*
*** Results from Mexican cohorts*

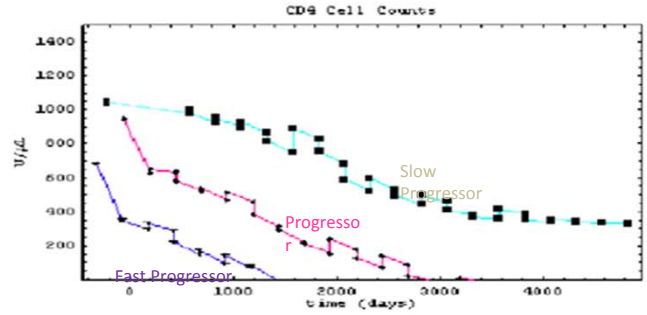
CD4 at entry status quo vs early detection

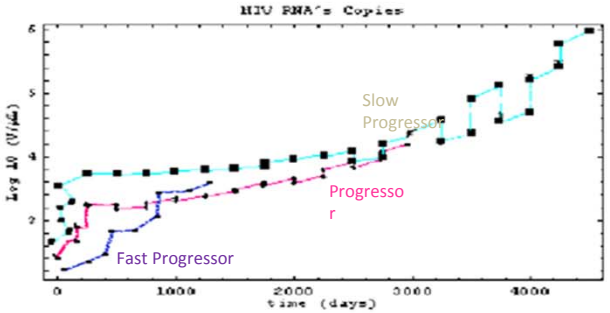


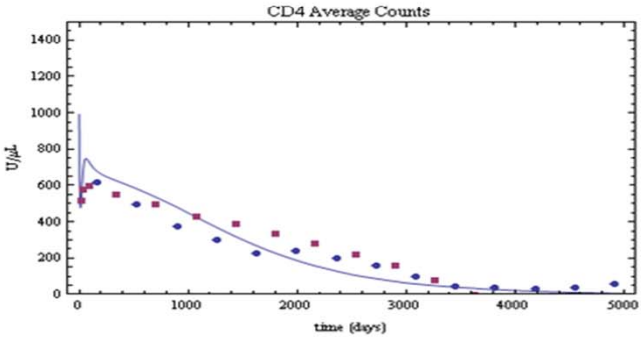
Methods

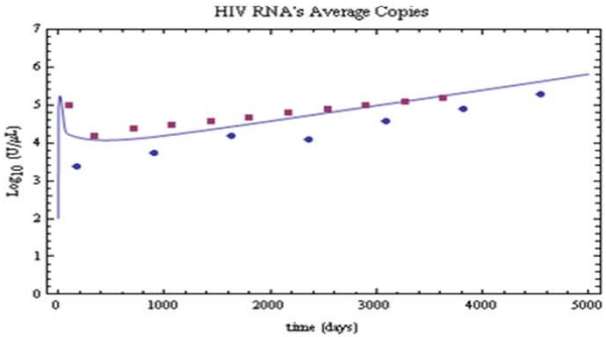
Natural history

- Differential equations
- Interactions between VL, CD4 and CD8 at a micro level and progression over time



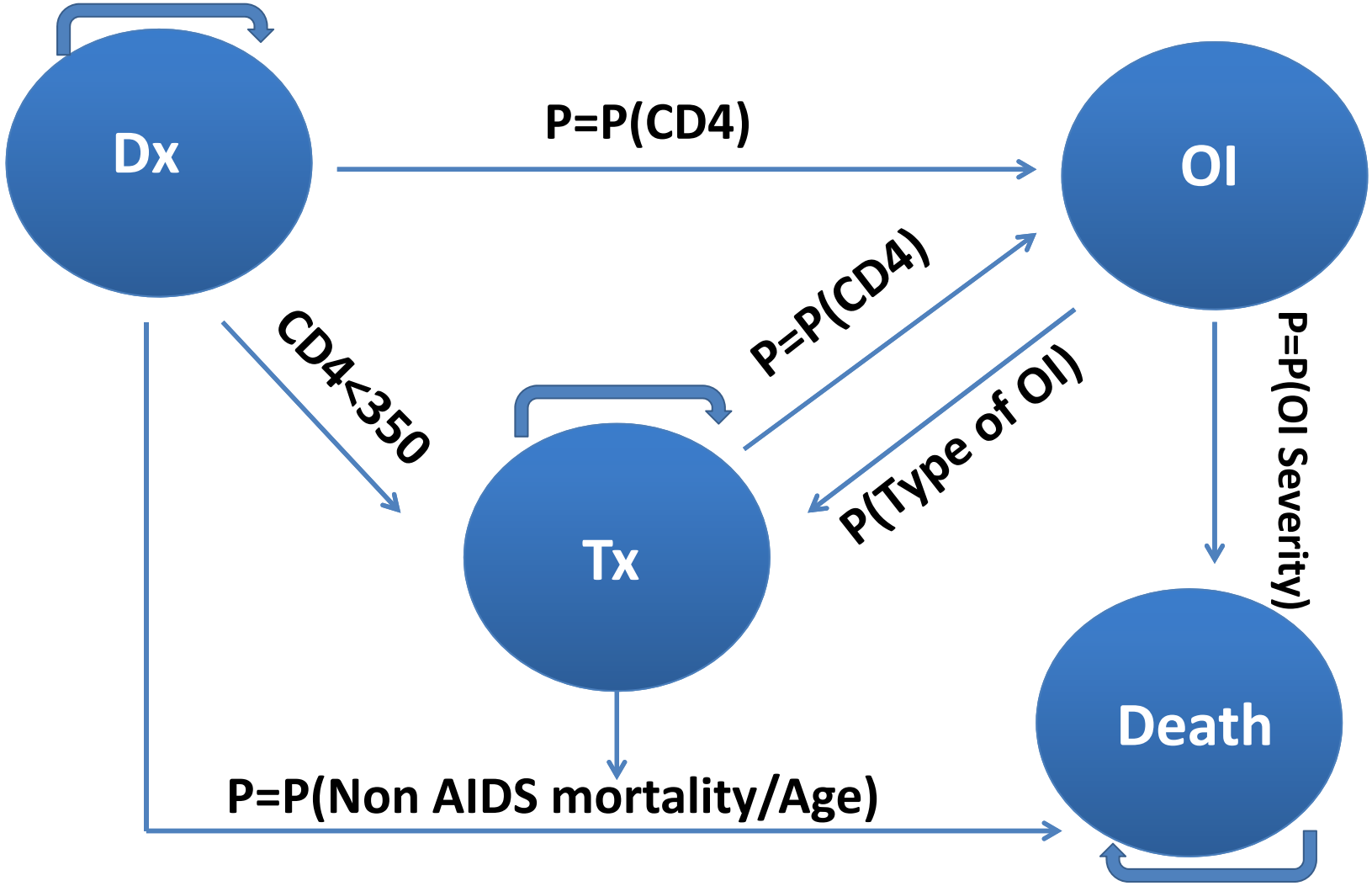






Curves of CD4 and VL of the model Data of Greenough et al. (•) and CDC (■)

Markov model



Failure and toxicity

Parameter	Failure (Prob)	Toxicity (Prob)	Reference
First Line (Tenofovir +Emtricitabine +Efavirenz)	0.005	0.0058	Sax PE et al., N Engl J Med 2009
Second Line (Zidovudina + Tenofovir + Didanosine)	0.018	0.003	Swindells S et al. BMC Infectious Diseases 2005
Third Line (Raltegravir+ Abacavir + Emtricitabine)	0.0191	0.001	Ramkumar K, Core Evidence 2009

Assumptions

- After failure: natural history
- 100% treatment adherence

Opportunistic infections

CD4 range	Distribution by type of OI			
	Mild	Moderate	Severe	Total
0-50	0.531	0.333	0.136	1
50-100	0.349	0.488	0.163	1
100-200	0.406	0.281	0.313	1
200-350	0.478	0.130	0.391	1
350-1000	0.400	0.400	0.200	1

*Source: Mexican cohort INCMNZS

Mortality	Mild	Moderate	Severe
Probability	0.0001	0.0005	0.0016

*Source: Mexican cohort INCMNZS

CD4 recovery

CD4 at treatment initiation	Changes in CD4 counts in 4 years
0-100	348 U/ml
100-200	363 U/ml
200-300	462 U/ml
300-400	367 U/ml
400-500	454 U/ml
500-600	399 U/ml

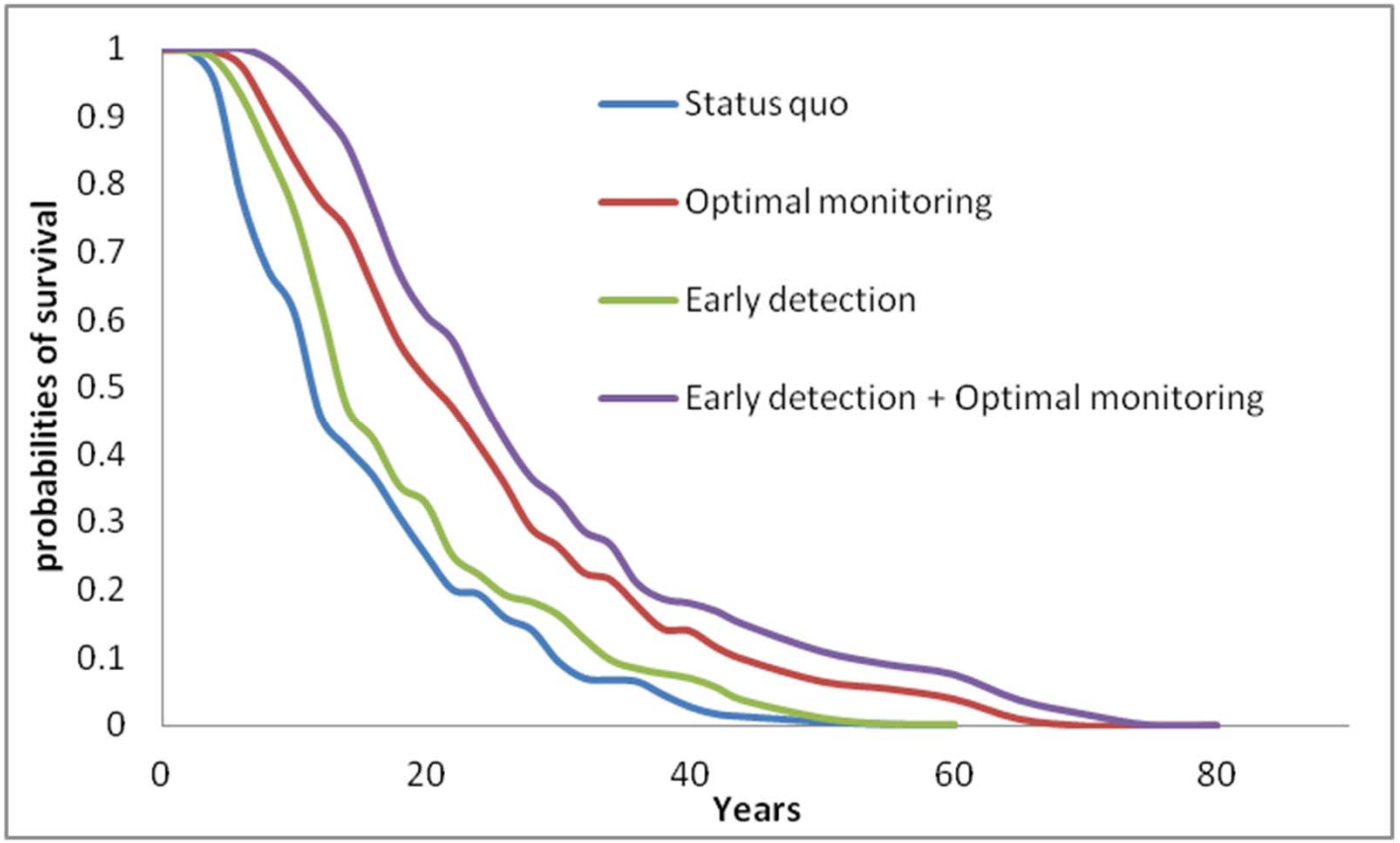
Source: Gilbert R. Kaufmann et al, CD4 T-Lymphocyte Recovery in Individuals With Advanced HIV-1 Infection Receiving Potent Antiretroviral Therapy for 4 Years, *Arch. Intern. Med*. 2003; 163:2187-2195.

Costs

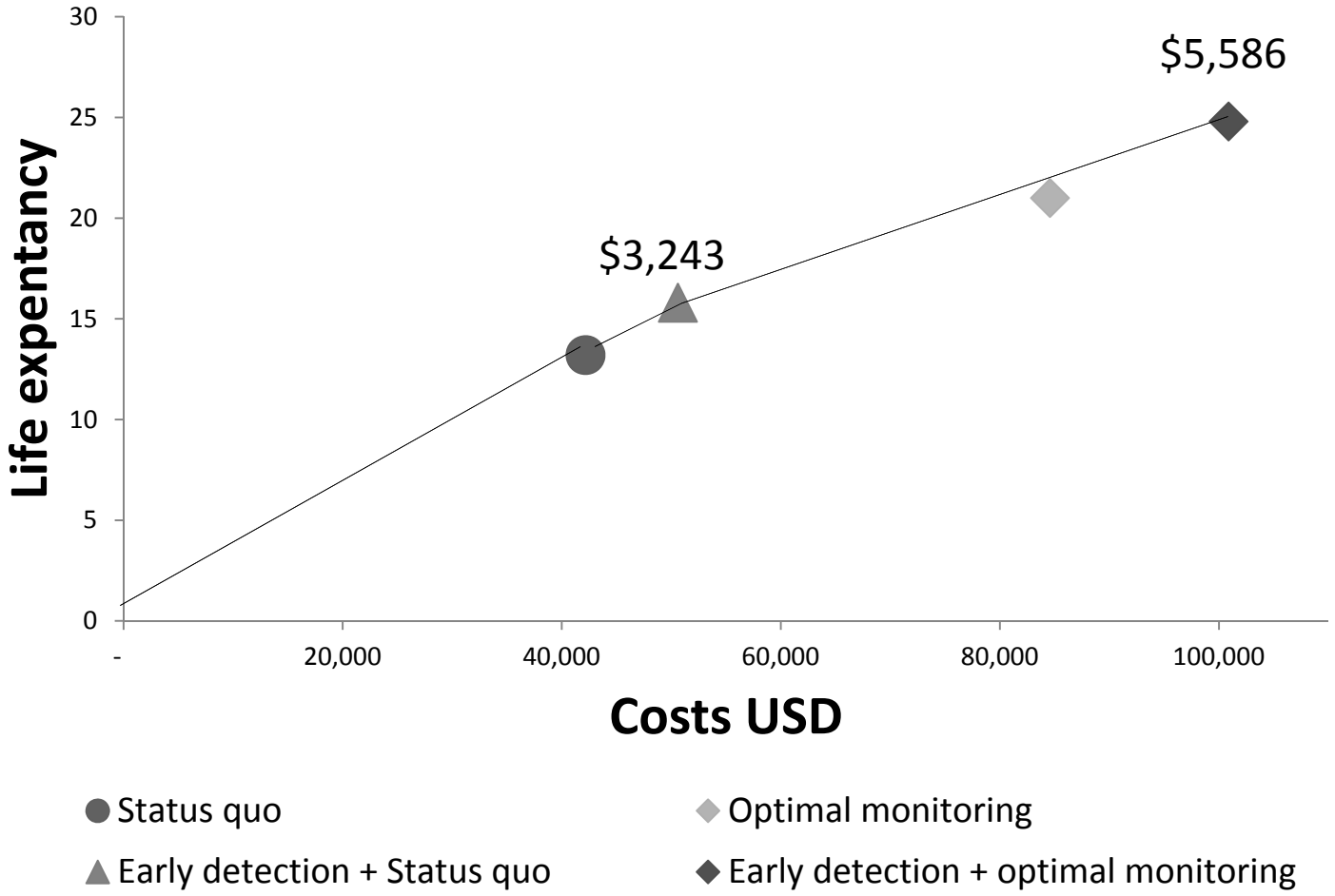
	USD	Source
First line treatment p/month	234	National AIDS Program, 2008
Second line treatment p/month	262	
Third line treatment p/month	1,393	
Prophylaxis	20	
Mild OI	118	Equity and Cost-Effectiveness in HIV/AIDS Care in Mexico, UC Mexus/CONACYT.
Moderate OI	419	
Severe OI	367	
CD4	102	
Viral Load	162	
Outpatient visit	10	

Results

Survival by treatment strategy



Costs and effects by strategy



ICER compared to status quo

Strategy	Costs (USD)	Life expectancy	Incremental CER
Status quo	42,173 (41,839, 41,506)	13.2 (13.0,13.4)	-
Early detection	50,607 (50,307, 50,831)	15.8 (13.6,14.0)	3,243 (3,103,3505)
Early detection + OM	100,886 (100,638, 101,063)	24.8 (24.6, 25.1)	5,061 (5,259, 5,287)
Optimal monitoring	84,579 (84,265, 84,828)	21.0 (20.8, 21.2)	5,436 (5233,5,613)

Bootstrapping samples of 25,000 patients repeated 1,000 times

Conclusions

Conclusion

- Early detection + optimal monitoring is a CE option
- Model assumes 100% adherence and does not include early detection costs
- Model can be applied to evaluate:
  - Improve treatment adherence
  - Improve health workers trainings