The Cost-effectiveness of Treatment as Prevention: Analysis of the HPTN 052 Trial

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Prevention of HIV-1 Infection with Early Antiretroviral Therapy

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Early ART compared to delayed ART conferred a 96% relative reduction in linked HIV transmissions among serodiscordant couples

Cohen et al. *NEJM* 2011

Objective
Collaboration: HPTN 052/CEPAC-International

- To project the cost-effectiveness of early compared to delayed ART for treatment and prevention in serodiscordant couples
  - We conducted analyses for two countries, South Africa, and India to assess regional differences in value

Methods: CEPAC-International Model

- CEPAC-International Model
  - Mathematical model of HIV natural history and treatment
  - Clinical and resource utilization data from South Africa and India
  - Cohort and ART efficacy parameters from HPTN 052 trial

Methods: Transmission Module in CEPAC

- Projects transmission events from index cases
  - Allows for transmission between 1° and outside partners
  - Accounts for 1st- and 2nd-order transmissions from the index case
  - Flexible structure allows input variation in:
    - Duration of partnerships
    - Activity outside primary partnerships
    - Transmission by viral load

Methods: Two Strategies

1) Delayed ART (CD4 <250/µl)
2) Early ART (at presentation)

- Evaluate outcomes in:
  - Clinical benefit, cost and transmissions
  - 5-year and lifetime horizons

Model Input Parameters: Cohort, Treatment, and Transmission

Parameter	Input
Mean CD4 (cells/μL)	449
48-wk virologic suppression	92%
Loss to follow-up rate (/100 py)	3.4
Average partners (/mo)	1.011
Transmission rate (/100 py)	0.103-1.483

Model Input Parameters: Costs (2011 US$)

	South Africa	India
ART (/mo)	13	11
OI treatment	300-1,000	40-300
Routine care	20-200	10-30
per capita GDP*	8,100	1,400

*WHO thresholds:

"Very cost-effective": <1x *per capita* GDP

"Cost-effective": <3x *per capita* GDP

[1]WHO Global Price Reporting Mechanism

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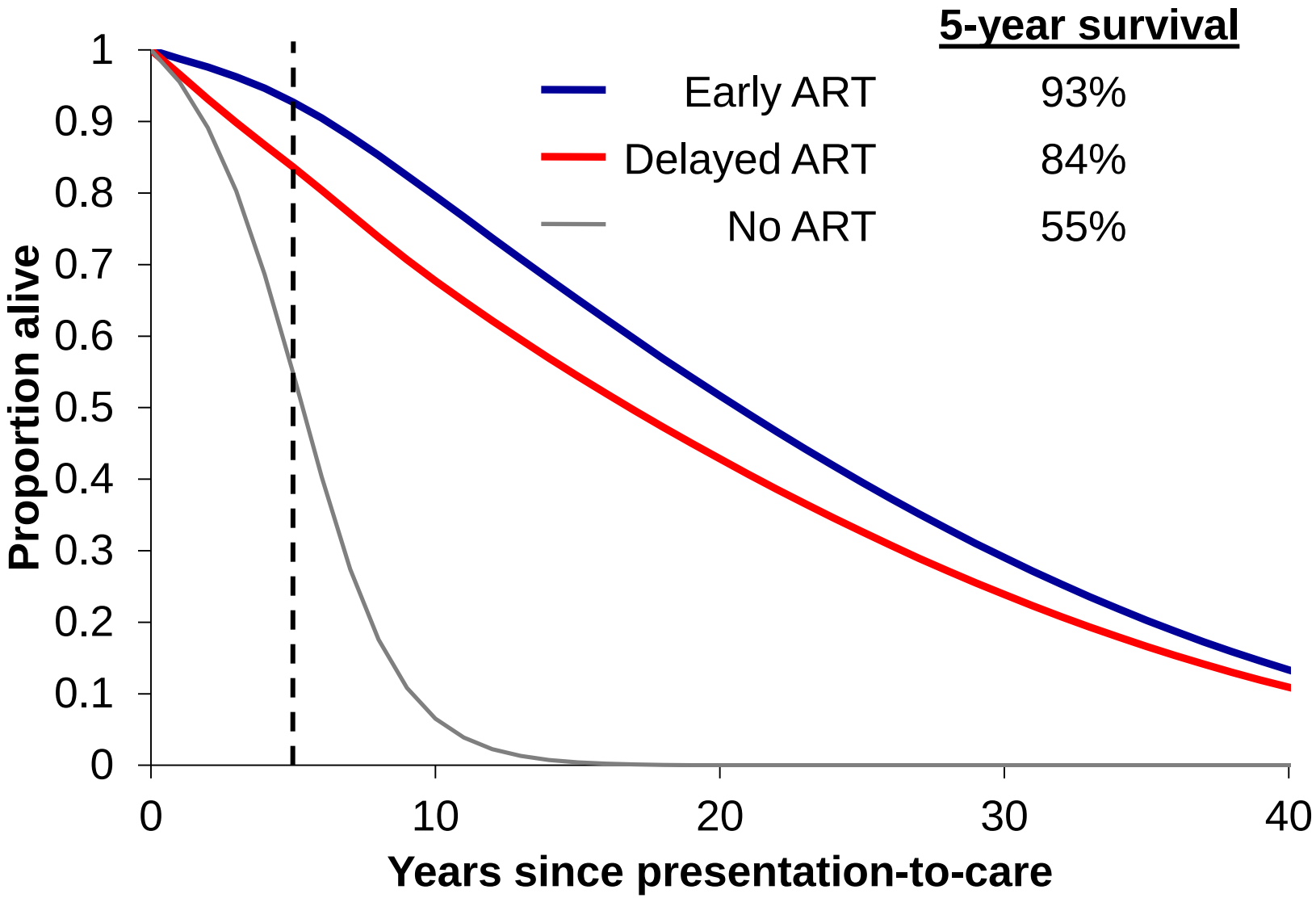
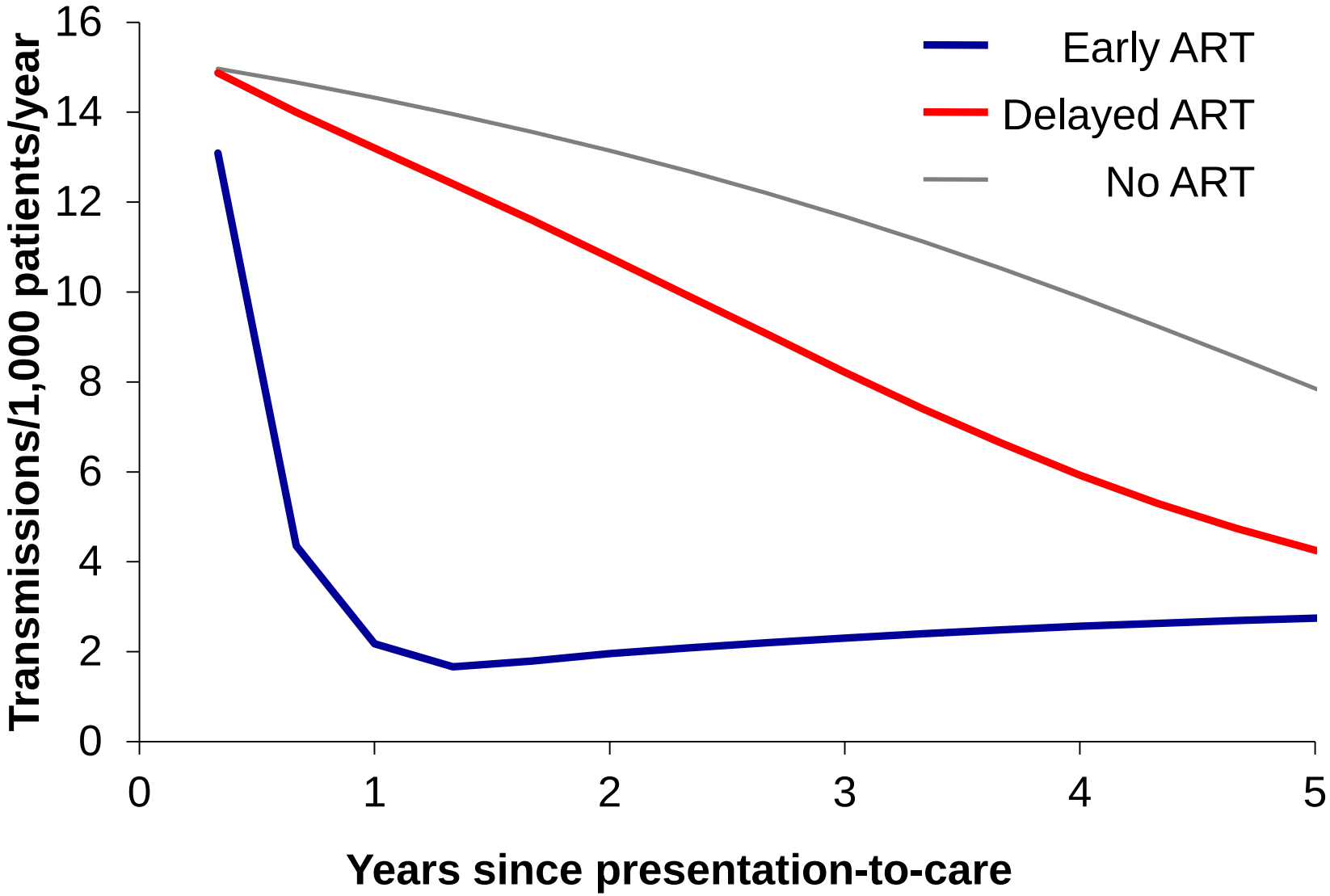
Results:
Survival for South Africa



Results:
Transmission Rates, 5 yrs, South Africa



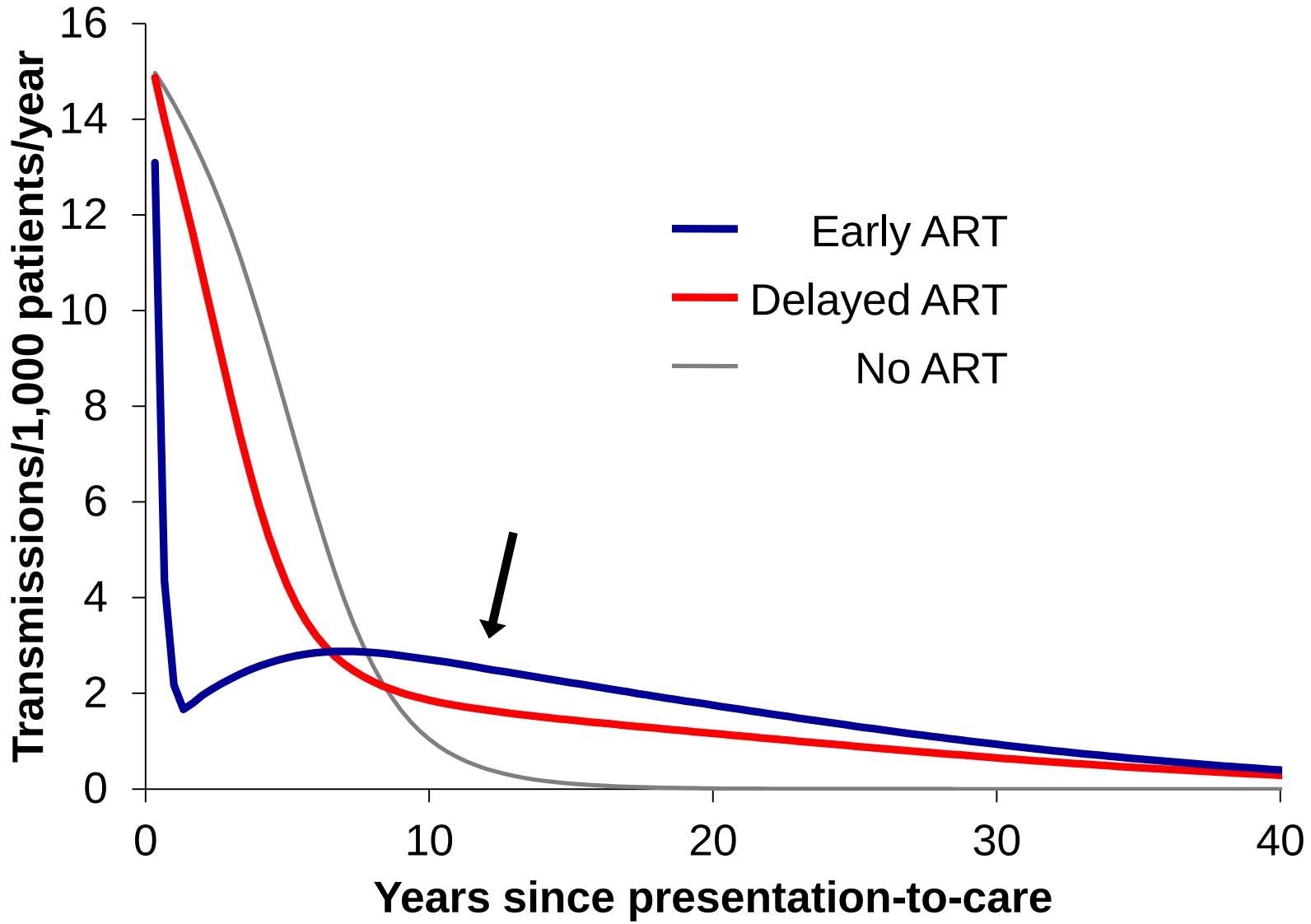
Results:
Cost-effectiveness, 5 yrs, South Africa

	Life expectancy* (years)	**Costs (USD 2011)**	**ICER† ($/YLS)**
Delayed ART	4.3	4,850	--
Early ART	4.6	4,830	Cost-saving

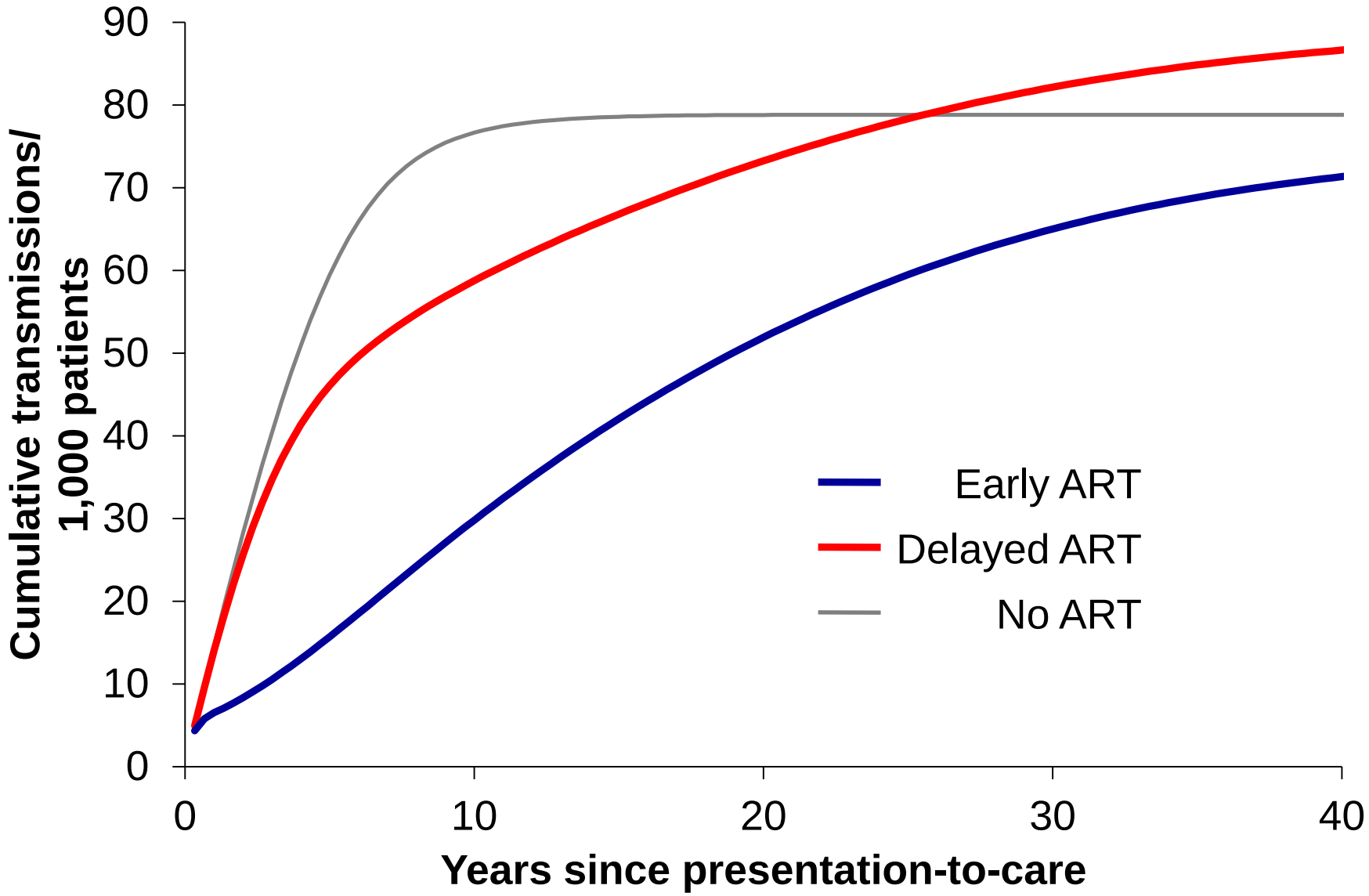
*Of 5.0 possible years

†Including projected survival losses and cost increases associated with 1st- and 2nd-order transmissions

Results:
Transmission Rates, Lifetime, South Africa



Results:
Cumulative Transmissions, South Africa



Results: Cost-effectiveness, Lifetime, South Africa

	Life expectancy (years)	Costs (USD 2011)	ICER† ($/YLS)
Delayed ART	13.3	15,970	--
Early ART	15.2	16,320	530

†Including projected survival losses and cost increases associated with 1st- and 2nd-order transmissions

per capita GDP for South Africa: $8,100

Results: Cost-effectiveness, India

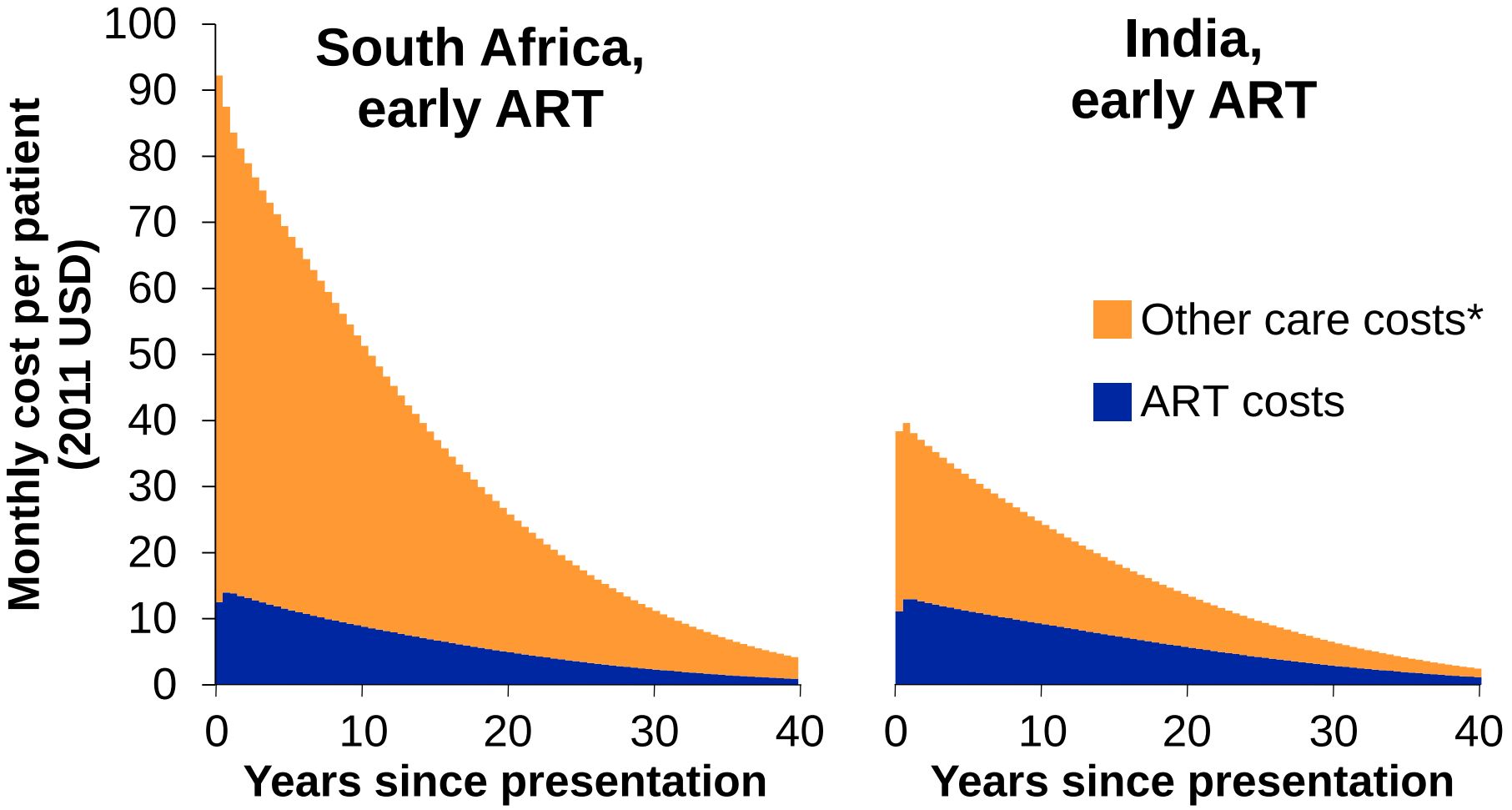
	Life expectancy (years)	Costs (USD 2011)	ICER† ($/YLS)
5-year horizon			
Delayed ART	4.4*	1,810	--
Early ART	4.6*	2,170	1,840
Lifetime horizon			
Delayed ART	14.2	6,840	--
Early ART	15.8	7,840	530

*Of 5.0 possible years

per capita GDP for India: $1,400

†Including projected survival losses and cost increases associated with 1st- and 2nd-order transmissions

Different Costs of HIV Care



*"Other care costs" include labs, routine care, OI prophylaxis, and treatment for HIV-related events

Sensitivity Analyses

Treatment and Cost

- Initial mean CD4
- ART starting criteria
- Loss to follow-up rates
- ART efficacy
- Long-term suppressive durability of ART
- OI incidence rates
- OI treatment and routine care costs

Transmission

- Duration of primary relationships
- Rate of new partner acquisition
- Acute infection transmissibility
- Acute infection duration

Sensitivity Analyses: Transmission

- 5-year horizon: early ART greatly reduces transmissions compared to delayed ART
  - ***Robust*** to changes in all parameters examined

- Lifetime horizon: early ART moderately reduces cumulative transmissions compared to delayed ART
  - ***Sensitive*** to changes in ART efficacy and long-term durability of suppression

Sensitivity Analyses: Cost-effectiveness

- 5-year horizon: early ART is cost-saving in South Africa and cost-effective in India
  - ***Sensitive*** to changes in all treatment- and cost-related parameters: variations made early ART very cost-effective in both settings

- Lifetime horizon: early ART is very cost-effective in both countries
  - ***Robust*** to changes in all parameters examined

Limitations

- Specific to the HPTN 052 trial; not necessarily generalizable to non-trial settings, or to individuals not in regular partnerships
- Excluded productivity and other non-medical benefits of transmission prevention
- Transmissions beyond 2nd-order from the index case excluded; likely have a minimal effect on cost-effectiveness results

Conclusions

- In serodiscordant couples – with ART efficacy and behavior data from HPTN 052 – early ART will prevent transmissions in the short-term
- In South Africa, over the short term, early ART may be cost-saving
- Early ART for serodiscordant couples is very cost-effective, regardless of country, ART efficacy, or behavior

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