The full value of health interventions:

The example of HIV treatment

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Full value of health interventions

- Health interventions to improve the health of the person receiving the intervention
- Non-health impacts
- Externalities

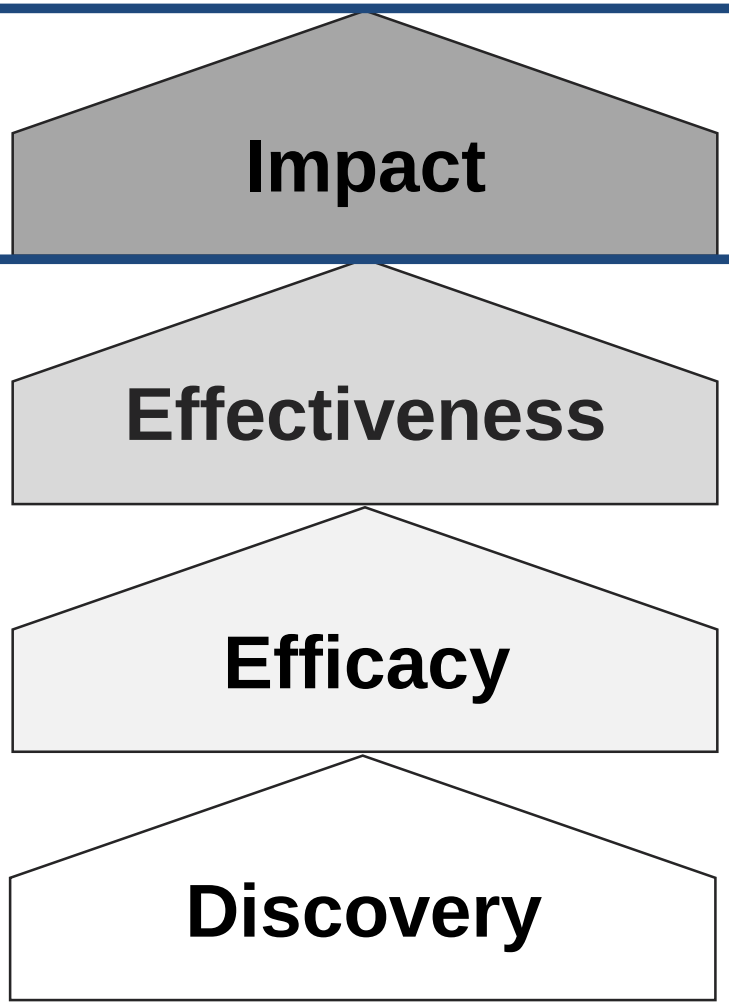
Importance for policy

- Are non-health impacts and externalities
  - Large?
  - Different across different health interventions?

Interventions across the life course

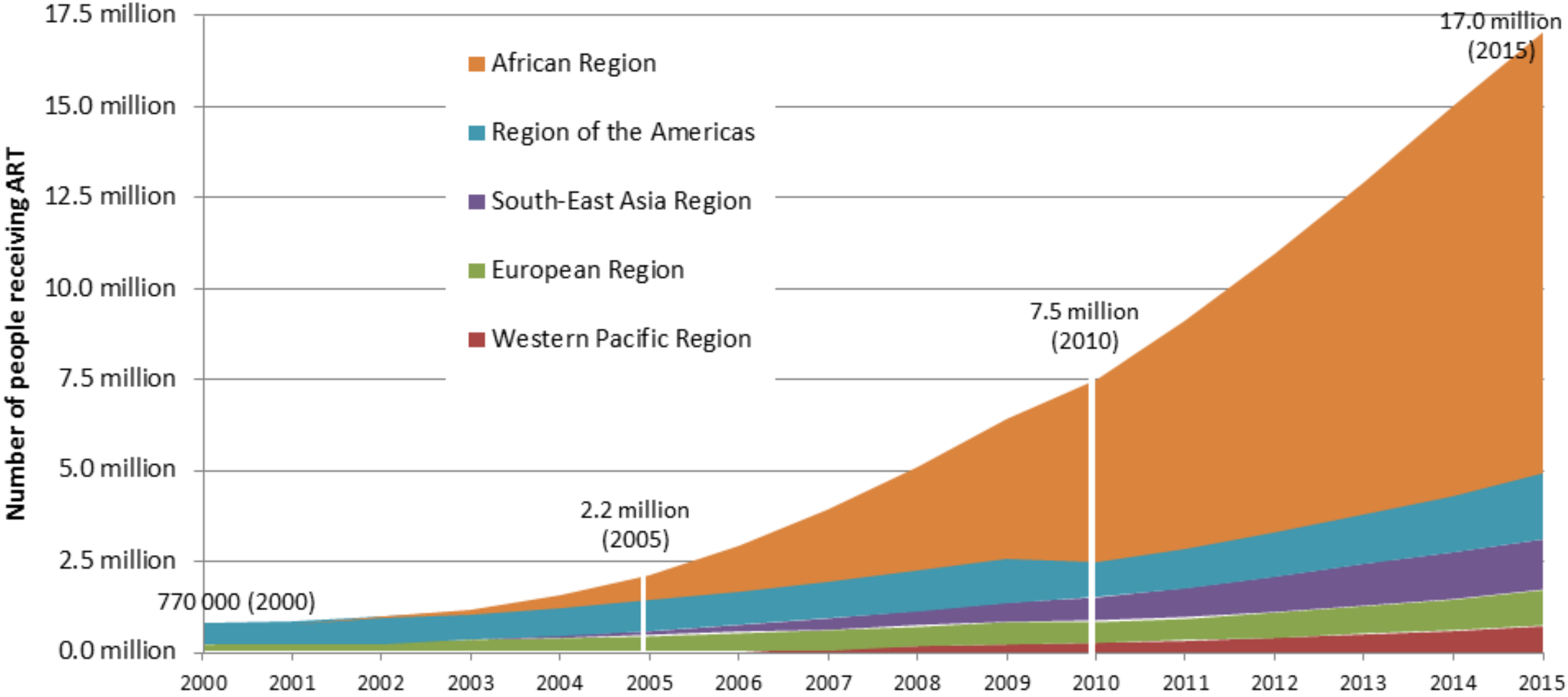
- Childhood – e.g., vaccinations
- Middle age – e.g., HIV treatment
- Old age – e.g., hypertension treatment

Value chain of health research



	Infrastructure	Outcome	Time horizon
Impact	• Real world	• Health and non-health	• >5 years
Effectiveness	• Real world	• Health	• 1-5 years
Efficacy	• Trial clinic	• Health	• 1-5 years
Discovery	• Laboratory	• Biological	• Short

Global ART

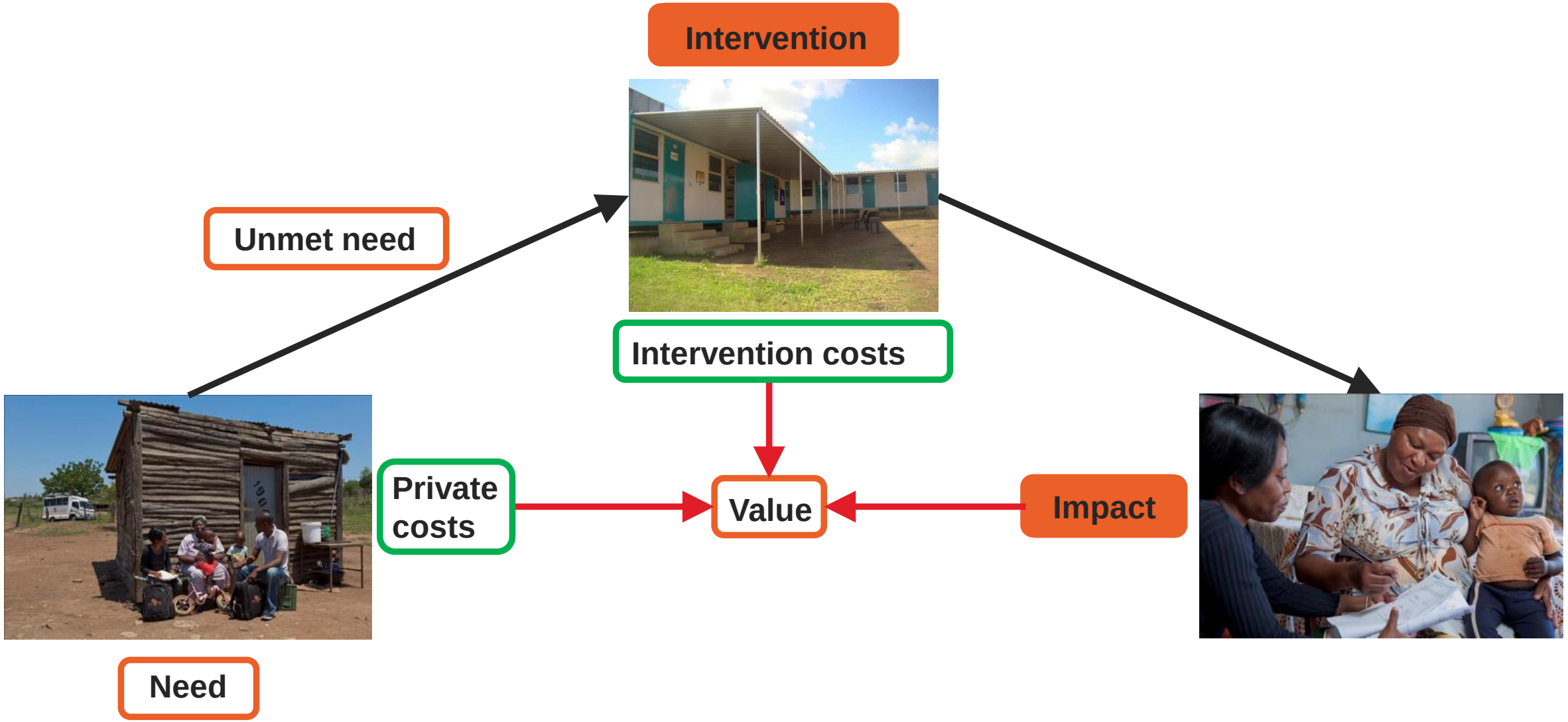


WHO 2016

Outline

- **Empirical methods**
- Non-health impacts
- Externalities

Population-based health research



Approaches to estimate impact and effectiveness

- **Experiments**
- **Strong quasi-experiments**
  - Natural experiments
  - Regressions discontinuity
  - Interrupted time series
  - Instrumental variable approaches
- **Weak quasi-experiments**
  - Fixed effects approaches
  - Difference-in-differences approaches
- **Non-experiments**
  - Stratification
  - Matching
  - Regression

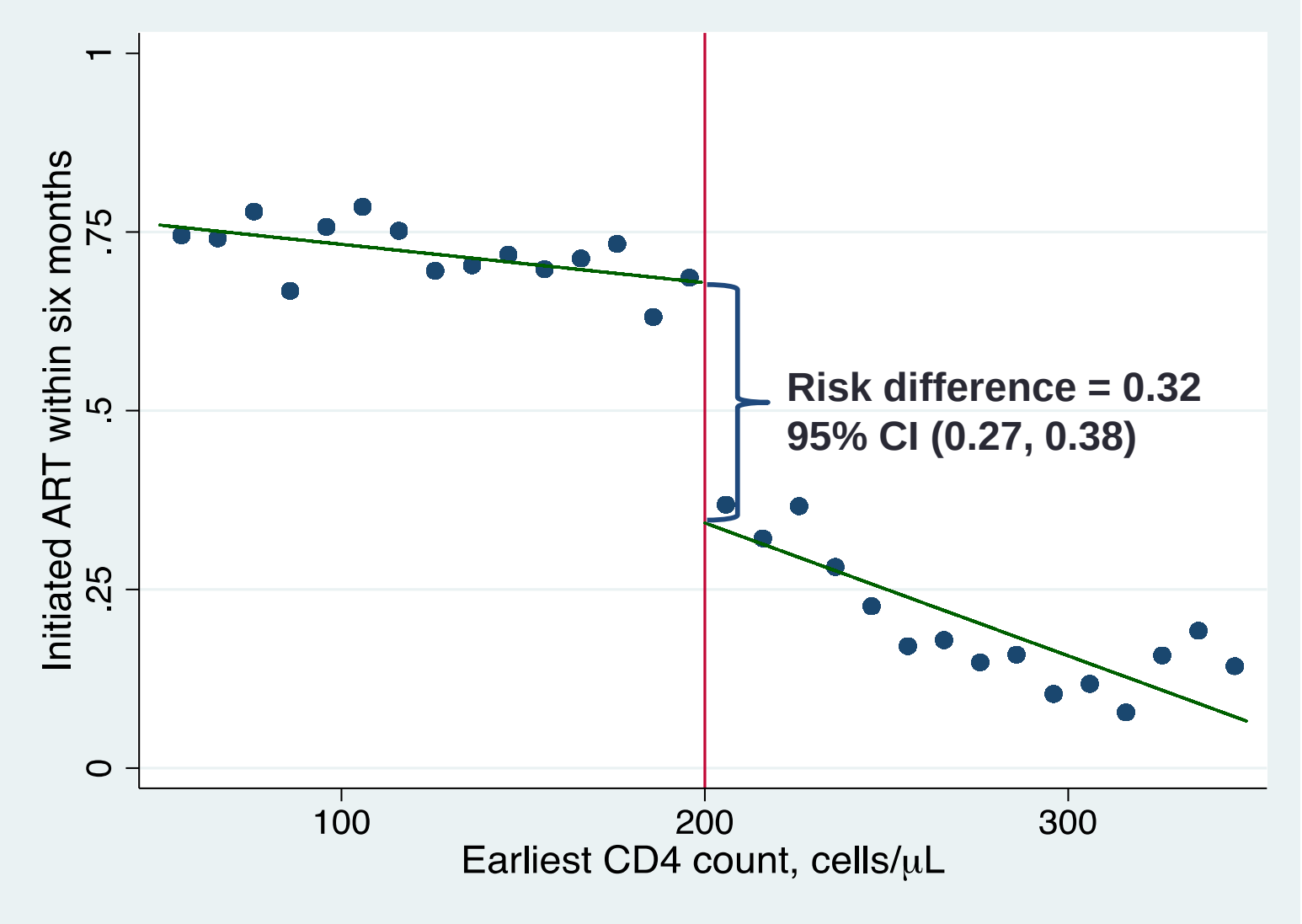
Control for all unobserved confounding

Control for some unobserved confounding

Only control for observed confounding

Journal of Clinical Epidemiology (forthcoming)

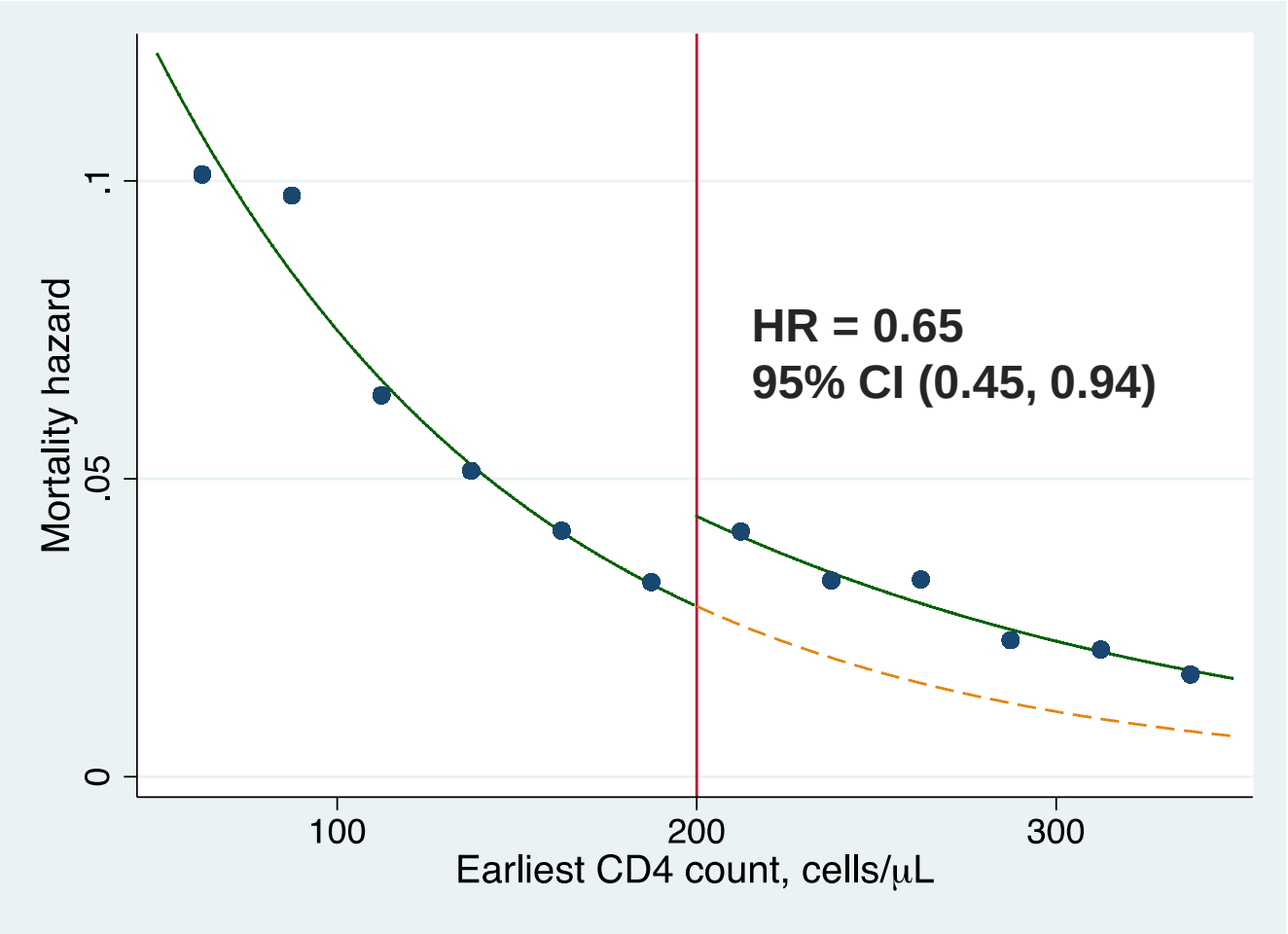
Quasi-experiment: regression discontinuity



Epidemiology 2014

ART impact on mortality

Regression discontinuity. *N* = 4391 patients who sought care; 2874 initiated ART; and 820 died during 13,139 person-years of follow up.



Epidemiology 2014

Outline

- Empirical methods
- **Non-health impacts**
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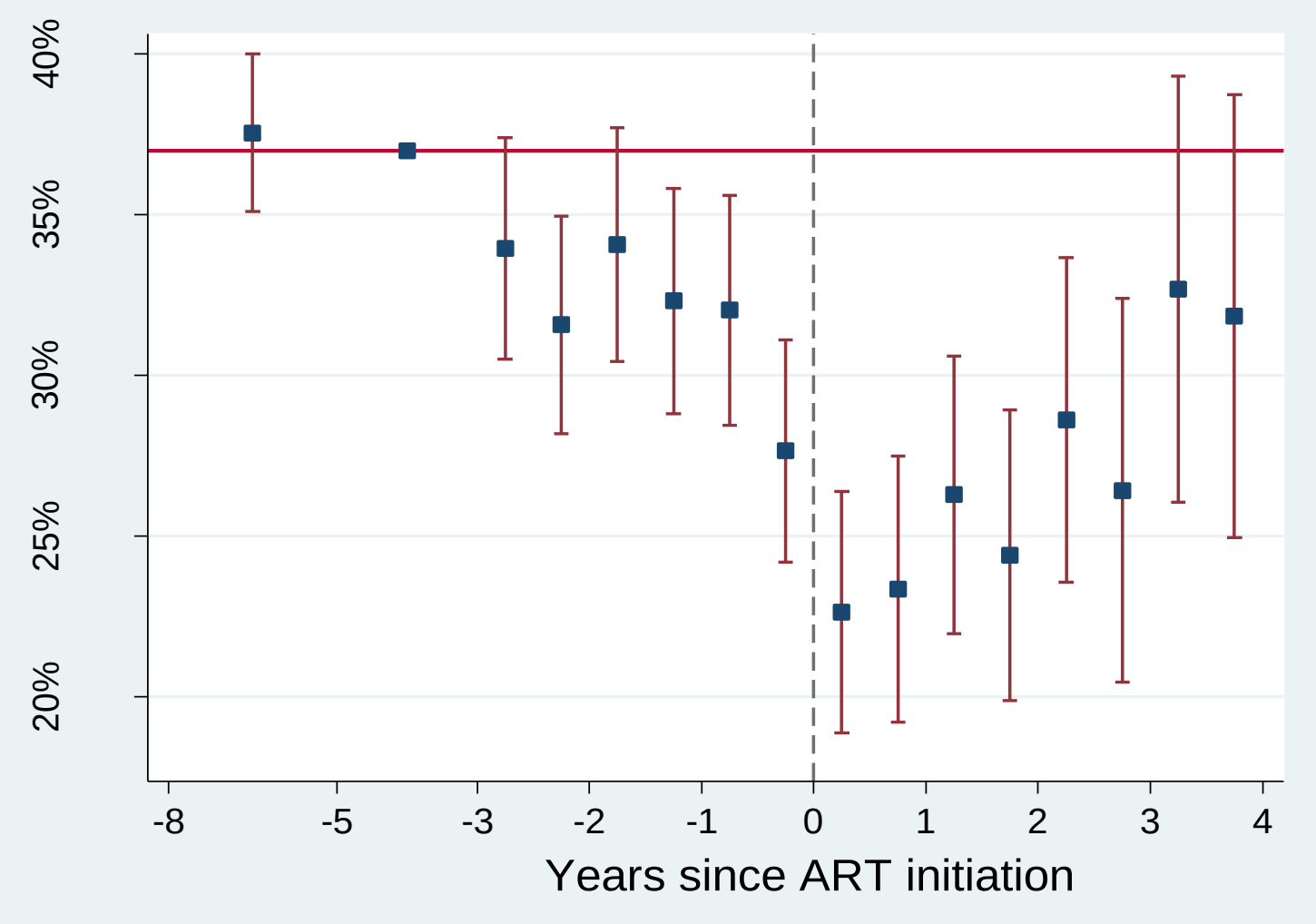
ART impact on employment

Individual fixed effects regressions, linear probability model, controlling for sex, age, education, calendar year, month and day of survey.

N = 32,316 persons with 138,020 observations.



Health Affairs 2012

AR therapy 'allows workers to rejoin economy'

Lesley Naudè

HIV patients receiving antiretroviral therapy (ART) in the public sector's treatment programmes are able to successfully re-enter the workforce, a new Zululand study finds.

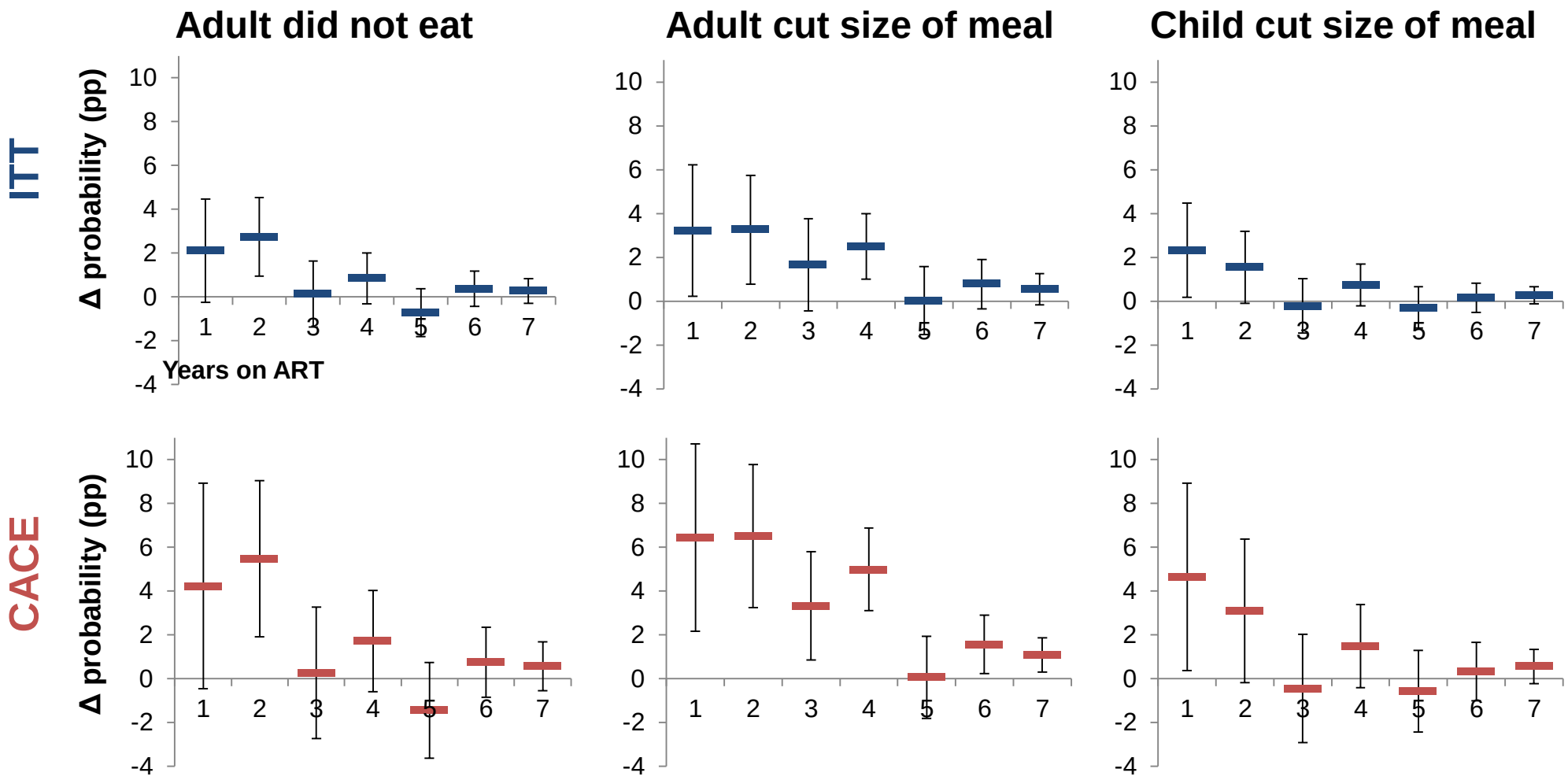
The study's findings were published last week in the July issue of Health Affairs, a leading health policy journal.

Four years after initiation of ART, employment among HIV patients in the study had recovered to about 90% of baseline rates observed in those same patients three to five

ART impact on food insecurity

Regression discontinuity at ART eligibility cut-off CD4 count 200/µl, controlling for sex and age.

N = 1662-2300 for “adult did not eat” and “child cut size of meal”; *N* = 1662-2297 for “adult cut size of meal”.

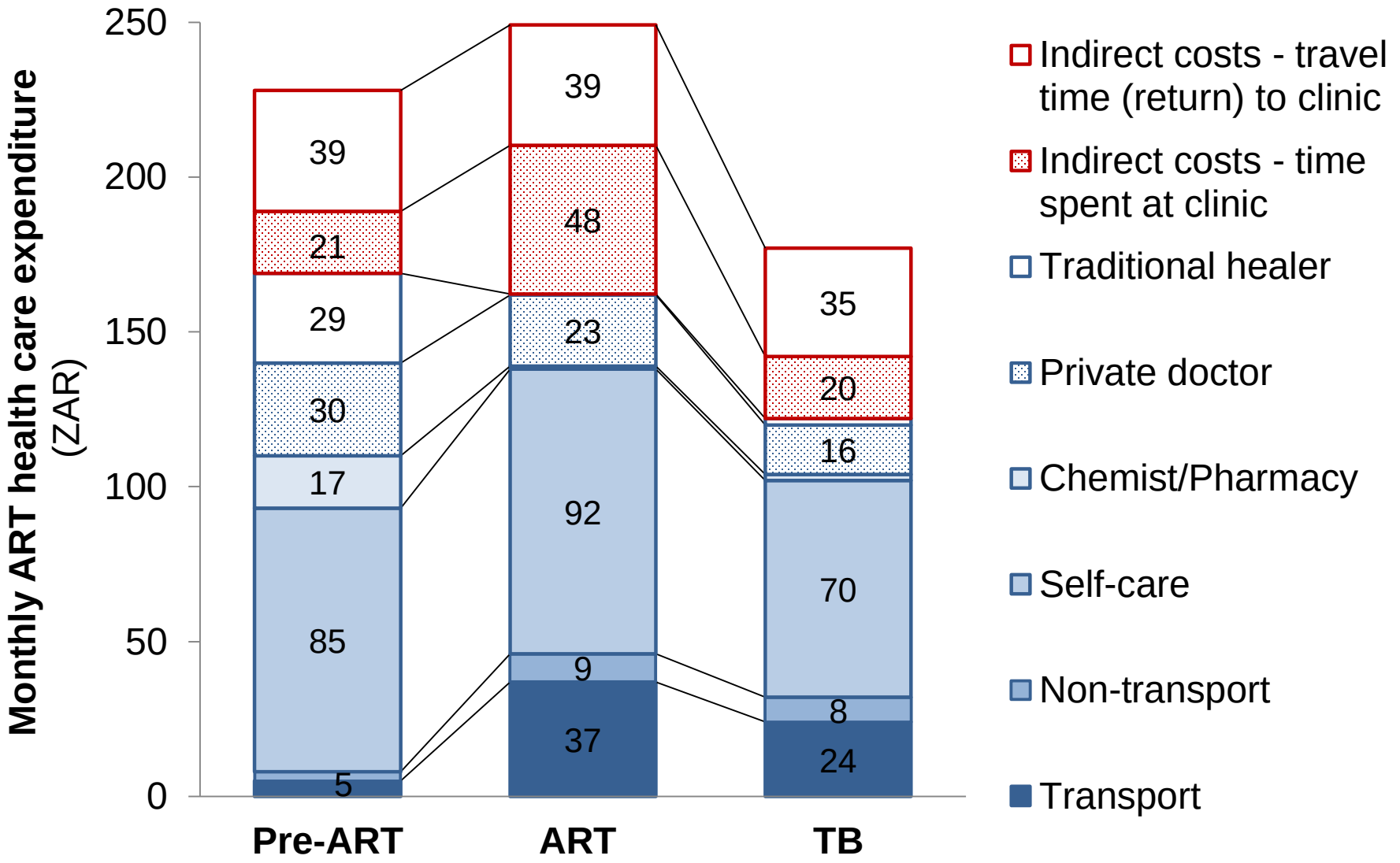


CROI 2016. ITT = intent to treat, CACE = complier average casual effect, pp = percentage points.

ART patient costs

Patient exit interviews
N = 400 for ART and TB; *N* = 300 for pre-ART.

Self-care includes expenditures for traditional medicines, items to fight disease bought at spaza shops, and special foods.

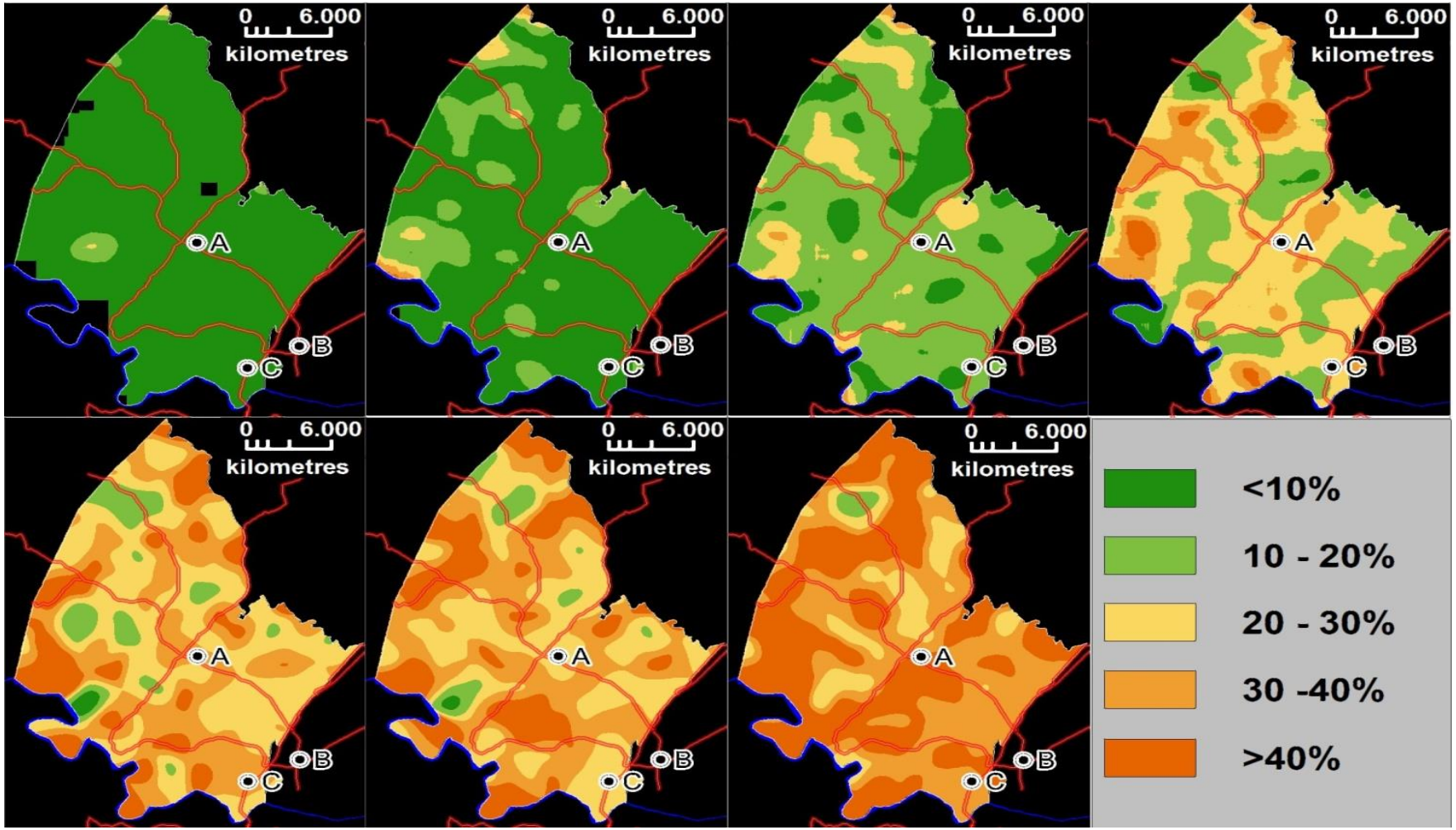


JAIDS 2015

Outline

- Empirical methods
- Non-health impacts
- **Externalities**

ART coverage over time across time and space



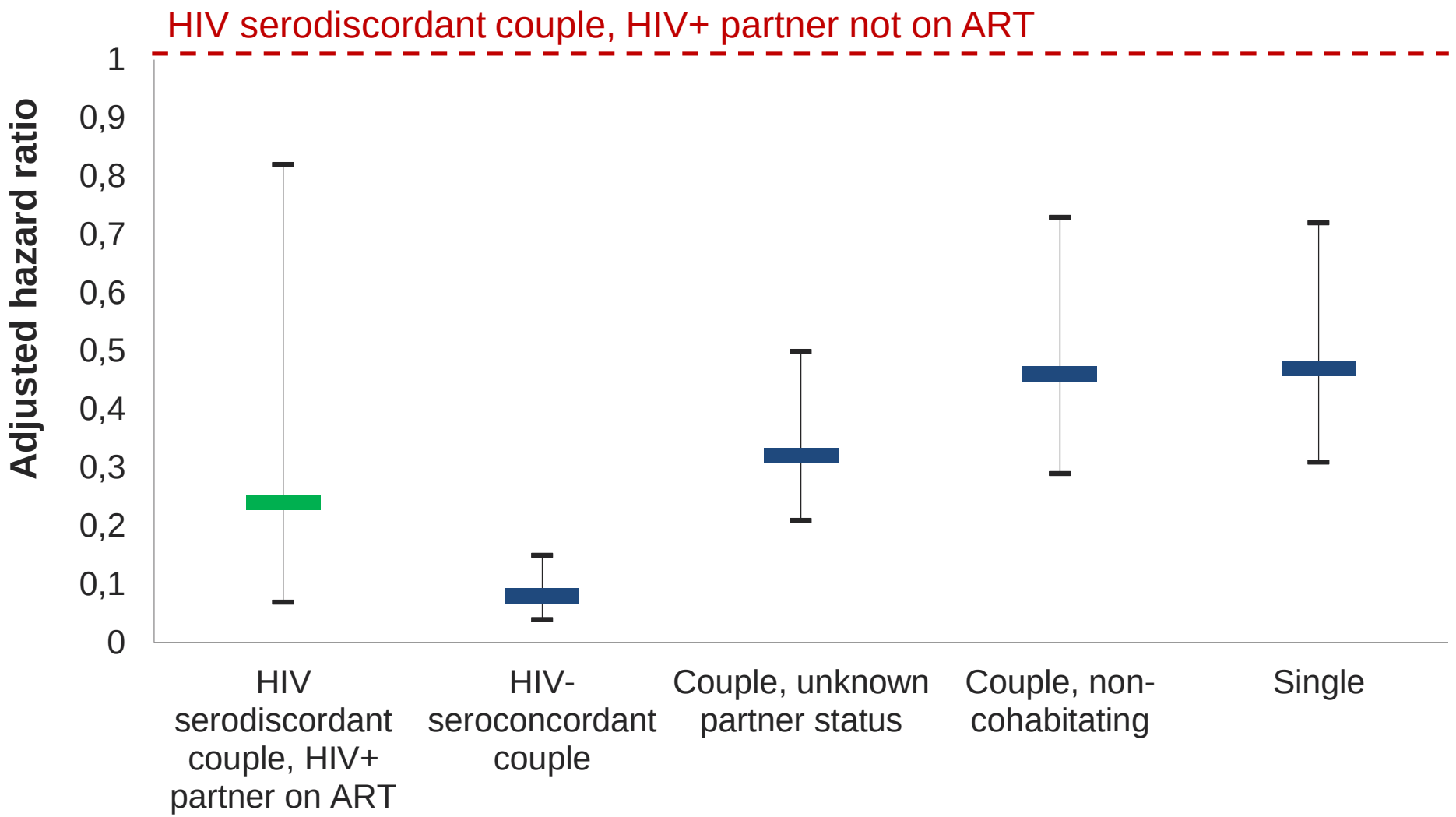
Science 2013

ART impact on partners

Prospective cohort study.

N = 17,016 individuals; 1,846 with an HIV+ partner.

Interval-censored survival analysis with time-varying ART exposure, education, multiple partners and condom use, as well as age and sex.



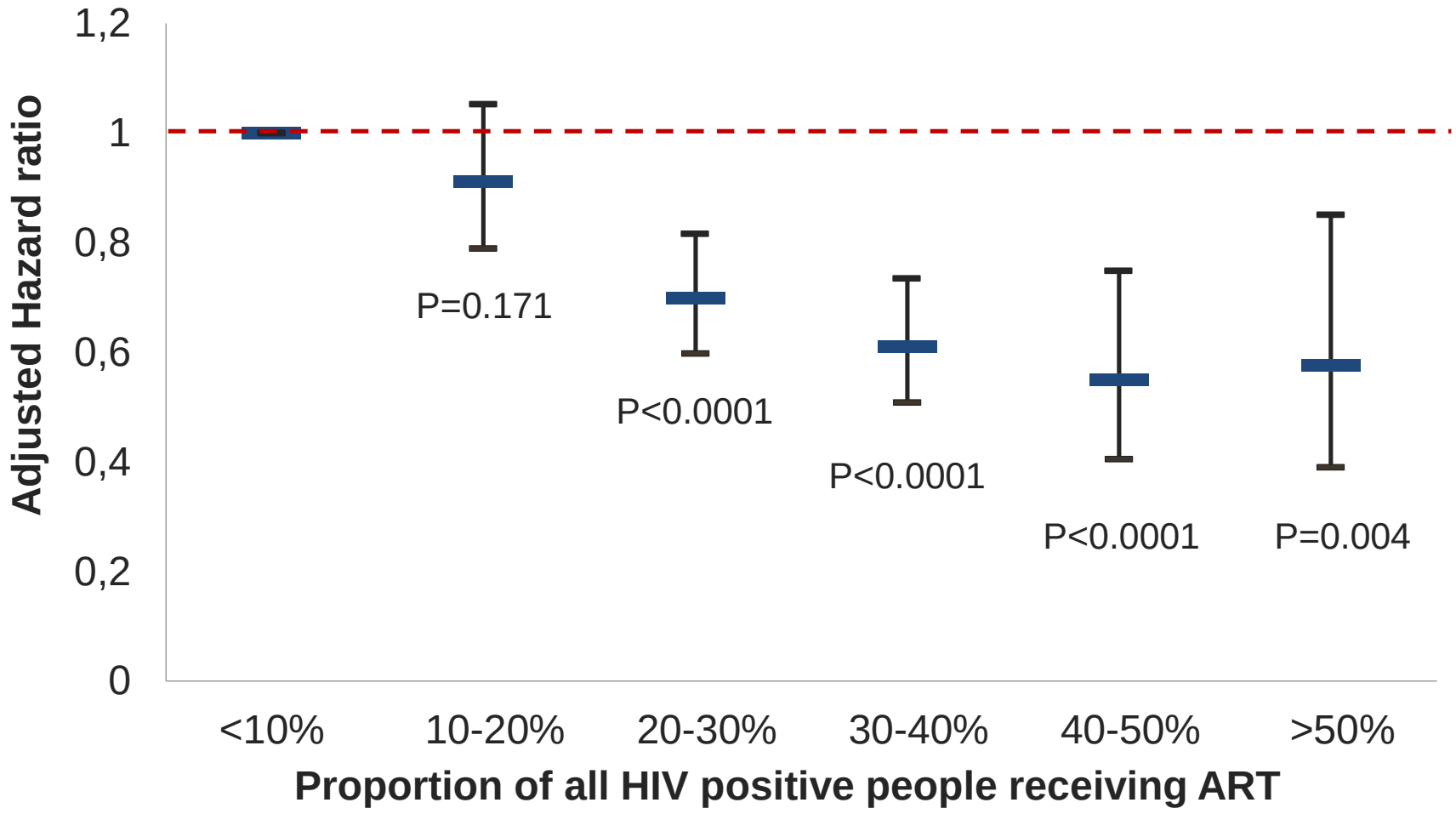
Clinical Infectious Diseases 2016

ART impact on the community

1,413 HIV seroconversions over 53,605 person-years

IV replication using differential distance (and travel time) between nearest and second nearest ART as instruments

- Strong first stage (p<0.0001)
- IV model: >40% ART aHR: 0.38 (95% CI: 0.17-0.84)



Science 2014, *SER* 2015

ART impact on children

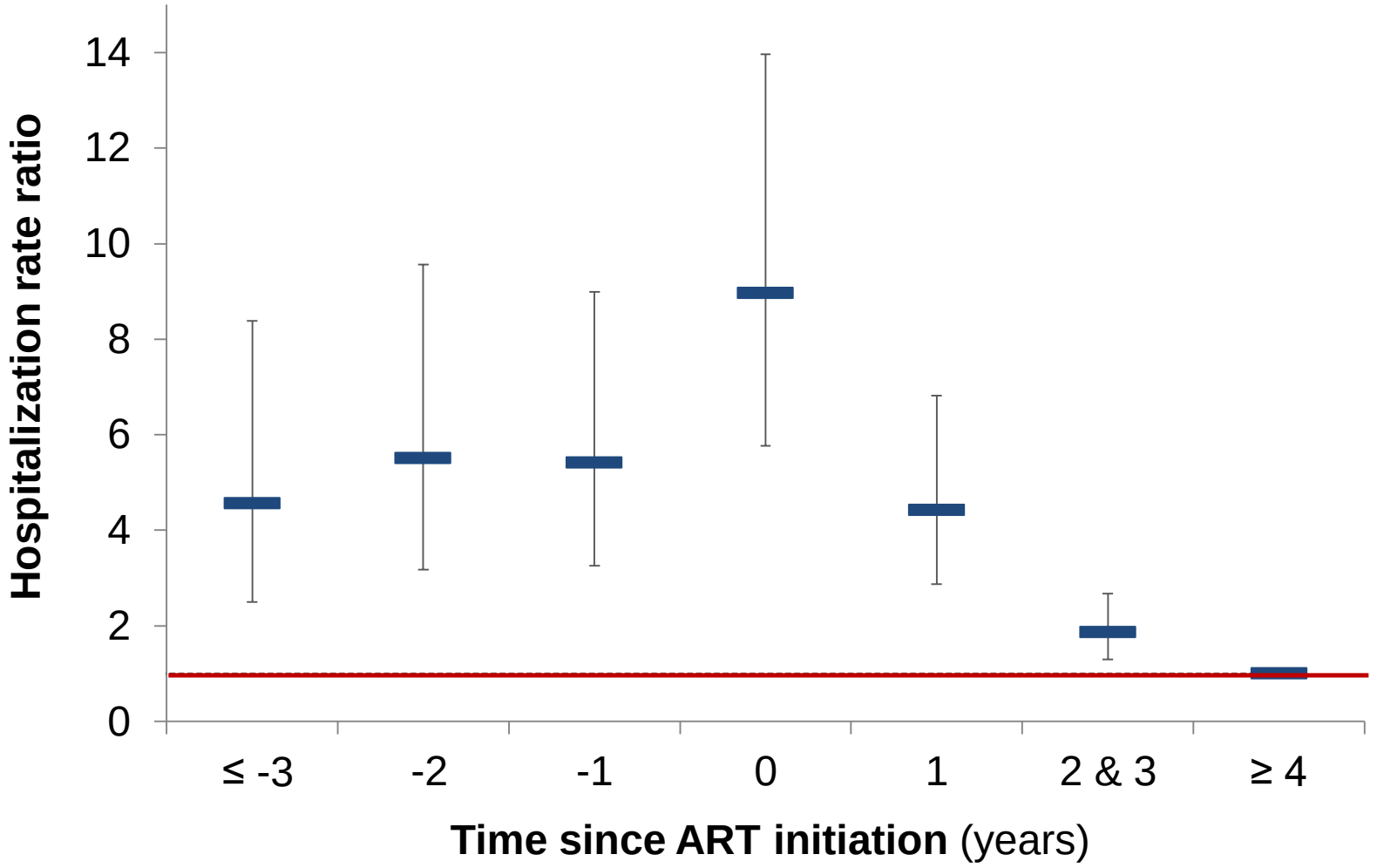
Regression discontinuity with assignment as instrumental variable, controlling for youngest age at which the child reached the highest grade, adult CD4 count distance below the cutoff value of 200 cells per mm^3, and adult CD4 count distance above the cutoff. Standard errors adjusted for clustering at the homestead level.

ITT = intent-to-treat; CACE = complier average causal effect; CI = confidence interval

	Point estimate	95% CI
First stage: ART initiation	0.297	0.239-0.354
ITT	0.343	0.094-0.592
CACE	1.159	0.206-2.112
N	3,998	

ART impact on the health system

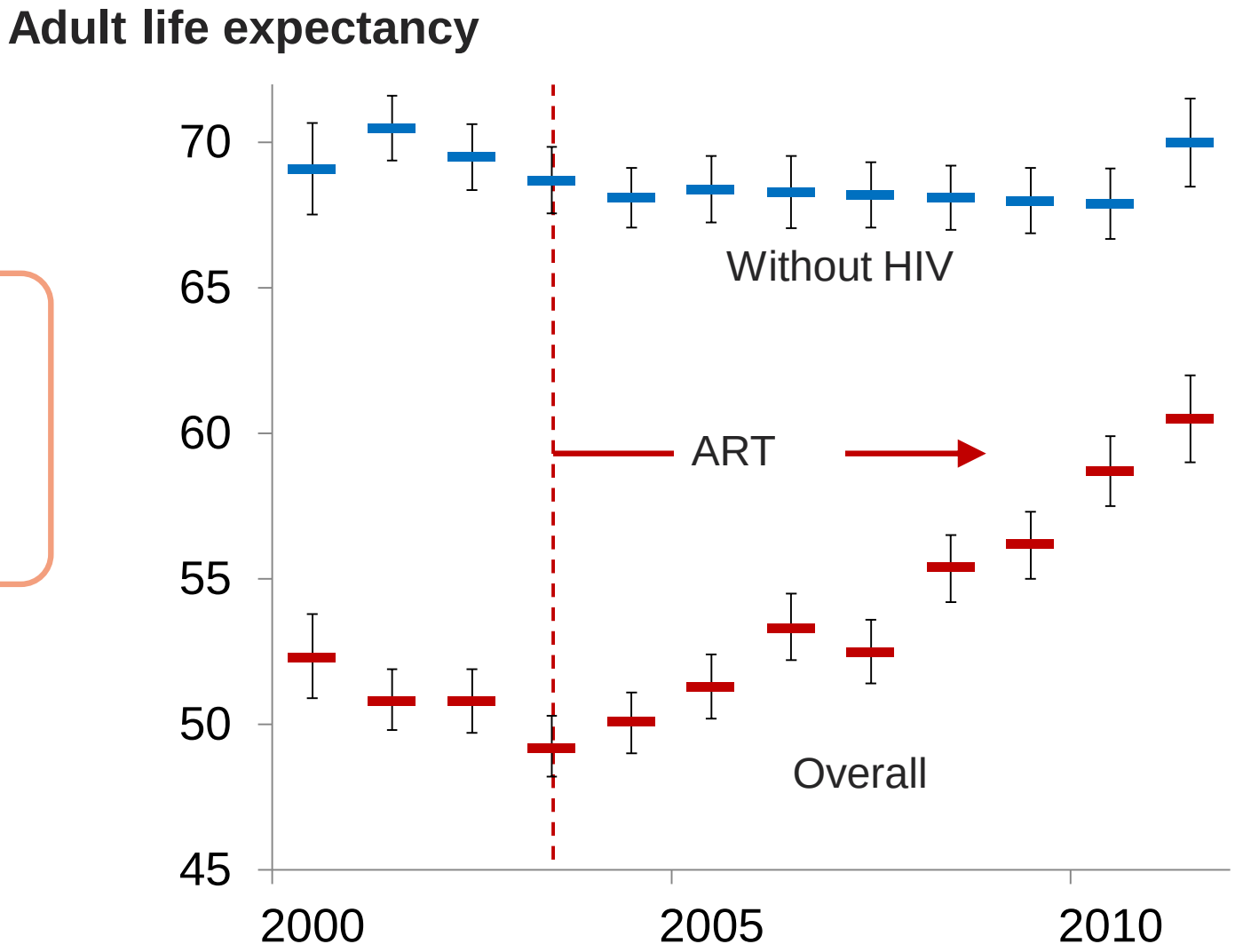
Individual fixed-effects regression, controlling for calendar year and age; 6,505 observations in 2,252 individuals (2009-2013). 103 hospitalizations per 1,000 person-years.



CROI 2015

Changing expectations – impacts on behavior?

N =13,060 deaths in 101,286 individuals in 651,350 person-years



Science 2013

Full value of health interventions

- Non-health impacts and externalities can be large
- Gradient of non-health impacts across the life course
- Impacts and externalities can be rigorously established in quasi-experiments

The causal effect of childhood measles vaccination on educational attainment: A mother fixed-effects study in rural South Africa

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ABSTRACT

Background: Because measles vaccination prevents acute measles disease and morbidities secondary to measles, such as undernutrition, blindness, and brain damage, the vaccination may also lead to higher educational attainment. However, there has been little evidence to support this hypothesis at the population level. In this study, we estimate the causal effect of childhood measles vaccination on educational attainment among children born between 1995 and 2000 in South Africa.

Methods and findings: We use longitudinal data on measles vaccination status and school grade attainment among 4783 children. The data were collected by the Wellcome Trust Africa Centre Demographic Information System (ACDIS), which is one of Africa's largest health and demographic surveillance systems. ACDIS is located in a poor, predominantly rural, Zulu-speaking community in KwaZulu-Natal, South Africa. Using mother fixed-effects regression, we compare the school grade attainment of siblings who are discordant in their measles vaccination status but share the same mother and household. This fixed-effects approach controls for confounding due to both observed and unobserved factors that do not vary between siblings, including sibling-invariant mother and household characteristics such as attitudes toward risk, conscientiousness, and aspirations for children. We further control for a range of potential

Thank you

Participants

Colleagues at Heidelberg, Harvard and AHRI

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