

Harvard and Tanzania Celebrate 25 Years of Collaboration

Implementation Science and the Practice of Public Health: The Case of PEPFAR

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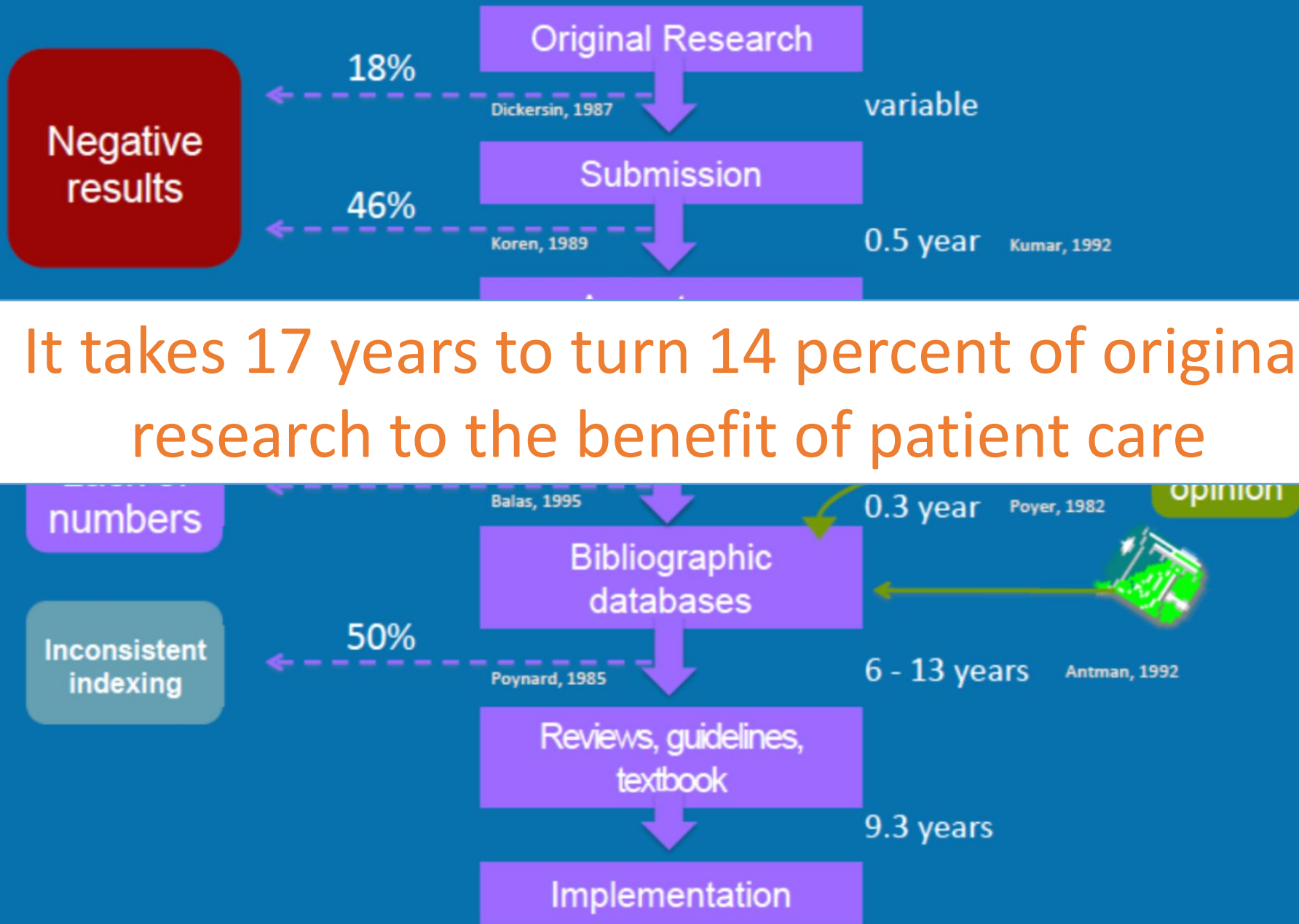
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Introduction to Implementation Science

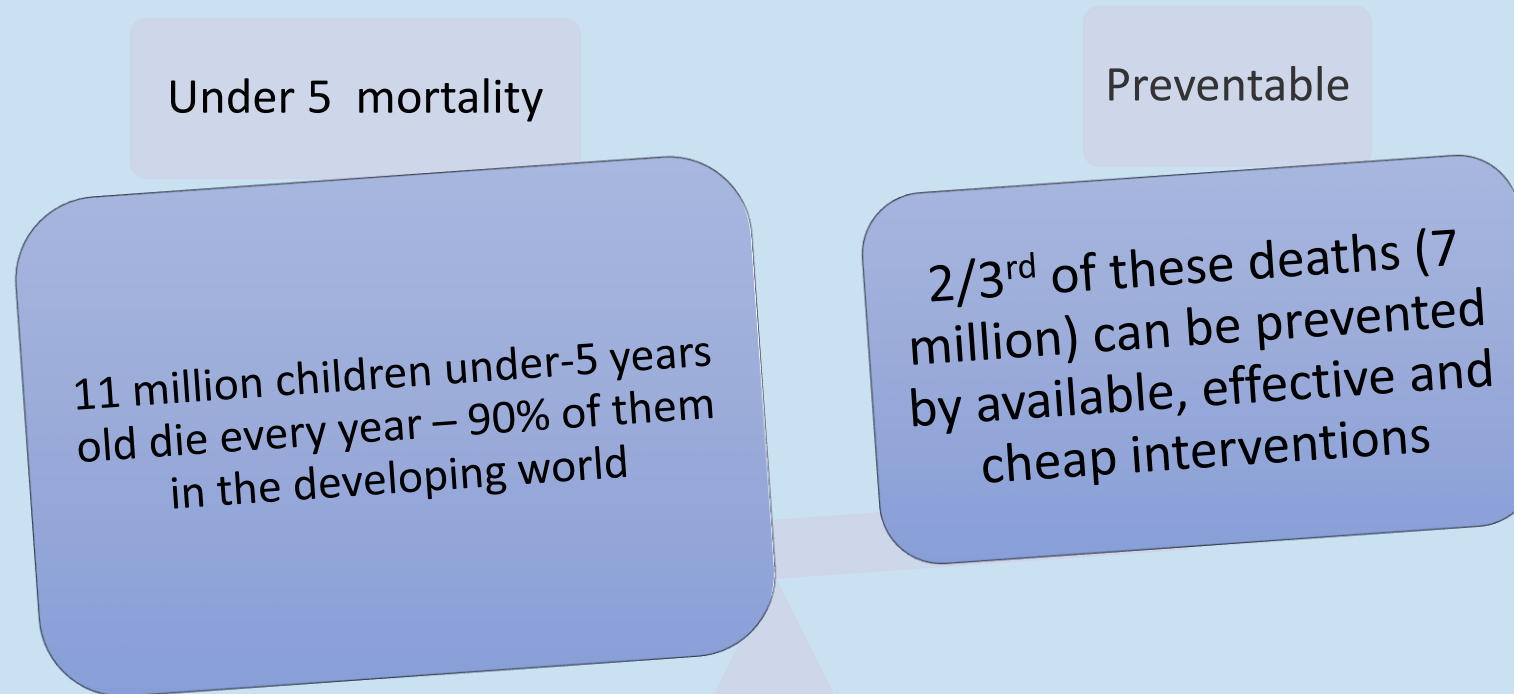


"PUBLICATION PATHWAY" Balas & Boren, 2000

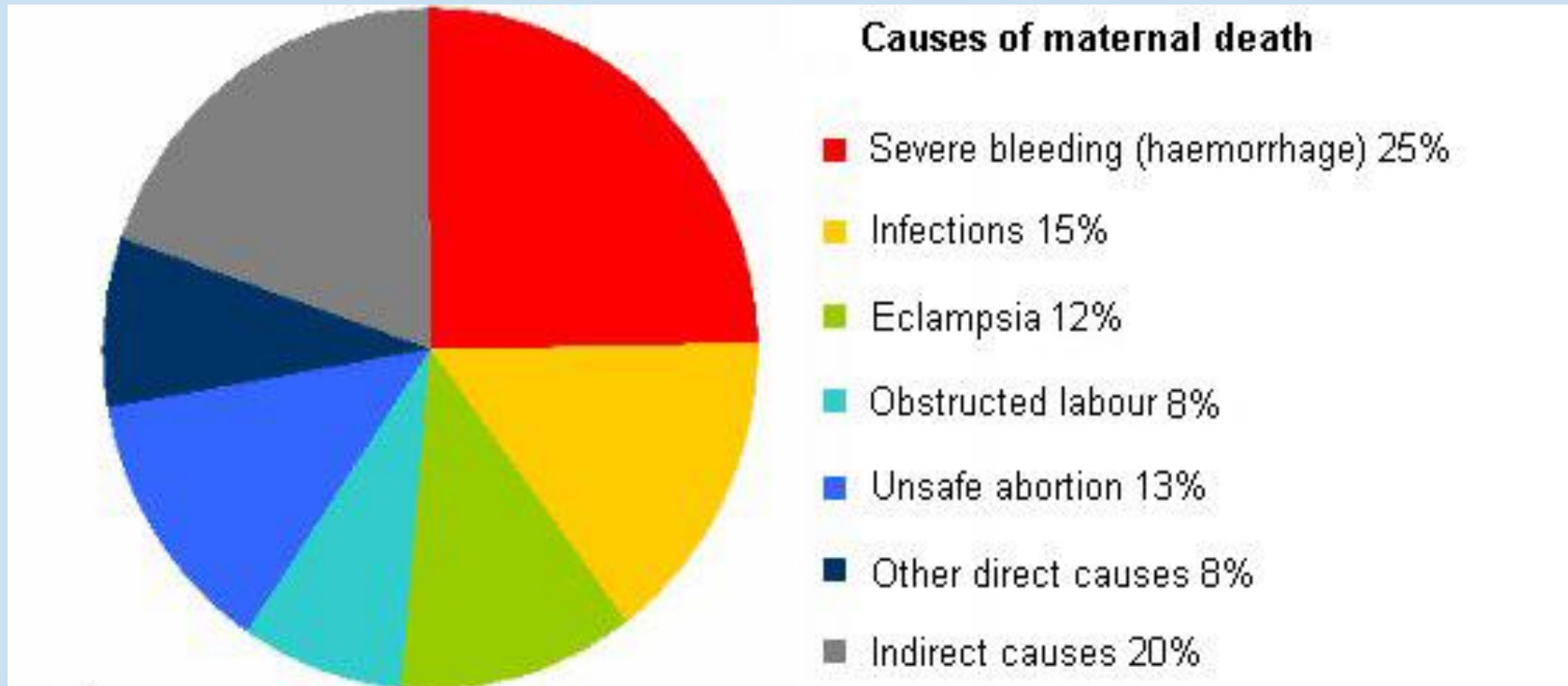


It takes 17 years to turn 14 percent of original research to the benefit of patient care

The “Know-Do” Gap: MDG 4 – Under 5 Mortality



The Know-Do Gap: MDG 5 -- Maternal mortality is nearly entirely preventable



*Source: The World Health Report 2005. Make every mother and child count.
Geneva, World Health Organization, 2005.*

The know-do gap: Obesity and diabetes are largely preventable

The global obesity epidemic is leading to skyrocketing rates of diabetes, CVD, cancer in the US and worldwide

- **Diabetes accounted for a full 12% of health expenditures in 2010 (Zhang P, Diabetes Res Clin Pract; 2010).**
- **60% of diabetes can be prevented by eliminating obesity (Hu et al., *N Engl J Med*, 2001)**
- ***Lifestyle intervention trials have reduced diabetes incidence by 58% (US), 29% (India), 42% (China).***

Implementation Science -- Definitions

“A systematic, scientific approach to ask and answer questions about how to get ‘what works’ to people who need it with greater speed, fidelity, efficiency, quality and relevant coverage”

“The scientific study of programs and interventions which promote the systematic uptake of clinical research findings and other evidence-based approaches into routine clinical practice and public health policy, hence improving the quality (effectiveness, reliability, safety, appropriateness, equity, efficiency) of health care.”

“Implementation science is about determining what works, in real-life full-scale settings.”

The implementation pipeline

efficacy →

effectiveness and cost-effectiveness →

implementation →

dissemination

Features of Implementation and Dissemination Science Research

3 types of research with unique features, designs, and objectives

- Theory-driven
- Mixed methods
- Adaptation vs. Fidelity
- Contextual (?when? ?where?) vs. External validity
- Economic evaluation/cost-effectiveness
- Sustainability
- Diffusion (network science)

The Impact of PEPFAR PMTCT Funding on Infant Mortality and Antenatal Care in Kenya

A quasi-experimental evaluation

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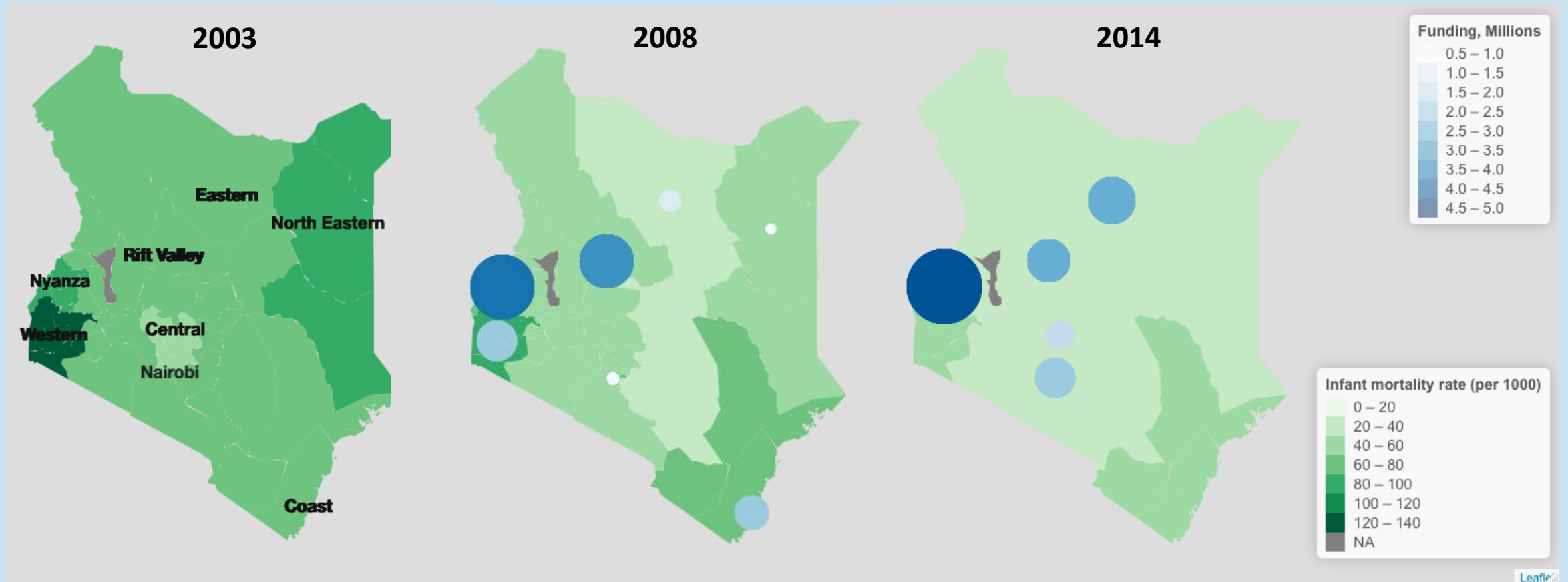
Elizabeth Lee, DrPH⁴

Background

- PEPFAR : the U.S. President's Emergency Plan for AIDS Relief
- PMTCT: Prevention of mother-to-child transmission of HIV
- Kenya has been a PEPFAR-focus country since 2004.
- PEPFAR has invested over \$240 million dollars in PMTCT programs in Kenya since 2004



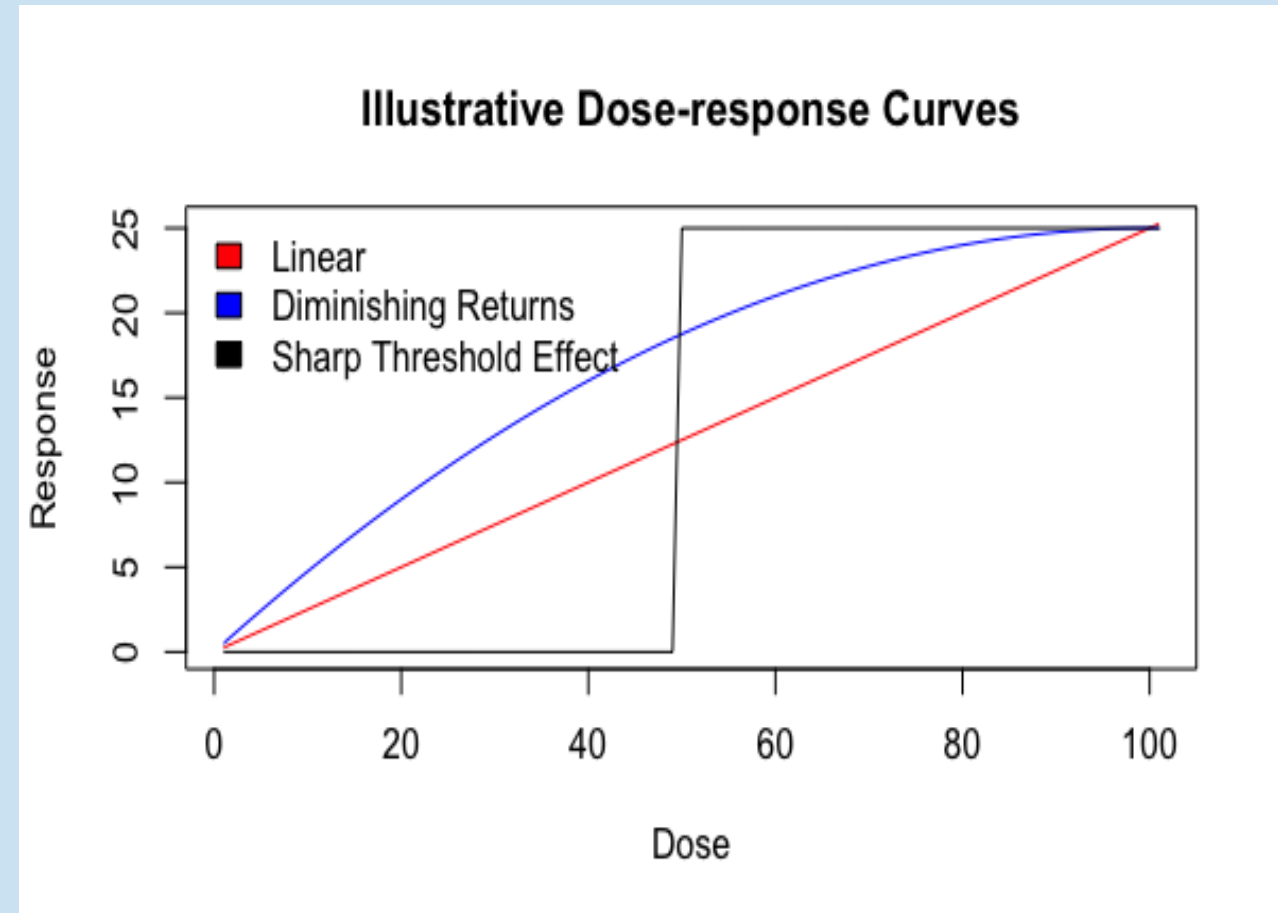
PEFPAR funding has coincided with a drastic decrease in infant mortality



Note: 10-year mortality rates come KDHS reports.

Study Design: A dose-response model

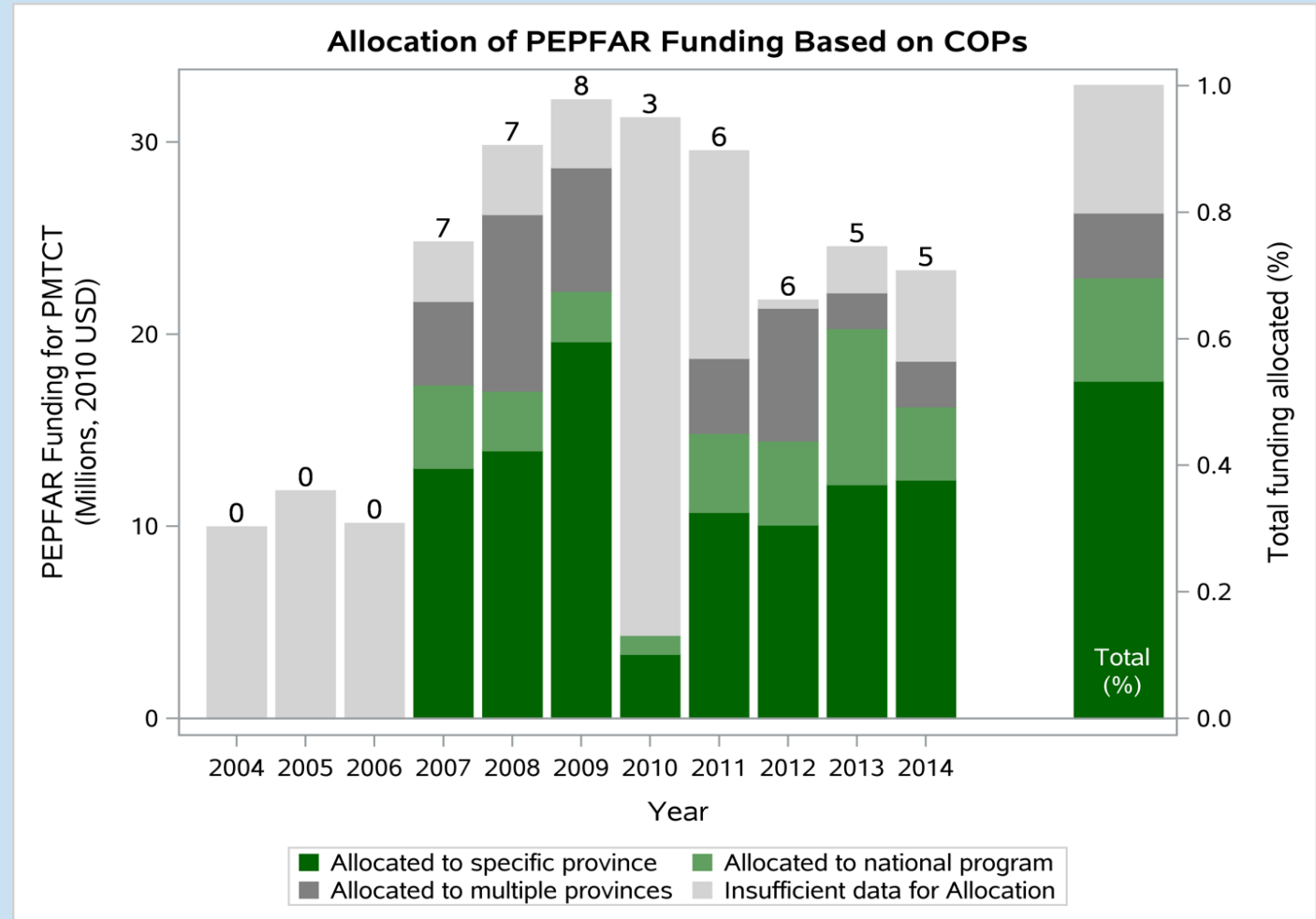
- Quasi-experimental design
- Continuous generalization of a difference-in-difference study
- Based on the principle that if a causal relationship exists, a higher “dose” of the exposure should lead to a stronger effect
- Dose-response models do not need to be linear!



Exposure: PEPFAR funding for PMTCT

■ Country Operational Plans (COPs)

- Submitted annually by all PEPFAR **implementing partners**
 - Describe planned expenditures
 - Disaggregated by **activity**, including PMTCT
 - PMTCT funding allocated to provinces based on narrative details in the COPs
- Used to calculate **annual per capita funding** and **cumulative per capita funding**



Outcomes

- Data on individual outcomes came from two nationally-representative, cross-sectional surveys:
 - Kenyan Demographic and Health Survey (KDHS)
 - Kenyan AIDS Indicator Survey (KAIS)
- Use similar methodology and identical or near-identical wording for many HIV/AIDS questions
- Also gather additional demographic and socioeconomic data

SECTION 7. AIDS AND OTHER SEXUALLY-TRANSMITTED DISEASES

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
701	Now I would like to talk about something else. Have you ever heard of an illness called AIDS?		
702	Is there anything a person can do to avoid getting AIDS?		
703	What can a person do? Anything else? RECORD ALL MENTIONED.		
704	Can people reduce their chances of getting it if one sex partner who has no other partners?		
705	Can a person get the AIDS virus from mosquitoes?		
706	Can people reduce their chances of getting it if condom every time they have sex?		
707	Can a person get the AIDS virus by sharing a needle?		
708	Can people reduce their chances of getting it by having sex at all?		
709	Is it possible for a healthy-looking person to have AIDS?		
710	Do you know someone personally who has it or someone who died of AIDS?		
711	Can the virus that causes AIDS be transmitted by... During pregnancy? During delivery? By breastfeeding?		

Appendix **F**

Individual Questionnaire

MINISTRY OF HEALTH
KENYA AIDS INDICATOR SURVEY
INDIVIDUAL QUESTIONNAIRE

IDENTIFICATION

PROVINCE* _____
DISTRICT _____
WASREP CLUSTER NUMBER _____
HOUSEHOLD NUMBER _____
LARGE (1) / SMALL (2) / URBAN/RURAL (NAIROBI/OMBARAKATI/NAIROBI-1, NAKURU/DOROTHY-BANYERI-2, SMALL TOWNS, RURAL=4)
NAME OF HOUSEHOLD HEAD _____
NAME AND LINE NUMBER OF RESPONDENT _____
SEX OF RESPONDENT* (MALE = 1, FEMALE = 2)

INTERVIEWER VISITS

	1	2	3	FINAL VISIT
DATE				DAY _____ MONTH _____ YEAR 2007
INTERVIEWER'S NAME				INT. NUMBER _____
RESULT*				RESULT _____
NEXT VISIT: DATE				TOTAL NUMBER OF VISITS _____
TIME				

LAB TECHNICIAN VISITS

	LAB TECH ID	RESULT
RESULT*		
NEXT VISIT: DATE		
TIME		
	AFFIX BAR CODE LABEL HERE	TOTAL NUMBER OF VISITS _____

LANGUAGE OF QUESTIONNAIRE: **ENGLISH**

LANGUAGE OF INTERVIEW: _____

HOME LANGUAGE OF RESPONDENT:
 01 SWAHILI 02 KISIKUYU 03 LUIS 04 MURINDANI 05 ENGLISH
 06 KALENJIN 07 KISII 08 MAASAI 09 SOMALI 10 OTHER
 11 KIMBA 12 LUYA 13 MERU 14 KISWAHILI

NAME SUPERVISOR _____ OFFICE EDITOR _____ KEYED BY _____
 DATE _____

*RESULT CODES:
 (1) COMPLETED (2) NOT AT HOME (3) POSTPONED (4) REFUSED (5) PARTLY COMPLETED (6) INCAPACITATED (7) OTHER (SPECIFY) _____
 **RESULT CODES:
 (1) AGREE (2) REFUSE (3) ABSENT

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Outcomes

HIV testing at ANC

- Receiving HIV counselling, testing, and test results as part of antenatal care
- N=21,048 mothers who gave birth ≤ 5 years before the interview date

Neonatal mortality

- Death within the first 30 days of life
- N=37,616 children born 1-60 months prior to the interview date

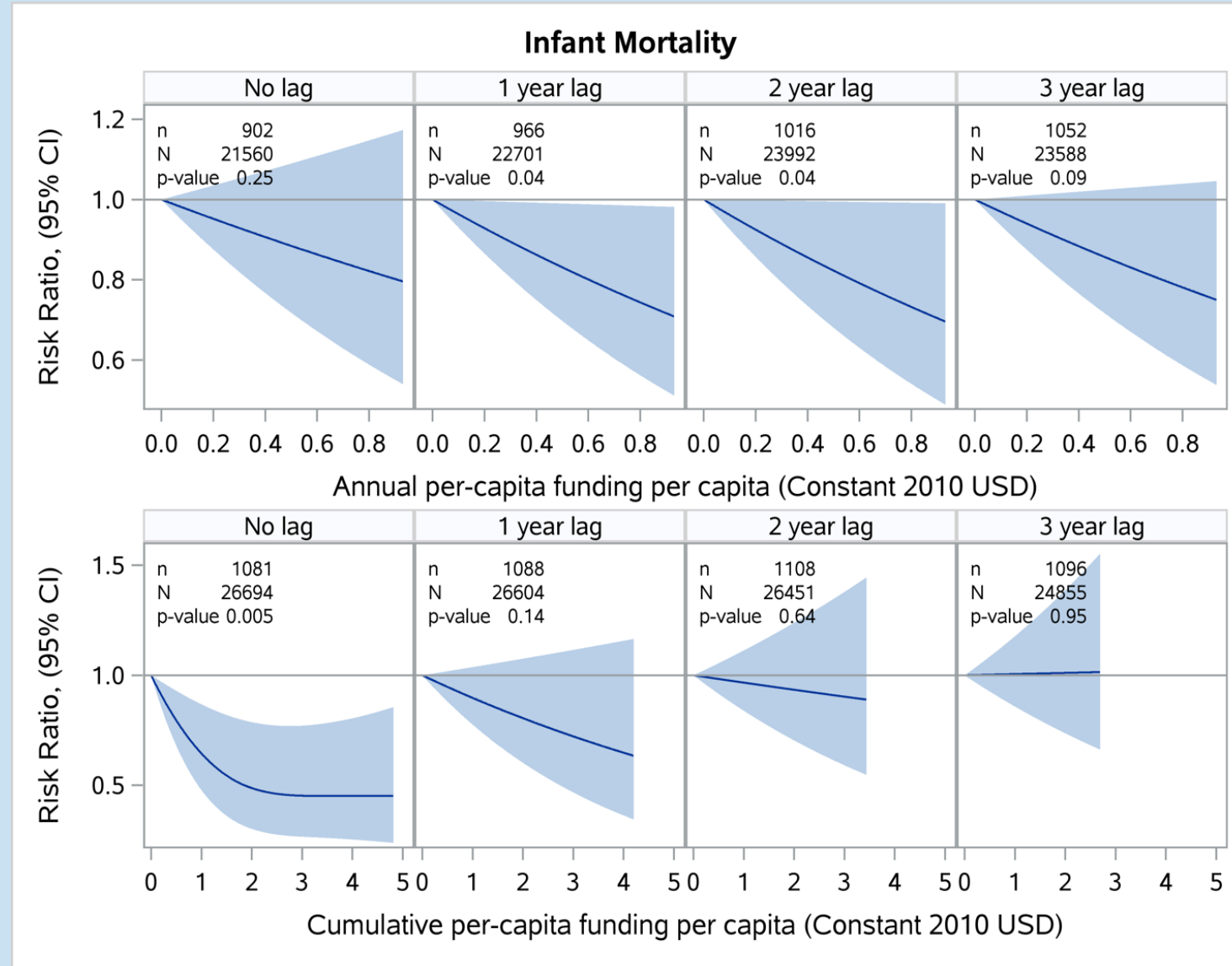
Infant mortality

- Death within the first year of life
- N=30,424 children born 12-60 months prior to the interview date

Infant mortality

Annual per-capita Funding for PMTCT

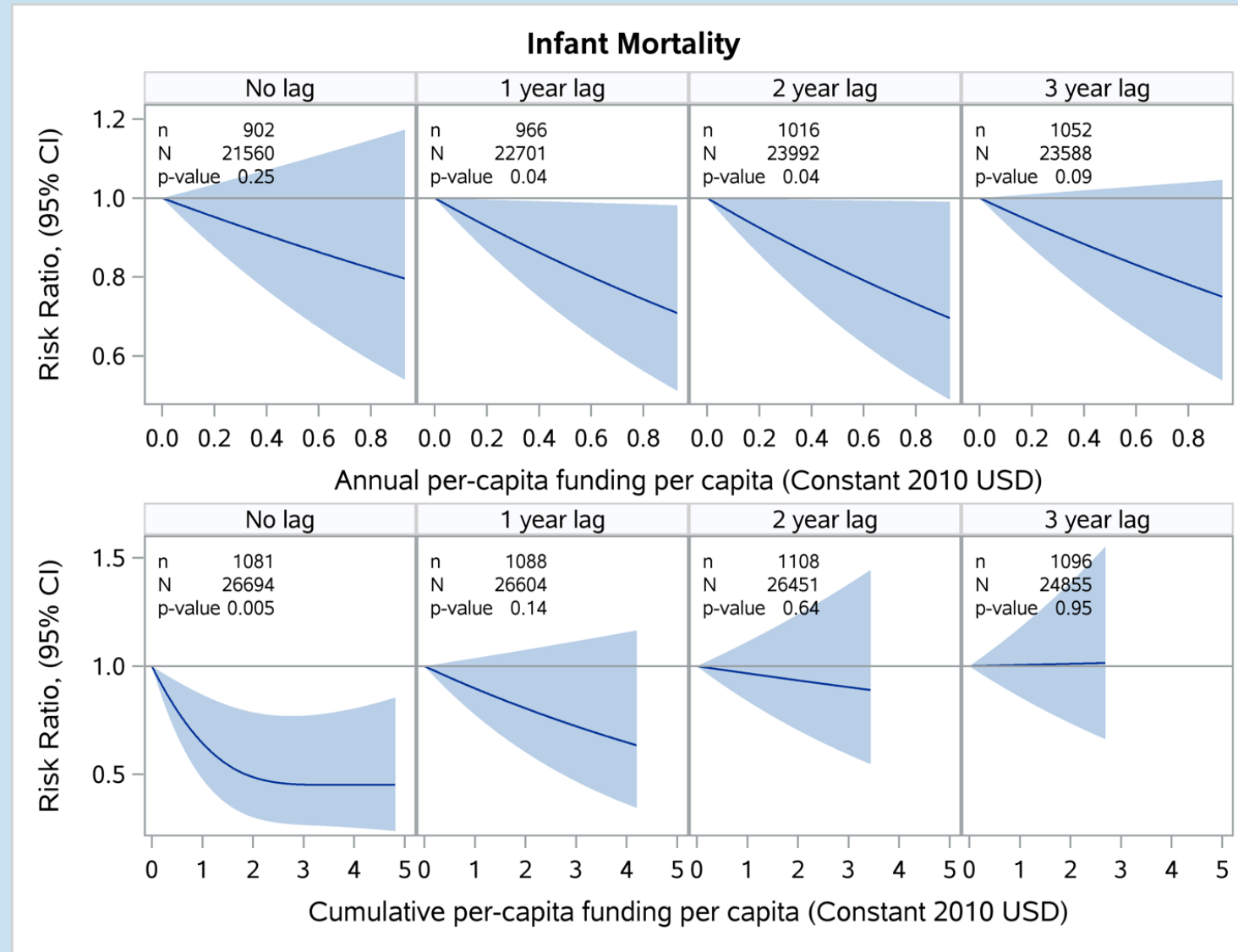
- Not associated with infant mortality in the year of funding allocation
- A \$0.33 increase was associated with:
 - a 11% (95% CI: 1-21%) reduction in infant mortality after a 1-year lag
 - a 12% (95% CI: 0-22%) reduction in infant mortality after a 2-year lag



Infant mortality

Cumulative per-capita
Funding for PMTCT

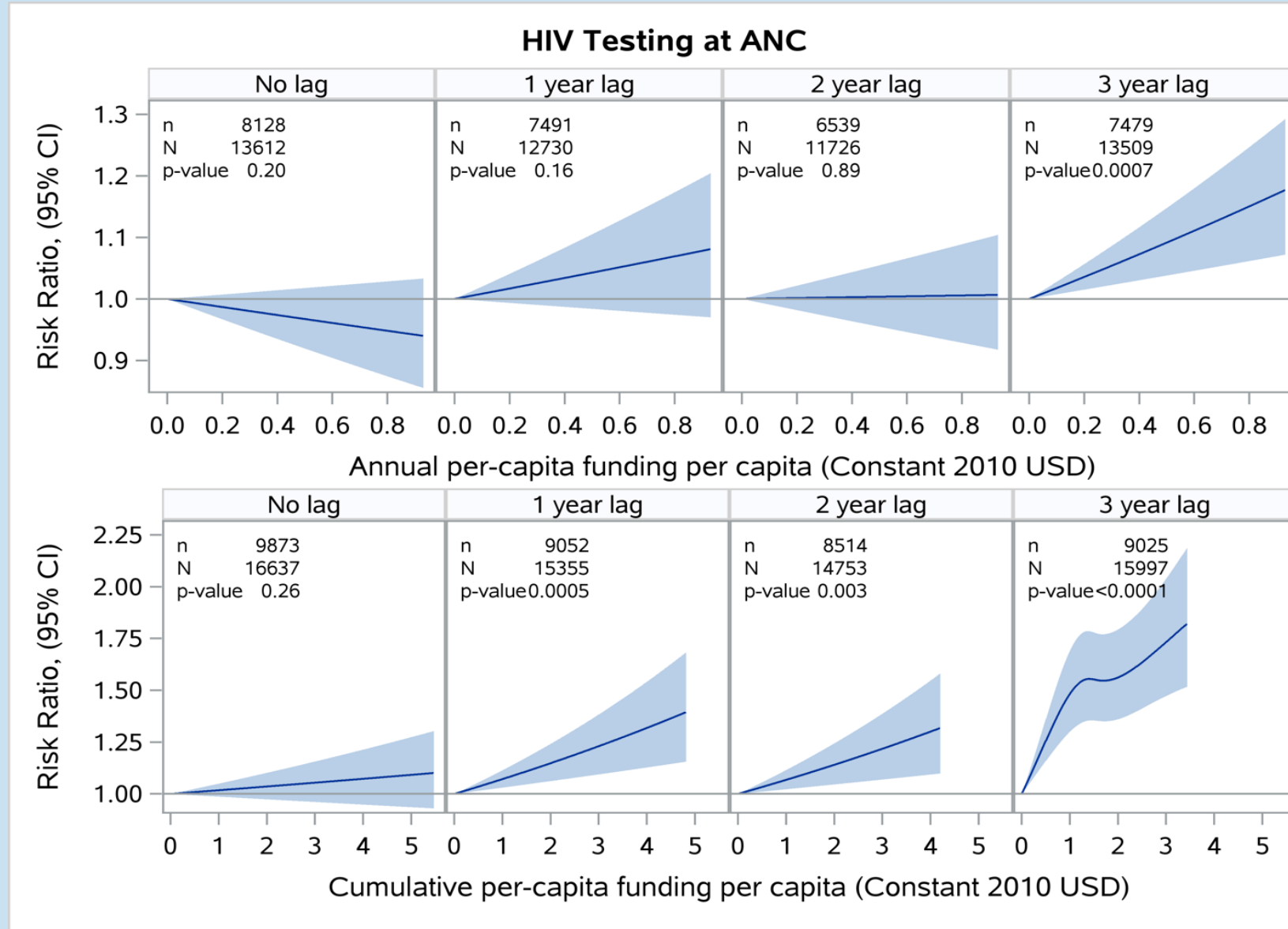
- A \$0.83 increase was associated with a 31% reduction in infant mortality (95% CI: 11-46%) in the year of funding allocation.
- Association became weaker after subsequent lags



HIV testing at ANC

Annual per-capita
Funding for PMTCT

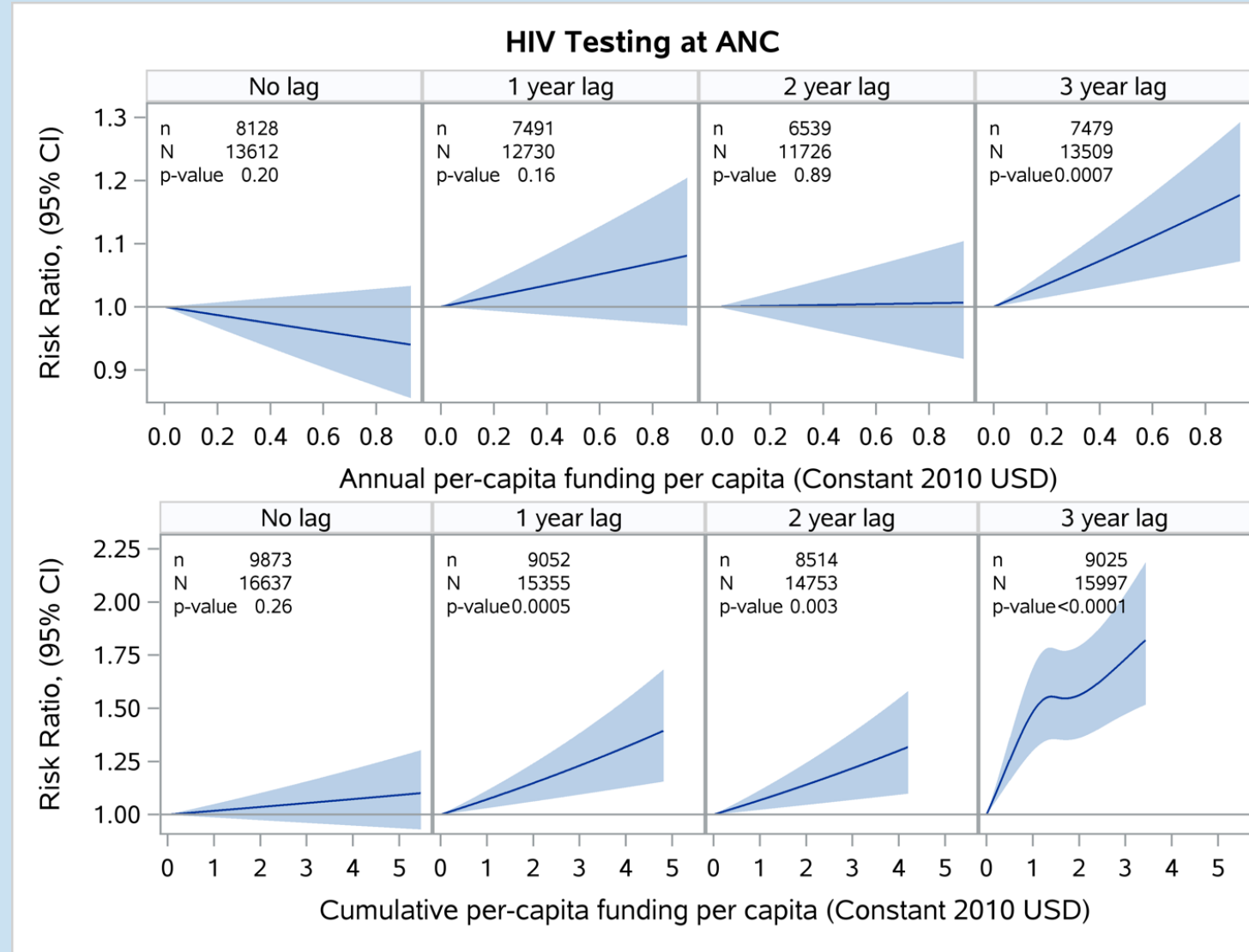
- Not associated with HIV testing at ANC in the year of funding allocation or when using a 1- to 2-year lag
- With 3-year lag, a \$0.33 increase was associated with a 6% increase (95% CI: 2-10%) in HIV testing at ANC



HIV testing at ANC

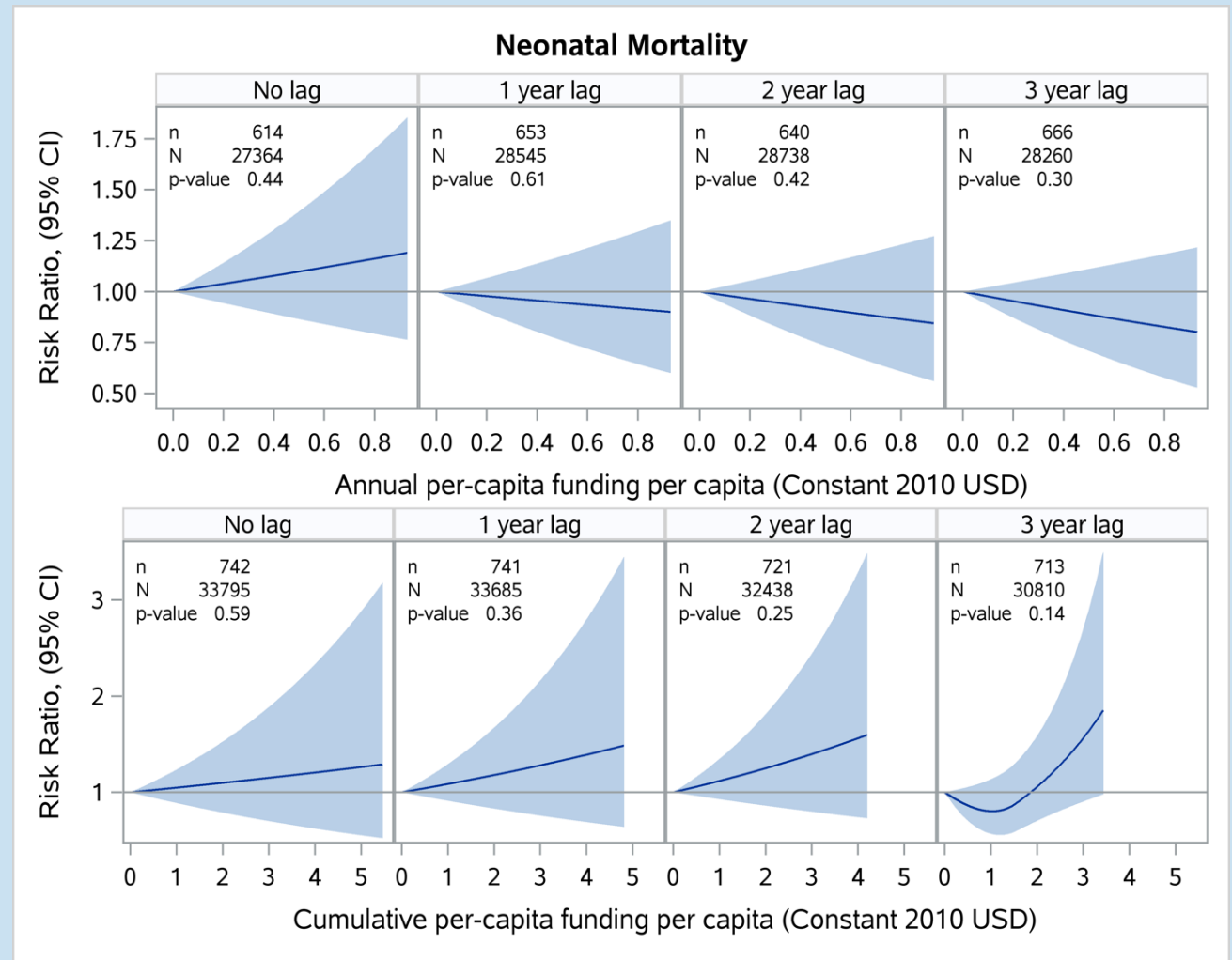
Cumulative per-capita
Funding for PMTCT

- Not associated with HIV testing at ANC in the year of funding allocation
- A \$0.83 increase was linearly associated with:
 - 6% increase in HIV testing at ANC after a 1- and 2-year lag (95% CIs: 3-9% and 2-9%, respectively)
 - a 42% (95% CI: 26-59%) increase in testing after a 3-year lag



Neonatal mortality

- Not associated with annual per-capita funding
- Not associated with cumulative per-capita funding



Delayed Effects of Annual Funding

Annual per capita funding was not associated with health outcomes in the year of allocation but **became beneficial** at later lags



Full impact of funding may not be observable for several years

Lagged effect may reflect:

- **Logistical delays** in transferring PEPFAR funds to implementing partners and local PMTCT programs
- **Biologic realities** of the outcomes of interest



Donors and program evaluators may wish to consider both logistic and biologic factors when defining a time horizon for program evaluations

Summary: Main findings

PEPFAR funding for PMTCT was associated with **reduced infant mortality** and **increased HIV testing at ANC** in Kenya.

Our findings are best interpreted as the effect of living in a province that receives a given level of PEPFAR funding and would likely underestimate the benefits of interacting directly with a PEPFAR-funded PMTCT program.

Thank you!

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References

Background

- Luboga SA, Stover B, Lim TW, et al. Did PEPFAR investments result in health system strengthening? A retrospective longitudinal study measuring non-HIV health service utilization at the district level. *Health Policy Plan* 2016; **31**(7): 897-909.
- Cohen RL, Li Y, Giese R, Mancuso JD. An evaluation of the President's Emergency Plan for AIDS Relief effect on health systems strengthening in sub-Saharan Africa. *J Acquir Immune Defic Syndr* 2013; **62**(4): 471-9.
- Duber HC, Coates TJ, Szekeras G, Kaji AH, Lewis RJ. Is there an association between PEPFAR funding and improvement in national health indicators in Africa? A retrospective study. *J Int AIDS Soc* 2010; **13**: 21.
- Lee MM, Izama MP. Aid Externalities: Evidence from PEPFAR in Africa. *World Development* 2015; **67**: 281-94.
- Bendavid E, Holmes CB, Bhattacharya J, Miller G. HIV development assistance and adult mortality in Africa. *JAMA* 2012; **307**(19): 2060-7. 30.
- Bendavid E. The President's Emergency Plan for AIDS Relief in Africa: An Evaluation of Outcomes. *Annals of Internal Medicine* 2009; **150**(10): 688.
- Liu L, Oza S, Hogan D, et al. Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. *Lancet* 2015; **385**(9966): 430-40.

References

Data sources

- Office of U.S. Global AIDS Coordinator. PEPFAR Dashboards. <https://data.pepfar.net/global> (accessed November 22 2016).
- Office of U.S. Global AIDS Coordinator. Country Operational Plans. <https://www.pepfar.gov/countries/cop/index.htm> (accessed November 22 2016).
- Central Bureau of Statistics [Kenya], Ministry of Health [Kenya], ORC Macro. Kenya Demographic and Health Survey 2003 [Dataset]. Calverton, Maryland, USA: CBS, MOH, and ORC Macro; 2004.
- National Bureau of Statistics [Kenya], National AIDS Control Council [Kenya], National AIDS/STD Control Programme [Kenya], Health MoP, Sanitation [Kenya], Kenya Medical Research Institute. Kenya Demographic and Health Survey 2008-09 [Dataset]. Calverton, Maryland, USA: KNBS and ICF Macro; 2010.
- National Bureau of Statistics [Kenya], Ministry of Health [Kenya], National AIDS Control Council [Kenya], Kenya Medical Research Institute, Population NCF, Development [Kenya]. Kenya Demographic and Health Survey 2014 [Dataset]. Rockville, MD, USA; 2015.
- National AIDS and STI Control Programme (NAS COP) [Kenya]. Kenya AIDS Indicator Survey 2007 [Dataset]. Nairobi: National Bureau of Statistics [Kenya]; 2009.
- National AIDS and STI Control Programme (NAS COP) K. Kenya AIDS Indicator Survey 2012. Nairobi: National Bureau of Statistics,, [Kenya]; 2014.
- World Bank. Subnational Population Database.
- PEPFAR Bilateral Countries. <https://www.pepfar.gov/countries/bilateral/index.htm> (accessed January 11 2018).
- The DHS Program: Where We Work. <https://dhsprogram.com/Where-We-Work/Country-List.cfm> (accessed January 11 2018).

References

Methods

- Fitzmaurice G, Laird N, Ware J. Applied Longitudinal Analysis. 2 ed. Hoboken, New Jersey: John Wiley & Sons, Inc; 2011.
- Wacholder S. Binomial regression in GLIM: estimating risk ratios and risk differences. *Am J Epidemiol* 1986; **123**(1): 174-84.
- Zou G. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol* 2004; **159**(7): 702-6.
- Durrleman S, Simon R. Flexible regression models with cubic splines. *Stat Med* 1989; **8**(5): 551-61.
- Govindarajulu US, Malloy EJ, Ganguli B, Spiegelman D, Eisen EA. The comparison of alternative smoothing methods for fitting non-linear exposure-response relationships with Cox models in a simulation study. *Int J Biostat* 2009; **5**(1): Article 2.
- Hertzmark E, Li R, Hong B, Spiegelman D. The SAS GLM CURV9 Macro. 2014. <https://www.hsph.harvard.edu/donna-spiegelman/software/glmcurv9/>.