

Service Delivery Redesign for Maternal and Newborn Health in Kakamega County, Kenya: Findings from a combined impact and process evaluation

Kevin Croke, on behalf of the SDR Evaluation team
Harvard TH Chan School of Public Health

October 31, 2025



SDR evaluation team

- Harvard School of Public Health:
 - Kevin Croke, Jan Cooper, Kennedy Opondo, Beatrice Wamuti, Se-in Kim, Nicolas Rahim, Margaret Kruk
- Kenya Medical Research Institute:
Wellcome Trust
 - Jacinta Nzinga, Easter Olwanda, Hillary Kimutai, Brian Arwah
- Ipsos-Kenya:
 - Led by Caroline Mackenzie, Rodgers Kegode

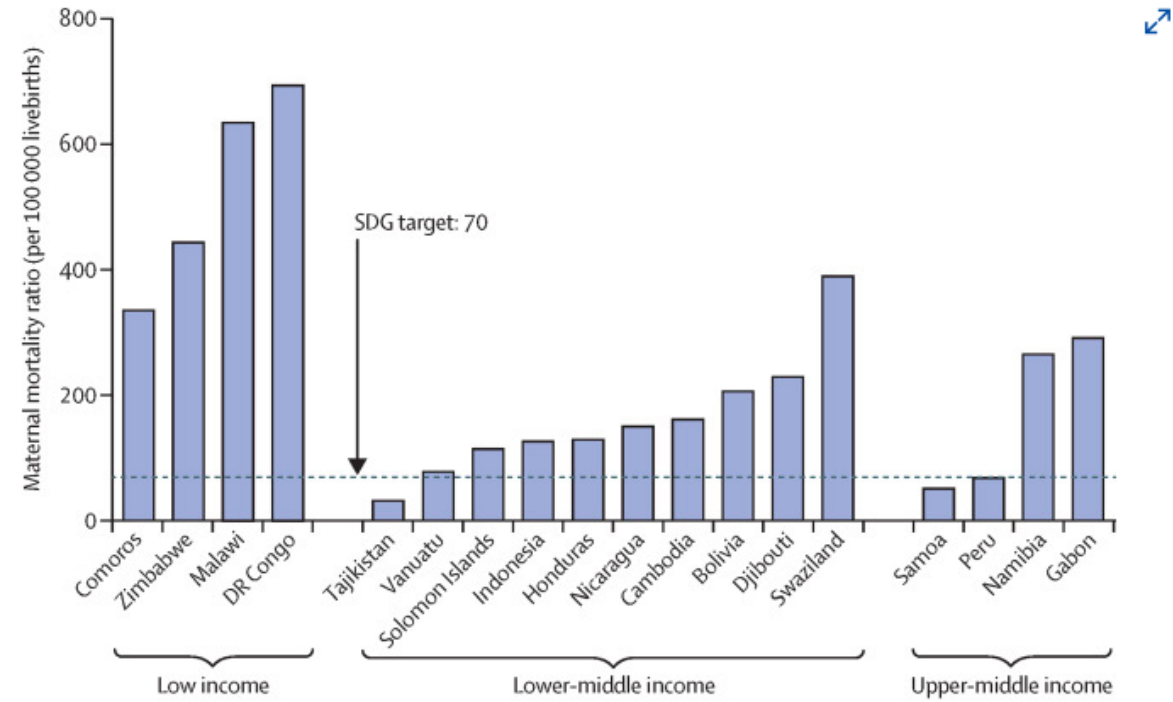


SDR for maternal and newborn health

- The concept of **Service Delivery Redesign** emerged from the 2016 Lancet Global Health Commission on High Quality Health Systems (HQSS), led by Prof. Margaret Kruk and Prof. Muhammad Pate
- Problem: persistence of high MMR and NMR, despite rapid increases in skilled birth attendance

SDR for maternal and newborn health problem definition

- Many deliveries have shifted from home to low-level clinics which do not provide life-saving emergency care
- Current measures of risk do not predict complications well
- Referral systems are not providing timely transport to life saving care



Source: Kruk et al 2018

Why SDR in Kenya?

Rapidly increasing facility delivery; slow progress on newborn and maternal survival

Figure 8.1 Trends in early childhood mortality rates

Deaths per 1,000 live births in the 5-year period before the survey

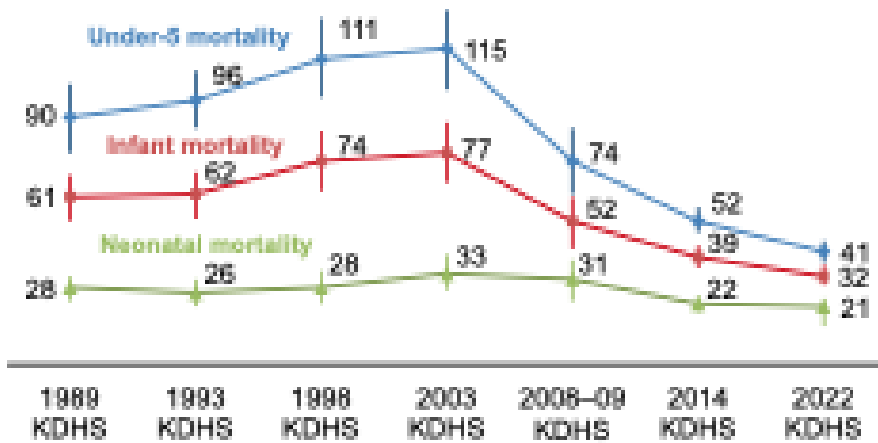
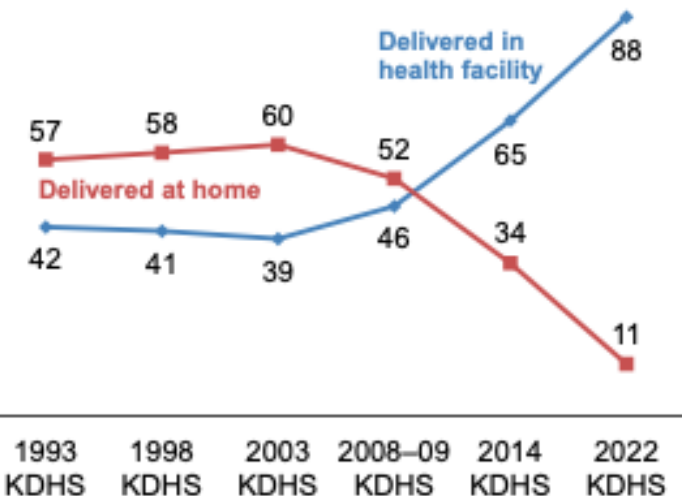


Figure 9.5 Trends in place of birth

Percentage of live births in the 2 years before the survey



Note: Data from 2003 and later are nationally representative, while data collected before 2003 exclude the North Eastern region and several northern districts in the Eastern and Rift Valley regions.

A hybrid implementation/effectiveness evaluation study

- One county in Kenya (Kakamega) decided to pilot this approach
- We were asked to conduct an evaluation of this pilot
 - Stepped wedge (observational) design to estimate causal impact
 - Implementation science/process evaluation to study the implementation process itself

From Lancet Commission to western Kenya...



SDR timeline

- April 2019: HQSS workshop in Nairobi
 - Kakamega named pilot county
- Fall 2019: Feasibility study
- Feb 2020: Gov. Oparanya decided to pilot SDR in Kakamega County
- Feb 2022: Data collection began
- March 2023: SDR launched in first subcounty
- March 2025: Data collection complete



Findings from Kakamega SDR baseline data

- Measures of risk captured during antenatal care fail to identify over half of maternal/newborn mortality in Kakamega (Cooper et al 2025)
- Large % of mothers in Kakamega already bypass nearest facilities for delivery; travel costs for delivery modestly higher for hospitals (Croke et al. 2024)
- Conditional on risk, elevated mortality for referred mothers with longer transport (Rahim et al, n.d.)

Health Policy and Planning, 39, 2024, 1099–1108
DOI: <https://doi.org/10.1093/heapol/czae088>
Advance access publication date: 20 September 2024
Original Article

OXFORD

Care seeking during pregnancy: testing the assumptions behind service delivery redesign for maternal and newborn health in rural Kenya

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Risk stratification during antenatal care failed to identify most mothers who experienced adverse pregnancy outcomes: A prospective study from Kakamega County, Kenya

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Project and evaluation teams

- Funding from Kakamega County and Gates Foundation
- Implementation support provided by Jacaranda Health
 - Additional support from Thinkwell, Thinkplace, Rescue.co
- Evaluation team:
 - Harvard TH Chan School of Public Health
 - KEMRI-Wellcome Trust, led by Prof. Jacinta Nzinga
 - Data collection support by Ipsos-Kenya

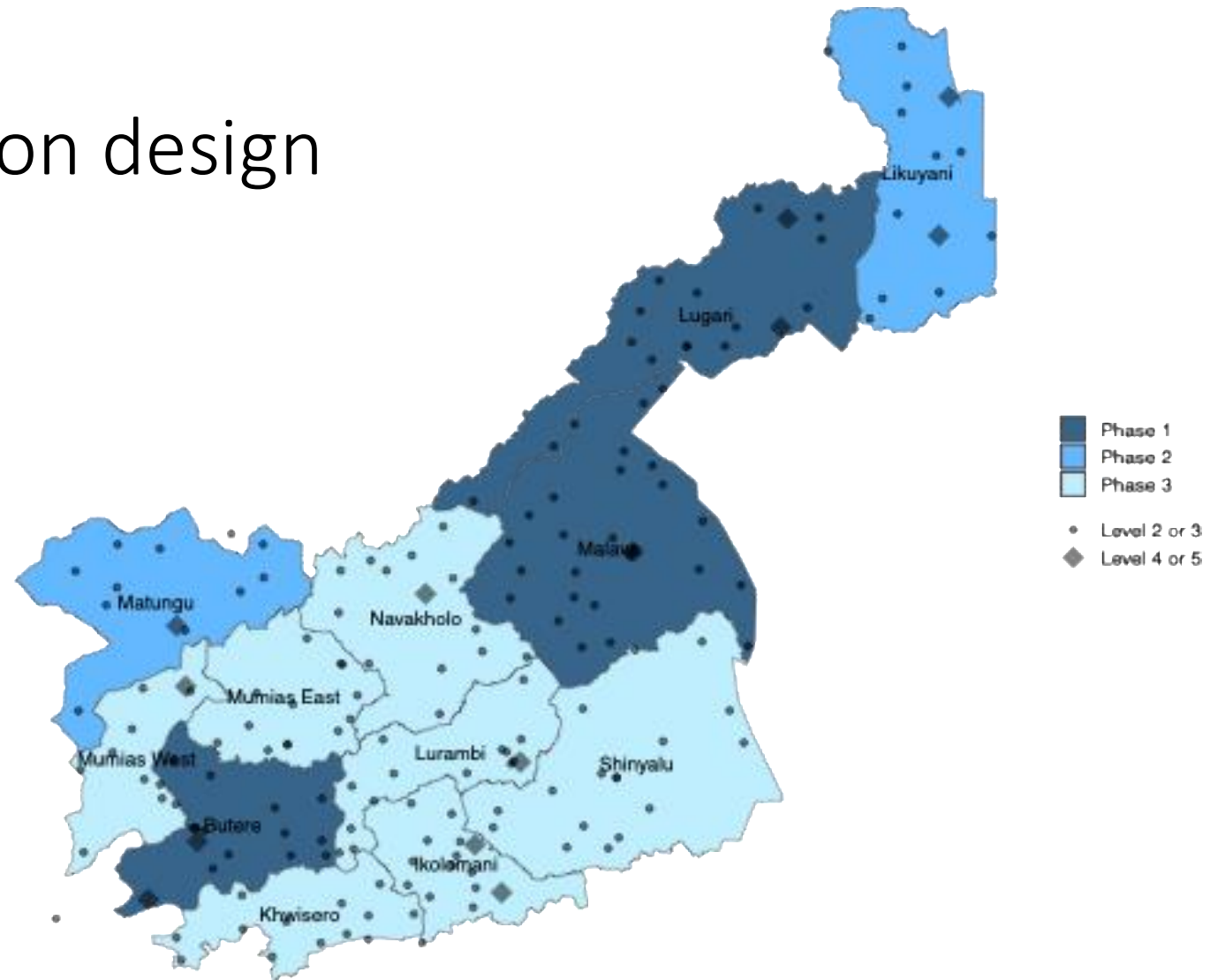


SDR program components in Kakamega

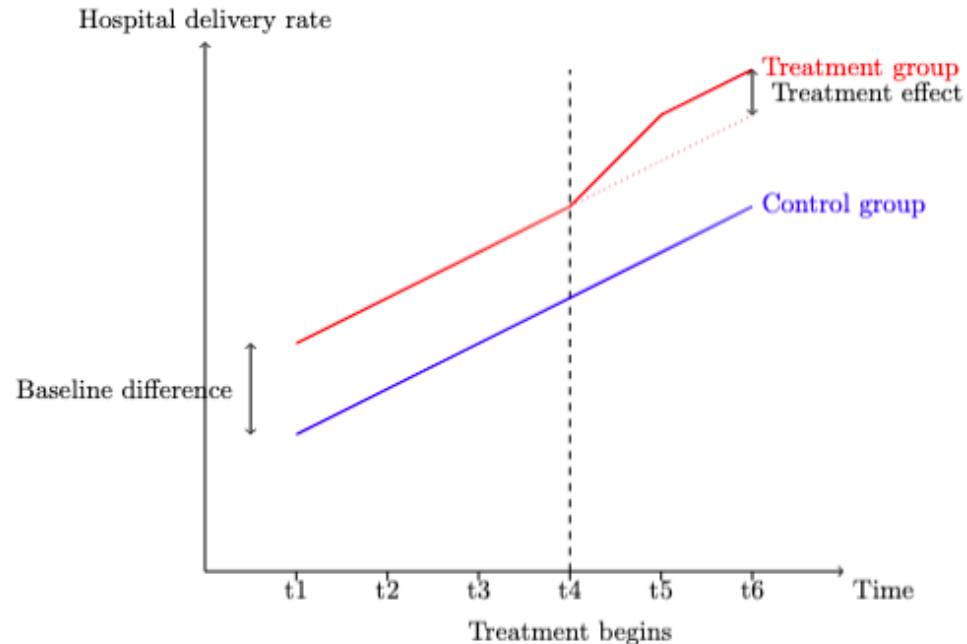
- Hospital infrastructure improvement
 - Expanding maternity wings; building/improving newborn units; OR construction/improvement
 - New equipment for maternity/NBU
 - Improved blood transfusion services
- Improved emergency transport
 - Rescue.co services
- Technical assistance for health finance reform
- Human resources/skills support
 - Clinical mentoring
 - Additional staff posted to delivery hubs

Program and evaluation design

- Phased implementation of SDR was planned across Kakamega's 12 subcounties
- Phased roll out was considered logistically more feasible
- Also allows for evaluation; learning from early subcounties



Evaluation design



- Controlled non-experimental design:

- We use the Callaway and Sant'Anna (2021) difference-in-difference estimator
 - Small number of clusters (12) means we need to use the Wild cluster-t bootstrap procedure (Cameron Gelbach Miller 2008)

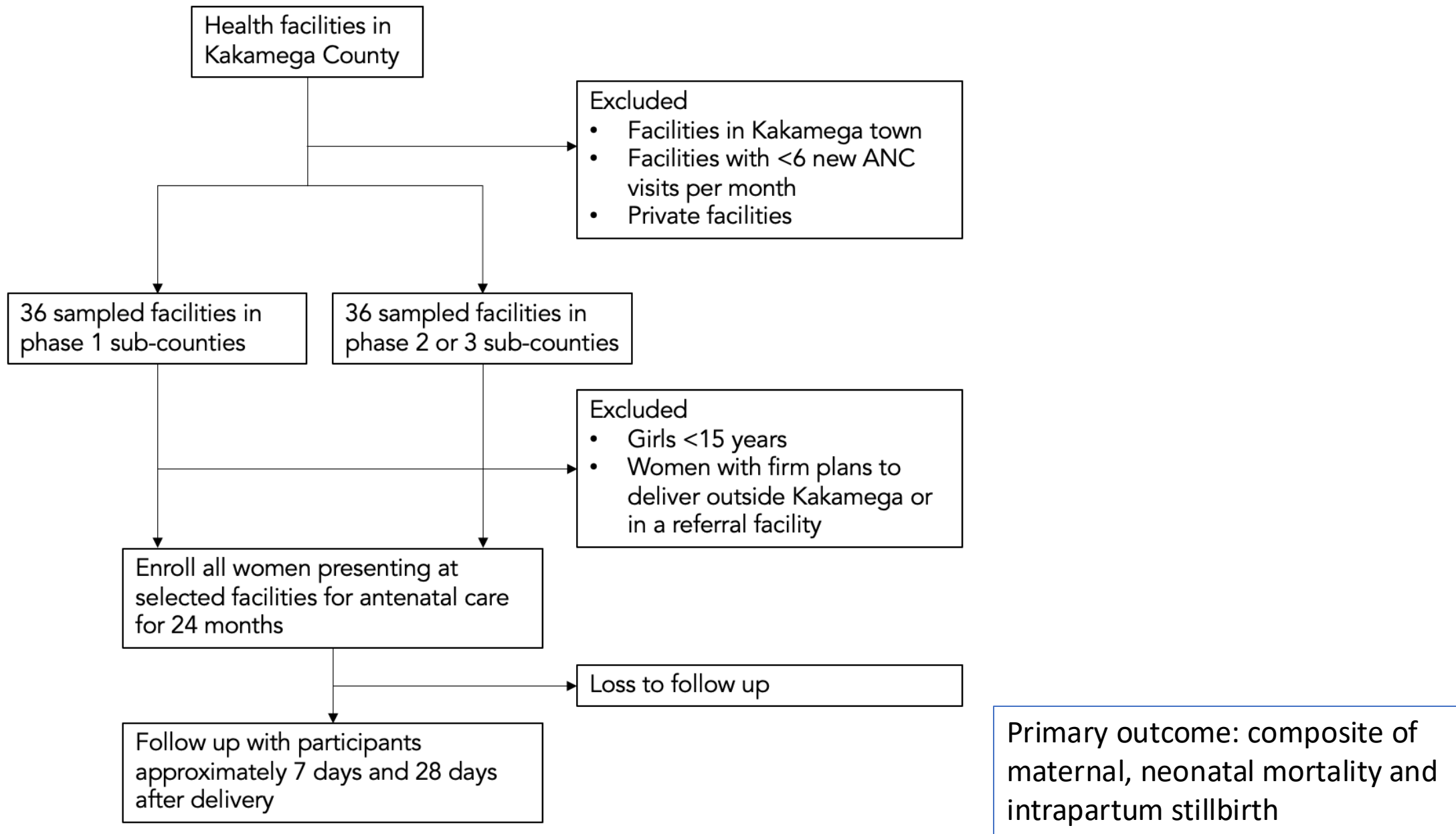
$$DD = (Y_{treat}^{post} - Y_{treat}^{pre}) - (Y_{control}^{post} - Y_{control}^{pre})$$

Evaluation data and measurement

- Pregnancy registry
 - Enrollment at ANC; follow up from 7 and 28 days after delivery
- Facility assessments; delivery observations (x4)
- Implementation science/process evaluation



Selection
Excluded
Included
Not selected



Data collection (conducted by Ipsos-Kenya): Feb 2022 – March 2025



	Pregnancy Registry	Longitudinal subsample
Enrolled	64,789	3,516
7 day	60,754 (93%)	3,200 (91%)
28 day	58,211 (89%)	3,121 (88%)

Study protocol/PAP

- Protocol proposed a stepped-wedge study across all of Kakamega (3 waves, 12 subcounties)
 - Also proposed interim analysis restricted to phase 1 (first 3 sub-counties)
- This analysis compares two Phase 1 subcounties (Malava, Lugari) to rest of Kakamega

Croke et al. *BMC Public Health* (2022) 22:1727
<https://doi.org/10.1186/s12889-022-13578-y>

BMC Public Health

STUDY PROTOCOL

Open Access



Service delivery reform for maternal and newborn health in Kakamega County, Kenya: study protocol for a prospective impact evaluation and implementation science study

Kevin Croke^{1*}, Anna Gage¹, Isabel Fulcher², Kennedy Opondo³, Jacinta Nzinga⁴, Benjamin Tsofa⁴, Sebastien Haneuse¹ and Margaret Kruk¹

Abstract

Background: Maternal and neonatal mortality remain elevated in low and middle income countries, and progress is slower than needed to achieve the Sustainable Development Goals. Existing strategies appear to be insufficient. One proposed alternative strategy, Service Delivery Redesign for Maternal and Neonatal Health (SDR), centers on strengthening higher level health facilities to provide rapid, definitive care in case of delivery and post-natal complications, and then promoting delivery in these hospitals, rather than in primary care facilities. However to date, SDR has not been piloted or evaluated.

Methods: We will use a prospective, non-randomized stepped-wedge design to evaluate the effectiveness and implementation of Service Delivery Redesign for Maternal and Neonatal Health in Kakamega County, Kenya.

Discussion: This protocol describes a hybrid effectiveness/implementation evaluation study with an adaptive design. The impact evaluation ("effectiveness") study focuses on maternal and newborn health outcomes, and will be accompanied by an implementation evaluation focused on program reach, adoption, and fidelity.

Keywords: Maternal mortality, Neonatal mortality, Quality of care, Kenya

2 out of 3 “Phase 1” sub-counties implemented during study period

Malava launch, March 2023



Lugari launch, October 2023



Butere: A new hospital building...but no SDR launch

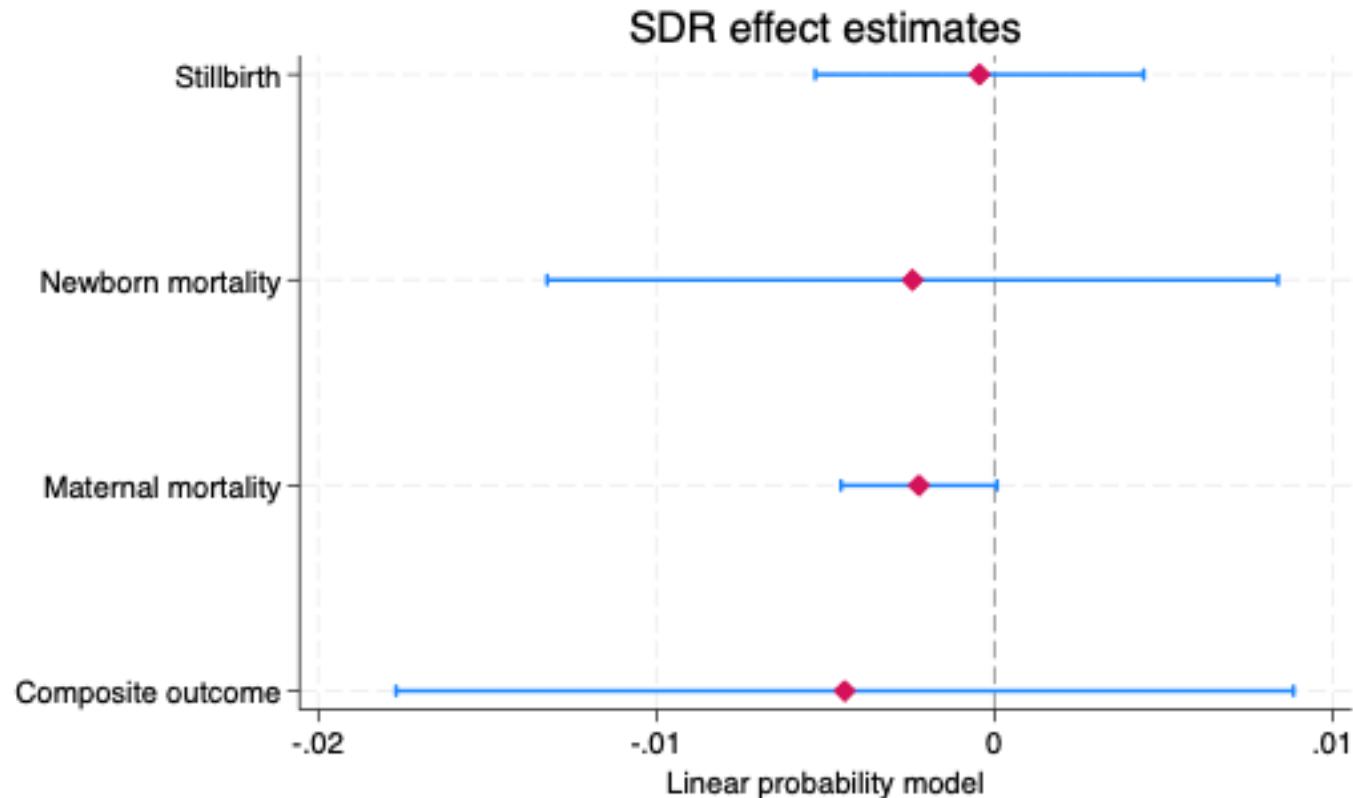
May 2022



August 2024



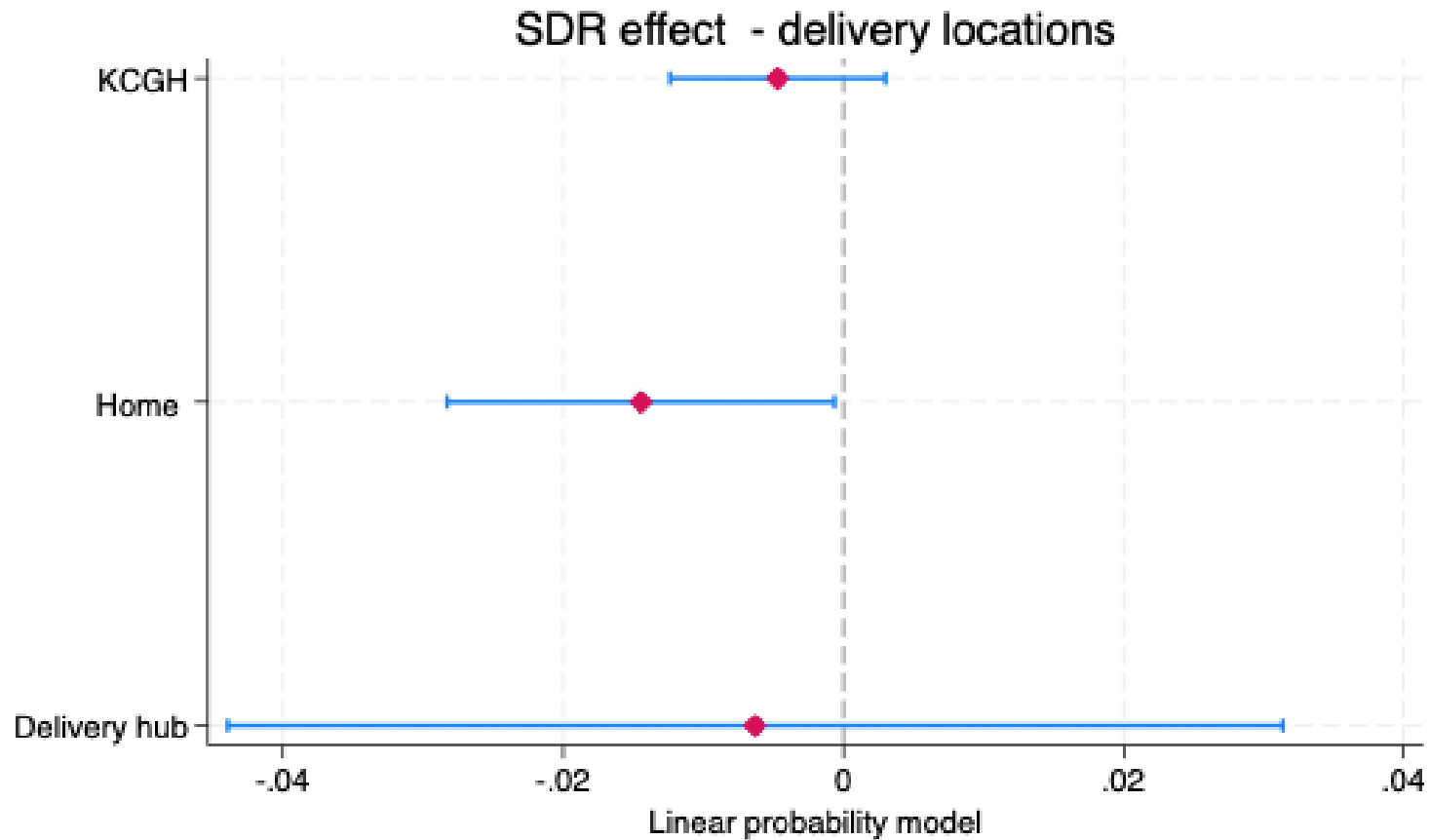
Primary outcomes: Mortality



- No change composite outcome (**study primary outcome**)
- Maternal mortality may have declined – but 95% confidence interval does include zero

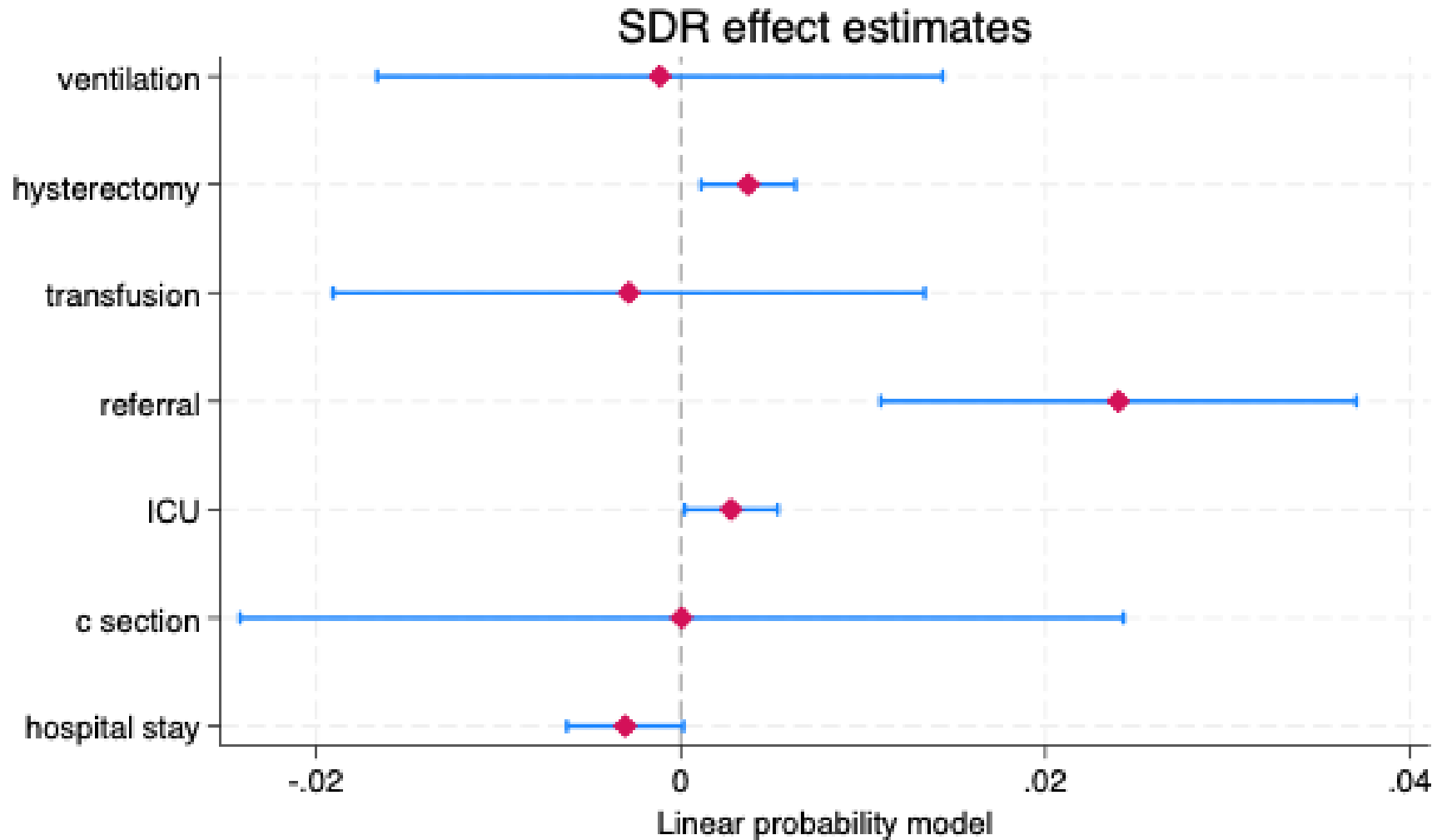
Note: Figure presents impact estimates (and 95% confidence intervals) from separate linear regressions estimating SDR's impact on each outcome

Secondary outcomes: delivery location



- No change in delivery hub (Level 4) delivery
- ~30% decrease in home births

Secondary outcomes: delivery process



Heterogeneity by subcounty

- A key insight from the new difference-in-difference literature is that we may want to consider each treated unit episode separately
- At the same time, process evaluation also indicates that Malava vs. Lugari implementation differed in important ways
- We estimate much large, significant effects on health outcomes when considering Malava along. No significant effects in Lugari.

Unpacking the results

- **Two SDR puzzles:**

- 1) **Explaining the null result:** Why did the intervention have no average effect on primary composite outcome?

- 2) **Exploring heterogeneous treatment effects:**

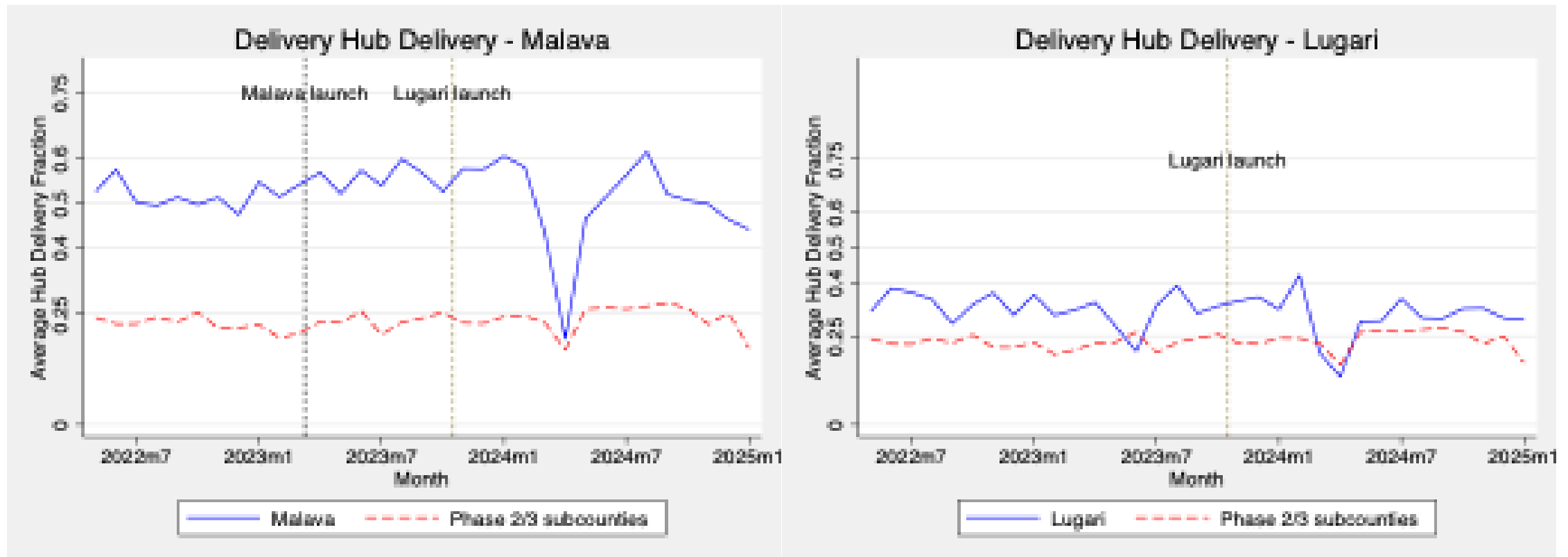
Why were results so different across sub-counties?

Which mechanisms can explain apparent impact on some outcomes?

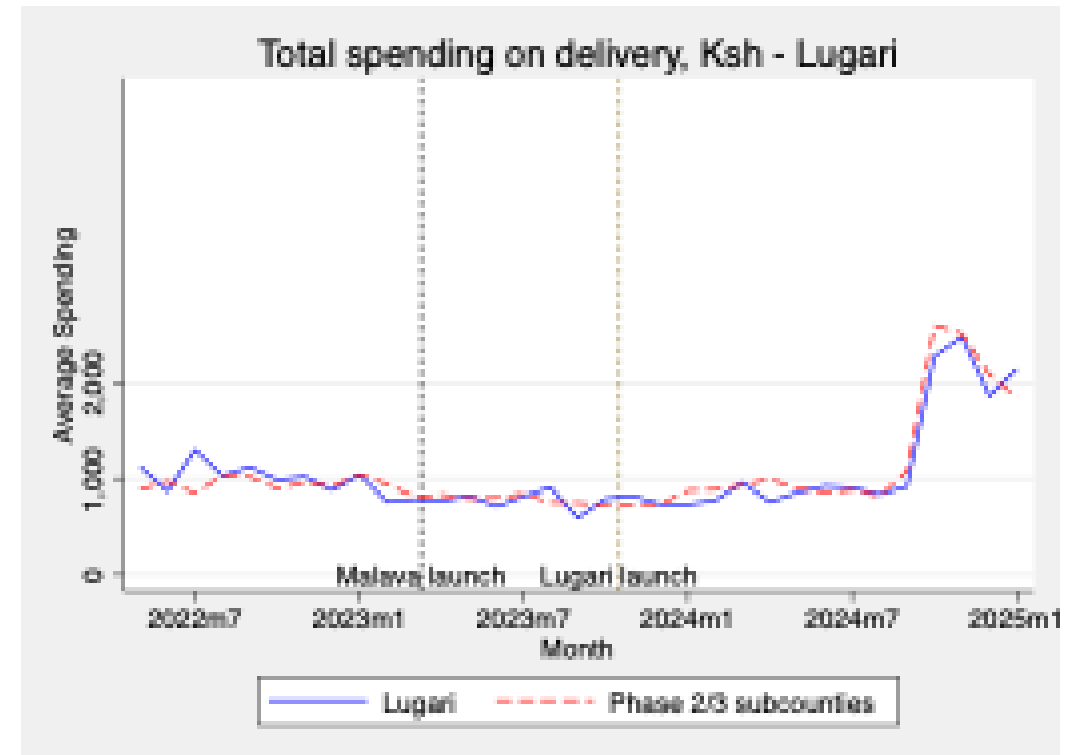
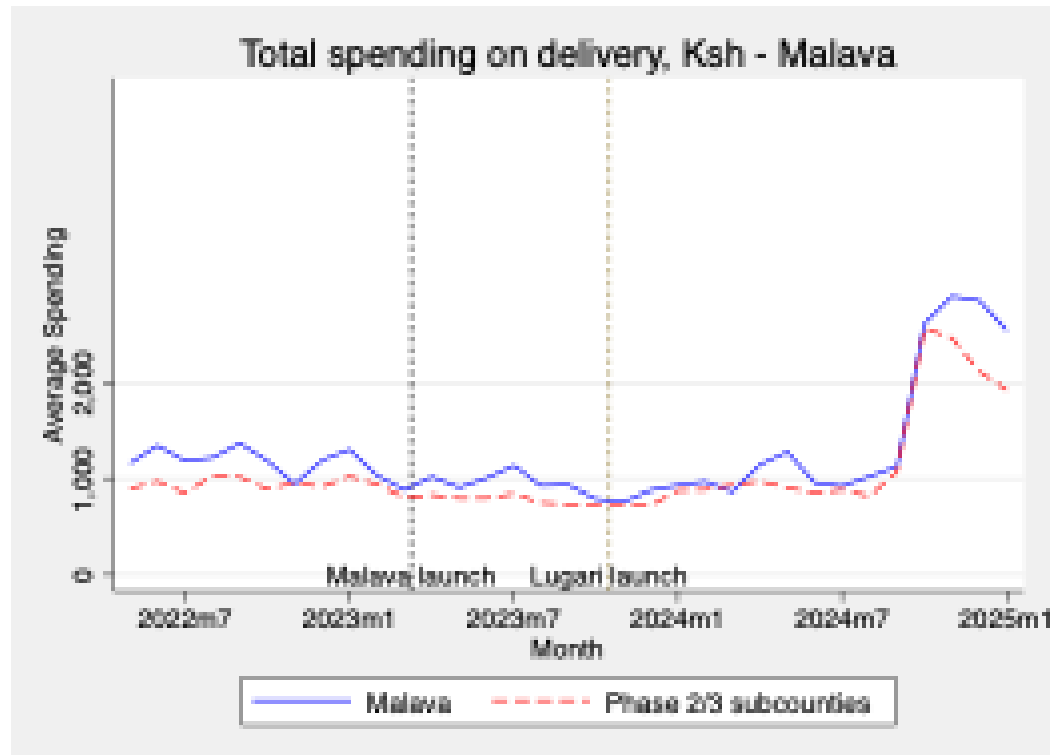
Puzzle 1: Why no effect on primary outcome?

- No change in key mechanisms of interest (delivery hub delivery, skilled health worker presence at delivery hubs)
 - National context: health worker strike, discontinuation of “Linda Mama”
- Implementation challenges including political economy dynamics
 - Hiring freeze:
 - Governor’s conflict/lawsuit with County Public Service Board
 - Inability to retain specialists e.g. ob/gyn deployed to Malava
 - No sustained increase in nurse staffing
 - Some resistance from (some) health workers
 - Non-use of new OR in Malava

No sustained increase in delivery at delivery hub hospitals



Discontinuation of Linda Mama: Large increases in spending on delivery



Puzzle 2: Why were effects so heterogeneous across sub-counties?

- Delivery shift model/messaging was completely different
 - “Deliver in delivery hub hospital” in Malava, vs.
 - “Deliver in a level 4 facility” in Lugari
- The role newborn units (NBUs) at delivery hubs
 - NBU operational at Malava since August 2023; 30-35 admissions / month
 - No NBU in Lumakanda
- In general, more intensive political and bureaucratic focus on Malava implementation

Discussion

- This study answers some questions, gives partial answers to others, and raises many more questions
- Clear evidence that SDR “package” not sufficient to change delivery behavior in sustained manner, or change human resources status quo
- The mechanisms that changed were not the ones that were expected to change – but they may have contributed to health gains (esp. in Malava)
- New questions about the effectiveness of these mechanisms...
 - new emergency transport models (i.e. Rescue)
 - Subcounty-level newborn units
- ...which suggests future research, potential revisions to the SDR model

Where are we now on SDR?

- Key funders have moved away from SDR
- Kenyan MOH emphasis on social health insurance and primary health care (SHIF, PCNs)
- World Bank continuing to finance some SDR work, with local adaptations
- Infrastructure-only phase 2 of SDR continues in Kakamega

Kakamega county, Jacaranda Health launch construction of Sh90m maternity ward

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