

# **Big Data, Local Impact, Healthy Lives**

## **Electronic Medical Records (EMR) in Malawi**

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**Data Analytics in Health Care**

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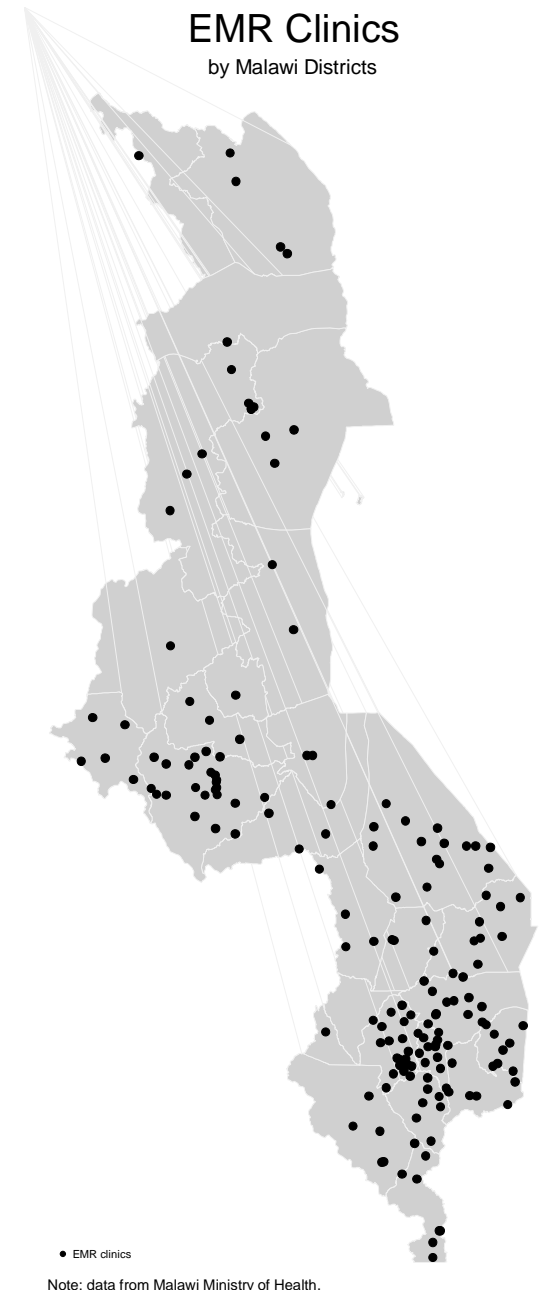
# Health Care in Malawi

## Malawi

- Population 19 million
- GDP per capita <400 USD
- Life expectancy is 50 years
- HIV, malaria, bacterial infection
- High infant and maternal mortality

## Health Care

- 753 health facilities in 2018Q4
- Includes hospitals, rural facilities, private clinics
- 120 facilities have electronic medical records (EMR) in 2018Q4



# HIV in Malawi

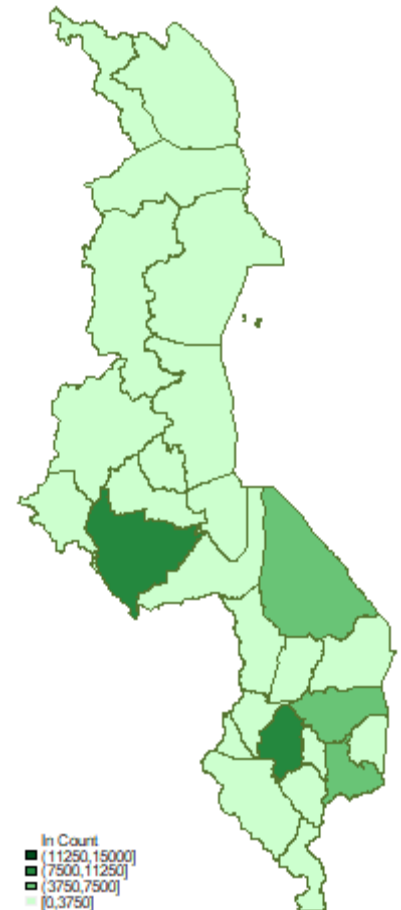
## Prevalence

- 9% HIV+
- > 10,000 deaths annually

## Treatment

- Antiretroviral therapy (ART)
- Free, effective, prevents transmission
- 78% of HIV+ on ART in 2018 (UNAIDS)
- Challenges include diagnosis, initiation, default

Total First Time ART Patients in 2018  
by Malawi Districts



# Database – Ministry of Health

- Facility-quarter panel data
  - Total patients in ART
  - ART initiations
  - Defaults
  - Deaths
  - Deaths early (1-3 months)
  - Deaths late (+4 months)



*Government of Malawi Ministry of Health*

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**Integrated HIV Program Report  
January – March 2013**

- ~ 17,000 observations for 778 facilities
- 2013Q1 to 2018Q4
- 86 facilities implemented EMR in this time window
- Data recorded cumulatively
- Measurement error

# EMR Central Database (BHT)



- Individual de-identified data on patients in ART treatment from all clinics with EMR systems as of end 2018
- ~880,000 patients in 124 clinics
- ~12 million observations
- Data is entered at point-of-care by nurses and other staff



Source: Baobab Health Trust  
([baobabhealth.org](http://baobabhealth.org))

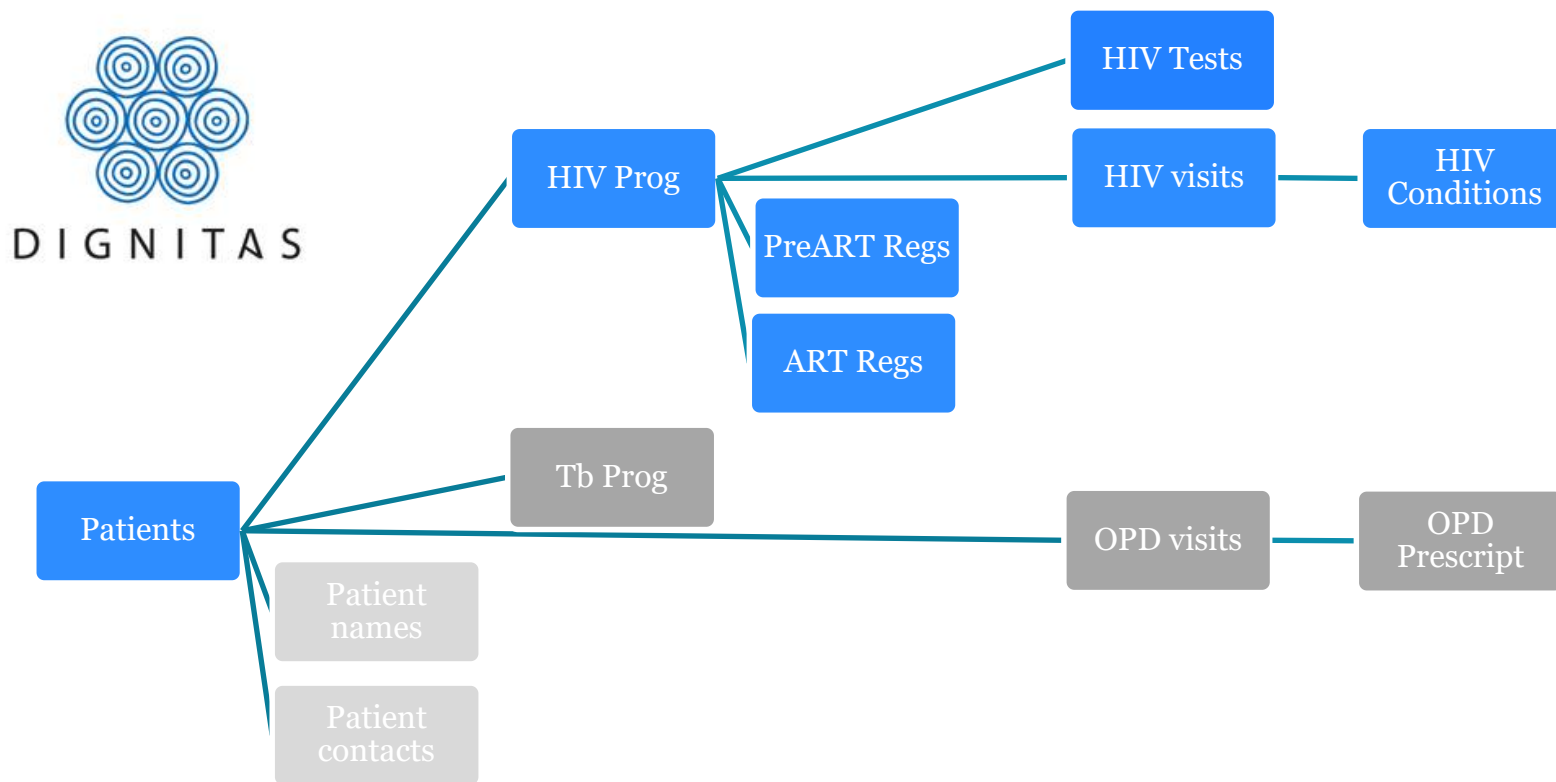
# EMR Central Database Inventory

| DataType          | N/1000 | %*   | Relevant Variables ; Notes  |
|-------------------|--------|------|---|
| ART Registration  | 756    | 0.93 | Var : <i>Date, TracingConsent, ARVReason, GuardRelation, EverART</i>  |
| HIV Visit         | 12,343 | 1.00 | Var : <i>Date, Staff, ART, PatientPresent, GuardianPresent, Breastfeeding, Weight, Height, TbStatus, HIVStage, ARVRegimen, TotalPillsLeft, ARVDispensedDays, ARVDispensedTill, CPT, IPT, CD4Count, NextVisitDate, VisitDuration, EntryDelay</i><br>Per Patient Mean 14.06 / SD 16.13 / Min 1 / 25% 2 / 50% 8 / 75% 20 / Max 209 |
| HIV Diagnosis     | 394    | 0.49 | Var : <i>Date, Location</i>   |
| Side Effect       | 90     | 0.06 | Var : <i>Date, Type</i>   |
| Other Symptom     | 728    | 0.12 | Var : <i>Date, Type</i>   |
| HIV Stage         | 219    | 0.23 | Var : <i>Date, Type</i> ; usually assessed at initiation  |
| Transfer Out      | 195    | 0.23 | Var : <i>Date, Origin~Destin</i> ; EMR clinic to EMR clinic transfers create duplicate IDs  |
| Transfer In       | 127    | 0.16 | Var : <i>Date, Origin~Destin</i>  |
| Remote Initiation | 111    | 0.14 | Var : <i>Date, Location</i> ; appears to be subset of Transfer In   |

\*N = total number of observations of this DataType.

\*Percent of patients who have at least one observation of this DataType.

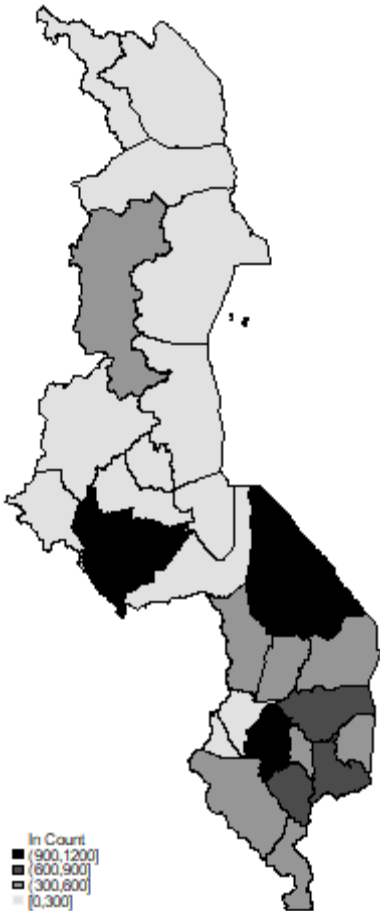
# Database – Dignitas International



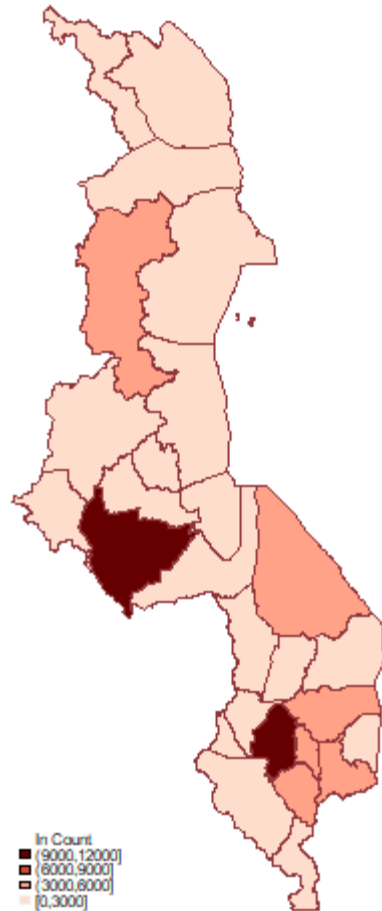
- Individual de-identified data on ART patients in Zomba district
- ~54,000 patients in 32 clinics (14 with EMR)
- ~871,000 observations
- 2005 to 2018
- Includes data on death dates, defaults, visit dates, TB status, ARV regimen, and patient weight, gender and age.

# Deaths and Defaults among ART patients

Total ART Deaths in 2018  
by Malawi Districts



Total ART Defaults in 2018  
by Malawi Districts



Avg. increase in ART  
deaths

69 cases per district  
( $p < 0.05$ )

Avg. increase ART  
defaults

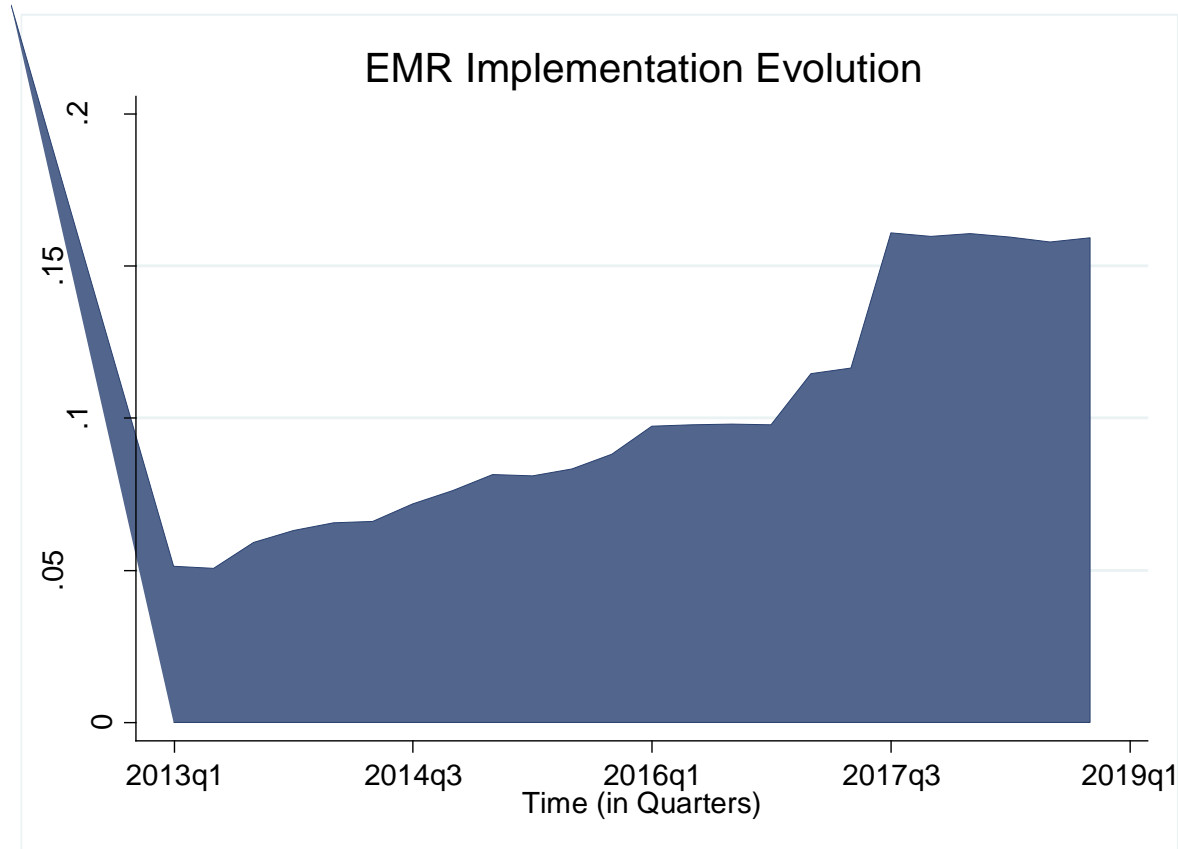
823 cases per district  
( $p < 0.01$ )



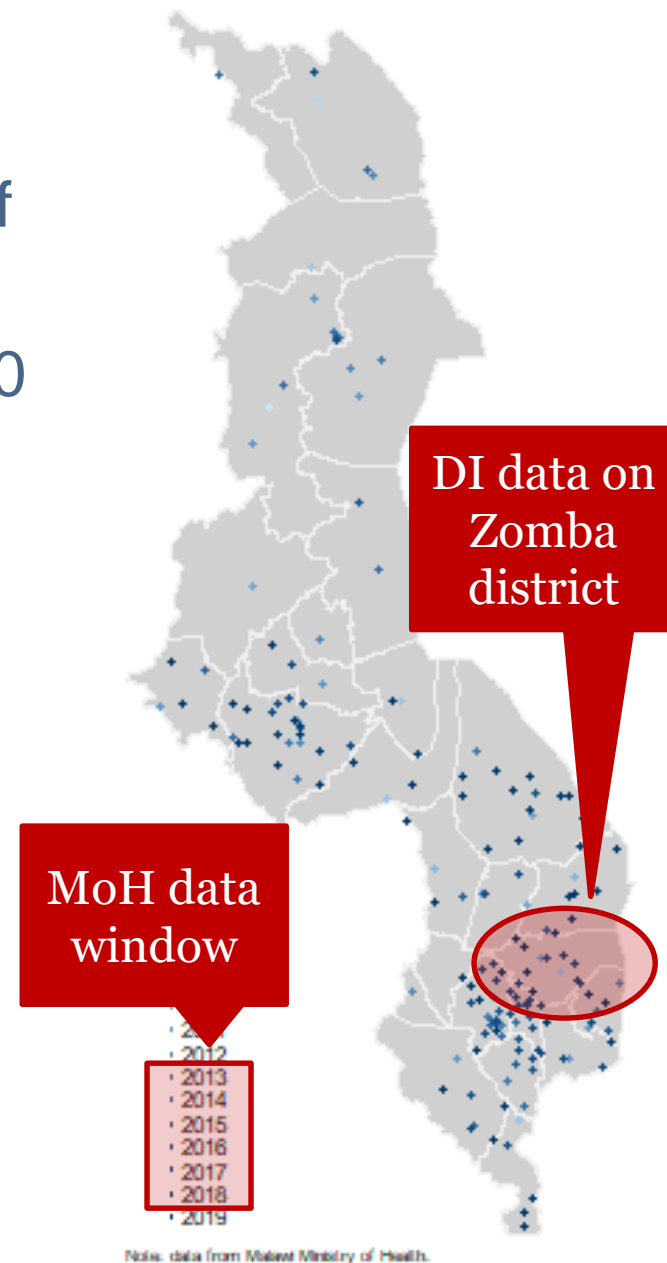
# Idea: Impact of EMR

- From 2013 to 2018, additional 10% of facilities introduced EMR
- Increase from 34 EMR facilities to 120

EMR Implementation Evolution



EMR Clinics by Year  
by Malawi Districts



# Idea: Impact of EMR

## EMR might

- Increase efficiency/new initiations
- Facilitate tracking
- Improve care

## Estimation

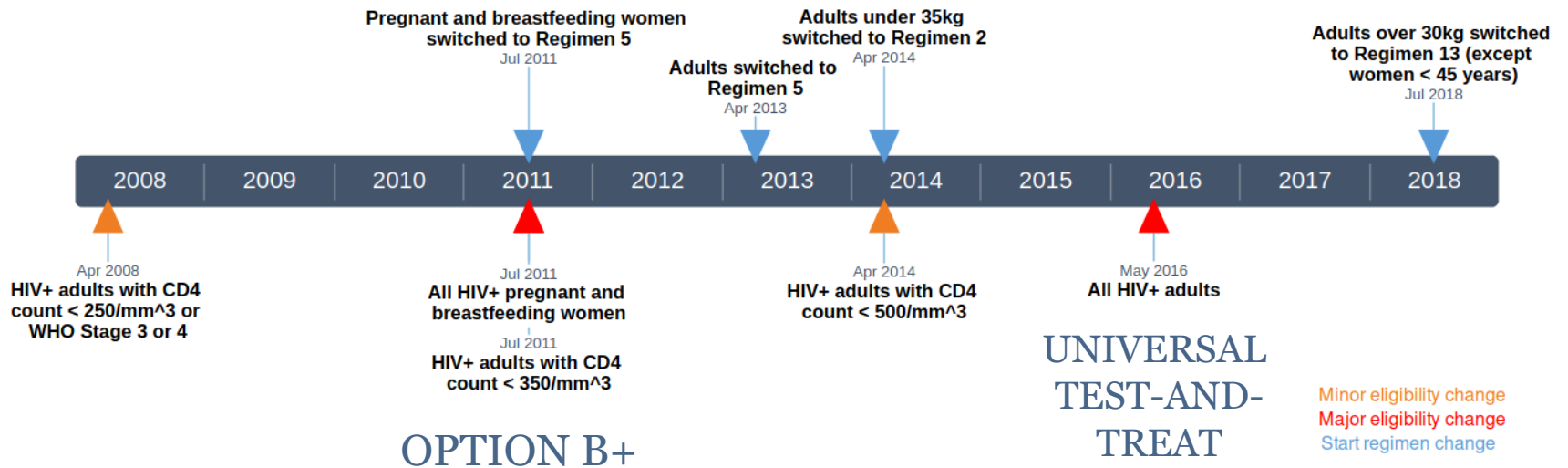
- Multi-period Differences-in-Differences (de Chaisemartin et al., n.d.; Goodman-Bacon, 2018)

$$Health\ Outcomes_{jt} = \beta_0 + \beta_1 EMR\_Post_{jt} + \gamma_j + \delta_t + \epsilon_{jt}$$

- Facility fixed effects  $\gamma_j$
- Quarter fixed effects  $\delta_t$
- Treatment dummy  $EMR\_Post_{jt}$
- Standard errors clustered at the facility level

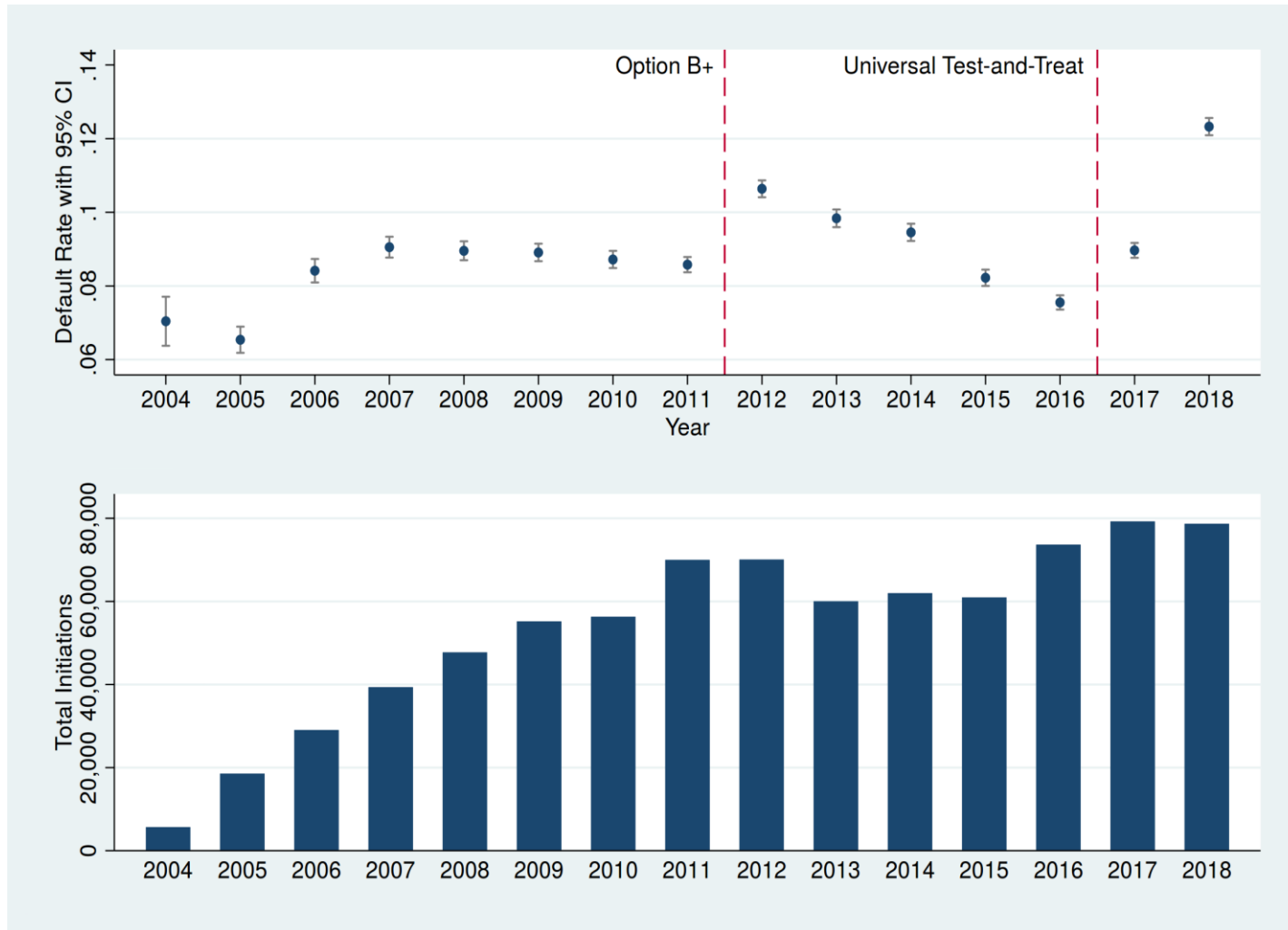
# Idea: Impact of Major Policy Change

## Timeline of Standard ART Start Regimens and ART Eligibility for HIV+ Adults in Malawi



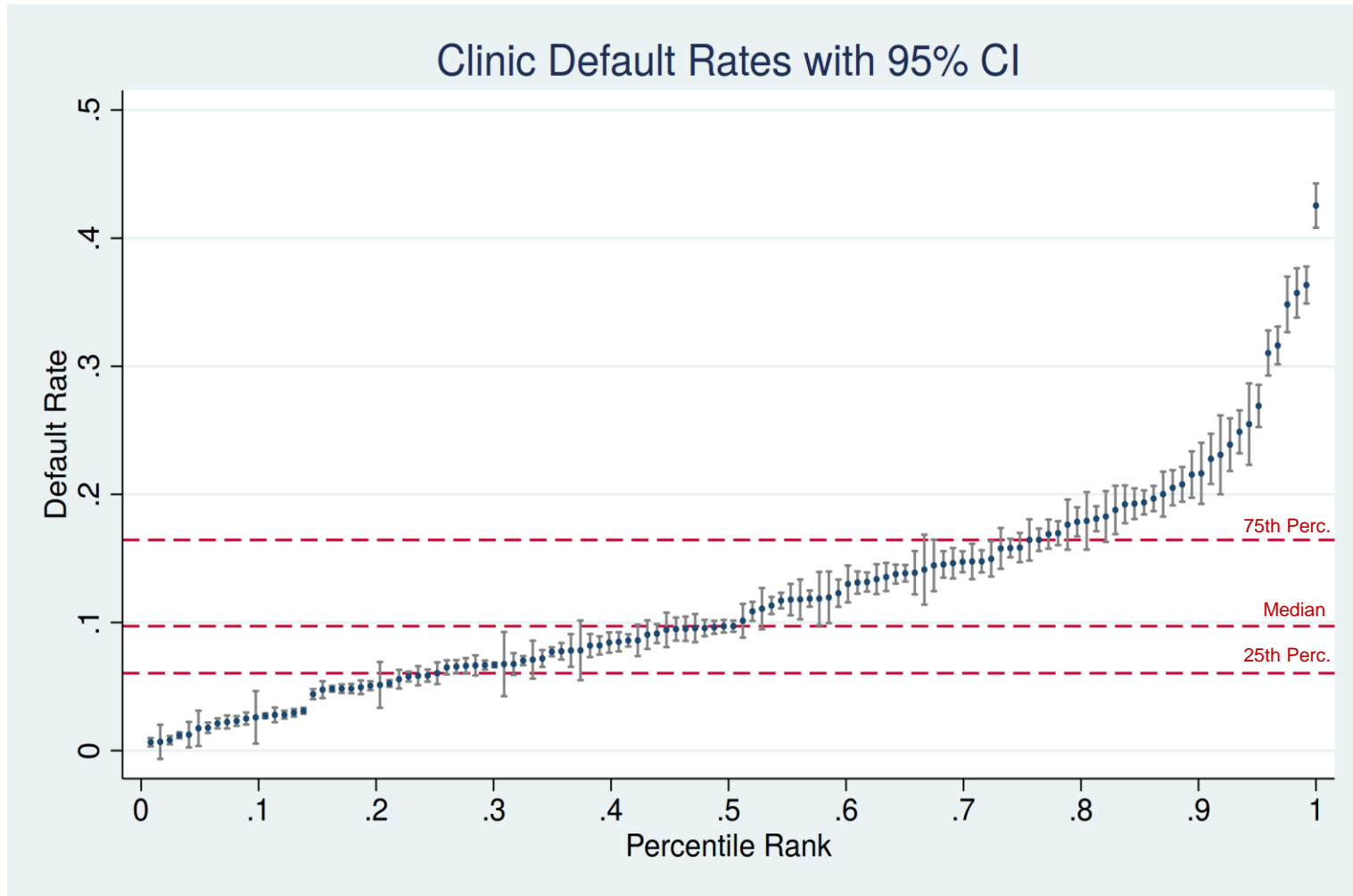
# Idea: Impact of Major Policy Change

Default rate = share of patients who never return after first visit



# Idea: Default by Facility

Share of patients who never return after first visit



# Idea: Data Privacy RCT

- Initiating ART involves **sharing your data** (name, address, phone number)
- There is a risk of breach
- Does this **deter health seeking?**
- Does the **data enable tracking?**
- Experiment: make salient the *right to remain anonymous*
- Outcomes: HIV testing, ART initiation, default

# Idea: Sharing Data RCT

What is **demand for health data**?

- Communities
- Health providers
- Patients

Examples

- HIV prevalence
- Treatment, default and death
- By demographic

# Idea: Sharing Data RCT

How does this **information spread**

- Within communities
- From provider to patient
- Is it driven by active diffusion vs. search?

What are **motivations for data sharing** by

- Health providers?
- Community leaders?



# Thank you!

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# APPENDIX

# Means test on District Evolution

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|                       | Year 2014 | Year 2018 | Difference<br>(2018-2014) | p-value |
|-----------------------|-----------|-----------|---------------------------|---------|
| Total Patients in ART | 4,962     | 6,100     | 1,138                     | 0.009   |
| First Time in ART     | 3,927     | 2,354     | -1,573                    | 0.000   |
| Default in ART        | 1,600     | 2,422     | 823                       | 0.002   |
| Died in ART           | 337       | 406       | 69                        | 0.021   |
| Districts             | 28        | 28        |                           |         |

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