

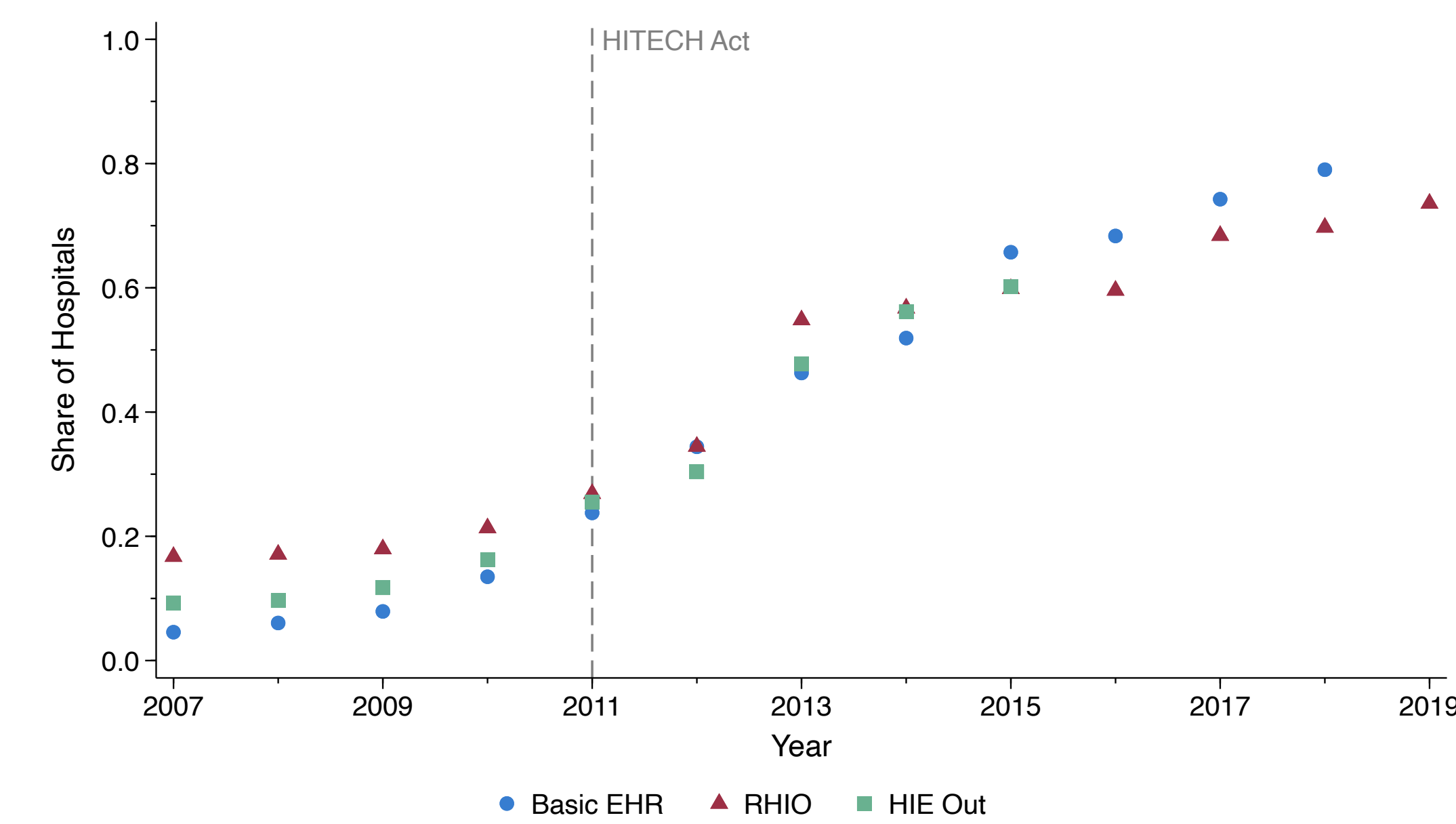
# SHARING IS CARING: THE ROLE OF HEALTH INFORMATION EXCHANGE (HIE) ON PATIENT CARE

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## INTRODUCTION

Health information technology has transformed the landscape of healthcare:

- Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 allocated \$30 billion to subsidize adoption of Electronic Health Records (EHR) systems; take-up high
- Despite early optimism, literature found modest/no effects of EHR adoption alone on clinical outcomes
- Along with EHR adoption has come dramatic increase in Health Information Exchange (HIE) across health care providers



**Fig 1.** Trends in hospital EHR adoption, participation in regional HIE organizations ("RHIO"), and HIE with other organizations outside of own hospital network ("HIE Out")

**Research Question:** How does HIE affect patient health outcomes?

- *Contribution to literature: more recent data, longer time period, causal research design, & focus on effects of digital drivers of information sharing across providers*

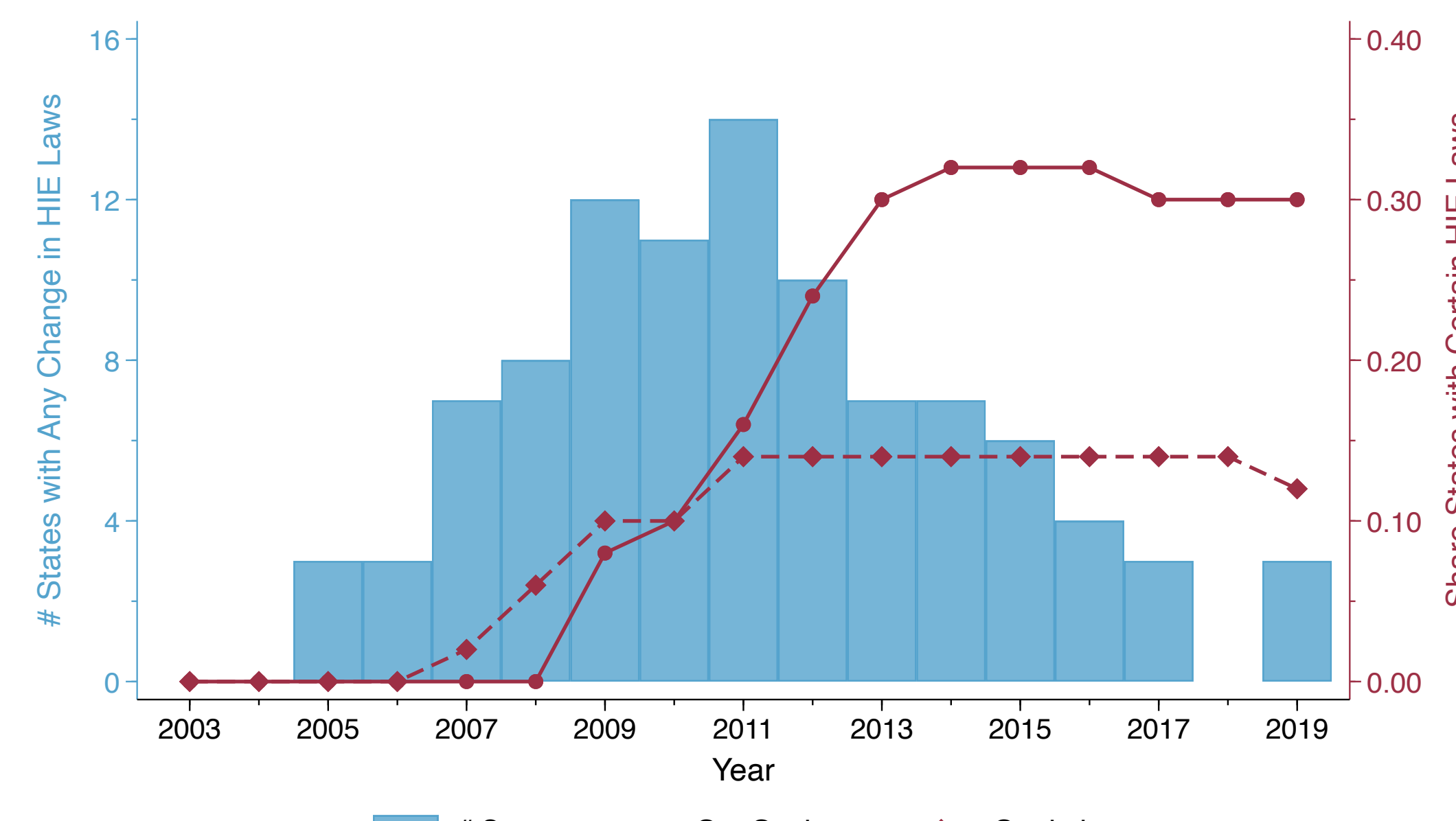
## DATA (2000-2019)

- AHA Annual & IT Surveys:** annual hospital-level characteristics incl. HIE
- Vital Statistics County-Level Mortality:** individual-level death records, incl. cause of death, personal characteristics
- CMS Hospital Compare:** quarterly hospital-level 30-day mortality & readmission rates by condition, star quality ratings, process measures
- Built state panel of 12 HIE legal dimensions:**

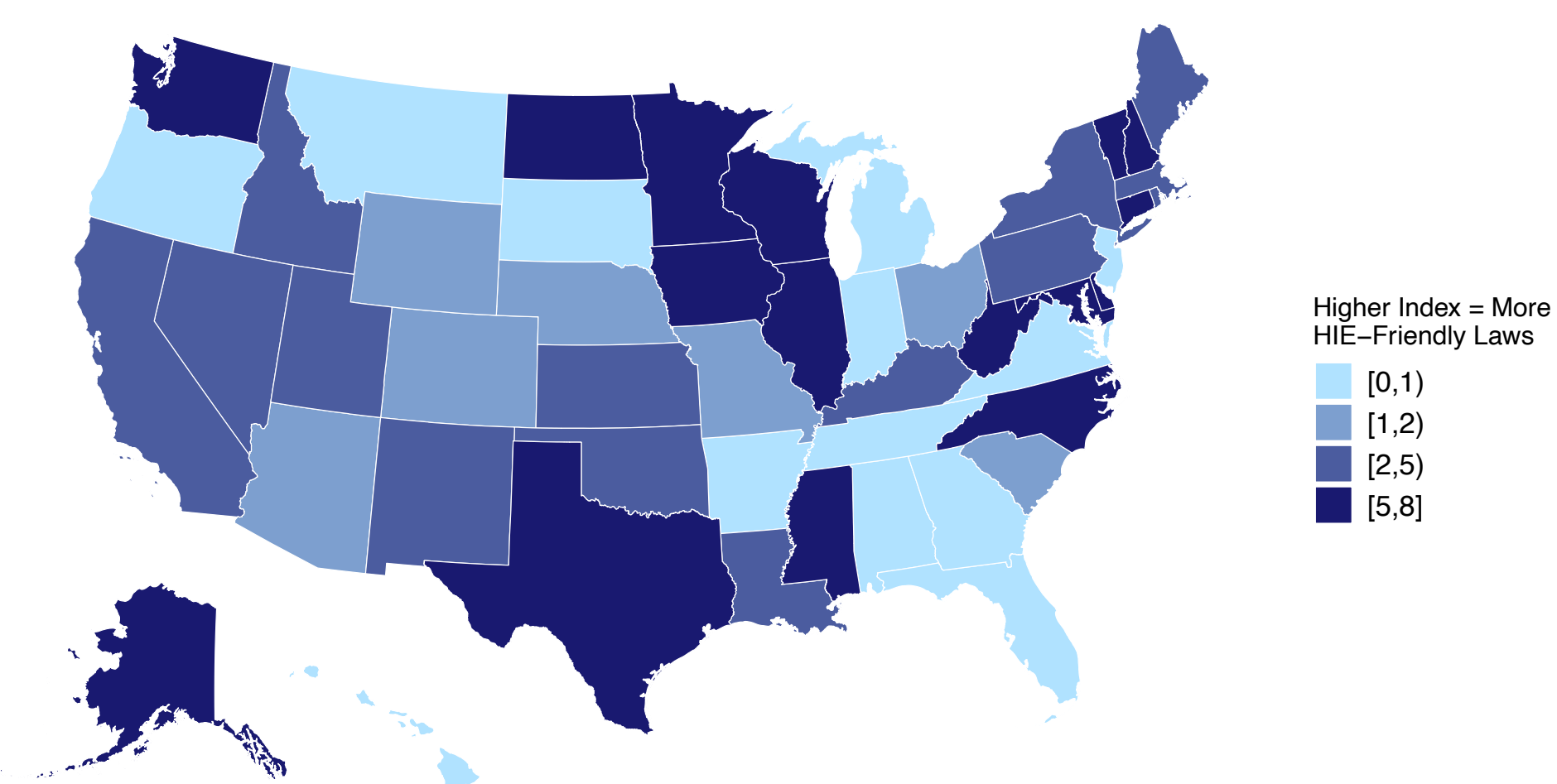
Category	Concept	Example
1. Data Protections	Data protections for privacy & security of patient data	<i>Is the patient consent model for HIE specified to be opt out?</i>
2. Governance	State's role in creating & operating HIE	<i>Does the state retain control over statewide HIE's operations?</i>
3. Sustainability & Financial Incentives	Whether state provides subsidies or legal immunity from liability for HIE	<i>Does the law provide immunity from liability for the HIE or its participants?</i>
4. Use and Users	Who is allowed to contribute to & use data from HIE	<i>Does the state authorize a public health authority to access HIE data?</i>

**Tab 1.** Overview of HIE laws

## SETTING



**Fig 2.** Changes in state HIE laws over time



**Fig 3.** Cross-sectional variation in state HIE laws, 2019

## EMPIRICAL STRATEGY

**Long-Difference (2009-2019):**

$$\Delta Y_c = \alpha + \beta \Delta X_c + \gamma \Delta V_c + \epsilon_c$$

- $\Delta Y_c$  = change in county  $c$  health outcomes
  - Flu/pneumonia deaths per 100K
  - 30-day hospital readmission rates for pneumonia, heart failure, AMI patients
- $\Delta X_c$  = change in county average of hospital RHIO
- $\Delta V_c$  = change in county controls:
  - 5-year age bins, uninsurance/unemployment/poverty rates, median household income
- Cluster SEs by state
- Weight by baseline county population

**Instrument** for  $\Delta X_c$  with  $\Delta Z_{S(c)} = \Delta$  state laws:

- **Option 1:** Ex-ante choose most important or interpretable of HIE laws (e.g., opt-out)
- **Option 2:** Use least absolute shrinkage and selection operator (LASSO) to choose instruments
  - Set of potential instruments =  $Z_{S(c)t}$  = levels of state HIE laws in each year  $t$
  - Constrain LASSO to select max 3 instruments
  - Run OLS on the LASSO-selected instruments (i.e., post-LASSO; avoids shrinkage bias)

(Belloni, Chernozhukov, and Hansen 2014)

## RESULTS

	Instrument = Opt-Out			
	Deaths per 100K Flu/Pneumonia	Pneumonia	Heart Failure	AMI
Regional HIE Organization	-28.81* (15.86)	-3.95** (1.83)	-3.04** (1.51)	-0.48 (0.78)
1st Stage F-Stat	7.8	4.4	4.7	5.6
Outcome Mean (SD)	58.79 (23.07)	17.25 (1.25)	21.99 (1.60)	16.57 (1.32)
Years	2009-2019	2009-2017	2009-2018	2009-2018
Observations	1,120	1,704	1,349	829

Notes: Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Tab 2.** Long-Difference 2SLS, Opt-Out Instrument

	Instrument = Lasso			
	Deaths per 100K Flu/Pneumonia	Pneumonia	Heart Failure	AMI
Regional HIE Organization	-21.17** (9.76)	-1.67** (0.70)	-1.69** (0.74)	-0.20 (0.92)
1st Stage F-Stat	27.3	16.2	22.9	9.0
Outcome Mean (SD)	58.79 (23.07)	17.25 (1.25)	21.99 (1.60)	16.57 (1.32)
Years	2009-2019	2009-2017	2009-2018	2009-2018
Observations	1,120	1,704	1,349	829

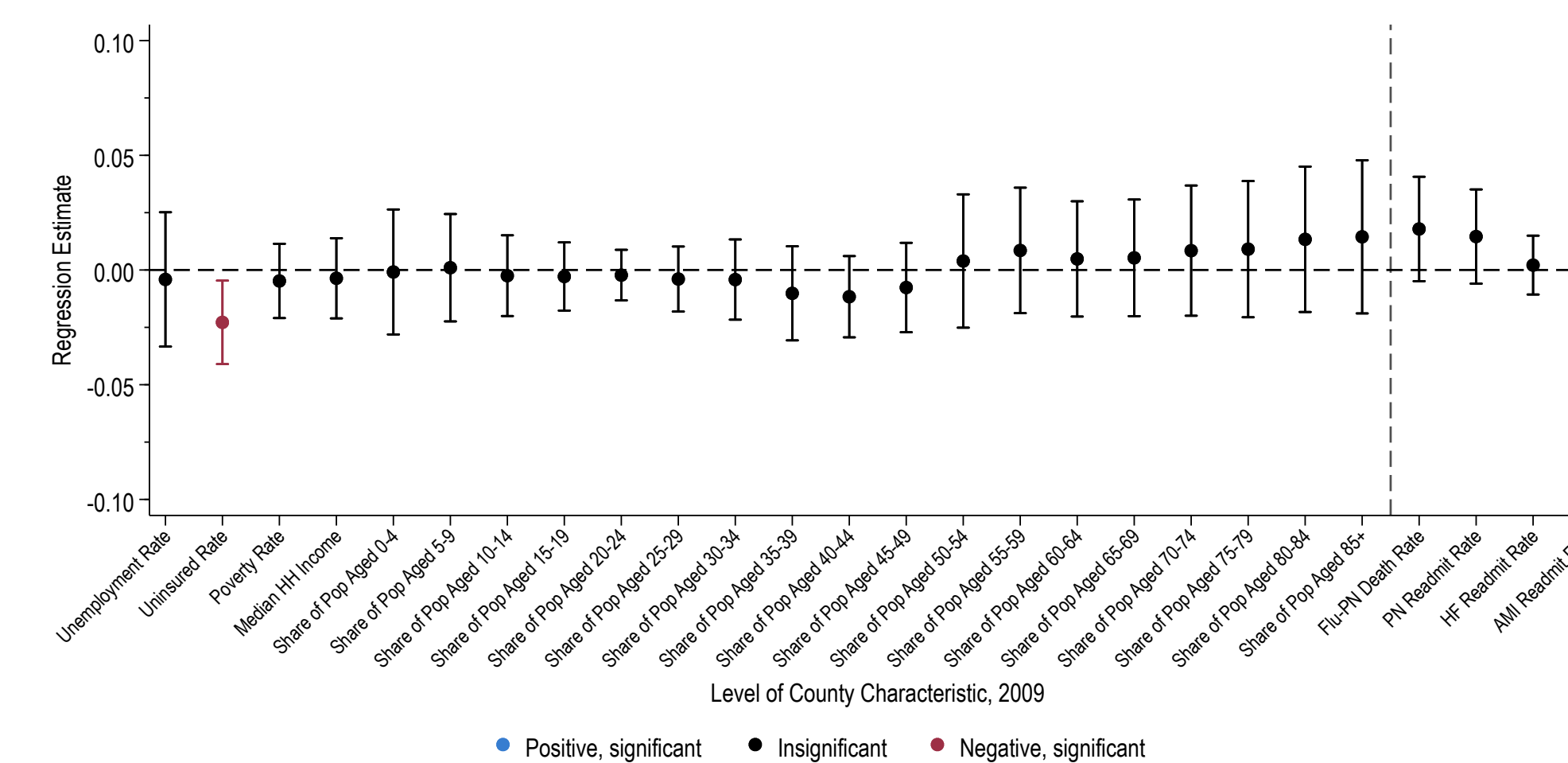
Notes: Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Tab 3.** Long-Difference 2SLS, Lasso Instrument

Robust to:

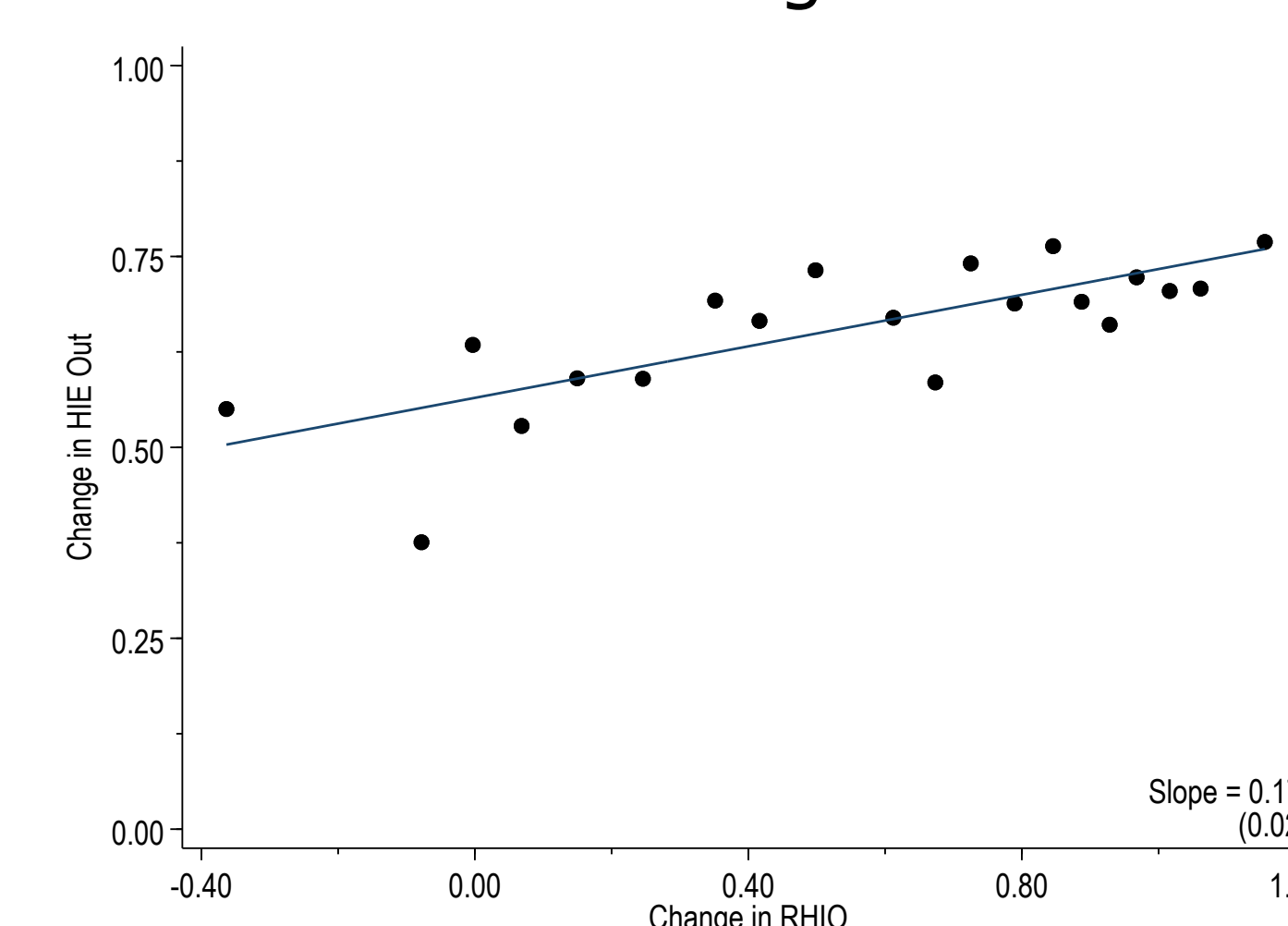
- Exclusion of controls
- Panel version with county and year FEs
- Shorter period (2009-2015; smaller magnitudes)

Balance checks show  $\Delta Z_{S(c)}$  (change in post-lasso prediction of RHIO) is uncorrelated with baseline levels of, and changes in, county characteristics:



**Fig 4.** Lasso instrument balance checks: baseline levels

Regional HIE Organization participation is strongly correlated with HIE across organizations:



**Fig 5.**  $\Delta$  HIE Out vs.  $\Delta$  RHIO (2009-2019)

## MAGNITUDES

10 percentage point  $\uparrow$  hospital RHIO  $\Rightarrow$  2.1  $\downarrow$  flu & pneumonia deaths per (100K) capita

- RHIO  $\uparrow$  by  $\approx 50$  percentage points 2009 to 2019  $\Rightarrow$  10.5 fewer flu & pneumonia deaths per capita, or  $\approx 18\%$  of mean
- Given adult population of 260 million  $\Rightarrow$  27,300 lives saved each year
- Given \$7.5 million per life (FEMA 2020)  $\Rightarrow$  \$205 billion saved each year from flu/pneumonia alone

Compared to HIE costs: \$30 billion HITECH Act + direct technology costs (\$) + disruption costs (\$?)

## POTENTIAL MECHANISMS

### 1. Care coordination between providers

- HIE may increase successful transfer of medical records & thus enhance communication
- Especially important for patients with chronic conditions (many providers) or with acute conditions transferred across providers (quick coordination critical)
- *Next step:* patient-level heterogeneity using Medicare Claims

### 2. Communication with Public Health Agencies

- HIE may allow Public Health Agencies (PHAs) to better track spread of infectious disease
- With better or faster information, PHAs can warn vulnerable populations & facilities of infectious disease spread
- *Next step:* RHIO-level heterogeneity using data on characteristics of RHIOs

## CONCLUSION

State laws matter for hospital HIE

Using laws as instruments, show that sharing health information is important for patient outcomes: increasing hospital RHIO decreases both hospital readmission rates as well as county flu/pneumonia death rates

More optimistic on effect of technology in health care than earlier studies

- Similar to broader literature of impact of technologies on productivity

Important to quantify benefits of data sharing given potential trade-off with privacy concerns

## CONTACT INFORMATION

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