

The Role of State Policy in Fostering Health Information Exchange*

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SUPPLEMENTARY APPENDIX

A. HIE State Law Database

We built the database of state health information exchange (HIE) laws by expanding and extending the database developed by Schmit, Wetter, and Kash.¹ The Schmit, et al. database was developed and validated following accepted policy surveillance standards.^{2,3} However, the Schmit et al., database was cross sectional, containing data only on laws in effect in 2016. To expand their database and in order to perform longitudinal analysis, we collected additional laws relating to HIEs that were in effect in each individual year on December 31st between 2000 and 2019 (i.e., for year 2020 we use laws dated at the end of 2019).

Collection of Historical Laws

On February 14, 2020, we used the 2000-2019 Westlaw historical databases of state statutes and regulations to search for laws pertaining to HIEs. The Westlaw historical databases include the statutes and regulations in effect at the end of the calendar year (plus or minus a month or two depending on the state). For example, the 2019 historical database would include laws in effect approximately December 2019; although, some states' laws are not archived until early January of the next calendar year.

We identified historical laws using two approaches. First, we searched the historical database for each law that was included in Schmit et al. database.¹ Second, as a redundant measure, we searched each historical database using the search terms described in Schmit et al.¹ This latter approach allowed us to capture all HIE laws that may have been repealed prior to 2016 as well as laws that may have been adopted after 2016. Our approach mirrored what others have done in creating historical legal datasets.^{4,5}

All identified laws were downloaded, de-duplicated, and scoped. As in Schmit et al., we included only laws pertaining to health information organizations “that facilitate access to identifiable health information among different entities for the purpose of patient treatment.”¹

Coding

We adopted and applied the validated coding criteria described in Schmit et al, with minor variations. These are described in Table 1. The variations were intended to simplify coding of some dimensions, eliminate dimensions outside our focus, and add dimensions of interest. The laws of every state were coded as they existed as of December 31st on each year between 2000 and 2019.

We used the Public Health Law Information Portal — a policy surveillance platform developed by the U.S. Centers for Disease Control and Prevention’s Public Health Law Program — to code all laws. The coding team consisted of a licensed attorney who is an experienced policy surveillance researcher (“coding lead”) and a team of four MIT undergraduate research assistants (“primary coders”). The coding lead used the Schmit et al., (2017) dataset to train the undergraduate researchers, assessing accuracy and concurrence by having all four primary coders code the same five jurisdictions for every year between 2000-2019. Subsequently, the remaining jurisdictions were divided among the coding team such that 50% of the remaining jurisdictions had 100% overlap between at least two primary coders (i.e., for all years 2000-2019), and 50% of the jurisdictions were coded by a single primary coder with another coder providing redundant coding for a single year (e.g., one person coding years 2000-

2019 and a second person coding year 2012). Detailed legal citation information was collected to assist code validation by the coding lead.

Coding meetings — led by the coding lead — were held to resolve coding differences between the primary coders. The coding lead was the tie-breaking vote but deferred to interpretations that were consistent with Schmit et al. (2017).¹ When only one primary coder covered a state, the coding lead verified that the provided legal citations supported the code. If the coding lead entered a final code that differed from a primary coder, the coding lead also verified the codes for adjacent years to ensure accuracy and consistency.

In addition to these coding procedures, two validation steps were taken. First, the coding lead independently verified the coding value for every instance when a law was updated or repealed. Second, the coding lead viewed graphical depictions of each state’s coding values for all dimensions and all years to check for values or patterns that could indicate coding errors (e.g., oscillating code values from year to year).

#	Coding Question	Comparison to Schmit et al. (2017) Protocol
1	Does the state have a law relating to an HIE pilot project?	Adapted for Longitudinal analysis
2	Does the law authorize implementation of a statewide HIE?	Identical
2.1	Who retains control over the statewide HIE’s operations?	Identical
3	Does the law incentivize HIE participation (excluding funds to be spent solely on HIE creation or implementation)?	Identical
4	Does the law specify the users and uses of the HIE?	Identical
4.1	Does the law mandate any providers to access or contribute to HIE data?	Identical
4.2	Does the state authorize non-healthcare providers (e.g., payers, researchers, public health) to access or use the HIE?	Composite of different dimensions
4.2.1	Does the state authorize a public health authority to access HIE data or otherwise authorize the HIE to be used for public health purposes?	Identical
5	Are there provisions in the law designed to promote privacy, security, or confidentiality related to HIE data?	Identical
5.1	Does the law require privacy protections for the HIE (excluding direct reference to state or federal privacy laws)?	Identical
5.1.1	Is patient consent required for disclosure of patient data in the HIE?	Identical
5.1.2	Does the state have a law permitting patients to request specific restrictions, changes, amendments, or otherwise exercising granular control over their data?	New dimension, but related to prior dimensions

5.2	Does the law address administrative, technical, or physical safeguards to secure HIE data (excluding direct references to state or federal laws)?	Identical
5.3	Are there express duties for providers or other HIE users to protect patient data from unauthorized accesses/disclosures?	Identical
6	Does the law specify sources of HIE funding, including acceptable or permissible funding sources?	Identical
6.1	State Resources	Identical
6.2	Participant Fees	Identical
6.3	Authority to request or accept funds from federal or private sources	Composite of different dimensions
7	Does the law provide immunity from liability for the HIE/HIO or its participants?	Identical

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Table A1: State Comparisons

	HIE Law Index		HIE Usage Index	
	2015		2015	
	Low	High	Low	High
HIE Law Index 2015	1.92	3.75		
HIE Law Index 2009	1.92	1.46		
HIE Usage Index 2015			0.61	0.80
HIE Usage Index 2009			0.14	0.17
Median Age	38.9	39.0	39.5	38.3
Share White	75.0	79.4	77.8	74.3
Household income	64670	66061	61607	68087
Households below poverty (%)	12.1	11.3	12.9	11.0
Median Housing Values	255546	217682	216642	275438
% no health insurance	8.9	7.1	9.2	7.9
Employment/population	71.5	74.6	70.5	73.8
% in Info Industry	1.66	1.59	1.60	1.69
Share voted democrat in 2008	53.7	51.5	54.0	52.5
Share voted democrat in 2012	47.6	49.9	46.2	50.0
Share voted democrat in 2016	43.5	45.0	41.9	45.7

Notes: This table compares mean state characteristics for states with above- vs below- median indexes for HIE Laws and HIE usage in 2015. The HIE Law Index is the number of categories predicted to increase in HIE adoption as shown in Table 1, normalized such that a positive value for each question predicts greater HIE adoption. The HIE Usage Index is the share of health information sharing across provider networks recorded in the AHA-IT survey, aggregated to the state level weighted by the number of hospital beds.

Table A2: Changes in Health Information Exchange & HIE Law Dimensions

Category	Change in Dimension:	Coefficient
Governance	Does the state have a law relating to an HIE pilot project?	0.0544* (0.03)
	Who retains control over the statewide HIE's operations?	0.00811 (0.05)
Sustainability and Financial Incentives	Does the law incentivize HIE participation (excluding funds to be spent solely on HIE creation or implementation)?	0.0422 (0.06)
	State Resources	0.0358 (0.03)
	Participant Fees	0.0984*** (0.02)
	Authority to request or accept funds from federal or private sources	0.0608** (0.03)
	Does the law provide immunity from liability for the HIE/HIO or its participants?	0.0233 (0.05)
Uses and Users	Does the law mandate any providers to access or contribute to HIE data?	0.0152 (0.04)
	Does the state authorize a public health authority to access HIE data or otherwise authorize the HIE to be used for public he	0.0276 (0.03)
Data Protections	Patient enrollment is required to use information	0.0534 (0.14)
	Patient is defaulted into information sharing	0.0851*** (0.03)
	Does the state have a law permitting patients to request specific restrictions, changes, amendments, or otherwise exercising granular	0.00124 (0.04)
Mean of the Dependent Variable	0.51	
N	2252	

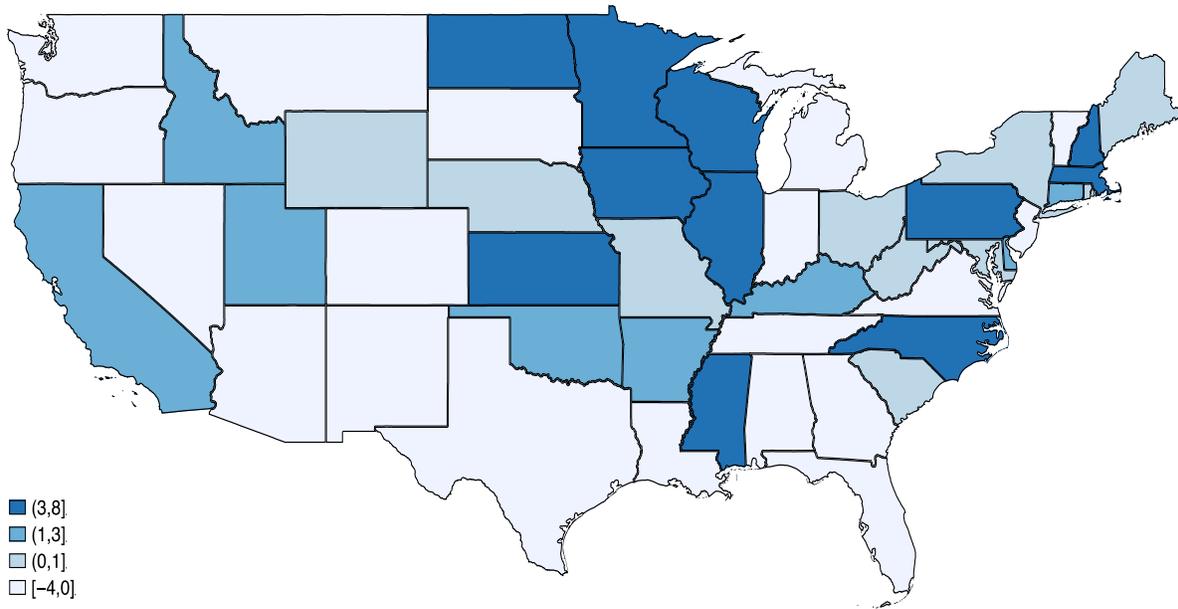
Notes. Each row is from a separate regression, weighted by the number of hospital beds in the hospital in 2009. The dependent variable is the change in the measure of health information sharing between 2009 and 2015. Each dimension is binary, and for the measures used in the indexes, they equal 1 if the law is thought to be supportive along that dimension and zero otherwise. Standard errors clustered at the state level are reported in parentheses. *=10%, **=5%, ***=1%

Table A3: Changes in Internal Health Information Exchange & HIE Law Dimensions

Category	Change in Dimension:	Coefficient
Governance	Does the state have a law relating to an HIE pilot project?	0.0659 (0.05)
	Who retains control over the statewide HIE's operations?	-0.0391 (0.04)
	Index	(0.00) (0.04)
	Does the law incentivize HIE participation (excluding funds to be spent solely on HIE creation or implementation)?	-0.00347 (0.05)
Sustainability and Financial Incentives	State Resources	0.00231 (0.03)
	Participant Fees	0.0625* (0.03)
	Authority to request or accept funds from federal or private sources	0.0352 (0.03)
	Does the law provide immunity from liability for the HIE/HIO or its participants?	0.0053 (0.03)
	Index	0.01 (0.01)
Uses and Users	Does the law mandate any providers to access or contribute to HIE data?	-0.0001 (0.04)
	Does the state authorize a public health authority to access HIE data or otherwise authorize the HIE to be used for public he	0.00827 (0.03)
	Index	0.00 (0.02)
Data Protections	Patient enrollment is required to use information	0.15 (0.09)
	Patient is defaulted into information sharing	0.0324 (0.03)
	Does the state have a law permitting patients to request specific restrictions, changes, amendments, or otherwise exercising granular	0.0226 (0.04)
	Index	0.0591** (0.03)
Overall Index		0.00568 (0.01)
Mean of the Dependent Variable	0.26	
N	2252	

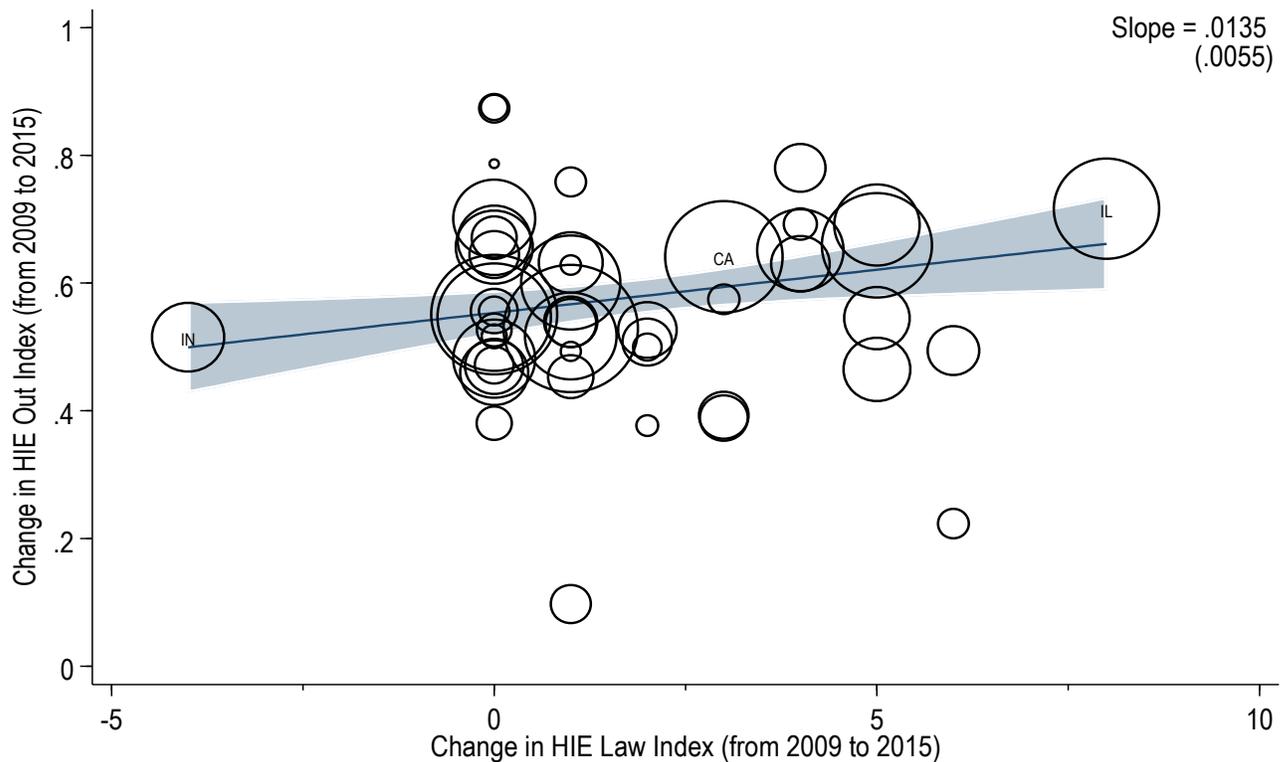
Notes. Each row is from a separate regression, weighted by the number of hospital beds in the hospital in 2009. The dependent variable is the change in the measure of health information sharing **within** healthcare provider systems between 2009 and 2015. Each dimension is binary, and for the measures used in the indexes, they equal 1 if the law is thought to be supportive along that dimension and zero otherwise. Standard errors clustered at the state level are reported in parentheses. *=10%, **=5%, ***=1%

Figure A1: Growth in the HIE Law Index between 2009 and 2015



Notes: This map shows the growth in HIE Law Index: the number of categories predicted to increase in HIE adoption as shown in Table 1, normalized such that a positive value for each question predicts greater HIE adoption. Quartiles. Alaska and Hawaii are not shown but have values of 1 and 0, respectively.

Figure A2: Growth in HIE Law Index and Growth in Health Information Exchange



Notes: Collapsed hospital-level data to state-level, weighting by hospital bed size in 2009.
Each black circle represents a state - circle sizes are proportionate to states' total number of hospital beds.
Blue line and blue shaded region represent regression line and 95% confidence interval, respectively.
Regression weights each state by its total number of hospital beds.