

[authors, credentials, titles, affiliations]

Ari Bronsoler, PhD

Behavioral Economist, Google, Cambridge, Massachusetts, United States

aribro@mit.edu

Joseph Doyle PhD

Erwin H. Schell Professor of Management and Applied Economics, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts, United States;

Research Associate, National Bureau of Economic Research, Cambridge, Massachusetts, United States

jjdoyle@mit.edu

Cason Schmit, JD

Assistant professor, Department of Health Policy and Management, Texas A&M University School of Public Health, College Station, Texas, United States

schmit@tamu.edu

John Van Reenen, PhD, MSc

Ronald Coase Chair in Economics and School Professor, Department of Economics, The London School of Economics and Political Science, London, United Kingdom of Great Britain and Northern Ireland;

Digital Fellow, Initiative for the Digital Economy, Massachusetts Institute of Technology, Cambridge,

Massachusetts, United States

j.vanreenen@lse.ac.uk

[title] The Role of State Policy in Fostering Health Information Exchange in the United States

[highlight] By focusing on 12 specific dimensions across the four categories of governance, financial sustainability, uses and users, and data protection, health care leaders and policymakers can spur increased use of HIE.

[summary/abstract]

Summary

It is widely agreed that health information sharing holds enormous potential to improve health care productivity. While the adoption of electronic health records in the United States over the past 15 years has been impressive, the use of data — and subsequent improvements in health care productivity — have been disappointing. This paper considers the role that state policy plays in the adoption and use of health information exchange (HIE) across providers. We built a novel database of state laws from 2000 through 2019 that tracks 12 dimensions of policies that may facilitate HIE usage. The dimensions fall along four categories: clarifying HIE governance, strengthening financial stability, specifying the uses and users of an HIE, and protecting the underlying data. We find that regulations related to privacy protections and HIE financial viability have substantial effects on information sharing. The category that has the strongest relationship with health information sharing is related to data protection. In states that add a dimension making the protection of data less costly, HIE usage increases by 18%. Within the category of data-protection measures, one stands out: enacting legislation that has patients participate by default leads to a 16% increase in usage. Adding a dimension for each of the other three categories leads to a 4% increase in HIE usage, although only the relationship with

financial sustainability is measured precisely enough to be statistically significant. In particular, states that set up the ability to charge participant fees and authorize the HIE to request state, federal, and private funding achieve greater health information exchange. These results point to policy levers that can catalyze the use of digital tools to improve health and lower health care costs.

[main text]

Health care delivery involves gathering information, making inferences, and communicating findings across providers and with patients. As a result, it has long been recognized that health information technology (health IT) holds enormous potential to improve productivity.¹ A 2005 RAND study estimated that health IT adoption could save the U.S. health care sector between \$142 billion and \$371 billion over a 15-year period.² In light of this potential, policymakers have stressed the use of health IT as a mechanism to improve both efficiency and clinical outcomes. The 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act allocated \$30 billion to increase adoption of health IT by subsidizing electronic health record (EHR) acquisition costs, changing reimbursement rules, and providing technical support. Critically, the HITECH incentives were contingent on providers attesting to their *meaningful use* of electronic health records according to regulatory standards and benchmarks, including standards for electronic health information exchange.

The subsequent rise in EHR adoption across hospitals and doctors' offices has been impressive. Although EHRs have been used since at least the early 1960s, fewer than 10% of hospitals (and fewer than 20% of physicians) were using EHRs prior to the HITECH Act.¹ Remarkably, by 2014,

97% of reporting hospitals had certified EHR technology.³

Despite the enormous level of investment and potential, the estimated impact of health information sharing has been disappointing so far. We recently reviewed the medical and economic literature on the effects of health IT on clinical quality, productivity, and workers, examining nearly 1,000 papers.⁴ The literature suggests that health IT improves clinical outcomes and lowers health care costs, but (i) the effects are modest, (ii) it takes considerable time for these effects to materialize, and (iii) there is much variation in the impact of IT across providers. It appears that health care providers require time to learn how to manage new tools made possible by the health care records system finally entering the digital age. These facts are consistent with lessons from other industries, where the management of new technologies is an important driver of IT productivity gains and heterogeneity.^{5,6}

A primary way to unlock the potential for digital health is through health information exchange (HIE). An HIE serves as a repository of health information that facilitates the tracking of patient care across providers, and often allows users to communicate within the HIE. HIEs are typically organized by Health Information Organizations (HIOs) consisting of regional payers and providers. Surveys of HIOs reveal the evolution of their capabilities and ongoing challenges.⁷ In addition to facilitating the sharing of data, the HIOs are increasingly offering services such as analytics, quality measurement, and the creation of disease registries. Key challenges for HIEs are financial viability and the management of patient consent rules, state regulations, and other concerns about privacy and confidentiality.

These challenges manifest in wide variation in the ability of HIEs to share data across providers and payers in a timely way.⁸ Some evidence suggests that HIEs can improve quality of care. For example, a study of hospital discharges for acute myocardial infarction patients in Florida from 2011–2014 found that hospitals participating in HIEs had lower readmission rates.⁹ Similarly, physician offices with robust health information sharing capabilities have been found to have 5% lower Medicare spending while maintaining quality.¹⁰ Going forward, there is an increasing sense that HIEs will benefit from policy initiatives where HIEs play a central role in freeing data from “walled gardens” controlled by EHR vendors to ensure privacy and usefulness to health care providers.¹¹ This is an active area of debate, and recent federal regulation provides a framework to standardize data sharing that may lower costs of HIEs.^{12,13}

This paper considers the role that state policy plays in the diffusion of health information sharing in the United States. The existing literature and evidence on factors impacting HIE, including policies, has been noted to have very significant limitations. Some of the policy research limitations include case studies, purely cross-sectional analysis, or a limited focus on only a few policy dimensions.^{14,15,16,17} More robust analysis of the impact of policy on HIEs requires more robust legal data. For example, a 2018 study identified an association between HIE engagement and three legal dimensions (HIE authorization, incentives, and consent models) in an exploratory analysis, but noted that their cross-sectional legal data prevented causal inferences.¹⁵ Other important policy research has focused on the significance of a few legal dimensions. For example, tougher state privacy laws have been found to slow its diffusion.¹⁵ Meanwhile, the growth in health IT was accompanied by similarly substantial adoption of state statutes and regulations to regulate it. In the absence of strong evidence-based

policy recommendations, the resulting landscape has a wide dispersion across states in the legal environment governing health information sharing. This study aims to fill a significant gap in the existing literature by incorporating new longitudinal legal data on multiple dimensions of HIE regulation.

In order to investigate the role of state policy, we constructed a new panel dataset that describes the legal environment along 12 dimensions related to health information exchange in each state on December 31 in every year between 2000 and 2019. We describe how state policy environments have changed over time. We then test whether health information sharing responds to changes in state laws that aim to promote its growth and usage. The findings can help health systems and providers better understand the obstacles and opportunities in HIE and inform health policy reforms aimed at facilitating the use of modern digital tools to improve health and health care productivity.

Data & Methods

Tracking Health IT Adoption & Usage

An advantage of the interest in health IT and its potential to improve health care is that there are high-quality data on its adoption and usage at the provider level. Our primary source is the surveys of hospitals conducted by the American Hospital Association. These surveys include a detailed list of health IT capabilities and usage for more than 2,500 hospitals that answered questions in both early and late waves of the survey from 2007 to 2018. We use the AHA-IT survey because it is comprehensive in the range of capabilities measured. Trends and other patterns reported in the AHA-IT data are similar when using other sources of data, including surveys by the Healthcare Information and Management Systems Society and adoption information from the Centers for

Medicare & Medicaid Services.)

The AHA-IT survey includes five questions related to health information sharing consistently over time. The survey asks whether the hospital can “electronically exchange/share” different types of data. These include (1) patient demographics, (2) laboratory results, (3) medication history, (4) radiology reports, and (5) clinical record. Hospitals report whether they can share each type of data with hospitals inside their system and hospitals outside their system. Our primary outcome is an *HIE Usage Index*, which measures a hospital’s sharing of data outside of their system. This is calculated as the share of these five external-sharing capabilities. We analyze changes in this adoption index between 2009 — just prior to the subsidies from the HITECH Act — until 2015, the end of the period when the AHA-IT survey questions were asked in a consistent manner. We report results from this specification because our main goal is to analyze the types of laws that matter for HIE usage relying on the most reliable data available. While ending in 2015 is a limitation compared to a more recent year, the AHA-IT survey shows that hospital membership in an HIO grew from 51% to 62% between 2015 and 2019, so there is still room to grow. Further, we constructed a proxy for HIE usage from 2009–2019 by incorporating survey items that are available for later years, and we find that the results are qualitatively similar though less precise, as expected given the noise introduced by this method. In the end, we believe the relationships established using the more-accurate 2009–2015 timeframe are applicable to policy makers today. We also supplement this analysis with measures of health information sharing *within* hospital systems that are also asked in the AHA-IT supplement (although, it is less clear whether or how laws on privacy would impact internal,

closed-system uses of health information).

Novel HIE Law Database

To investigate the role of state policy on health information sharing, we built a new panel dataset of legal impediments and catalysts for joining and maintaining an HIE. Our database required collecting, reading, and coding laws with any relation to HIEs, their amendments, and their repeals to describe the legal environment in each state in years between 2000 through 2019; our model is informed by and expands on the protocol for HIE policy surveillance established by Schmit, et al. in 2017.¹⁸ The construction of our dataset is described more fully in the Appendix.

Our database tracks when state policies became more (or less) supportive for health information sharing along four broad categories where laws can clarify: (1) governance, (2) financial sustainability including state subsidies, (3) uses and users, and (4) data protections. Specifically, we coded 12 questions related to these categories shown in Table 1, which also reports the *ex ante* hypothesis of whether the presence of the dimension in state law is likely to spur adoption established in prior work.¹⁸

PRODUCTION: PLEASE BEGIN TABLE 1

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Under *governance*, we ask questions about the state's role in creating and operating a viable HIE in a market or in the state as a whole. When it comes to *financial sustainability*, we track whether the state directly subsidizes the creation of HIEs or whether the funding streams are clarified under the law in the state. We also consider immunity from liability as part of the incentives established by the state. The database also records whether the law specifies the *uses and users* of an HIE, as this can spur participation and usefulness. For example, most HIEs may be used by public health agencies for surveillance of infectious disease, which informs policy both during the current pandemic, as well as seasonal outbreaks of diseases such as influenza. Other users include payers and providers, where the combination of data feeds can be particularly informative. Much of the database characterizes *data protections* for privacy, confidentiality, and security of patient data. For example, greater patient control of data access is expected to raise the cost of establishing an HIE. In particular, some states require patients to *opt into* data sharing (i.e., active consent), while others require patients to *opt out* (i.e., passive consent). Such default "nudges" in the choice architecture of HIE participation are expected to have large effects on participation, similar to effects found in the areas of organ donation¹⁹ or retirement savings.²⁰ If patients have to opt into data sharing, the expectation is that HIE will be less used. As a result, the implementation cost and the potential coverage of the data will likely affect HIE usage.

When we measure changes in states' legal environments, we summarize the factors in Table 1 with a summary *HIE Law Index*. This is simply the sum of the dimensions present in the state, where we normalize the measures such that a higher score is predicted to increase HIE

adoption *ex ante*. We also disaggregate the index and consider each of the dimensions separately.

Analyses

We report time series and cross-sectional comparisons of health IT usage and policy variation.

We then explore the relationship between the legal environment and the use of health IT with the following model for provider p in state s :

$$\Delta Y_{ps} = \beta_0 + \beta_1 \Delta L_s + \varepsilon_{ps} \quad (1)$$

In this equation, ΔY_{ps} is the change in the HIE Usage Index from 2009 to 2015 described above. ΔL_s represents the change in the HIE Law Index over the same time period. The goal of *long-differencing* the outcome and the legal variables is to estimate the cumulative impact of the law changes, as we expect an adjustment period between the time laws are passed and provider behavior changes. (A full analysis of the dynamics of provider behavior changes in response to changes of the laws is an active area of research and beyond the scope of this paper.) The long differencing also controls for state fixed effect: unobservable characteristics of states that do not change much over time. We cluster the standard errors at the state level to reflect the nature of the variation in the legal changes, and we weight observations by hospital size (number of beds) in the baseline year so that the analyses are more representative of providers in relation to the number of patients they treat.

Results

Health Information Exchange Laws & Usage Over Time

Health information sharing has surged over time along with changes in the policy environment. Figure 1 displays two time series.

PRODUCTION: PLEASE BEGIN FIGURE 1

[title] Figure 1. HIE Law Prevalence & HIE Usage

[caption] Two time series are plotted: The share of health information exchange policy dimensions that are present in state legislation, averaged across states each year, is shown in green (left vertical axis). The HIE Usage Index is the fraction of health information capabilities for sharing across health care providers weighted by hospital beds (a size measure) in each state and then averaged across states in each year. This is shown in orange (right vertical axis).

Notes: Share of HIE policy dimensions, range is 0.0 to 1.0, where 1.0 represents all states with laws addressing all of the dimensions.. HIE Usage Index, range is 0.0 to 1.0, where 1.0 represents all hospital in all states having the full set of cross-hospital information-sharing capabilities measured in the AHA-IT survey. .

Source: The authors

PRODUCTION: PLEASE END FIGURE 1

First, state legislative activity is measured using the share of the 12 dimensions of our state-law database that are present in the state in a given year and then averaged over all states to arrive at a time series. The average share of the legal dimensions present across states rose from less than 7% in 2000 to 36% by 2015. The growth has an inflection at the time of the HITECH Act, levels off and begins to

fall as the HITECH subsidies begin to be exhausted.

Second, given that our legal measures are at the state-year level, we aggregate the provider level HIE Usage Index described above to the state-year level, weighting by beds to reflect hospital size, and then averaged this measure across states each year. This weighted average of the share of capabilities across hospitals rose from less than 12% in 2007 to over 70% by 2015. Figure 1 shows that the two series move together quite closely. This is likely due to a combination of policies responding to changes in health IT usage and laws affecting adoption. (Alternative measures of health IT capabilities show similar increases in adoption, including the share of within-network data sharing capabilities and the share of hospitals with an electronic health record.)

HIE Laws & Usage Across States

In addition to variation over time, there is also substantial cross-sectional variation in the policy environment across states. Figure 2 shows a map of the HIE Law Index in 2015.

PRODUCTION: PLEASE BEGIN FIGURE 2

[title] Figure 2. HIE Law Index in 2015

Notes: This map shows the HIE Law Index for each state in 2015: the number of 12 dimensions 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 are shown in different shades of blue, darker shades reflecting more pro-HIE laws. Alaska and Hawaii are not shown but have values of 6 and 0, respectively.

Key:

Dark blue [7–8]

Medium-dark blue [4–6]

Medium-light blue [1–3]

Light blue [0]

Source: The authors

PRODUCTION: PLEASE END FIGURE 2

In 2015, no states had laws that positively address more than 8 of the 12 dimensions. States in the top quartile have 7 or 8 dimensions, while those in the bottom quartile are all zero. Figure 2 shows there is substantial spatial variation with no obvious systematic differences by economic or political factors. The most pro-HIE laws are in Texas and the mid-West, with the anti-HIE environments in states in the deep South, Rocky Mountains, and Great Lakes.

In the Appendix, two columns of Table A1 characterize states that are above- or below- median in the HIE Law Index in 2015 (i.e., more- or less-supportive laws). The policy environments were fairly similar in 2009, which is not surprising given the large rise in legislation was just beginning at that time. By 2015, the above-median states passed laws with more-supportive policies, adding about two dimensions, while the below-median states stayed at their 2009 level. These two sets of states are similar in terms of demographics, with similar age and racial composition. More-supportive policy regimes are found in states with slightly higher incomes and lower poverty rates (11.3 versus 12.1). The political leanings are also similar across these two sets of states, as measured by the share voting for the Democratic nominee in presidential elections.

The comparison is similar for the HIE Usage Index, as shown in the last two columns of Table A1. The measure is higher in the above-median states by definition — the difference is approximately 0.2 in an index that ranges from 0 to 1. The HIE Usage Index was fairly similar across these states in 2009. States with more information sharing have somewhat higher incomes (\$68,000 versus \$62,000) and lower

levels of the uninsured (7.9% versus 9.2%). Politically, there is no strong pattern, with high-HIE states less likely to vote Democratic in the 2008 presidential election, and more likely to vote Democratic in 2012 and 2016.

Changes in State HIE Policy Predict Growth in HIE Usage

So which state policies spur HIE usage? We estimate the relationship in equation (1) by regressing our measures of the growth in HIE Usage Index on the growth in the HIE Law Index. Figure A1 shows a map of the growth in HIE Law Index across states from 2009 to 2015 and suggests that there is much variation across states. High-growth states are spread out across the northeast, southeast, and the Plains states. In fact, there is considerable heterogeneity within every region of the United States, with no concentration of states that had low to moderate growth. While we examine the long difference in the HIE Law Index from 2009 to 2015, the growth is monotonic within states: 32 states see only increases in the index, 17 have no changes, and one state (Indiana) saw a reduction (i.e., HIE laws that were repealed).

Table 2 presents our main results. As expected, the change in HIE usage is positively and significantly associated with changes in our legal index with a coefficient of 0.0135 and a standard error of 0.005.

PRODUCTION: PLEASE BEGIN TABLE 2

[title]

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To place this estimate in context, Figure A2 shows a scatter plot of the relationship. There is a mass point at zero — states like New Jersey, Texas, and Oregon did not change their laws over this time period and there is another set of populous states whose growth in the HIE Law Index is five, such as Massachusetts and Wisconsin. The point estimate of 0.0135 in Table 2 suggests that moving from states that had no change in the HIE Law Index to states that added 5 dimensions would increase their HIE Usage by 6.8 percentage points. Recall that the average change in HIE Usage is 52%, so this increase represents a 13% increase compared to the average. This is a non-trivial magnitude and suggests that the legal environment could be very important for HIE.

When we look at each category of the legal index, the measure that has the strongest relationship with health information sharing is related to data protection laws. In states that add a dimension making the collection and use of data less costly, the HIE Usage Index increases by 9 percentage points (18% of the mean). Introducing laws clarifying governance, setting out the uses and users of the HIE, and strengthening the financial sustainability of exchanges increases the HIE Usage Index by approximately 2 percentage points, although only the relationship with financial sustainability is measured precisely enough to be statistically significant.

These indexes are useful as summary measures to test what types of laws matter for health information sharing. Table A2 reports results for each dimension in order to examine which ones are

driving the overall results. (These measures are not independent, so some caution is warranted regarding the likelihood of finding a significant relationship when conducting multiple hypothesis tests. We regard the summary index results in Table 2 as testing largely independent hypotheses and Table A2 is a way to unpack those overall results.)

All of the measures that we predicted would increase HIE usage are found to be positively correlated with actual usage. In terms of sustainability and financial incentives, the states that set up the ability to charge participant fees are found to increase the HIE Usage Index by 10 percentage points. Adding the authority to request state, federal, and private funding also seems important for successful health information exchange (a 6 percentage-point increase). In terms of various measures of data protection, one measure stands out: enacting legislation that has patients participate by default leads to an 8 percentage-point increase in HIE Usage Index.

In the Appendix, we report results for additional measures of health IT usage, namely the share of within-system sharing capabilities at the hospital. Given that the laws related to HIE were specifically geared toward external sharing, we expect the relationships to be weaker. That said, they may well be complements when investing in health IT infrastructure. The results show that laws related to external sharing are also related to within-provider sharing, but the results are, indeed, weaker. Three of the measures are the opposite sign, and only the data-protection index is statistically significantly related: adding one dimension increases the change in within-provider health information exchange by 6 percentage points, or 23% of the mean.

Limitations

This is a descriptive exercise that traces out changes in the policy environment across states and over time. The relationship between these changes and the use health IT provides a causal effect of the policies under the strong assumption that factors outside of our model are not correlated with the policy changes and cause changes in health IT usage directly.

Looking Ahead

Health data sharing is a persistent challenge in U.S. health systems.^{21,22,23} Accordingly, the federal government continues to aggressively incentivize increased data sharing through laws, policies, and appropriations. The federal policy efforts include the 2016 21st Century Cures Act and its subsequent 2020 regulations on “information blocking,” and the release of the 2022 Trusted Exchange Framework.²⁴ In addition to these policies, Congress appropriated \$500 million for health data modernization in the 2020 CARES Act in response to the data challenges faced during the Covid-19 response.^{25,26} Just as our legal data show substantial state legislative activity following the passage of the federal HITECH incentives, states may similarly look to adopt new laws to take advantage of the CARES Act’s data modernization funds. Our findings can inform these legislative efforts.

Our work shows that state policy can play a large role in setting conditions that incentivize the use of health IT. Some policies are directly related, such as setting up governance structures, funding clarity, and even mandating the uses and users of an HIE. Other policies affect the cost of participation in an HIE, including privacy, confidentiality, and security provisions that protect

health data.

State adoption of these laws is not predicted by political variables or population demographics. It appears that in a flurry of state legislation at a time of rapid adoption of health IT, spurred in part by the HITECH Act, led to plausibly exogenous variation in the types of law changes observed at that time.

While we cannot fully rule out competing explanations, such as unobserved changes in states that chose laws that are supportive of HIE, we find evidence that state-specific laws related to the governance of HIEs, the funding of HIEs, and privacy rules that govern whether patients must opt-in or opt-out of data sharing are strongly associated with state-specific use of health information exchange.

Notably, many of the HIE laws included in our study were implemented when existing evidence of impact was limited.¹⁴ For states looking to encourage further adoption and *meaningful use* of these new technologies, this evidence provides suggestions for adopting new laws or amending existing ones. Direct subsidies and structures that allow for revenue generation appear important and amenable to policy changes. The evidence also highlights that additional state privacy protections impose costs on health information sharing beyond those from existing federal protections.²⁷ Notably, our findings can also inform federal privacy efforts, such as the proposed American Data Privacy and Protection Act and the Federal Trade Commission's advance notice of proposed rulemaking on commercial surveillance to ensure that future federal policies are crafted to avoid unintended consequences and costs in health IT.^{28,29,30} Technological innovations that lower these costs while maintaining privacy could

relax this tradeoff and spur the ability of these technologies to live up to their potential of improving healthcare productivity.

Appendix

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