

Associations Between Physician Practice Models and Health Information Exchange

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Emerging physician practice models seek to improve health care value compared with traditional health care delivery models, including better quality and lower costs.^{1,2} These new practice models can take many forms,³ including accountable care organizations (ACOs), clinically integrated networks (CINs), and integrated delivery networks (IDNs), among others.

Emerging physician practice models have become increasingly common in recent years. For example, the first national survey of ACOs was performed in 2012-2013 and identified approximately 260 ACOs in the United States.⁴ By 2017-2018, the number of ACOs in the United States had increased to 862.⁵ More than 30 million Americans now receive care through an ACO.⁶ CMS has set a target that the majority of health care in the United States be delivered under some emerging practice model as of 2018, a large shift from the approximately 20% of care delivered under these models in 2014.⁷ Although there has been a somewhat mixed history of success in achieving increased value through these new practice models,⁸ these care delivery approaches constitute a growing and increasingly important portion of the US care delivery landscape.^{9,10}

At roughly the same time as new models for health care delivery have become more prevalent, a significant shift toward the use of electronic health records (EHRs) and health information exchange (HIE) has occurred. In 2007, prior to CMS' rollout of adoption incentive payments for EHRs, approximately 35% of office-based physicians reported using any EHR.¹¹ By 2017, that figure had increased to 86%, with 80% of physicians reporting using an EHR system that meets federal meaningful use standards for promoting interoperability.¹² Along with the rapid expansion of EHR use driven by the Health Information Technology for Economic and Clinical Health Act,¹³ physicians and hospitals are also exchanging electronic health data through purpose-built HIE platforms and organizations. The expansion of HIE has been less rapid than that of EHRs, but in the roughly 10 years since the emergence of the first financially viable HIE around 2009, more than 40 financially viable HIE organizations have emerged.¹⁴ Substantial barriers to HIE adoption remain, however, including financial, technological, organizational, and environmental factors.¹⁵

ABSTRACT

OBJECTIVES: The interaction between emerging physician practice models and the use of health information exchange (HIE) remains understudied. We examined associations between the use of emerging practice models and the use of HIE. We also examined barriers to HIE adoption among physicians who were not utilizing HIE.

STUDY DESIGN: Survey data came from a 2019-2021 statewide census of all physicians in Arizona collected at the time of license renewal (n=3312, or 17.9% of all practicing physicians).

METHODS: Primary outcomes were physician-reported HIE use for patient care summaries and for laboratory results. Secondary outcomes were 5 common HIE barriers among non-HIE users. The primary predictor was physician practice model: accountable care organization (ACO), clinically integrated network (CIN), or integrated delivery network (IDN) vs traditional care delivery model. Covariates included physician specialty, age, gender, and county of practice.

RESULTS: Compared with physicians in traditional care delivery models, physicians in ACOs, CINs, or IDNs had significantly higher odds of using HIE to share both patient care summaries ($P < .01$) and laboratory results ($P < .05$ for ACOs), although associations varied across provider and practice characteristics. ACO providers not using HIE were more likely to cite a lack of connectivity and lack of information as HIE barriers.

CONCLUSIONS: Providers in an emerging practice model are more likely to use HIE than those in a traditional care delivery model. However, nuances in these associations suggest a persistence of previously identified HIE gaps, and the barriers cited provide guidance for increasing HIE use among different practice types.

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TAKEAWAY POINTS

- ▶ We leverage a rich data set of several thousand physicians to investigate the interplay between participation in emerging provider practice models such as accountable care organizations (ACOs), clinically integrated networks (CINs), or integrated delivery networks (IDNs) and use of health information exchange (HIE).
- ▶ We find a strong but not deterministic relationship between ACO/CIN/IDN participation and HIE use. We identify notable areas for future study and policy attention where providers are participating in either HIE or ACO/CIN/IDN models but not both. We also find notable patterns in barriers to use of HIE between ACO/CIN/IDN-participating providers and nonparticipating providers, including demographic and practice characteristics and differential self-reported barriers to future adoption and use of HIE.
- ▶ Nuances in associations between ACO/CIN/IDN participation and use of HIE suggest a persistence of previously identified HIE gaps, and the barriers cited provide guidance for increasing HIE use among different practice types.
- ▶ Recognizing and identifying co-occurrence of ACO/CIN/IDN participation and HIE in today's health care delivery environment is especially important given that achieving the full theoretical benefits of emerging practice models may necessitate wider use of HIE.

From a conceptual standpoint, it is reasonable to suspect that the concurrent growth of physician practice models and HIE has been mutually reinforcing and mutually beneficial. A consistent objective across all forms of emerging practice models is to incentivize care coordination across care delivery settings.¹⁶ Coordinated care can promote delivery of timely health services and follow-up, potentially resulting in fewer unnecessary or repeated services. However, relational, managerial, and informational barriers exist. Health information technology is an important tool for combating common informational barriers.¹⁷ HIE may help to facilitate interprovider and interorganization communications in health care and yield more productive health care encounters for patients.^{16,18,19} This can be seen empirically as communities with established HIEs are associated with lower per capita Medicare costs.²⁰ Additionally, through the Medicare Access and CHIP Reauthorization Act, providers can be eligible to receive payment incentives for HIE participation in an effort to promote greater care coordination.

Yet the evidence base regarding the intersection of emerging practice models and the use of HIE remains somewhat limited, in part due to methodological and data challenges.²¹ For example, data on physician practice model proliferation come in part from the ACOs themselves, such as Dartmouth's National Survey of ACOs. That survey is not specifically aimed at identifying EHR or HIE usage patterns and therefore has a somewhat narrow set of EHR and HIE data elements as of its current (fourth) wave.⁶ Similarly, the best available data on growth and characteristics of HIEs come from a survey of HIE organizations, but that survey does not simultaneously examine the use of an emerging practice model. Data reported in an appendix to a 2021 reporting of HIE survey data by Adler-Milstein et al suggest that only about one-third of HIEs can generate quality measures necessary for participation in an emerging practice model, such as an ACO; approximately one-half of HIEs report providing data sufficient for eventually generating quality measures.¹⁴ In short, comparisons of adoption and use of both an emerging practice model and HIE may be limited by the

lack of individual provider-level data and may be subject to the ecological fallacy. Therefore, relatively little is known about the types of providers who are and are not utilizing an emerging practice model and simultaneously using HIE to share health care data.

The primary purpose of this study was to examine the association between emerging physician practice models, such as ACOs and integrated settings, and the use of HIE at the level of the individual provider. The secondary purpose of this study was to examine whether there is an association between the use of an emerging practice model and barriers to HIE use among the physicians who were not exchanging information electronically.

METHODS

Conceptual Framework

In examining associations between emerging physician practice models and the electronic exchange of health care information, we focused specifically on 3 practice models—ACOs, CINs, and IDNs—and 2 types of health care data—patient care summaries and laboratory results. We focused on these 2 types of health care data because we hypothesized that these are critical data types shared in settings such as ACOs, CINs, and IDNs. Use of HIE can have different benefits depending on the specific types of health care services used. In emergency departments, for example, HIE can result in faster access to information from external sources.²² In the case of ACOs, CINs, and IDNs, however, it is especially relevant that primary care providers receive timely and complete summaries of patients' visits with specialist providers.²³ Likewise, laboratory results that are unavailable at the time of a patient's visit can result in the need for additional patient visits or repeat tests,¹⁹ both of which would be disincentivized under a value-based payment care delivery model. We therefore hypothesized that participation in an ACO, CIN, or IDN would be positively associated with the likelihood of HIE use relative to physicians practicing in traditional care delivery models such as fee for service.

Data

Data for this study come from the Arizona State University Center for Health Information and Research's ongoing survey on physicians' use of electronic medical records and exchange of electronic health data. Additional information on this survey is contained in the [eAppendix](#) (available at ajmc.com). Briefly, the survey's sample frame is all licensed Arizona physicians. Survey responses are voluntarily completed online following completion of the license renewal application. As of 2020, approximately 95% of Arizona physicians report using EHRs, more than 900 organizations participate in the state's HIE, and approximately 18 ACOs exist in the state.^{24,25}

In 2019–2021, 18,485 physicians renewed their medical licenses and received an invitation to complete this survey. A total of 3312 complete responses were received, for an overall response rate of 18%. This represents roughly 18% of all physicians practicing in the state of Arizona, as the survey does not use a fractional sampling frame or multistage sampling design. As shown in eAppendix Table 1, respondents and nonrespondents differed on some but not all observable dimensions. Survey weights were used to account for observable differences in provider age, gender, degree type, and Medicaid acceptance status between providers who did and did not complete the survey.

Our primary outcomes of interest were 2 separate dichotomous measures of using HIE to share (1) patient care summaries and (2) laboratory results. “Yes” indicates that a physician reported exchanging that type of data electronically via HIE. “No” indicates that the respondent exchanged that type of data via fax, did not exchange, or did not know. Our secondary outcomes of interest were 5 separate dichotomous measures for the types of barriers (if any) reported by physicians who reported that they did not electronically exchange either patient care summaries or laboratory results. The 5 barrier types were informed by previous studies^{14,15,19} and were (1) lack of an HIE, (2) concerns about patient confidentiality, (3) lack of technological support for problems, (4) lack of connectivity between EHR and other systems, and (5) lack of information from other providers.

Our main predictors of interest were 2 dichotomous variables that identified whether a physician (1) self-identified participation in an ACO or (2) self-identified participation in an integrated care model (part of either a CIN or IDN), where the reference group was participation in a traditional care delivery model (eg, traditional fee-for-service private practice or other types of models). Approximately 1% of physicians responded that they practiced “concierge” medicine and were excluded from these analyses.

We also included several covariates in multivariable models: (1) practice type (solo private practice, group private practice, hospital-based, community clinic); (2) specialty (primary care, pediatric, medical-surgical); (3) gender (female, male); (4) degree type (MD, DO); (5) Medicaid provider (yes, no); (6) age (25–34, 35–44, 45–54, 55–64, ≥65 years); and (7) county of practice (Maricopa [Phoenix area], Pima [Tucson area], other). Although not a perfect match, county of practice can serve as a rough proxy for rurality. Maricopa and Pima counties are the 2 largest and more urbanized counties in Arizona. The remaining 13 counties are, with some exceptions, rural in nature.

Statistical Analyses

We calculated univariate summary statistics on our sample including count and percentage for all variables. We compared data on survey respondents with complete data (n = 3312) vs those with incomplete data; results are shown in eAppendix Table 1. We calculated multivariable logistic regression models of our primary outcomes of interest on our primary predictors of interest plus iteratively added sets of control variables. All models controlled for demographics including physician’s gender, age, county, and Medicaid status. An

TABLE 1. Sample Descriptive Statistics*

Dichotomous provider characteristic	Count (%)
HIE used for patient care summaries	2480 (74.88)
HIE used for labs	2717 (82.03)
ACO	897 (27.09)
Integrated model (CIN or IDN)	782 (23.60)
Traditional care delivery	1633 (49.31)
Female	1130 (34.12)
MD degree	2836 (85.64)
AHCCCS provider	2509 (75.75)
Aged 25–34 years	225 (6.79)
Aged 35–44 years	824 (24.88)
Aged 45–54 years	876 (26.45)
Aged 55–64 years	742 (22.39)
Aged ≥ 65 years	646 (19.49)
Maricopa County	2087 (63.01)
Pima County	606 (18.29)
Other county	621 (18.71)
Solo private practice	498 (15.01)
Group private practice	826 (24.97)
Hospital based	1463 (44.17)
Community clinic	525 (15.85)
Primary care specialty	1387 (41.87)
Pediatric specialties	331 (10.00)
Medical-surgical specialties	1594 (48.13)
Observations	3312

ACO, accountable care organization; AHCCCS, Arizona Health Care Cost Containment System; CIN, clinically integrated network; HIE, health information exchange; IDN, integrated delivery network.

*This table presents descriptive statistics for the analytic sample as the count (and percentage) of the sample that is described by the indicated dichotomous characteristic.

additional model was run that also controlled for practice type. Our final “full” model controlled for demographics, practice type, and provider specialty. Separate models were estimated for provider’s use of HIE to exchange patient care summaries and the use of HIE to exchange laboratory results. We also ran separate models for each of the 4 physician practice types to examine relationships between variables of interest that are specific to a given practice type. To examine our study’s secondary purpose, we ran separate regression models of each of the 5 types of barriers to HIE use on the full set of predictors and covariates. All analyses were performed using Stata/MP version 16.1 (StataCorp LLC), and all models were estimated using heteroscedasticity-robust SEs. Ethical approval for this study was obtained from the Arizona State University Institutional Review Board.

RESULTS

Complete data on HIE use, physician practice model, and physician demographic data were available for 3312 physicians in Arizona. As shown in Table 1, 75% of respondents reported using HIE to

TABLE 2. Provider Characteristics Predict Whether They Use HIE to Share Patient Care Summaries^a

Characteristic	(1) Model 1: odds ratio (95% CI)		(2) Model 2: odds ratio (95% CI)		(3) Model 3: odds ratio (95% CI)	
		P		P		P
ACO	2.595 (2.03-3.32)	<.001	1.943 (1.48-2.55)	<.001	1.948 (1.48-2.56)	<.001
Integrated model (CIN or IDN)	3.317 (2.53-4.36)	<.001	2.192 (1.60-3.00)	<.001	2.172 (1.59-2.97)	<.001
Traditional care delivery	Reference		Reference		Reference	
Solo private practice			0.422 (0.29-0.61)	<.001	0.415 (0.29-0.60)	<.001
Group private practice			0.679 (0.48-0.96)	.027	0.677 (0.48-0.96)	.027
Hospital based			1.229 (0.88-1.72)	.232	1.247 (0.89-1.75)	.203
Community clinic			Reference		Reference	
Primary care specialty					1.006 (0.81-1.25)	.958
Pediatric specialties					0.776 (0.54-1.11)	.169
Medical-surgical specialties					Reference	
Female	0.752 (0.61-0.93)	.008	0.731 (0.58-0.92)	.007	0.748 (0.59-0.94)	.014
Male	Reference		Reference		Reference	
MD degree	0.827 (0.69-0.99)	.038	0.777 (0.64-0.94)	.010	0.776 (0.64-0.94)	.011
DO degree	Reference		Reference		Reference	
Accepts Medicaid	0.940 (0.71-1.24)	.660	1.044 (0.77-1.41)	.779	1.037 (0.77-1.40)	.815
Does not accept Medicaid	Reference		Reference		Reference	
Aged 25-34 years	1.541 (0.89-2.66)	.121	1.410 (0.79-2.53)	.249	1.411 (0.78-2.54)	.250
Aged 35-44 years	1.935 (1.42-2.64)	<.001	1.658 (1.19-2.31)	.003	1.642 (1.17-2.29)	.004
Aged 45-54 years	1.609 (1.21-2.14)	.001	1.576 (1.15-2.15)	.004	1.584 (1.16-2.16)	.004
Aged 55-64 years	1.227 (0.93-1.62)	.146	1.150 (0.86-1.54)	.350	1.143 (0.85-1.53)	.375
Aged ≥ 65 years	Reference		Reference		Reference	
Maricopa County	0.868 (0.67-1.12)	.280	0.863 (0.65-1.14)	.300	0.874 (0.66-1.16)	.346
Pima County	0.790 (0.57-1.09)	.155	0.763 (0.54-1.08)	.125	0.768 (0.54-1.09)	.135
Other county	Reference		Reference		Reference	
Observations	3312		3027		3013	

ACO, accountable care organization; CIN, clinically integrated network; HIE, health information exchange; IDN, integrated delivery network.

^aEach column displays the exponentiated coefficients (95% CIs in parentheses) from a logistic regression of provider characteristics (indicated by row labels) predicting whether a provider reports using Arizona’s HIE to share patient care summaries with other providers; models were estimated using heteroscedasticity-robust SEs.

exchange patient care summaries and 82% reported using HIE to exchange laboratory results. Approximately half (49%) of physicians reported practicing in a traditional care delivery modality whereas 27% practiced in an ACO and 24% practiced in an integrated care model (CIN or IDN).

There was a significant association between physician practice model and use of HIE to exchange patient care summaries. Compared with physicians in traditional care delivery models, physicians in emerging practice settings (ACOs, CINs, or IDNs) had significantly higher odds of using HIE to share patient care summaries (Table 2, model 1). Estimates from the full model (Table 2, model 3) show that physicians in ACOs had 1.948 times greater odds of using HIE to share patient care summaries compared with physicians in traditional care delivery models ($P < .001$). Physicians in integrated care models had 2.172 times greater odds of using HIE to share patient care summaries compared with physicians in traditional care delivery models ($P < .001$). These patterns are consistent when separately estimating the associations with HIE use among ACO practices that are and are not also in a CIN or IDN (eAppendix).

Similarly, there was a significant association between physician practice model and the use of HIE to exchange laboratory results (Table 3). Physicians in ACOs had 2.079 times higher odds of using HIE to share laboratory results compared with physicians in traditional care delivery models ($P = .039$). Physicians in integrated care models had 1.981 times higher odds of using HIE to share laboratory results compared with physicians in traditional care delivery models, but this was not significant ($P = .055$).

The association between practice model and HIE use varied somewhat across the 4 practice types assessed (Table 4). There was a strong and positive association between ACO status and the use of HIE to exchange patient care summaries for solo private practitioners (odds ratio [OR], 2.311; $P = .035$), group private practitioners (OR, 1.996; $P = .008$), and hospital-based practitioners (OR, 1.594; $P = .046$), but there was no significant association between these variables for practitioners at community clinics ($P = .057$). In integrated care models, there was no significant relationship between integrated

care model and HIE use among solo private practitioners ($P = .371$) or community clinics ($P = .340$). There was a significant positive association between integrated care model and HIE use in group private practice (OR, 4.760; $P = .001$) and hospital-based practices (OR, 2.082; $P = .002$).

Despite having higher odds of using HIE, **Table 5** shows that ACO physicians were significantly more likely to report a lack of connectivity with other providers and a lack of information from other providers as barriers to using HIE than were physicians in traditional care delivery models (OR, 1.426; $P < .05$; and OR, 1.649; $P < .001$, respectively). Differences in self-reported barriers to using HIE also emerged across other practice or physician characteristics included in the regression models. For example, physicians in group or private practice were significantly more likely to report concerns over confidentiality (OR, 1.883; $P < .01$) than were physicians in community clinics. Additionally, physicians in Maricopa County (which contains Phoenix and is largely an urban county) were less likely to report a lack of connectivity as a barrier to HIE (OR, 0.649; $P < .01$).

DISCUSSION

Our study leveraged a rich physician-level data source to assess the association between emerging physician practice models and the use of HIE. We were able to account for practice- and physician-level factors using a large, statewide census of physicians in a relatively large and diverse state. To our knowledge, this study presents one of the largest samples of physician-reported data on the associations between emerging practice model participation and HIE use. We found that providers in ACOs and integrated models such as CINs and IDNs were more likely to report using HIE to exchange patient care summaries and laboratory results than were their peers in traditional care delivery models.

A positive relationship between ACO or integrated care models and the use of HIE is consistent with our study's hypothesis and with some,^{19,22,23} although not all,^{26,27} prior literature. There may be synergistic benefits to ACO or integrated care modalities and HIE use.²⁸ Odds

TABLE 3. Provider Characteristics Predict Whether They Use HIE to Share Laboratory Results^a

Characteristic	(1) Model 1: odds ratio (95% CI)	P	(2) Model 2: odds ratio (95% CI)	P	(3) Model 3: odds ratio (95% CI)	P
ACO	3.310 (1.82-6.01)	<.001	2.301 (1.16-4.58)	.018	2.079 (1.04-4.17)	.039
Integrated model (CIN or IDN)	3.989 (2.27-7.01)	<.001	1.869 (0.93-3.75)	.048	1.981 (0.99-3.98)	.055
Traditional care delivery	Reference		Reference		Reference	
Solo private practice			0.162 (0.07-0.37)	<.001	0.151 (0.06-0.36)	<.001
Group private practice			0.408 (0.18-0.93)	.034	0.441 (0.19-1.04)	.062
Hospital based			1.123 (0.46-2.72)	.798	1.114 (0.45-2.74)	.815
Community clinic			Reference		Reference	
Primary care specialty					1.551 (0.93-2.58)	.091
Pediatric specialties					8.732 (2.16-35.33)	.002
Medical-surgical specialties					Reference	
Female	0.966 (0.62-1.50)	.877	0.882 (0.55-1.42)	.602	0.749 (0.45-1.25)	.270
Male	Reference		Reference		Reference	
MD degree	0.641 (0.42-0.98)	.040	0.702 (0.43-1.13)	.149	0.673 (0.41-1.10)	.116
DO degree	Reference		Reference		Reference	
Accepts Medicaid	0.684 (0.38-1.23)	.207	0.727 (0.37-1.41)	.347	0.749 (0.38-1.48)	.408
Does not accept Medicaid	Reference		Reference		Reference	
Aged 25-34 years	6.821 (1.49-31.12)	.013	5.615 (0.99-31.78)	.051	4.515 (0.87-23.48)	.073
Aged 35-44 years	3.423 (1.86-6.29)	<.001	3.279 (1.69-6.37)	<.001	3.439 (1.73-6.85)	<.001
Aged 45-54 years	3.947 (2.16-7.21)	<.001	4.005 (2.06-7.80)	<.001	4.006 (2.01-8.00)	<.001
Aged 55-64 years	2.255 (1.34-3.79)	.002	2.841 (1.56-5.16)	.001	2.717 (1.48-5.00)	.001
Aged ≥ 65 years	Reference		Reference		Reference	
Maricopa County	0.980 (0.55-1.74)	.944	1.033 (0.54-1.97)	.920	0.966 (0.51-1.84)	.916
Pima County	0.639 (0.33-1.25)	.191	0.596 (0.28-1.28)	.185	0.606 (0.28-1.33)	.211
Other county	Reference		Reference		Reference	
Observations	3312		3027		3013	

ACO, accountable care organization; CIN, clinically integrated network; HIE, health information exchange; IDN, integrated delivery network.

^aEach column displays the exponentiated coefficients (95% CIs in parentheses) from a logistic regression of provider characteristics (indicated by row labels) predicting whether a provider reports using Arizona's HIE to share laboratory results with other providers; models were estimated using heteroscedasticity-robust SEs.

TABLE 4. Association Between Provider Characteristics and Using HIE to Share Patient Care Summaries by Provider Practice Type*

Characteristic	(1) Solo practice		(2) Group practice		(3) Hospital-based practice		(4) Community clinic	
	Odds ratio	P	Odds ratio	P	Odds ratio	P	Odds ratio	P
ACO	2.311	.035	1.996	.008	1.594	.046	2.627	.057
Integrated model (CIN or IDN)	2.726	.371	4.760	.001	2.082	.002	1.349	.340
Traditional care delivery	Reference							
Primary care specialty	1.759	.020	0.987	.950	0.890	.575	0.695	.235
Pediatric specialties	1.129	.813	0.703	.305	0.715	.259	0.562	.252
Medical-surgical specialties	Reference							
Female	0.664	.135	0.868	.500	0.747	.164	0.673	.171
Male	Reference							
MD degree	0.827	.354	0.728	.068	0.594	.009	1.338	.264
DO degree	Reference							
Accepts Medicaid	1.077	.872	1.359	.294	1.003	.990	0.908	.774
Does not accept Medicaid	Reference							
Aged 25-34 years	6.541	.158	3.242	.041	1.162	.750	0.589	.425
Aged 35-44 years	3.239	.010	1.505	.195	1.495	.225	1.105	.825
Aged 45-54 years	2.239	.008	1.558	.129	1.477	.242	0.868	.762
Aged 55-64 years	1.935	.024	1.074	.802	0.897	.721	0.766	.534
Aged ≥ 65 years	Reference							
Maricopa County	1.165	.599	0.615	.128	1.025	.928	0.793	.456
Pima County	1.999	.073	0.583	.170	0.580	.081	0.860	.692
Other county	Reference							
Observations	242		452		673		241	

ACO, accountable care organization; CIN, clinically integrated network; HIE, health information exchange; IDN, integrated delivery network.

*Each column displays the exponentiated coefficients (and *P* value) from a logistic regression of provider characteristics (indicated by row labels) predicting whether a provider reports using Arizona's HIE to share patient care summaries with other providers, estimated within a specific provider group (indicated by column labels); models were estimated using heteroscedasticity-robust SEs.

of HIE use for patient summaries or laboratory results increased by roughly 50% to 100% for providers in ACOs or integrated care models (Tables 2 and 3), a substantively large relationship. Yet the relationship was not absolute, meaning that although many ACO and integrated care model providers used HIE, some did not. Purposive exploration of the workflow and technological capacities in these settings may benefit from further study.

Additionally, we observed important nuances in relationships between emerging practice models and HIE use according to provider practice type. Specifically, the positive relationships between emerging practice model participation and use of HIE was primarily driven by providers in group and hospital-based practices. Community clinics did not see significant associations between an emerging practice model and HIE use, whereas solo practitioners saw heterogeneous associations between specific practice types (ACO vs integrated care model) and HIE use. It has been previously shown that providers in small practices and in underserved settings face substantial barriers to HIE adoption.⁷ However, previous evidence on this topic did not differentiate the traditional fee-for-service care model from these emerging physician practice models. Recent evidence suggests that technical and other barriers to small-practice participation in data exchange persist.²⁹

Our study provides new evidence that HIE barriers specific to small practices and community clinics may manifest even in emerging practice models such as ACOs and integrated care models.

Among the physicians who were not using HIE to exchange information, barriers tended to vary by a provider's practice type. Providers in ACOs were more likely to report a number of barriers, including a lack of connectivity and information from other providers. These findings help to explain why one prior study found that emerging practice model participation was associated with a lower overall likelihood of HIE participation.²⁶ Our results show that emerging practice participation is associated with a higher use of HIE among physicians in Arizona, but some of the physicians who adopted an emerging practice model are confronting barriers to using Arizona's HIE. This suggests that some physicians and/or health practices may benefit from assistance with establishing connections to other providers when adopting an emerging practice model. Improvements to HIE connectivity may also need to be targeted.

Limitations

Our study's findings should be viewed in light of several limitations. First, our data are cross-sectional, and we do not have data on the timing of HIE adoption or physician practice; endogeneity may be

TABLE 5. Reported Barriers to Sharing Electronic Patient Records*

Characteristic	(1) No HIE available	(2) Confidentiality concerns	(3) No tech support	(4) Lack of connectivity	(5) Lack of information from other providers
Mean of outcome	23.45%	28.55%	36.53%	59.25%	45.81%
ACO	0.783 [0.567-1.082]	0.960 [0.711-1.296]	1.050 [0.800-1.377]	1.426** [1.101-1.846]	1.649*** [1.279-2.127]
Integrated model (CIN/IDN)	1.314 [0.936-1.844]	0.929 [0.657-1.315]	1.028 [0.761-1.390]	1.101 [0.828-1.465]	1.531** [1.154-2.030]
Traditional care delivery	Reference				
Solo private practice	1.468 [0.943-2.284]	1.962** [1.254-3.068]	0.875 [0.590-1.299]	0.862 [0.594-1.250]	1.259 [0.867-1.828]
Group private practice	1.089 [0.734-1.615]	1.883** [1.248-2.840]	1.017 [0.720-1.437]	1.066 [0.767-1.482]	1.367 [0.984-1.900]
Hospital based	0.999 [0.699-1.428]	1.394 [0.945-2.057]	0.968 [0.709-1.321]	0.954 [0.706-1.291]	1.231 [0.911-1.663]
Community clinic	Reference				
Primary care specialty	1.135 [0.882-1.461]	0.819 [0.638-1.051]	0.986 [0.789-1.232]	1.145 [0.925-1.416]	1.144 [0.926-1.413]
Pediatric specialties	0.852 [0.555-1.309]	0.774 [0.511-1.174]	1.009 [0.698-1.458]	1.058 [0.743-1.507]	0.964 [0.684-1.359]
Medical-surgical specialties	Reference				
Female	1.081 [0.833-1.404]	0.991 [0.764-1.286]	0.985 [0.783-1.239]	1.256* [1.006-1.567]	1.277* [1.027-1.589]
Male	Reference				
MD degree	1.119 [0.899-1.393]	1.018 [0.824-1.257]	1.263* [1.043-1.531]	1.306** [1.092-1.562]	1.087 [0.908-1.301]
DO degree	Reference				
Accepts Medicaid	1.075 [0.758-1.524]	1.545* [1.066-2.238]	1.261 [0.923-1.724]	1.234 [0.925-1.645]	1.178 [0.885-1.568]
Does not accept Medicaid	Reference				
Aged 25-34 years	1.041 [0.551-1.967]	0.766 [0.388-1.512]	1.023 [0.581-1.799]	1.133 [0.681-1.885]	0.665 [0.396-1.115]
Aged 35-44 years	1.526* [1.013-2.297]	0.968 [0.653-1.436]	1.101 [0.772-1.570]	1.540* [1.105-2.145]	0.929 [0.667-1.294]
Aged 45-54 years	1.177 [0.806-1.717]	1.071 [0.754-1.521]	1.261 [0.910-1.748]	1.730*** [1.274-2.348]	1.093 [0.805-1.482]
Aged 55-64 years	1.097 [0.753-1.598]	0.980 [0.693-1.387]	0.985 [0.713-1.362]	1.423* [1.055-1.919]	1.183 [0.877-1.596]
Aged ≥ 65 years	Reference				
Maricopa County	0.586*** [0.434-0.792]	0.931 [0.684-1.267]	0.624*** [0.477-0.816]	0.649** [0.500-0.842]	0.936 [0.722-1.212]
Pima County	0.826 [0.571-1.196]	1.058 [0.721-1.553]	0.914 [0.658-1.269]	0.839 [0.606-1.162]	1.104 [0.801-1.521]
Other county	Reference				
Observations	2379	2379	2379	2379	2379

ACO, accountable care organization; CIN, clinically integrated network; HIE, health information exchange; IDN, integrated delivery network.

* $P < .05$; ** $P < .01$; *** $P < .001$.

*Each column displays the exponentiated coefficients (95% CIs in parentheses) from a logistic regression of provider characteristics (indicated by row labels) predicting whether a provider reports experiencing the barrier to sharing electronic patient records indicated by the column labels; models were estimated using heteroscedasticity-robust SEs.

present and findings should be viewed as associative only. Second, our measure of HIE use is self-reported and does not measure intensity of use; further study of frequency of use or validation of actual usage patterns may shed additional light on the relationships observed, including the seemingly counterintuitive finding that ACO participants reported both relatively high levels of exchange and relatively high prevalence of barriers to exchange. Third, our data come from a statewide survey of all licensed physicians and are subject to potential response bias; however, we applied sample weights based on the population of physicians' gender, age, degree (MD/DO), and Medicaid acceptance. The survey is deployed as part of the biannual license renewal process and encompasses a number of topic areas, and we are not aware of any specific reasons why certain practice models or HIE participants would be more or less likely to respond. Fourth, because our survey did not identify the physician's individual practice, ACO, or CIN/IDN itself, we are not

able to incorporate statistical adjustment for potential clustering of SEs at the practice or organization levels. This may potentially result in SEs that are narrower than they would otherwise be and, if that were the case, could lead to potential for type 1 error. Fifth, our findings are associative, and causality cannot necessarily be inferred; there are a number of factors—one of which is financial—that may promote or inhibit use of HIE in certain practice models.¹⁹

CONCLUSIONS

Our study leveraged a large and comprehensive sample of physicians to assess the association between emerging physician practice models and the use of HIE. We found a strong positive relationship indicating that providers in emerging practice models are more likely to use HIE for patient care summaries and laboratory results. Important nuances exist in this relationship, however.

Not all emerging practice model physicians are using HIE, and the association is relatively weaker—or nonexistent—in settings that have previously been found to face unique HIE barriers. The types of barriers to HIE use cited by physicians varied by practice model and type, potentially providing guidance for future initiatives aimed at increasing use of HIE across different physician practices. Achieving the full theoretical benefits of emerging practice models may necessitate widespread use of HIE. Likewise, the use of HIE may enable successful pursuit of health care delivery modalities such as ACOs and integrated care models. Our study's physician-level evidence provides information on the complex relationships occurring at this important practice model–HIE nexus. ■

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eAppendix

Additional Details About Survey & Underlying Data

This survey is sponsored in part by the Arizona Health Care Cost Containment System (AHCCCS), Arizona's state Medicaid program and surveys all Arizona physicians at the time of their medical license renewal on a biannual basis. The survey's sample frame is all licensed Arizona physicians, making it a de facto census of licensed MDs and DOs who are licensed in Arizona. Survey responses are voluntary and are completed online following completion of the license renewal application. The survey has been deployed in various iterations since 2007, with topics and questions varying over time. The current version of the survey has been in use since 2017 and includes questionnaire items related to use of various health information technologies, and use of and barriers to electronic exchange of clinical data, among other topics. Responses are obtained at the individual physician level. To reduce respondent burden, survey responses are linked with an administrative dataset obtained from Arizona medical boards for fields such as age, gender, and specialty. This administrative dataset contains data on all licensed Arizona physicians, including both respondents and non-respondents.

Across 2019-2021, a total of $N=18,485$ physicians practicing in Arizona renewed their licenses and received an invitation to complete this survey. A total of $n=3,312$ complete responses were received, for an overall response rate of 18%. This represents roughly 18% of all physicians practicing in the state of Arizona, as the survey does not use a fractional sampling frame or multi-stage sampling design. As shown in Appendix Table A1, respondents and non-respondents differed on some but not all observable dimensions. For example, respondents were more likely to have a DO versus MD degree, be ages 25-34, practice in a rural area, practice at a community clinic, and specialize in primary care or medical-surgery specialties. Among respondents, individuals with incomplete data—who were thus unable to be included in multivariable analyses—were less likely to practice in an ACO or other integrated care delivery setting but were no more or less likely to utilize HIE in their practices. All analyses were performed using survey weights to account for non-response. Survey weights accounted for provider's age, gender, license-type, and Medicaid acceptance status.

eAppendix Table 1. Comparison between analytic sample and incomplete survey entries

Dichotomous characteristic:	Analytic Sample		Incomplete Entries		Difference	
	Count	Percent	Count	Percent	Percentage	P Value
Female	3312	34.12	15173	32.22	1.96	0.035
MD license	3312	85.64	15173	92.08	-6.44	<0.001
AHCCCS provider	3312	75.75	15173	75.42	0.33	0.025
Age 25 - 34	3312	6.79	15173	6.51	0.28	0.001
Age 35 - 44	3312	24.88	15173	24.54	0.34	0.024
Age 45 - 54	3312	26.45	15173	26.31	0.14	0.342
Age 55 - 64	3312	22.39	15173	22.31	0.08	0.568
Age 65+	3312	19.49	15173	20.33	-0.84	<0.001
Maricopa county	3312	63.01	15173	66.6	-3.59	0.085
Pima county	3312	18.29	15173	19.18	-0.89	<0.001
Other (rural) county	3312	18.71	15173	14.23	4.48	<0.001
ACO	3312	27.09	2414	9.65	17.44	<0.001
Integrated setting	3312	23.6	2414	8.74	14.86	<0.001
Traditional care delivery	3312	49.31	2414	81.61	-32.3	<0.001
Solo private practice	3312	15.01	1129	13.2	1.81	0.057
Group private practice	3312	24.97	1129	29.5	-4.52	0.325
Hospital-based	3312	44.17	1129	45.26	-1.09	0.042
Community clinic	3312	15.85	1129	12.05	3.81	0.026
Primary care specialty	3312	41.87	14823	33.06	8.81	<0.001
Pediatric specialties	3312	10	14823	8.78	1.22	0.934
Medical-Surgical Specialties	3312	48.13	14823	58.15	-10.02	<0.001
HIE Used for Patient Summaries	3312	74.88	121	77.94	-3.06	0.757
HIE Used for Labs	3312	82.03	68	79.34	2.69	0.217

Note: The number of incomplete entries reflects the number of responses that contained the indicated variable that were not included in the analytic sample because of item nonresponse on one or more other items included in the analyses. Certain variables, such as gender, age, and license type were extracted from other sources, and thus were available for all physicians in the state.

eAppendix Table 2. Results from model regressing HIE Use for Patient Summaries on Provider Characteristics using alternative 4-category classification for primary predictor variable

(Analogous to regression results shown in Table 2 in main manuscript, which uses a 3-category classification for primary predictor variable that includes “ACO only” and “ACO and Integrated” in a single “ACO” category)

	(1) <u>Model 1:</u> Odds Ratio [95% CI]		(2) <u>Model 2:</u> Odds Ratio [95% CI]		(3) <u>Model 3:</u> Odds Ratio [95% CI]	
		<i>P</i> <i>value</i>		<i>P</i> <i>value</i>		<i>P</i> <i>value</i>
ACO and Integrated	8.703 [3.95,19.16]	0.000	5.813 [2.61,12.97]	0.000	5.844 [2.62,13.06]	0.000
ACO only	2.185 [1.69,2.83]	0.000	1.677 [1.27,2.22]	0.000	1.673 [1.26,2.22]	0.000
Integrated only	3.317 [2.53,4.36]	0.000	2.218 [1.62,3.03]	0.000	2.197 [1.61,3.01]	0.000
Traditional care delivery	<i>reference</i>					
Solo private practice			0.431 [0.30,0.62]	0.000	0.424 [0.29,0.61]	0.000
Group private practice			0.692 [0.49,0.97]	0.035	0.691 [0.49,0.97]	0.035
Hospital-based			1.226 [0.87,1.72]	0.240	1.247 [0.89,1.76]	0.205
Community clinic			1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Primary care specialty					1.025 [0.82,1.28]	0.828
Pediatric specialties					0.775 [0.54,1.11]	0.169
Medical-Surgical Specialties					1.000 [1.00,1.00]	.
Female	0.762 [0.62,0.94]	0.012	0.743 [0.59,0.93]	0.010	0.759 [0.60,0.96]	0.020
Male	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
MD license	0.818 [0.68,0.98]	0.029	0.772 [0.64,0.94]	0.009	0.772 [0.64,0.94]	0.010
DO license	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.

Accepts Medicaid	0.940 [0.71,1.24]	0.660	1.046 [0.77,1.41]	0.768	1.038 [0.77,1.40]	0.808
Does not accept Medicaid	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Age 25 - 34	1.522 [0.88,2.63]	0.133	1.401 [0.78,2.51]	0.259	1.399 [0.78,2.52]	0.264
Age 35 - 44	1.947 [1.42,2.66]	0.000	1.672 [1.20,2.33]	0.003	1.655 [1.18,2.31]	0.003
Age 45 - 54	1.600 [1.20,2.13]	0.001	1.565 [1.15,2.14]	0.005	1.571 [1.15,2.15]	0.005
Age 55 - 64	1.222 [0.93,1.61]	0.157	1.145 [0.85,1.54]	0.367	1.138 [0.85,1.53]	0.389
Age 65+	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Maricopa county	0.886 [0.68,1.15]	0.360	0.876 [0.66,1.16]	0.353	0.889 [0.67,1.18]	0.412
Pima county	0.820 [0.59,1.14]	0.233	0.786 [0.56,1.11]	0.173	0.793 [0.56,1.12]	0.191
Other county	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Observations	3312		3027		3013	

NOTE: Exponentiated coefficients

eAppendix Table 3. Results from model regressing HIE Use for Labs on Provider Characteristics using alternative 4-category classification for primary predictor variable

(Analogous to regression results shown in Table 3 in main manuscript, which uses a 3-category classification for primary predictor variable that includes “ACO only” and “ACO and Integrated” in a single “ACO” category)

	(1) <u>Model 1:</u> Odds Ratio [95% CI]		(2) <u>Model 2:</u> Odds Ratio [95% CI]		(3) <u>Model 3:</u> Odds Ratio [95% CI]	
		<i>P</i> <i>value</i>		<i>P</i> <i>value</i>		<i>P</i> <i>value</i>
ACO and Integrated	<i>(Dropped)</i>		<i>(Dropped)</i>		<i>(Dropped)</i>	
ACO only	2.553 [1.40,4.67]	0.002	1.760 [0.88,3.52]	0.111	1.538 [0.75,3.13]	0.236
Integrated only	3.986 [2.27,7.01]	0.000	1.872 [0.93,3.77]	0.079	1.988 [0.99,4.00]	0.054
Traditional care delivery	<i>reference</i>					
Solo private practice			0.157 [0.07,0.37]	0.000	0.146 [0.06,0.35]	0.000
Group private practice			0.391 [0.17,0.90]	0.028	0.428 [0.18,1.02]	0.056
Hospital-based			1.083 [0.44,2.65]	0.861	1.072 [0.43,2.67]	0.882
Community clinic			1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Primary care specialty					1.600 [0.96,2.68]	0.074
Pediatric specialties					8.993 [2.22,36.43]	0.002
Medical-Surgical Specialties					1.000 [1.00,1.00]	.
Female	0.982 [0.63,1.53]	0.936	0.901 [0.56,1.45]	0.667	0.764 [0.46,1.28]	0.310
Male	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
MD license	0.644 [0.42,0.99]	0.045	0.711 [0.44,1.16]	0.170	0.681 [0.41,1.12]	0.132
DO license	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.

Accepts Medicaid	0.681 [0.38,1.23]	0.203	0.729 [0.37,1.42]	0.351	0.756 [0.38,1.50]	0.424
Does not accept Medicaid	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Age 25 - 34	6.683 [1.46,30.69]	0.015	5.593 [0.98,32.06]	0.053	4.429 [0.83,23.61]	0.081
Age 35 - 44	3.508 [1.89,6.50]	0.000	3.341 [1.70,6.58]	0.000	3.509 [1.74,7.10]	0.000
Age 45 - 54	4.085 [2.22,7.52]	0.000	4.156 [2.12,8.15]	0.000	4.191 [2.08,8.46]	0.000
Age 55 - 64	2.354 [1.40,3.97]	0.001	2.961 [1.62,5.40]	0.000	2.846 [1.54,5.25]	0.001
Age 65+	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Maricopa county	1.052 [0.59,1.88]	0.865	1.120 [0.58,2.16]	0.735	1.064 [0.55,2.06]	0.853
Pima county	0.692 [0.35,1.37]	0.289	0.640 [0.29,1.39]	0.261	0.670 [0.30,1.49]	0.325
Other county	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.	1.000 [1.00,1.00]	.
Observations	926		830		827	

NOTE: Exponentiated coefficients. “ACO and Integrated” variable dropped from all models due to lack of variation in the outcome variable for these two models (i.e., all ACO and Integrated physicians reported using HIE to labs)

eAppendix Table 4. Results from model regressing HIE Use for Patient Summaries on Provider Characteristics by provider practice types using alternative 4-category classification for primary predictor variable

(Analogous to regression results shown in Table 4 in main manuscript, which uses a 3-category classification for primary predictor variable that includes “ACO only” and “ACO and Integrated” in a single “ACO” category)

	(1)		(2)		(3)		(4)	
	<u>Solo Practice</u>		<u>Group Practice</u>		<u>Hospital-based Practice</u>		<u>Community Clinic</u>	
	Odds Ratio	<i>P Value</i>	Odds Ratio	<i>P Value</i>	Odds Ratio	<i>P Value</i>	Odds Ratio	<i>P Value</i>
ACO and Integrated	<i>dropped</i>		5.077	0.041	3.663	0.010	<i>dropped</i>	
ACO only	2.032	0.083	1.798	0.031	1.357	0.206	1.965	0.064
Integrated only	2.752	0.364	4.764	0.001	2.088	0.002	1.350	0.341
Traditional care delivery	<i>reference</i>							
Primary care specialty	1.749	0.021	0.999	0.995	0.919	0.684	0.717	0.283
Pediatric specialties	1.132	0.809	0.694	0.290	0.723	0.281	0.554	0.250
Medical-Surgical Specialties	<i>reference</i>							
Female	0.665	0.137	0.871	0.512	0.767	0.208	0.700	0.227
Male	<i>reference</i>							
MD license	0.819	0.331	0.731	0.073	0.587	0.007	1.283	0.345
DO license	<i>reference</i>							
AHCCCS provider	1.057	0.904	1.374	0.278	0.994	0.982	0.919	0.806
Not AHCCCS provider	<i>reference</i>							
Age 25 - 34	6.375	0.165	3.271	0.040	1.158	0.758	0.536	0.366
Age 35 - 44	3.091	0.014	1.524	0.182	1.520	0.207	1.076	0.872
Age 45 - 54	2.205	0.009	1.547	0.135	1.457	0.261	0.886	0.796
Age 55 - 64	1.927	0.024	1.074	0.803	0.877	0.667	0.759	0.522
Age 65+	<i>reference</i>							
Maricopa county	1.189	0.552	0.602	0.112	1.071	0.803	0.818	0.519
Pima county	2.005	0.074	0.584	0.169	0.614	0.121	0.921	0.831
Other county	<i>reference</i>							
Observations	463		844		1258		418	

NOTES: Exponentiated coefficients shown. “ACO and Integrated” variable dropped from Solo (1) and Community (4) models due to lack of variation in the outcome variable for these two models (i.e., all ACO and Integrated physicians reported using HIE to exchange patient summaries)

eAppendix Table 5. Reported barriers to sharing electronic patient records using alternative 4-category classification for primary predictor variable

(Analogous to results shown in Table 5 in main manuscript, which uses a 3-category classification for primary predictor variable that includes “ACO only” and “ACO and Integrated” in a single “ACO” category)

	(1) No HIE Available	(2) Confidentiality Concerns	(3) No Tech Support	(4) Lack of Connectivity	(5) Lack Info from Other Providers
Mean of outcome	23.45%	28.55%	36.53%	59.25%	45.81%
ACO and Integrated	1.620 [0.267,9.839]	3.081 [0.597,15.89]	3.393 [0.705,16.33]	0.428 [0.100,1.835]	5.377 [0.906,31.91]
ACO only	0.864 [0.475,1.570]	0.851 [0.476,1.520]	1.527 [0.896,2.602]	1.589 [0.917,2.754]	1.569 [0.951,2.591]
Integrated only	1.070 [0.560,2.043]	0.335** [0.159,0.704]	0.860 [0.465,1.591]	0.965 [0.531,1.753]	2.087* [1.161,3.753]
Traditional care delivery	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Solo private practice	1.468 [0.943,2.284]	1.962** [1.254,3.068]	0.875 [0.590,1.299]	0.862 [0.594,1.250]	1.259 [0.867,1.828]
Group private practice	1.089 [0.734,1.615]	1.883** [1.248,2.840]	1.017 [0.720,1.437]	1.066 [0.767,1.482]	1.367 [0.984,1.900]
Hospital-based	0.999 [0.699,1.428]	1.394 [0.945,2.057]	0.968 [0.709,1.321]	0.954 [0.706,1.291]	1.231 [0.911,1.663]
Community clinic	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Primary care specialty	1.135 [0.882,1.461]	0.819 [0.638,1.051]	0.986 [0.789,1.232]	1.145 [0.925,1.416]	1.144 [0.926,1.413]
Pediatric specialties	0.852 [0.555,1.309]	0.774 [0.511,1.174]	1.009 [0.698,1.458]	1.058 [0.743,1.507]	0.964 [0.684,1.359]
Medical-Surgical Specialties	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>

Female	1.081 [0.833,1.404]	0.991 [0.764,1.286]	0.985 [0.783,1.239]	1.256* [1.006,1.567]	1.277* [1.027,1.589]
Male	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
MD license	1.119 [0.899,1.393]	1.018 [0.824,1.257]	1.263* [1.043,1.531]	1.306** [1.092,1.562]	1.087 [0.908,1.301]
DO license	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Accepts Medicaid	1.075 [0.758,1.524]	1.545* [1.066,2.238]	1.261 [0.923,1.724]	1.234 [0.925,1.645]	1.178 [0.885,1.568]
Does not accept Medicaid	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Age 25 - 34	1.041 [0.551,1.967]	0.766 [0.388,1.512]	1.023 [0.581,1.799]	1.133 [0.681,1.885]	0.665 [0.396,1.115]
Age 35 - 44	1.526* [1.013,2.297]	0.968 [0.653,1.436]	1.101 [0.772,1.570]	1.540* [1.105,2.145]	0.929 [0.667,1.294]
Age 45 - 54	1.177 [0.806,1.717]	1.071 [0.754,1.521]	1.261 [0.910,1.748]	1.730*** [1.274,2.348]	1.093 [0.805,1.482]
Age 55 - 64	1.097 [0.753,1.598]	0.980 [0.693,1.387]	0.985 [0.713,1.362]	1.423* [1.055,1.919]	1.183 [0.877,1.596]
Age 65+	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Maricopa county	0.586*** [0.434,0.792]	0.931 [0.684,1.267]	0.624*** [0.477,0.816]	0.649** [0.500,0.842]	0.936 [0.722,1.212]
Pima county	0.826 [0.571,1.196]	1.058 [0.721,1.553]	0.914 [0.658,1.269]	0.839 [0.606,1.162]	1.104 [0.801,1.521]
Other county	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Observations	2379	2379	2379	2379	2379

Note: Each column displays the exponentiated coefficients (95% confidence intervals in square brackets) from a logistic regression of provider characteristics (indicated by row labels) predicting whether a provider reports experiencing the barrier to sharing electronic patient records indicated by the column labels; models were estimated using heteroscedasticity-robust standard errors.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$