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Information Retrieval Pathways for Health Information Exchange in Multiple Care Settings

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Healthcare professionals used a complex combination of information retrieval pathways for health information exchange to obtain clinical information from external organizations.

ABSTRACTObjectives

To determine which health information exchange (HIE) technologies and information retrieval pathways healthcare professionals relied on to meet their information needs in the context of laboratory test results, radiological images and reports, and medication histories.

Study Design

Primary data was collected over a 2-month period across 3 emergency departments, 7 primary care practices, and 2 public health clinics in New York state.

Methods

Qualitative research methods were used to collect and analyze data from semi-structured interviews and participant observation.

Results

The study reveals that healthcare professionals used a complex combination of information retrieval pathways for HIE to obtain clinical information from external organizations. The choice for each approach was setting- and information-specific, but was also highly dynamic across users and their information needs.

Conclusions

Our findings about the complex nature of information sharing in healthcare provide insights for informatics professionals about

the usage of information; indicate the need for managerial support within each organization; and suggest approaches to improve systems for organizations and agencies working to expand HIE adoption.

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We sought to understand the dimensions of information retrieval pathways that healthcare professionals used to engage in health information exchange (HIE) within the context of laboratory test results, radiological images and reports, and medication histories

- Our findings imply that HIE models need to support both push and pull methods to meet the very diverse needs of health professionals.
- We suggest that the more the data from HIE exchange services are integrated and work flows are harmonized with the electronic health record, the better.
- Our findings indicate that both clinical and nonclinical staff would benefit from organizational support meant to reduce the complex data gathering situation for clinicians and improve productivity.

Improving access to patient information at the point of care figures prominently into many countries' goals¹ for health system reform and improvement. Clinicians require patient information from disparate sources to overcome patients' fragmented patterns of care and poor clinical communication during transitions of care. Difficulty in accessing health records, or finding patient information to be completely inaccessible during the delivery of care, creates inefficiencies,^{2,3} fosters duplication of ^{4,5}services fails to support optimal decision making,^{4,6} and threatens patient safety.^{3,7}

Health information exchange (HIE) addresses these shortcomings by providing clinicians who are not part of the same organizational entity with the capability to electronically retrieve and share health-related information across regional, community, or organizational boundaries.⁸⁻¹⁰ Studies have shown that HIE can lead to numerous benefits such as reduced utilization of healthcare services,¹¹ reduced diagnostic testing,¹² prescription safety,¹³ public health support, and cost savings.¹⁴⁻¹⁶ Healthcare organizations can engage in HIE using different technological architectures for point-to-point communication

(ie, the direct exchange of data between electronic health record [EHR] systems from different vendors) between providers, and under various interorganizational collaborations such as services provided through a single intermediary health information organization.^{16,17}

HIE models vary across the United States, but often involve physicians, hospitals, and other healthcare stakeholders in the community joining a local HIE effort run by a regional health information organization (RHIO)¹⁸ or another model for exchange. These include enterprise HIE efforts (ie, an HIE system privately owned, funded, and developed by a single enterprise or organization)¹⁹ and vendor-mediated exchange.^{20,21} In general, RHIOs have emerged as the leading model to facilitate the electronic exchange of information between healthcare organizations.²² A common feature for all HIE models is that information exchange is enabled through the electronic transmission of data represented by 2 exchange methods –“push” and “pull”.^{17,23} Push takes place when clinical data are electronically deposited into a recipient’s system after a sender initiates transfer. Pull is initiated when a user proactively uses a HIE system to retrieve aggregated patient health data stemming from multiple sources across a community.

Existing studies have evaluated the use of pull-based HIE systems,²⁴⁻²⁷ and 1 quantitative study examined RHIO-managed HIEs with both push and pull capabilities,¹⁷ however, little qualitative research exists that examines the experience of healthcare professionals using multiple HIE models and push/pull methods at their place of work.

With the myriad options organizations have for HIE, our goal was to understand the dimensions of the information retrieval pathways used by healthcare professionals to engage in HIE. We sought to assess how healthcare professionals met their information needs in the context of laboratory test results, radiological images and reports, and medication histories. Access to these types of data has the greatest potential for impact on patient health, and holds the greatest promise for cost savings,²⁸ improved diagnosing and monitoring of health and diseases,²⁹ detection of diseases at an early stage,³⁰ and reduced frequency of repeat diagnostic testing.³¹

METHODS

Study Design and Setting

We undertook a qualitative multicase study approach in New York state. The state provides a relevant setting to evaluate HIE; it has invested more than \$440 million in health information technology and HIE adoption over the last 7 years.³² We consulted with the New York eHealth Collaborative, a private-public nonprofit organization charged with facilitating statewide HIE by coordinating the creation of a network to connect healthcare providers, to identify 3 RHIOs serving distinctly diverse communities; this selection process would maximize variation and allow for comparison.⁵ The RHIOs that matched our criteria for selection agreed to participate in the study and cooperated in identifying care organizations for our study sites. The communities varied in terms of population size and consented patients, and in the number of users (clinicians and staff) with access to their local RHIO's HIE (Table 1). Each RHIO implemented a different commercial HIE platform; the exchange architectures also differed. Community A and Community C used a federated model, and Community B used a centralized model. In a federated model, an organization locally stores and retains control over the patient information, and it responds when another organization, also a member of the same RHIO HIE effort, requests information. In a centralized model, patient data is stored in a central repository maintained by the RHIO after being collected from the organizations participating in the local RHIO effort.

We provided a brief project overview and obtained verbal and written informed consent from each care organization's clinicians and staff who agreed to participate in this study. The consent form was provided by the Institutional Review Board of Weill Cornell Medical College, which approved this study.

Data Collection

Data was collected during 2-day site visits at each participating care organization. To increase the internal validity of our study, we used 2 sources for evidence: observation and interviews.³⁴ All data collection began in May 2013 and ended in June 2013. RHIO staff helped identify and secure the cooperation of key informants who had experience utilizing various HIE models. We used a snowball sampling procedure in which we first interviewed a key informant; they were then asked to identify and help recruit other potential informants who were familiar with HIE and could provide additional insight about their information retrieval experiences.³⁵ Because these other potential informants came from the key informants' social networks, we believed this would reflect the

perspectives of a diverse community of healthcare professionals.³⁶ We also observed participants and recorded the field notes of healthcare professionals engaging in HIE activities.³⁷ Data gathering at each site ended when the point of data saturation was reached—that is, when the interviews and observations did not produce any new information.³⁸ All interviews lasted an average of 30 minutes and were conducted using a semi-structured protocol. This allowed us to delve deeper into a topic concerning information retrieval approaches, to pose additional questions based on subject responses, and to thoroughly understand the answers that were given. All interviews were audio recorded and transcribed.

Data Analysis

From the interviews and observations, it was possible to obtain a narrative of HIE models and exchange methods used in each community. For this analysis, we undertook an iterative, open-coding approach to the interview and observational data.³⁹ To begin, we identified broad themes around the important concepts of information retrieval pathways for the types of information sought, based on our research objective. We completed the initial coding as close as possible to the date of data collection. During a second cycle of coding, we identified new concepts and relationships that were not adequately represented by the initial categories. This open coding was undertaken independently by authors PK and JRV, who were responsible for all phases of the coding. Collaboratively, PK and JRV reviewed and revised the coding schemes to consolidate redundant codes.

RESULTS We interviewed a total of 48 individuals across 3 emergency departments (EDs), 7 primary care practices (PCPs), and 2 local public health departments (LHDs) (Table 1). We observed healthcare practitioner activities for more than 40 hours across all 3 communities. The PCPs included a federally qualified health center, a community health center, solo practices, and large group practices. Each care organization was equipped with an EHR) and had access to their RHIO's HIE system. The LHDs provided clinical services but did not have an EHR. LHDs were included in this study because HIE can provide them with access to previously hard-to-obtain clinical and demographic data for the purposes of disease surveillance, disaster response, and healthcare service delivery. We obtained the perspective of 3 broad types of professionals: clinicians (physicians, nurses, physician assistants, scribes, pharmacists,

and medical assistants); case managers and public health disease investigation staff; and administrative staff (directors, information technology specialists, medical records personnel, quality managers, clerks, and front-desk staff). We used these larger groupings to protect confidentiality.

Information Retrieval Pathways

Based on the observations and interviews, we found that all 3 care settings (EDs, PCPs, and LHDs) relied on a combination of HIE models (RHIO-based and non—RHIO-related exchange services) and exchange methods (“push” and “pull”) to acquire clinical data from external organizations. These 2 dimensions of models and methods created 4 mutually exclusive categories of information retrieval pathways for HIE (Table 2). Based on these combinations of models and methods, we define these 4 categories as:

1. **RHIO-pull:** clinicians actively use a RHIO-managed Web-query portal to retrieve information from other healthcare organizations participating in the local RHIO effort. Authorized system users “pulled” patient information by logging into the portal and searching for such information. The query-based HIE systems were independent of the practices’ or hospitals’ EHRs and were available in all 3 communities.
2. **RHIO-push:** RHIOs facilitate the automatic delivery of Continuity of Care Documents (CCDs)—an electronic document exchange standard for clinical documents, or other defined sets of electronic message standards designed to facilitate the data exchange of a clinical document between EHRs from different vendors. This method also included instances of DIRECT project services, if they were provided by the RHIO. DIRECT is a federal project designed to facilitate the sharing of single-patient information between provider EHRs on a point-to-point basis.²³
3. **Alternate-pull:** clinicians manually retrieve clinical data from external organizations using a non—RHIO-related exchange service. Examples include providers with read-only privileges to the local hospital’s

information systems (ie, providers use a login and password to remotely access laboratory and radiology data from another organization).

4. **Alternate-push:** clinical data are automatically delivered to the healthcare organization using non-RHIO services. Examples include vendor-mediated exchanges in which laboratory reports from specialists are automatically delivered to a PCP's system. Instances of DIRECT protocol usage that were not RHIO-facilitated were included in this category. These information retrieval pathways are resources in addition to each organization's internal information systems, such as an EHR, picture archiving and communication system (PACS), or laboratory information system. Table 3 outlines, by care setting, the favored methodologies used by healthcare professionals to retrieve information.

Emergency Departments

For healthcare professionals working in EDs, their first choice for seeking information was using their own EHR and other hospital-based systems. Generally, interviewees thought going to their own systems was *"a lot easier"* and that their systems were fairly comprehensive and up to date. For example, radiology data was often retrieved through a hospital's PACS, were because *"[it] has everything that the patient has had done."* One Community C clinician noted, *"Our EHR is where I get my lab results on a daily basis."*

There were some exceptions. When healthcare professionals needed *"historical data,"* wanted to *"compare patient's labs prior,"* or if all other internal information gathering approaches had been exhausted, they would use RHIO-pull. In the ED, RHIO-pull was used to obtain additional radiology information. A clinician in Community B noted that the ability to retrieve images and reports was particularly useful when she knew the patient had sought care in other hospitals. Similarly, RHIO-pull was the only option to obtain prior laboratory data; it was commonly used for comparing historical laboratory values with current test values. In all communities, RHIO-pull was used to retrieve data for medication reconciliation or in response to patients exhibiting drug-seeking

behavior. For example, a Community Clinician reported he would pull data *“when I questioned a patient’s use of medications.”*

Primary Care Practices

Healthcare professionals at PCPs used a combination of information retrieval pathways for HIE. In general, clinicians preferred to have clinical data automatically transferred into their EHRs from external organizations, via RHIO-push, because it did not interfere with their natural work flow. In comparison, RHIO-pull was less preferred because it led to inconveniences and work flow disruptions due to the additional time and effort required to access and find data in the RHIO-managed *Web-query* portal. One clinician said, *“We get CCDs through [RHIO]. We can access [RHIO-managed Web-query portal], although we don’t do that very much just because it really disrupts the work flow.”* Some clinicians used both RHIO-push and RHIO-pull depending on the situation. One staff member said *“We’ll use the Web portal depending on what we get from the CCD. Sometimes it’s easier to go to the Web portal. Sometimes it’s easier to do the CCD...”*

Because RHIO-push used CCDs, it was the primary mechanism used to procure medication and laboratory information from external sources. However, RHIO-push still presented challenges. For example, interviewees said that when data are pushed into their systems, time is required for interpretation. They said, too, that the amount of information delivered to the practice was substantial and *“a little intimidating.”* Also, because of the format of the CCD and the amount of information each document contained, several interviewees used the RHIO-pull or Alternate-pull. One clinician noted, *“Say they had an x-ray done at [local hospital]. We can go directly to [their PACS] and get that a little quicker than you could [if you went] through the entire CCD.”* Providers also reported that technical challenges sometimes caused them to use RHIO-pull, because they *“cannot parse an x-ray or an x-ray report into the system.”* Lastly, regardless of method of delivery, data still had to be checked for accuracy: *“[If] a patient says they have an allergy, but the CCD says they don’t, you’re going to listen to the patient.”*

PCPs had access to many sources of information outside the efforts of the RHIO-based services and used alternate-pull and alternate-push to engage in HIE. Community A had access to a local hospital’s EHR, a laboratory company’s information systems, a hospital’s PACS, vendor-mediated delivery of clinical documents, and access to Surescripts

as part of their EHR. Practices in Community B also had access to vendor-mediated document delivery and to a local hospital's laboratory information system and PACS. Laboratory reports from specialists were an example of vendor-mediated exchange: one clinician said, *"When our patients go to see the specialists, we get cc'd labs that are done."*

Remote log-ins, the process by which clinicians are provided with remote access privileges to another organization's system by using a user name and password, were prevalent for laboratory and radiology data. One clinician said, *"I generally go to the source,"* and another added, *"If we needed to see the images that the different hospital systems have, a PAC system is set up so that's where we ended up signing in."* Remote logins did frustrate some clinicians who said, *"[External organizations] kind of lock everything down where you need 18 steps to get to where you need to go."* In general, when Alternate-pull proved difficult, PCPs would resort to pulling the data from the RHIO-managed Web-based query system. A clinician said, *"If I've done blood work on somebody, and they're supposed to send it...sometimes it doesn't always get sent...So I can go on [RHIO-managed Web-based query system] and look up the results."*

Public Health

Healthcare professionals in public health settings relied on the RHIO-pull and Alternate-pull methods for information retrieval. Clinicians regularly used RHIO-pull to retrieve information not available in their own internal systems. For example, a tuberculosis nurse emphasized: *"The first thing I usually do is go into the RHIO and get some background on each of the cases that I've gotten a report on. I'm looking at chest x-ray results, CAT [computed tomography] scan results, biopsy results, recent clinic notes from a physician [explaining] why they got the test."* Additionally, accessing the RHIO-pull supported efficient work. A case manager said, *"It allows us to access radiology reports instead of waiting for the provider..."* and another added, *"I do obtain those lab reports regularly, and [it] is a huge help to be able to get them as soon as they're available."*

Alternate-pull methods were predominantly in the form of remote logins to other organizations. This included access to the local hospital and a local radiology group. One nurse said, *"Most of the time we can access their imaging online,"* and another said, *"I will see which lab it came from and I will ordinarily go to the [local hospital EHR]."* For imaging, clinicians relied on the Alternate-pull for

getting information. One nurse stated, *“We’re pretty good about getting the reports and the x-rays sent over from the hospitals. I think the reports are faxed and then the courier brings over the chest x-rays,”* and another added, *“We have to call and ask them to get us a disk over here or we pick up the disk.”*

DISCUSSION

Healthcare professionals used a complex combination of information retrieval pathways for HIE to obtain clinical information from external organizations. The choice for each approach was setting- and information-specific, but was also highly dynamic across users and their information needs.

Across each clinical site, several general features of information retrieval approach were consistent. First, the organization’s own internal information system (ie, its EHR) was the primary source of information. Second, when the EHR was the focal technology, that resulted in more reliance on “push” methods for the automatic delivery of information, whether it was through RHIO-push or Alternate-push. Data being pushed were not without technical challenges (ie, too much data), but the information was still accessible and stored within the EHR. Third, pull methods were used when the primary information retrieval method failed to meet clinicians’ information needs. Of the 4 information retrieval pathways for HIE, RHIO-pull required the most change to workflows.

These findings imply that HIE models need to support both push and pull methods to meet the very diverse needs of health professionals.^{17,23} Although levels of usage of each HIE model varied, each type of exchange served a purpose to meet the user’s information needs. This has further relevance for those measuring and evaluating exchange activities. The multiple mechanisms and reasons for exchange suggest somewhat of a substitution effect among systems (eg, Alternate-pull used instead of RHIO-pull). As a result, measuring individual system usage may be inadequate or misleading about the level of HIE adoption. Composite measures of all exchange activity may be more informative.

As multiple HIE models appear to be the reality for the foreseeable future, attempts to centralize data will continue to be a challenge. To make data management easier for providers and organizations, those working to foster the exchange (eg, RHIOs, vendors, and government agencies) can support numerous technological innovations. Given that the EHR is the primary source of information, we

suggest that the more the data from the exchange systems are integrated and work flows are harmonized with the EHR, the better.

The choice of primary and secondary information sources among different sites suggests implementation priorities for those fostering exchange. Based on this study, push methods would address many of the work flow and information needs of primary care settings, particularly when considering patient information like medication and laboratory results that have discrete data elements capable of being parsed. The nature of care in the ED suggests using RHIO-pull may be the best match. Public health agencies have less advanced internal information systems, but they possess a voracious appetite for information and their work flows are based on prolonged data collection and investigation.⁴⁰ HIE systems using RHIO-pull fit the public health work flow, but only if they contain a broad amount of information sources. Remote portal access to local hospitals will support public health work, but will not necessarily help efficiency if users have to repeatedly search multiple systems institution by institution.

In addition, of interest to the leadership of health organizations, these findings indicate that both clinical and nonclinical staff would benefit from organizational support. First, the sheer number of available information sources does not, in and of itself, create increases in productivity.⁴¹ Multiple systems with different log-ins, use cases, and designs can place strains on the organization and on individuals.⁴²

As more demands are being placed on the workforce for technology skills and competencies,⁴³ managers need to ensure that staff members have sufficient computer skills to navigate multiple systems and avenues when challenges arise. One possibility to address the complex data-gathering situation for clinicians would be to introduce medical scribes. By assuming most of the data-gathering and documentation responsibilities, scribes tend to increase physician productivity.⁴⁴ Second, the multiple information retrieval pathways indicates that professionals have complex mental models of determining where the data are available and under what circumstances they expect to find it. With the increased availability of externally created information, healthcare organizations are going to need to develop formalized methods for retaining and using this knowledge. These strategies can include creating directories, developing formal

learning collaboratives, sharing best practices, holding discussion groups, or specific trainings.⁴⁵⁻⁴⁷

Study Limitations

The primary limitation of this study is that it is confined to experiences in New York state; the differences in infrastructure, policies, and maturity of HIE systems may limit the generalizability of our findings. Additionally, while our sample included both urban and rural settings and organizations of different types and sizes, we cannot speak to the experiences of specialty care providers or use of HIE systems for inpatient care.

CONCLUSION

The exchange of health information is a critical strategy to improve patient safety and the quality of care. Healthcare professionals make use of a variety of technologies and methods to support their information needs.

Understanding clinicians' information retrieval pathways for HIE can assist in improving the design and functionality of HIE systems and aid their integration into organizational work flows. These findings provide insights for informatics professionals about the usage of information, indicate the need for managerial support within each organization, and suggest approaches to improve systems for organizations and agencies working to expand HIE adoption.

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Authorship Information:

Concept and design (PK, RK, JRV); acquisition of data (PK, JRV); analysis and interpretation of data (PK, RK, JRV); drafting of the manuscript (PK, RK, JRV); critical revision of the manuscript for important intellectual content (PK, RK, JRV); statistical analysis (PK, JRV); obtaining funding (RK, JRV); administrative, technical, or logistic support (RK).

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Differences in Savings and Quality by Type of ACO Model

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2016-2018 Next Generation Accountable Care Organization (ACO) and Medicare Shared Savings Program cost and quality data show similar performance, suggesting that increasing financial risk to health systems may not affect performance.

ABSTRACT

Objectives: The evolution in the accountable care organization (ACO) payment model initiatives by CMS reflects an increased understanding of the benefits and hurdles of using such an advanced payment model. As the Medicare Access and CHIP Reauthorization Act requires Medicare providers to choose an incentive-based payment track, which can include participation in an ACO, understanding what is achievable in the different types of ACO models is important. The most recent version, the Next Generation ACO (NGACO) model, increases both the risk and financial reward that providing organizations can realize relative to other types of Medicare Shared Savings Program (MSSP) ACOs. This study aims to examine the differences in savings and quality scores across MSSP ACOs and NGACOs.

Study Design: Observational retrospective study of ACO-level data.

Methods: In this study, we used panel data to estimate fixed effects regressions comparing ACO savings and quality scores across the 2 ACO types (NGACO and MSSP) using publicly accessible aggregated ACO data. We studied 737 unique ACOs (680 MSSP ACOs and 74 NGACO in our sample, with 17 ACOs switching from one type of ACO to the other) from 2016 to 2018.

Results: On average, the NGACOs had more aligned beneficiaries, but no statistically significant differences emerged in average gross savings (\$1.90 million for NGACOs vs \$2.21 million for MSSP ACOs; $P = .78$) after adjusting for size and fixed effects. We also found mostly insignificant differences across 37 quality measures used to calculate the share of savings that ACOs receive.

Conclusions: NGACO and MSSP cost and quality data show similar performance, suggesting that increasing financial risk to health systems may not affect performance.

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The Affordable Care Act in 2010 established an innovation center within CMS and facilitated the testing of various payment reform models focused on improving patient care and population health without increasing costs and lowering them where possible.¹⁻³ As part of these efforts, CMS rolled out the Medicare Shared Savings Program (MSSP) in 2012, which allowed eligible providers to create accountable care organizations (ACOs) with the hope that increased coordinated care would result in savings that could be shared as long as quality standards were met.

As evidence emerged about how ACOs worked and their effectiveness compared with prior payment models in both cost and quality, CMS has tested and refined additional aspects of the ACO programs.⁴⁻⁶ The Pioneer ACO model included providers that largely already had the requisite infrastructure and care coordination practices in place, and they were able to show improvements in quality, but evidence on cost savings was mixed.^{7,8} CMS also initiated the broader MSSP in 2012, with less stringent risk-sharing requirements. To address concerns about the significant start-up costs for an ACO without that existing infrastructure, CMS designed a Medicare Advance Payment (AP) ACO model that provided an up-front fixed payment to participating ACOs and then a monthly payment thereafter based on the number of attributed beneficiaries. These advanced payments were to be recouped from shared savings in the first agreement period

only. The Medicare ACO Investment Model (AIM) then built on the AP ACO model by allowing more ACOs (entering MSSP in 2012-2016) to defray the capital investments necessary to form and maintain an ACO. Empirical evidence to date on these advanced alternative payment models (APMs) is mixed, with the AP model demonstrating little effect on quality and an overall increase in total spending per beneficiary per month (PBPM),⁹ whereas the AIM has shown savings of \$381.5 million, but the program includes only 14 (of 47) AIM ACOs still in the shared savings program.¹⁰ Nonetheless, since the initiation of the MSSP, ACO participation has grown to 517 ACOs with 11.2 million aligned beneficiaries nationwide in 2020.¹¹

The Next Generation ACO (NGACO) model, rolled out in 2016, offered higher levels of risk and reward than earlier ACO models, mechanisms that enabled a graduation from traditional fee-for-service reimbursements to population-based payments, and tools to support better patient engagement and care management. One important goal of the NGACO model, as stated by CMS, “is to test whether strong financial incentives for ACOs, coupled with tools to support better patient engagement and care management, can improve health outcomes and lower expenditures for Original Medicare fee-for-service beneficiaries.”¹² This model, which will run through 2021, has more than 45,000 providers and more than 1.2 million aligned beneficiaries.¹³ The evaluation results to date suggest divergent effects in the first 2 years, with nearly \$117 million in increased spending among the 2016 cohort of participating ACOs and more than \$86 million in reduced spending among the 2017 cohort.¹³ Further understanding the relationships between increased financial risk and performance in cost and quality between MSSP and NGACO programs may have important implications for health systems and individual health care providers in terms of deciding to accept varying levels of risk in these advanced APMs.

In this study, we examined NGACOs using publicly available ACO data from CMS that included NGACOs and MSSP ACOs from 2016 to 2018. We aimed to investigate the extent to which ACO performance on reported cost and quality measures varied for beneficiaries participating in NGACOs relative to those participating in the lower-risk MSSP ACO models.

METHODS

Data and Measures

We used publicly available data from 2016 to 2018 from CMS that aggregated all quality measures, net costs, and savings rates from all MSSP ACOs. We included NGACOs and all other MSSP ACOs with active agreements, hereafter denoted as an ACO type of “NGACO” and “MSSP,” respectively.

We focused on outcome measures that are reported consistently across the different ACO types, which included 37 quality measures categorized by CMS under patient/caregiver experience, care coordination/patient safety, preventive health, and at-risk population. We also examined a key cost measure: gross savings/losses, calculated as the total benchmark expenditures minus the total aligned beneficiary expenditures. Benchmark expenditures in the NGACO model are set each performance year prospectively, using expenditures, risk scores, and quality measures from a 1-year historic baseline that is regionally detrended with the intention to avoid penalizing successful performance.^{14,15} For the other MSSP ACOs, benchmarks can vary based on agreement start date and risk track (1- or 2-sided) but broadly weigh more heavily on an ACO’s recent expenditures without the regional detrending.¹⁶ For either type of ACO, if expenditures on all ACO-aligned beneficiaries exceed that benchmark, it will have losses. We included the number of aligned beneficiaries and the calendar year as covariates in regression models.

Statistical Analysis

We used panel data analyses, accounting for ACOs that we observed over multiple years. We calculated descriptive statistics and compared means using 2-sided t tests by ACO type (MSSP vs NGACO).

We also estimated linear regressions to adjust for the number of aligned beneficiaries in each ACO and the calendar year. Finally, we estimated fixed effects regressions to adjust for time-invariant ACO characteristics—for example, the state or health care market in which the ACO is operating or the ACO’s key partners (to the extent that these characteristics did not change). The regressions followed this form:

$$outcome_{it} = \beta_1 NGACO_{it} + \beta_2 Benes_{it} + \tau_t + \eta_i + \varepsilon_{it},$$

where *outcome* is one of the outcome measures for ACO i in year t , *NGACO* is an indicator for ACOs participating in the NGACO program, *Benes* is a continuous measure of the number of attributed beneficiaries, τ is a vector of year fixed effects, and η is a vector of ACO fixed effects. To adjust for multiple

comparisons, we applied a Bonferroni correction and considered differences statistically significant with a P value $< .002$. All analyses were performed using Stata version 16 (StataCorp).

RESULTS

In our sample, there were 737 unique ACOs over the 3-year period; 17 switched from one type of ACO to the other. Thus, there were 680 MSSP ACOs and 74 NGACOs in our sample (see **Table 1**). On average, NGACOs had about 9000 more aligned beneficiaries than MSSP ACOs ($P < .001$). The savings rate was between 1% and 2%, on average, and not statistically different across the 2 groups, even after adjusting for differences in the number of aligned beneficiaries and calendar year and in our fixed effects estimation. NGACOs appeared to have higher average gross savings, at about \$4.5 million, relative to MSSP ACOs at \$2.38 million ($P = .04$), but once we adjusted for the ACO size and calendar year and ACO fixed effects, this difference became smaller in magnitude and statistically insignificant (adjusting for ACO size/year: $P = .82$; adjusting for ACO size/year and ACO fixed effects: $P = .78$).

In **Table 2**, we present adjusted score components in the patient/caregiver experience domain based on the fixed effects regression results. Scores are not significantly different by ACO type, except that the Consumer Assessment of Healthcare Providers and Systems patients’ rating of providers is slightly higher among NGACOs relative to MSSP ACOs, but after adjusting for multiple comparisons, this does not meet our level of significance ($P = .02$).

Next, we examined adjusted score components in the care coordination and patient safety domain. In **Table 3**, we present the predicted means from the fixed effects regression results. Only the difference in ACO8, the risk-standardized measure for all-condition readmissions, approaches statistical significance ($P = .019$), with NGACOs having slightly higher readmission rates.

In **Table 4**, we present adjusted score components for preventive health and at-risk populations. Here we found marginally significant differences for some at-risk population measures. NGACOs had a lower percentage of beneficiaries with depression with remission at 12 months¹⁷ ($P = .016$) and lower use of aspirin or another antiplatelet among patients with ischemic vascular disease ($P = .007$).¹⁸

DISCUSSION

Our analyses suggest no significant difference in gross savings/losses between MSSP ACOs and NGACOs after adjusting for the number of aligned beneficiaries and ACO fixed effects. Also, no consistent differences emerged between the 2 payment models in most quality measure domains.

Our findings have significant potential implications for both health care systems and health care providers participating in single-sided vs double-sided risk advanced APMs. The lack of difference in gross savings/losses and quality measure domains between MSSP ACOs and NGACOs may influence the decision of an ACO's leadership to participate in either of these programs. Our analysis suggests that, on average, gross savings/losses between MSSP and NGACO models were not significantly different and that other differences between programs (such as risk to an ACO) may be more important factors in determining program participation. In contrast, it is unclear if individual providers may be influenced to join or remain in a payment model with an increased risk like an NGACO, as individual providers' exposure to such risk/rewards are likely influenced by other factors not evaluated in this study (eg, employed vs affiliated provider contracts, gainsharing).

Our work differs from most of the CMS-sponsored evaluation studies of ACOs because we are not using individual beneficiary-level data, but our findings are consistent with several of the studies examining earlier CMS ACO models.^{9,12} A final evaluation of the NGACO model is still under way, but our findings suggest very few differences in the key outcomes that will be used for generating savings payments between the NGACO and MSSP models. However, we note that selection is still a significant concern, as the providers and organizations that have chosen to participate in an MSSP ACO or NGACO are likely very different from those who did not but who may be considering forming one in response to the Medicare Access and CHIP Reauthorization Act (MACRA). As earlier research has found, there are significant start-up and infrastructure costs and hurdles to forming an ACO, which may influence which providers decide to participate in an ACO vs choosing the Merit-based Incentive Payment System payment track to receive reimbursement for their Medicare beneficiaries.

Limitations

Our analysis includes the following limitations: First, we do not observe data for all ACOs at all points in time and we have no pre-ACO data,

which would allow us to explore and possibly adjust for potential selection effects. Second, although we are able to estimate fixed effects models to adjust for time-invariant characteristics of the ACOs, ACOs likely adapted their behaviors over time in ways that would affect their performance and quality measures. Thus, our work should be considered exploratory and descriptive and not causal. Nonetheless, understanding to what extent there might be differences is useful for providers considering how to respond to MACRA. We also note that some of CMS' quality measures are not risk adjusted (eg, patient experience and process measures).

CONCLUSIONS

The results of this study provide evidence that ACOs in the NGACO model perform similarly to organizations participating in the MSSP model on publicly reported quality and cost measures. These findings suggest that ACO models with increased financial risk to providers may not significantly affect performance on such cost and quality measures.

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