State Funding for Health Information Technology and Selected Ambulatory Healthcare Quality Measures

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Summary

Background: Previous studies on the effects of health information technology (health IT) on ambulatory quality have had mixed results. New York State has invested heavily in health IT throughout the State, creating a unique opportunity to assess effects on health care quality across multiple communities.

Objective: To determine any association between primary care providers' receipt of funding from New York State's Healthcare Efficiency and Affordability Law for New Yorkers Program (HEAL NY) and ambulatory quality of care

Methods: A statewide, longitudinal cohort study of primary care physicians in New York State was conducted. Data regarding which primary care physicians received funding through the HEAL NY program (Phase 5 or Phase 10) in 2008 or 2009 were obtained from the New York State Department of Health. Health care quality in 2010 was measured using claims data that had been aggregated across 7 commercial health plans across the state. Physicians were divided into 2 groups, based on receipt of HEAL funding (yes/no). Any association was measured between study group and each of 7 quality measures, all of which appear in the Stage 1 federal Meaningful Use program. Negative binomial regression was used, adjusting for provider gender and specialty.

Results: The study included 3,988 primary care providers, of whom 863 (22%) had received HEAL NY funding. The HEAL-funded physicians provided higher quality of care on 5 of the 7 measures: breast cancer screening, eye exams in patients with diabetes, nephropathy screening in patients with diabetes, influenza vaccination and pneumococcal vaccination (p<0.0001 for all adjusted comparisons). The HEAL-funded group provided higher quality of care by an absolute 2 to 6 percentage points per measure for those 5 measures.

Conclusion: Primary care physicians who received state funding for health IT provided higher quality of care than those who did not receive such funding.

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1. Introduction

Previous studies that have explored the relationship between interoperable electronic health records (EHRs) and ambulatory quality have had mixed results [1-9]. Previous studies on the relationship between health information exchange (HIE) on ambulatory quality have been similarly mixed.[10, 11] Despite the limited empirical data on the effects on ambulatory quality, interoperable EHRs and HIE are being implemented widely, in part in response to an unprecedented investment by the federal government in financial incentives for the adoption and meaningful use of these technologies [12, 13].

New York State began investing in health information technology (health IT, including both interoperable EHRs and HIE) in 2004, 7 years before the federal government EHR Incentive Program began [14, 15]. Through its Healthcare Efficiency and Affordability Law for New Yorkers Capital Grant Program (HEAL NY), New York State has invested $800 million in health IT across the state [14, 15]. These investments were made in Phases, with Phase 1 beginning in 2006, Phase 5 in 2008, Phase 10 in 2009, and Phase 17 in 2010 [14]. (These are consecutive phases of funding for health information technology, even though the phases are not numbered consecutively.)

Two of the major aims of this funding were to offset the costs of EHRs – thereby overcoming the barrier of upfront costs for physicians – and to implement HIE. The state did not require providers to use a single technology vendor; instead, they allowed some variation in the functionalities and user interfaces of EHRs and HIE across providers. The HEAL NY program focused on primary care providers in the ambulatory setting, distributed throughout the state in multi-payer communities. Funding from the state was awarded to multi-stakeholder community-based grantees, who enrolled participating physicians and other providers in their communities [16].

2. Objectives

The objective of this study was to measure the effect of the HEAL NY program on ambulatory care quality. Specifically, the study sought to determine whether HEAL funding was associated with higher quality on 7 different measures. Quality measures were selected from among those included in Stage 1 of the federal EHR Incentive Program (also known as "Meaningful Use") [17]. Even though this study predated Meaningful Use, these measures were chosen, because they have been endorsed nationally as clinically important and expected to be improved by the use of health IT.

3. Methods

3.1 Overview

A longitudinal cohort study of primary care physicians in New York State was conducted. The study determined any association between HEAL NY funding in 2008 or 2009 and subsequent healthcare quality in 2010. The Institutional Review Board of Weill Cornell Medical College approved the protocol. This study was conducted by directors and a member of the Health Information Technology Evaluation Collaborative, a multi-institutional academic collaborative, which is conducting independent evaluations of the HEAL NY program [18, 19].

3.2 Data

Data were derived from two different sources. First, the New York State Department of Health provided lists of physicians who benefited from HEAL NY Phase 5 or HEAL NY Phase 10 funding for EHRs and/or for participation in an HIE. (Similar data were not available for HEAL NY Phases 1 and 17.) Second, the New York Quality Alliance (NYQA) provided claims data for calendar year 2010, which had been aggregated by a third party data aggregation company across 7 commercial payers in New York State.

To derive our sample, only those primary care physicians (general internists, family medicine physicians and general practitioners) who had at least 100 patients in the NYQA claims dataset were included. The sample was divided into 2 groups: those who received funding for HEAL NY Phase 5 or Phase 10 and those who did not.

Four other provider-level variables were considered: gender, specialty (family medicine or general internal medicine), region of New York State, and panel size (the number of patients attributed to the provider, which is described below).

Seven different healthcare quality measures were considered: breast cancer screening, cervical cancer screening, colorectal cancer screening, eye examinations for patients with diabetes, nephropathy screening for patients with diabetes, influenza vaccination, and pneumococcal vaccination. These measures were selected, because they were the subset of Stage 1 Clinical Quality Measures from the Meaningful Use program [17] that could be measured accurately from claims data and were also hypothesized to be affected by the HEAL NY program.

Greater adherence to recommended care on these measures was considered higher quality. This approach is consistent with Donabedian's framework for measuring quality of care, which postulates that compliance with best practices is an important aspect of the technical performance of a practitioner and that technical performance is a key component of quality of care [20]. All of the measures considered in this study have been endorsed as best practices by national quality organizations, such as the National Quality Forum, based on evidence that compliance with those measures improves population health [21].

3.3 Statistical analysis.

The analysis first attributed claims to patients and patients to providers, using attribution logic developed previously [22]. Briefly, this logic assigned a patient to a provider if he or she declared that provider as his/her primary care provider in the context of health plan enrollment, or if he or she had 1 preventive care visit or 1 Evaluation and Management (E&M) visit in the previous calendar year with that provider; the handling of ties is described elsewhere [22]. Patients who were not attributed to any primary care provider were excluded. It was determined for each patient in the sample whether the patient was eligible for each quality measure and, if so, whether or not the patient had received recommended care.

Descriptive statistics were used to characterize the primary care physicians, overall and stratified by study group. Analysis of variance (ANOVA) was used to compare continuous variables and chi-squared tests were used to compare dichotomous and categorical variables across study groups. Unadjusted and adjusted proportions of eligible patients who received recommended care for each quality measure were also calculated, stratified by study group. Negative binomial regression was used to determine any association between study group and receipt of recommended care for each of the quality measures, adjusting for provider gender and specialty. No adjustments were made for panel size per se, because that was incorporated into the denominator of the quality measure.

P-values ≤0.05 were considered significant. All analyses were conducted using SAS software (version 9.3, Cary, NC).

4. Results

A total of 3,988 primary care providers were included, of whom 863 (22%) had received funding from HEAL NY Phase 5 or Phase 10 and 3125 (78%) had not. Providers who received HEAL funding were more likely to be female (34% vs. 30%, $p = 0.03$), more likely to be family medicine physicians or general practitioners (47% vs. 32%, $p <0.0001$), and more likely to have larger panel sizes (487 vs. 356 patients, $p<0.0001$), compared to providers not receiving HEAL funding (▶Table 1). Providers receiving HEAL funding were also less likely to live on Long Island (8% vs. 24%), less likely to live in New York City (36% vs. 44%), and more likely to live in the Northern region (35% vs. 7%), compared to providers not receiving HEAL funding ($p<0.0001$).

The number of patients contributing to each quality measure, across study groups, ranged from 25,201 patients for nephropathy screening in diabetes to 528,234 patients for influenza immunization. Sample sizes of patients for each measure, stratified by study group, are shown in ▶ Table 2.

Providers receiving HEAL funding were more likely to provide higher quality of care on 5 out of 7 measures in unadjusted models: providers receiving HEAL funding were more likely to screen for breast cancer (62% of patients screened vs. 59% of patients), more likely to obtain diabetes eye exams (61% vs. 55%), more likely to screen for nephropathy in diabetes (76% vs. 72%), more likely to obtain influenza vaccination (35% vs. 30%), and more likely to obtain pneumococcal vaccination (21% vs. 16%) (each unadjusted comparison p<0.0001, ▶ Table 2). Similarly, the unadjusted odds of receiving recommended care was higher for providers who received HEAL funding on 5 of 7 measures, with the odds increasing by 4% to 28% per measure (▶ Table 3).

When the regression models adjusted for provider gender and specialty, the results persisted, with HEAL-funded physicians outperforming non-HEAL-funded physicians on the same 5 measures (▶ Table 4). The magnitude of the adjusted difference ranged from 2% to 6% per measure (▶ Table 4). The odds of receiving recommended care were 4% to 29% higher per measure for HEAL-funded physicians, compared to non-HEAL-funded physicians (▶ Table 5).

5. Discussion

This statewide study found that primary care providers who received state funding to offset the cost of health IT were more likely to provide higher quality of care than primary care providers who did not receive state funding. This association was observed for 5 of 7 quality measures considered: breast cancer screening, eye exams in patients with diabetes, nephropathy screening in patients with diabetes, influenza vaccination and pneumococcal vaccination. The magnitude of the effect was an absolute 2 to 6 percentage points per measure.

The HEAL funding in this study supported both adoption of EHRs and implementation and use of HIE. Therefore, it is difficult to determine which technology may have contributed to the association observed. In addition, this study does not capture the use of EHRs or HIE among those who did not receive HEAL funding. Thus, the comparison being made here is between receiving and not receiving state funding. This is useful in that it enables measurement of the effectiveness of the policy as a whole. However, this study cannot determine the exact mechanism by which the state funding may have enabled improvements in quality.

It is not clear why HEAL funding was associated with higher quality scores for some measures but not others. Performance on quality measures is influenced by many factors; for example, EHRs can vary in the types of clinical decision support they provide by measure, providers can vary in their usage of and responsiveness to clinical decision support by measure, and patients can vary in their preferences for recommended care by measure. This study does not capture data on these possibilities directly. However, it is not uncommon to see different effects of an intervention on different quality measures.

This study is notable for its inclusion of claims data that have been aggregated across 7 commercial payers throughout the state, enabling a sample size of more than 525,000 patients for the most common measure. Multi-payer evaluations are important, because they more accurately depict physician performance than any single payer study. The 7 payers included here covered patients in all regions of New York State, from Long Island to the Northern Region. This is also critical for statewide evaluation.

The magnitude of improvement observed is smaller than the 12–20% magnitude of improvement seen in some studies of EHRs that were conducted in the inpatient setting or selected outpatient settings [23]. However, those other studies were not conducted in community settings. Our previous study of EHRs and quality in a single community in New York State found that EHRs were associated with an improvement of 3 to 13 percentage points per measure, which is similar to the effect size of the present study [24].

This study has several limitations, in addition to those discussed above. This study is longitudinal in that the intervention preceded the outcome, but this study does not include baseline data on quality prior to the start of the HEAL NY program, so we are not able to assess differences in

changes in quality over time. This study does not distinguish the effects of HEAL NY Phase 5 vs. 10, nor does it include data on receipt of state funding through HEAL NY Phase 1 or Phase 17; the direction of bias that this might introduce is unclear. This study is observational, and we cannot rule out confounding by unobserved variables, such as provider age and other provider characteristics. This study also does not adjust for case mix, in part because meaningful use measures are not intended to be case-mix-adjusted. This study considers only 7 quality measures, which reflect processes of care that comprise a subset of all quality measures. Also, although adherence to these quality measures has been shown to improve population health in general over time, we did not measure health outcomes directly in this study. Finally, this study does not calculate the financial return-on-investment, as the HEAL program may have had other effects on healthcare utilization beyond the quality measures described here.

This study suggests several areas for future research. Future studies could delve more deeply into how providers use EHRs and HIE, as well as explore associations between patterns of use and healthcare quality. Future studies could also directly assess the impact of the federal Meaningful Use program on healthcare quality. Additional studies could expand the number and types of quality measures used, possibly focusing on measures at the intersection of quality and cost (such as ambulatory-care sensitive hospitalizations or readmissions).

6. Conclusions

In summary, New York State has made significant financial investments in health information technology, preceding federal initiatives in this area by several years. Receipt of New York State funding to offset the cost of interoperable EHRs and HIE was associated with higher quality care for the majority of measures we considered. Ongoing evaluations of health information technology initiatives are needed to monitor the outcomes of these programs.

Clinical Relevance Statement
This study found that primary care physicians who received funding from a New York State program to implement and use health IT provided higher quality of care on 5 of 7 quality measures considered: breast cancer screening, eye exams in patients with diabetes, nephropathy screening in patients with diabetes, influenza vaccination and pneumococcal vaccination (p<0.0001 for all adjusted comparisons). The magnitude of this effect was an absolute 2 to 6 percentage points per measure for those 5 measures. These findings are consistent with and support national efforts to encourage the use of health IT by health care providers.

Conflict Of Interest
The authors have no conflicts of interest.

Human Subjects Protections
The Institutional Review Board of Weill Cornell Medical College approved the study protocol.

	Total	HEAL+	HEAL-	p-value
	N (%)*	N (%)*	N (%)*	
Total	3,988	863 (21.6)	3125 (78.4)	
Gender				
Male	2758 (69.2)	571 (66.2)	2187 (70.0)	0.03
Female	1230 (30.8)	292 (33.8)	938 (30.0)	
Specialty				
FM/GP†	1405 (35.2)	402 (46.6)	1003 (32.1)	<0.0001
GIM	2583 (64.8)	461 (53.4)	2122 (67.9)	
Region				
Central	141 (3.5)	59 (6.8)	82 (2.6)	<0.0001
Hudson Valley	555 (13.9)	96 (11.1)	459 (14.7)	
Long Island	819 (20.5)	67 (7.8)	752 (24.1)	
New York City	1687 (42.3)	307 (35.6)	1380 (44.2)	
Northern	510 (12.8)	304 (35.2)	206 (6.6)	
Western	9 (0.2)	7 (0.8)	2 (0.1)	
Missing	267 (6.7)	23 (2.7)	244 (7.8)	
Panel Size	384.7 (321.9)	487.4 (399.6)	356.4 (290.7)	<0.0001

Table 1 Characteristics of primary care providers, stratified by receipt of funding through the Healthcare Efficiency and Affordability Law for New Yorkers Capital Grant Program (HEAL NY)*

*HEAL+ = received HEAL NY funding. HEAL- = did not receive HEAL NY funding. FM/GP = family medicine and general practitioners. GIM = general internal medicine.
† Of this row, only 51 physicians were general practitioners (4%) and the rest were family medicine physicians.

Table 2 Unadjusted average proportions of patients receiving recommended care by provider, stratified by receipt of funding through the Healthcare Efficiency and Affordability Law for New Yorkers Capital Grant Program (HEAL NY)

Quality Measure	HEAL+		HEAL-		p-value
	N Providers (Patients)	Mean (95% CI)	N Providers (Patients)	Mean (95% CI)	
Breast Cancer Screening	855 (94,489)	61.8 (61.0–62.6)	3086 (274,358)	59.4 (59.0–60.0)	<0.0001
Cervical Cancer Screening	863 (169,657)	72.1 (71.6–72.7)	3121 (496,998)	72.2 (71.8–72.5)	0.92
Colorectal Cancer Screening	416 (29,575)	35.4 (34.2–36.6)	1117 (47,209)	35.9 (35.1–36.8)	0.49
Diabetes Eye Exam	221 (9,441)	60.5 (58.5–62.6)	455 (15,832)	54.7 (53.3 – 56.2)	<0.0001
Diabetes Nephropathy Screening	221 (9,428)	75.9 (73.8–78.0)	453 (15,773)	72.0 (70.5–73.5)	<0.0001
Influenza Immunization	847 (152,043)	35.0 (33.8–36.2)	3069 (376,191)	30.0 (29.5–30.6)	<0.0001
Pneumonia Vaccine	682 (71,124)	21.1 (20.1–22.2)	2406 (145,928)	16.3 (15.8 –16.7)	<0.0001

Key: HEAL+ = received HEAL NY funding. HEAL- = did not receive HEAL NY funding. CI = confidence interval.

Table 3   Unadjusted odds of receipt of recommended care, based on receipt of funding through the Healthcare Efficiency and Affordability Law for New Yorkers Capital Grant Program (HEAL NY)

Quality Measure	IRR for HEAL+ (vs. HEAL-)	Lower 95% CI	Upper 95% CI	p-value
Breast Cancer Screening	1.04	1.02	1.06	<0.0001
Cervical Cancer Screening	1.00	0.99	1.01	0.92
Colorectal Cancer Screening	0.99	0.95	1.03	0.49
Diabetes Eye Exam	1.11	1.06	1.15	<0.0001
Diabetes Nephropathy Screening	1.05	1.02	1.09	<0.0001
Influenza Immunization	1.16	1.12	1.21	<0.0001
Pneumonia Vaccine	1.28	1.23	1.37	<0.0001

Key: IRR = incidence rate ratio. HEAL+ = received HEAL NY funding. HEAL- = did not receive HEAL NY funding. CI = confidence interval.

Table 4   Adjusted average proportions of patients receiving recommended care by provider, stratified by receipt of funding through the Healthcare Efficiency and Affordability Law for New Yorkers Capital Grant Program (HEAL NY)*

Quality Measure	HEAL+	HEAL-	p-value
	Mean (95% CI)	Mean (95% CI)	
Breast Cancer Screening	61.8 (61.0–62.7)	59.3 (58.8–59.7)	<0.0001
Cervical Cancer Screening	72.2 (71.6–72.7)	72.1 (71.7–72.4)	0.78
Colorectal Cancer Screening	35.2 (34.1–36.4)	35.7 (34.9–36.5)	0.51
Diabetes Eye Exam	60.6 (58.6 – 62.7)	54.8 (53.4–56.2)	<0.0001
Diabetes Nephropathy Screening	75.4 (73.3 – 77.5)	72.1 (70.6 – 73.6)	<0.0001
Influenza Immunization	35.3 (34.0–36.5)	29.9 (29.4–30.5)	<0.0001
Pneumonia Vaccine	21.0 (20.0–22.0)	16.3 (15.8–16.7)	<0.0001

* Sample sizes are the same as shown in Table 2.
Key: HEAL+ = received HEAL NY funding. HEAL- = did not receive HEAL NY funding. CI = confidence interval.

Table 5 Adjusted odds of receipt of recommended care, based on receipt of funding through the Healthcare Efficiency and Affordability Law for New Yorkers Program (HEAL NY)

Quality Measure	Predictors	IRR	Lower 95% CI	Upper 95% CI	p-value
Breast Cancer Screening	HEAL+ vs. HEAL-	1.04	1.03	1.06	<0.0001
	Gender: Male (vs. Female)	0.94	0.93	0.96	<0.0001
	Specialty: GIM (vs. FP/GP)	1.04	1.03	1.06	<0.0001
Cervical Cancer Screening	HEAL+ vs. HEAL-	1.00	0.99	1.01	0.79
	Gender: Male (vs. Female)	0.96	0.96	0.97	<0.0001
	Specialty: GIM (vs. FP/GP)	1.03	1.02	1.04	<0.0001
Colorectal Cancer Screening	HEAL+ vs. HEAL-	0.99	0.95	1.03	0.50
	Gender: Male (vs. Female)	0.92	0.88	0.96	<0.0001
	Specialty: GIM (vs. FP/GP)	1.08	1.04	1.13	<0.0001
Diabetes Eye Exam	HEAL+ vs. HEAL-	1.11	1.06	1.15	<0.0001
	Gender: Male (vs. Female)	1.03	0.98	1.08	0.22
	Specialty: GIM (vs. FP/GP)	0.95	0.91	1.00	0.04
Diabetes Nephropathy Screening	HEAL+ vs. HEAL-	1.05	1.01	1.08	0.01
	Gender: Male (vs. Female)	0.95	0.92	0.99	0.01
	Specialty: GIM (vs. FP/GP)	0.97	0.93	1.01	0.17
Influenza Immunization	HEAL+ vs. HEAL-	1.18	1.13	1.23	<0.0001
	Gender: Male (vs. Female)	1.01	0.97	1.04	0.76
	Specialty: GIM (vs. FP/GP)	1.08	1.04	1.11	<0.0001
Pneumonia Vaccine	HEAL+ vs. HEAL-	1.29	1.22	1.36	<0.0001
	Gender: Male (vs. Female)	0.85	0.81	0.91	<0.0001
	Specialty: GIM (vs. FP/GP)	1.03	0.98	1.08	0.25

Key: IRR = incidence rate ratio. CI = confidence interval. HEAL+ = received HEAL NY funding. HEAL- = did not receive HEAL NY funding. GIM = general internal medicine. FP/GP = family medicine and general practitioners.

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