PULLING INFORMATION IN RESPONSE TO A PUSH: USAGE OF QUERY-BASED HEALTH INFORMATION EXCHANGE IN RESPONSE TO AN EVENT ALERT. *PRELIMINARY REPORT*

Evidence from a study of three New York State Qualified Entities' (QEs) Subscription Alert and Query-based exchange services.

HEALTH INFORMATION TECHNOLOGY SOLUTIONS TO IMPROVE CARE DELIVERY

New York State, a leader in health information exchange has charged the NY eHealth Collaborative (NYeC) as its State Designated Entity to lead and coordinate the Statewide Health Information Network for New York (SHIN-NY). A network of networks that includes 8 regional health information organizations (RHIOs) certified as Qualified Entities and a statewide connector, the SHIN-NY serves as a tool to help providers and health plans provide the best healthcare for patients and reduce unnecessary costs. Use of the SHIN-NY supports the exchange of health information to make critical patient information available at the point of care and support innovative delivery approaches that are now widespread in New York State.

TAKEAWAYS

- → USAGE OF SUBSCRIPTION ALERT SERVICES AND QUERY-BASED EXCHANGE INCREASED OVER A ONE YEAR PERIOD BY 95% FOR ALERTS AND 102% FOR QUERY-BASED EXCHANGE
- → HOME HEALTH/LONG TERM CARE ARE THE LARGEST RECIPIENTS OF ALERTS
- → 7% OF USERS ACCESS QUERY-BASED EXCHANGE SERVICES IN RESPONSE TO AN ALERT WITHIN 7 DAYS
- → QUERIES AFTER AN ALERT IS RECEIVED ARE MOST COMMON IN SPECIALTY CLINICS (17% WITHIN 24 HOURS)
- → INCLUDING CCDS WITH ALERTS REDUCES QUERY USAGE

In the past paper-based health care world, health care providers had difficulty accessing patient information. Today, providers have multiple options to obtain critical information about their patients. Two important approaches to information exchange that support and facilitate patient health information exchange are:

Query-based exchange as information sharing interventions: In query-based information exchange, end users find patient information from community-wide, longitudinal patient records. The community-wide, longitudinal records are maintained by the State's Qualified Entities (QE) in accordance with strict privacy and security rules. Because end users request the information when needed, this approach is referred to as a query. Additionally, many end users access these records through a web portal.

Subscription alert services as information sharing interventions: Alert services automatically notify a health care provider when a patient has been

admitted to or discharged from a participating hospital or emergency department. Alerts are real-time, electronic, automatic, and delivered to providers in accordance with state and federal privacy regulations.

In New York State, all QEs offer both query-based exchange and core subscription alert services free of charge to all Participants to enhance the flow of information between settings of care.

Query-based exchange has been in use in New York State and in other locations in the US for more than a decade and subscription alert services are growing nationwide.[1] Importantly, multiple evaluations have demonstrated that query-based exchange subscription and alert services reduce unnecessary utilization and reduce costs for New York State.[2–7]

Box 1. Comparison of information sharing interventions in New York State.

Query-based exchange	Subscription Alert Services
• Providers and staff access community-wide, longitudinal records	• Providers and staff receive notices about patient events automatically
• Comprehensive patient data	• Limited patient data
• Secure	• Secure
• Service offered by Qualified Entities	• Service offered by Qualified Entities

This preliminary report describes how these two approaches to information exchange work together within the State in a complementary fashion. This is the first part of a multi-phase study, with additional phases focusing on user stories and the impact of these services on health care costs and utilization.

Note: For the purposes of this report, we excluded all records from sending facilities that were not hospitals or health systems and alerts that were not for an admission/discharge from a hospital or emergency department. Also, because more than one alert may be sent per health care encounter, we reduced all records into unique sender-recipient combinations for a single patient per day.

KEY FINDING #1: USAGE OF SUBSCRIPTION ALERT SERVICES AND QUERY-BASED EXCHANGE INCREASED OVER TIME

Figure 1. Number of Alerts Sent by Three Qualified Entities in New York State.

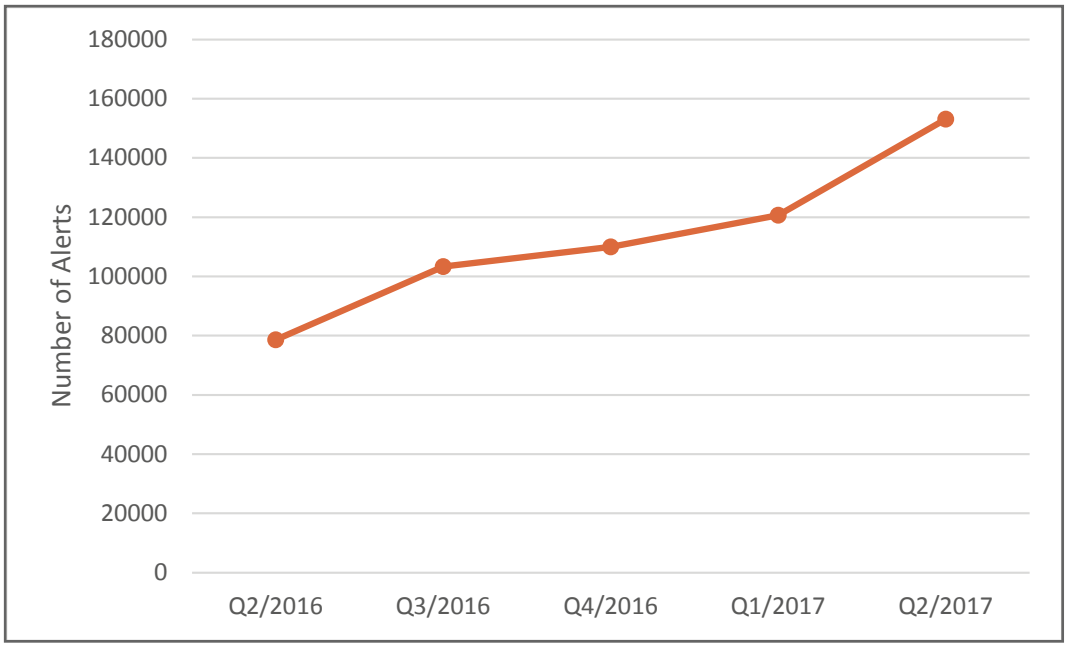
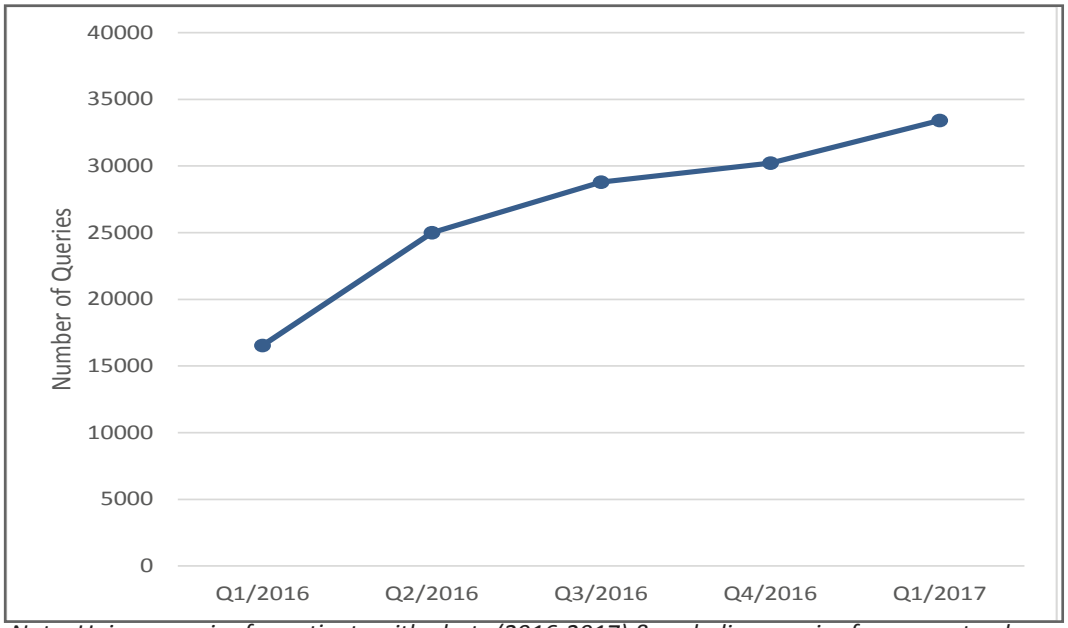


Figure 2. Number of Queries to Three Qualified Entities' Longitudinal Patient Record Systems in New York State.



Note: Unique queries for patients with alerts (2016-2017) & excluding queries for consent only.

- The number of alerts being sent for patients with alerts is increasing over time.
- The number of queries is increasing over time.

KEY FINDING #2: CHARACTERISTICS ASSOCIATED WITH ALERTS

Table 1. Patient Characteristics Associated with Alerts from Three Qualified Entities in New York State.

	N	%
Patient Gender		
Male	249,436	38.9
Female	358,384	55.8
Other/Unknown	34,099	5.3
Patient Age		
<18	27,955	4.4
18 - 29	67,932	10.6
30 - 44	109,991	17.1
45 - 64	221,171	34.6
65+	213,870	33.3

Table 2. Characteristics of Alerts from Three Qualified Entities in New York State.

	N	%
Alert Timing		
Admit	229,047	35.7
Discharge	236,410	36.8
Both	176,462	27.5
Alert Setting		
Emergency Department	412,712	64.3
Inpatient	179,490	28.0
Both	49,717	7.7
Alert Source Type		
General Hospital	639,434	99.6
Specialty Hospital	2,485	0.4
Alert Source Location		
Downstate Metropolitan	309,119	48.2
Upstate Metropolitan	274,296	42.7
Micropolitan	50,715	7.9
Rural	7,789	1.2

Table 2. Characteristics of Alerts from Three Qualified Entities in New York State (continued).

	N	%
Direct to EHR		
Yes	335,318	52.2
No	306,601	47.8
CCD Attached		
Yes	286,708	44.7
No	355,211	55.3

- Alerts are more likely to be sent for women than men.
- More alerts are sent for individuals between the ages of 45-64 and those that were 65 or older.
- Alerts are most commonly sent when a patient had been discharged from an emergency department than an inpatient setting.
- Most alerts come from general hospitals.
- Slightly more than half of alerts are sent directly to an EHR; the remaining half are sent via other methods including secure email or other messaging.
- Many alerts include Continuity of Care Documents (CCD).

"We have a client who we were able to see how much she was utilizing the emergency room. It allowed us to make a goal around that for her that we would have never known without it [alerts]. It [alerts] helped us to see the volume of visits and focus on that in our program with her."
-Director of Programs, Social Service and Mental Health Organization

KEY FINDING #3: LONG TERM CARE/HOME HEALTH ARE THE LARGEST RECIPIENTS OF ALERTS

Table 3. Types of Organizations that Received Alerts from Three Qualified Entities in New York State.

	N	%
Receiving Organization Type		
Primary Care Clinic[1]	103,898	16.2
Federally Qualified Health Center	119,413	18.6
Specialty/Multi-Specialty Clinic[2]	49,959	7.8
Long Term Care/Home Health	178,807	27.9
Health Home	141,894	22.1
Behavioral Health	14,932	2.3
Payer	8,975	1.4
Other[3]	22,479	3.5
Missing	1,562	0.2

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.
[3]"Other" includes social services, community services, and other non-clinical care settings.

- A wide variety of health care organizations received alerts.
- Home health received the largest number of alerts.
- Federally Qualified Health Centers and Primary Care Clinics (both independent and hospital-based practices) were the next most common recipients of alerts.

"RHIO alerts have been very helpful to our organization. It also has saved us money as we pay an aide for going to a home even if someone is not there. Now we are alerted in advance and can call the aide."
-Executive Director, Home Care Organization

KEY FINDING #4: PROVIDERS USE QUERY-BASED EXCHANGE IN RESPONSE TO ALERTS

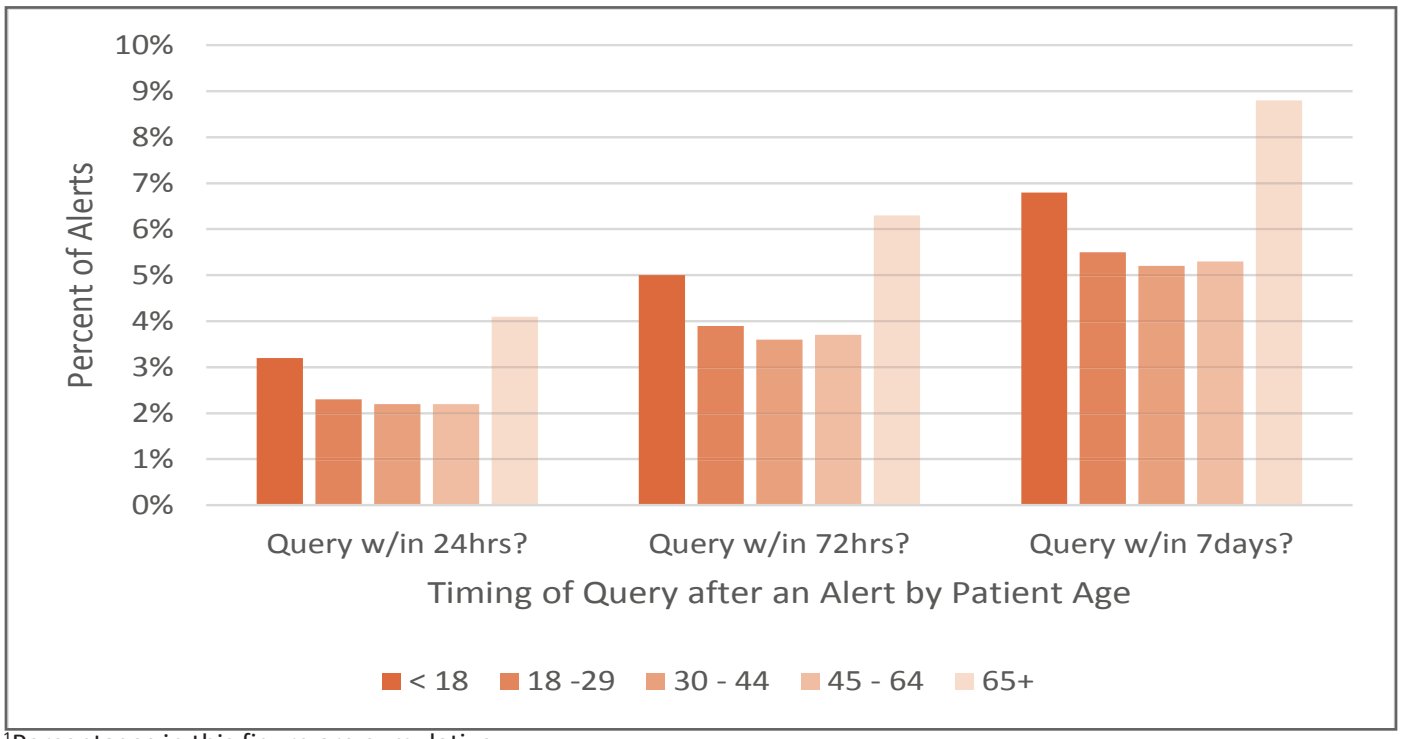
Figure 3. Percent[1] of Alerts from Three Qualified Entities in New York State with a Query within 24 hours, 72 hours, and 7 days.

[1]Percentages in this figure are cumulative

- Both alerts and query-based information exchange are supported by New York State and the Federal Government.
- Within 24 hours, nearly 3% of alerts resulted in end users accessing query portals for additional patient information.
- Within 7 days, more than 6% of alerts resulted in query access.

KEY FINDING #5: QUERIES AFTER ALERTS ARE RECEIVED ARE MORE COMMON FOR OLDER PATIENTS

Figure 4. Percent[1] of Alerts from Three Qualified Entities in New York State with a Query within 24 hours, 72 hours, and 7 days.



[1]Percentages in this figure are cumulative

- Organizations are more likely to access Qualified Entities' query-based portal services if they received an alert for patients over the age of 65 years.
- Usage of query-based portals after an alert is received was next highest for children (< 18 years old).

"It [alerts] keeps me a step ahead of the game, because right now there is no communication between the hospital and me or the doctors and me. This really helps so that I can address them and try to build confidence with the doctors and the discharge planners. It's increasing my communication with the health care professionals that are taking care of her so that we can all work together."
-Respiratory Therapist, Pharmacy and Home Healthcare Organization

KEY FINDING #6: QUERIES AFTER AN ALERT IS RECEIVED ARE MOST COMMON IN SPECIALTY CLINICS

Table 4. Organizational Characteristics Associated with Utilization of Query-Based Services Following an Alert in Three Qualified Entities in New York State.

	Total number of alerts received (n)	Query w/in 24hrs?	Query w/in 72hrs?	Query w/in 7days?
		Y(%)	Y(%)[4]	Y(%)[4]
All alerts	641,919	2.9	4.6	6.5
Receiving Organization Type				
Primary Care Clinic[1]	103,898	1.6	2.6	3.5
Federally Qualified Health Center	119,413	3.6	6.0	8.9
Specialty/Multi-Specialty Clinic[2]	49,959	16.5	25.8	35.7
Long Term Care/Home Health	178,807	0.6	0.9	1.3
Health Home	141,894	0.8	1.4	2.1
Behavioral Health	14,932	4.7	7.4	10.6
Payer	8,975	6.3	9.3	12.0
Other[3]	22,479	3.4	5.8	8.0
Missing	1,562	0.4	0.5	0.5

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.
[3]"Other" includes social services, community services, and other non-clinical care settings.
[4]Percentages are cumulative

- Specialty and Multi-Specialty Clinics queried for additional information in response to 1 out of every 7 alerts within 24 hours.
- Payers are also more likely to use query-based portals within 24 hours than other types of providers.
- Organizations that received a larger number of alerts tended to have fewer queries in response to the alerts.

KEY FINDING #7: INCLUDING CCDS WITH ALERTS REDUCES QUERY USAGE

Table 5. Characteristics Associated with Utilization of Query-Based Services Following an Alert in Three Qualified Entities in New York State.

	Total number of alerts received (n)	Query w/in 24hrs?	Query w/in 72hrs?	Query w/in 7days?
		Y(%)	Y(%)[1]	Y(%)[1]
All Alerts	641,919	2.9	4.6	6.5
Alert Timing				
Admit	229,047	2.8	4.9	7.3
Discharge	236,410	3.1	4.7	6.2
Both	176,462	2.6	4.2	5.9
Alert Setting				
Emergency Department	412,712	2.5	4.1	5.9
Inpatient	179,490	3.6	5.4	7.3
Both	49,717	3.9	6.3	9.2
Alert Source Location				
Metropolitan-Upstate	274,296	3.1	4.9	7.2
Metropolitan-Downstate	309,119	2.7	4.3	5.9
Micropolitan	50,715	2.6	4.4	6.4
Rural	7,789	3.4	5.3	8.4
Direct to EHR				
Yes	306,601	2.3	3.7	5.0
No	335,318	3.4	5.5	7.9
CCD Attached				
Yes	286,708	2.4	3.9	5.3
No	355,211	3.2	5.2	7.5

[1]Percentages in this figure are cumulative

- Alerts sent after an individual had been discharged were most likely to result in an organization accessing QE query-based portal services within 24 hours.
- Alerts that were sent after a patient had been admitted were more likely to result in queries within 72 hours or 7 days.
- Alerts that were sent when a patient had been to both the ED and inpatient setting in the same day were most likely to result in an organization accessing QE query-based portal services for all time intervals.
- Alerts that were sent with a Continuity of Care Document (CCD) attached were less likely to result in an organization accessing QE query-based portal services.

TAKEAWAY POINTS FOR POLICY MAKERS

- Health care organizations have unprecedented access to patient information.
- Alerts and query-based exchange technologies serve many different types of organizations.
- Alerts can prompt end users to seek additional information from query-based portals.
- Federally Qualified Health Centers are key users of health information exchange technologies.
- Health homes are a key recipient of alert services.

IMPLICATIONS FOR PROVIDERS

- End users access query-based portals in response to alerts.
- Alerts associated with inpatient admissions are more likely to prompt the need for additional information.
- Including CCDs (which have additional information beyond the alert content) decreases the need to access the query portal.

REFERENCES

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7. Yaraghi, N. (2015). An Empirical analysis of the financial benefits of health information exchange in emergency departments. Journal of the American Medical Informatics Association : JAMIA, 1169–1172. http://doi.org/10.1093/jamia/ocv068

APPENDIX

Appendix A. Buffalo Report

KEY FINDING #1: USAGE OF SUBSCRIPTION ALERT SERVICES AND QUERY-BASED EXCHANGE INCREASED OVER TIME

Figure 1. Number of Alerts Sent by HEALTHeLINK.

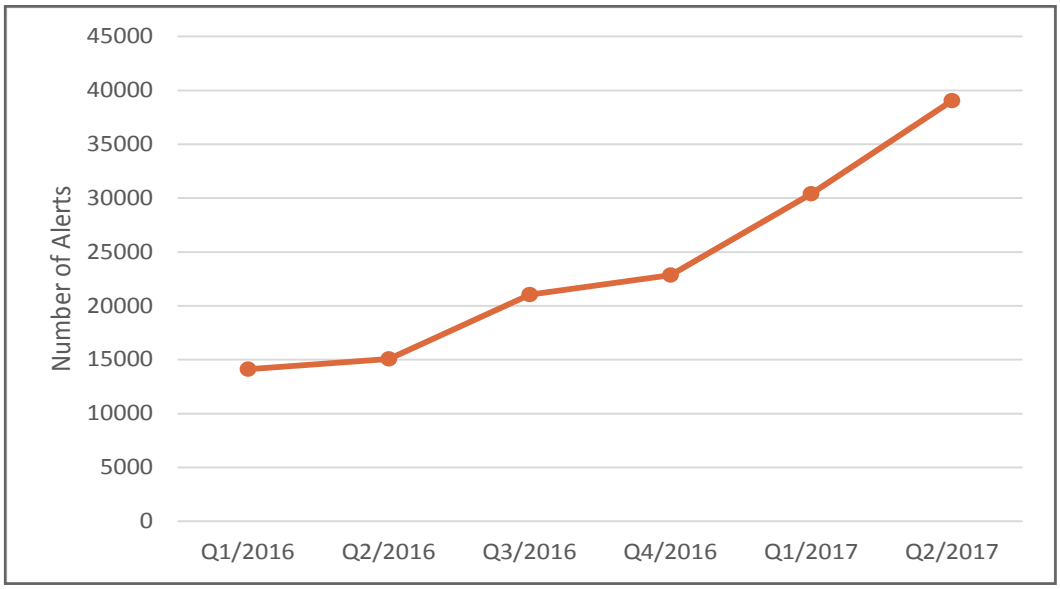
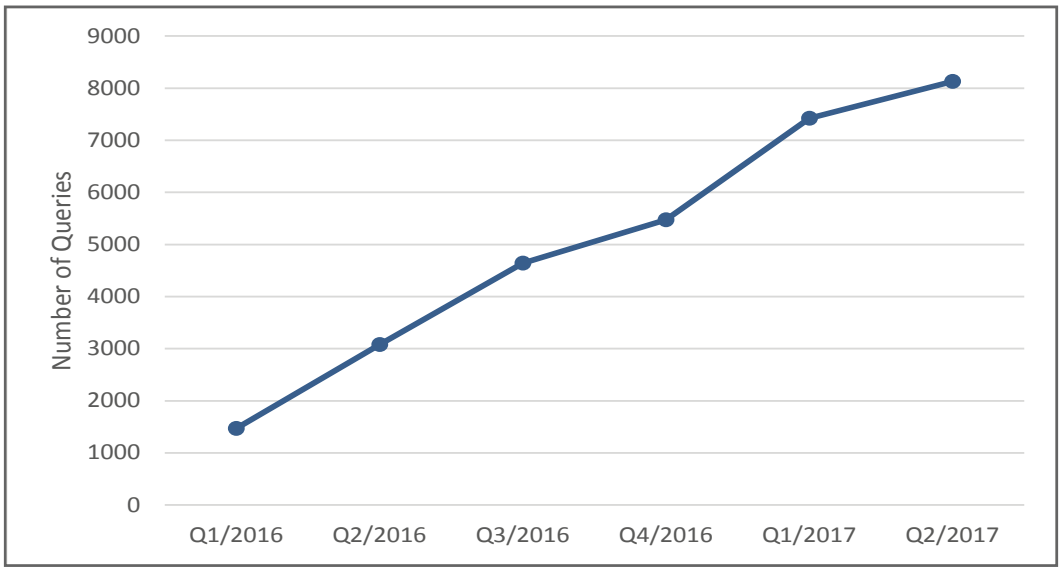


Figure 2. Number of Queries to HEALTHeLINK's Patient Record System.



Note: Unique queries for patients with alerts (2015-2017) & excluding queries for consent only.

- The number of alerts being sent for patients is increasing over time.
- The number of queries is increasing over time.

KEY FINDING #2: CHARACTERISTICS ASSOCIATED WITH ALERTS

Table 1. Patient Characteristics Associated with Alerts from HEALTHeLINK.

	N	%
Patient Gender		
Male	54,868	38.5
Female	79,206	55.6
Other/Unknown	8,385	5.9
Patient Age		
< 18	5,692	4.0
18 - 29	19,795	13.9
30 - 44	31,836	22.4
45 - 64	51,539	36.1
65+	33,597	23.6

Table 2. Patient Characteristics Associated with Alerts from HEALTHeLINK.

	N	%
Alert Timing		
Admit	38,730	27.2
Discharge	53,781	37.8
Both	49,948	35.1
Alert Setting		
Emergency Department	113,879	79.9
Inpatient	27,575	19.4
Both	1,005	0.7
Alert Source Type		
General Hospital	141,539	99.3
Specialty Hospital	920	0.7
Alert Source Location		
Metropolitan	106,227	74.6
Micropolitan	33,046	23.2
Rural	3,136	2.2
Direct to EHR		
Yes	5,578	3.9
No	136,881	96.1

- Alerts are more likely to be sent for women than men.
- Alerts are sent most frequently for individuals that were 45-64 years old.
- Alerts are more likely to be sent when a patient had been discharged from an emergency department or an inpatient setting.
- Alerts are sent most frequently when a patient has been seen in the Emergency Department.
- Alerts are not commonly sent directly to the end users' electronic health record systems (other methods of delivery include secure email or other messaging).

KEY FINDING #3: HEALTH HOME ORGANIZATIONS ARE THE LARGEST RECIPIENTS OF ALERTS

Table 3. Types of Organizations that Received Alerts from HEALTHeLINK.

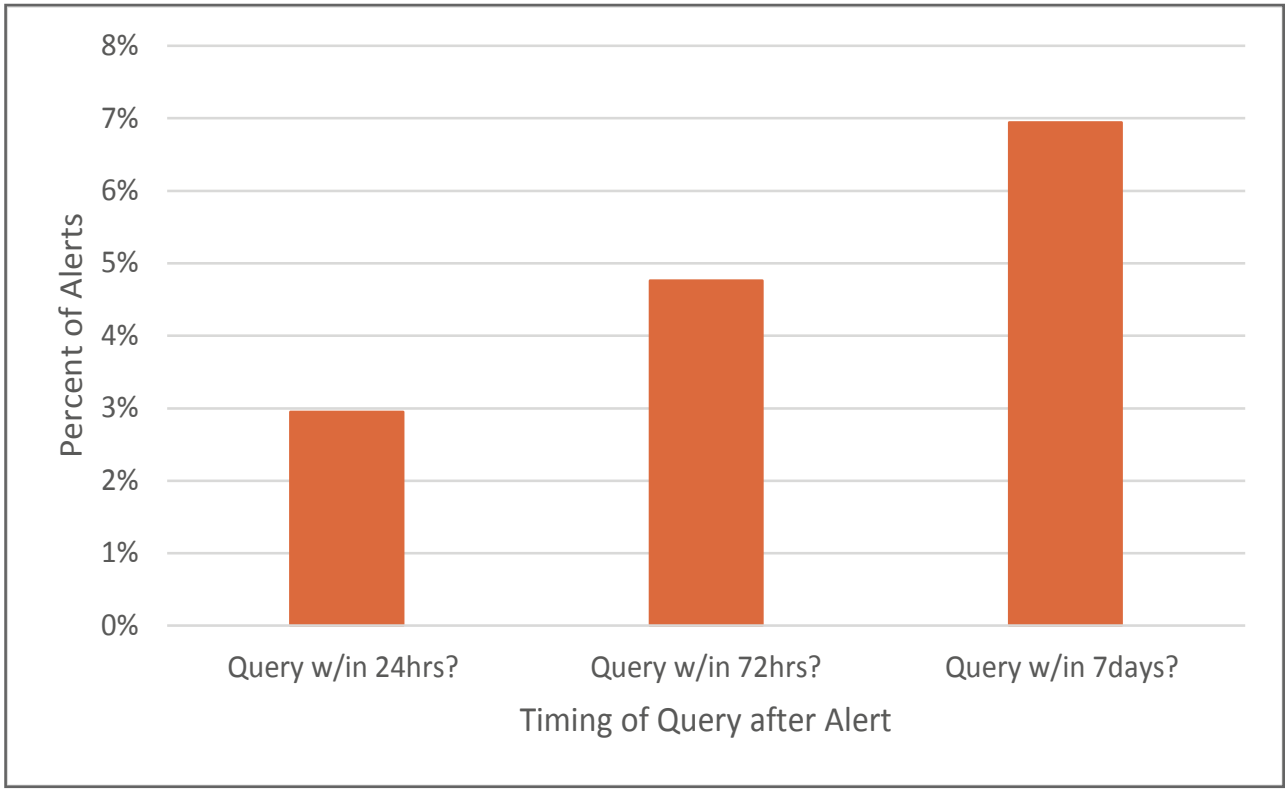
	N	%
Receiving Organization Type		
Primary Care Clinic[1]	46,335	32.5
Federally Qualified Health Center	9,501	6.7
Specialty/Multi-Specialty Clinic[2]	30,242	21.2
Long Term Care/Home Health	1,053	0.7
Health Home	47,271	33.2
Behavioral Health	5,004	3.2
Payer	620	0.4
Other[3]	2,433	1.7

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.
[3]"Other" includes social services, community services, and other non-clinical care settings.

- Health Homes received the largest number of alerts.
- Primary Care Clinics and Specialty/Multi-Specialty Clinics were the next most common recipients of alerts.

KEY FINDING #4: PROVIDERS USE QUERY-BASED EXCHANGE IN RESPONSE TO ALERTS

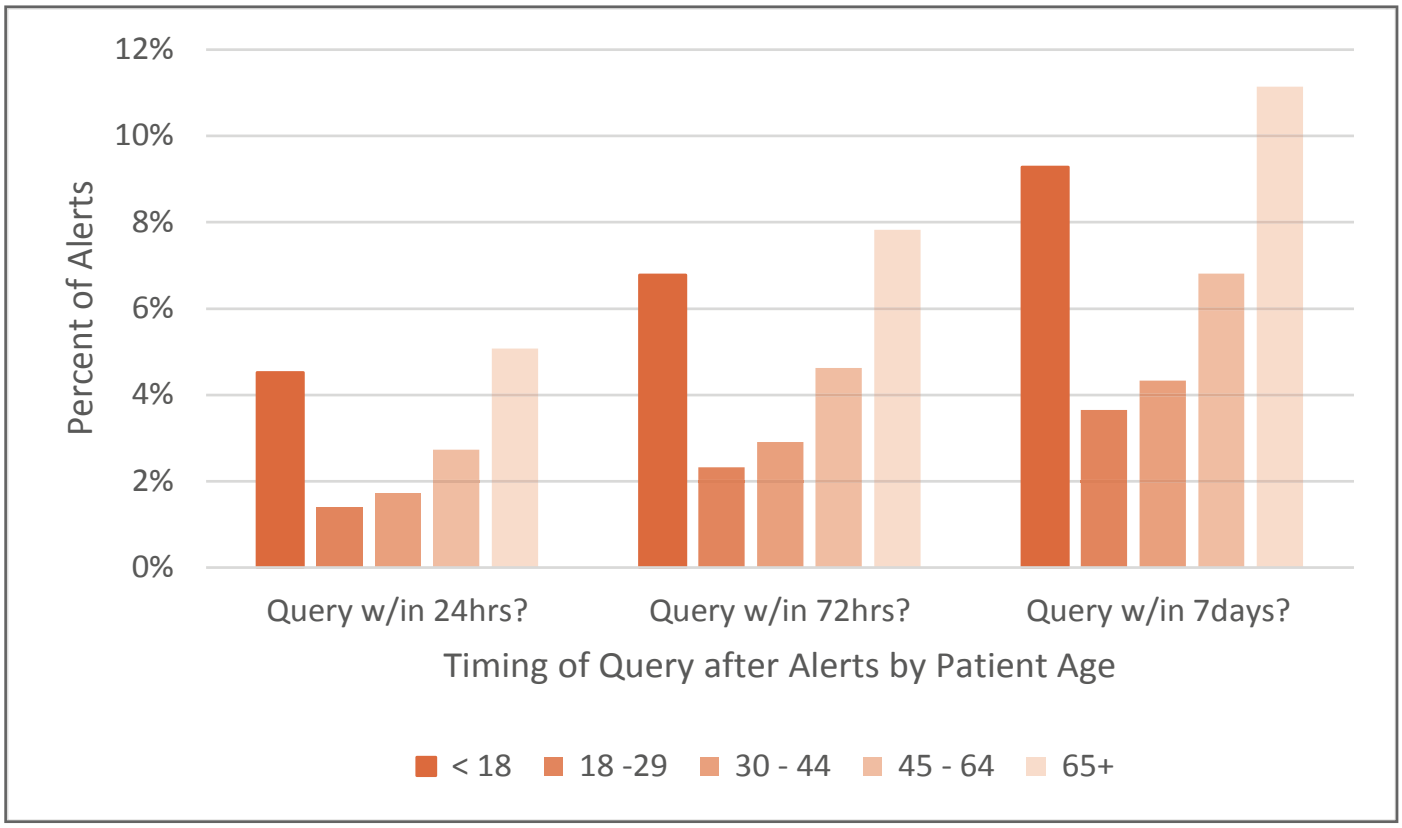
Figure 3. Percent of Alerts from HEALTHeLINK with a Query within 24 hours, 72 hours, and 7 days.



- Both alerts and query-based information exchange are supported by New York State and the Federal Government.
- Within 24 hours, about 3% of alerts resulted in end users accessing query portals for additional patient information.
- Within 7 days, approximately 7% of alerts resulted in query access.

KEY FINDING #5: QUERIES AFTER ALERTS ARE RECEIVED ARE MORE COMMON FOR OLDER AND YOUNGER PATIENTS

Figure 4. Percent of Alerts from HEALTHeLINK with a Query within 24 hours, 72 hours, and 7 days by Patient Age.



- Organizations are most likely to access Qualified Entities' query-based portal services if they received an alert for younger (<18) and older patients (65+).

KEY FINDING #6: QUERIES AFTER AN ALERT IS RECEIVED ARE MOST COMMON IN LONG TERM CARE/HOME HEALTH AND PAYER ORGANIZATIONS

Table 4. Organizational Characteristics Associated with Utilization of Query-Based Services Following an Alert from HEALTHeLINK.

	Total number of alerts received (n)	Query w/in 24hrs?	Query w/in 72hrs?	Query w/in 7days?
		Y	Y	Y
All Alerts	142,459	3.0	4.8	6.9
Receiving Organization Type				
Primary Care Clinic[1]	46,335	0.3	0.4	0.6
Federally Qualified Health Center	9,501	1.6	3.0	5.2
Specialty/Multi-Specialty Clinic[2]	19,183	7.0	10.9	15.6
Long Term Care/Home Health	1,053	25.5	40.7	56.8
Health Home	47,271	2.4	4.2	6.3
Behavioral Health	4,840	3.3	5.2	7.8
Payer	620	36.6	52.7	73.2
Other[3]	2,433	0.0	0.0	0.0

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.
[3]"Other" includes social services, community services, and other non-clinical care settings.

- While Long Term Care/Home Health and Payer agencies did not receive a large number of alerts, both were highly likely to access query-based portal services for the alerts they did receive.
- Specialty or Multi-specialty clinics were the next group most likely to use query-based portals.

KEY FINDING #7: QUERIES WITHIN 24 HOURS ARE MOST COMMON WHEN A PATIENT HAD BEEN DISCHARGED OR WAS SEEN IN BOTH AN ED AND INPATIENT SETTING

Table 5. Characteristics Associated with Utilization of Query-Based Services Following an Alert from HEALTHeLINK.

	Total number of alerts received (n)	Query w/in 24hrs? Y(%)	Query w/in 72hrs? Y(%)	Query w/in 7days? Y(%)
All Alerts	142,459	3.0	4.8	6.9
Alert Timing				
Admit	38,730	3.3	5.7	8.9
Discharge	53,781	3.1	4.9	6.8
Both	49,948	2.5	3.9	5.6
Alert Setting				
Emergency Department	113,879	2.9	4.7	6.9
Inpatient	27,575	3.4	5.1	7.0
Both	1,005	3.5	6.0	9.0
Direct to EHR				
Yes	5,578	1.8	3.1	4.4
No	136,881	3.0	4.8	7.0

- Alerts sent after an individual had been admitted from an emergency department or inpatient setting were most likely to result in an organization accessing QE query-based portal services within 24 hours.
- Alerts that were sent when a patient had been to both the ED and inpatient setting in the same day were most likely to result in an organization accessing QE query-based portal services across all times.
- Alerts that were sent direct to an EHR were less likely to result in a query across all times.

Appendix B. New York City Report

KEY FINDING #1: USAGE OF SUBSCRIPTION ALERT SERVICES AND QUERY-BASED EXCHANGE INCREASED OVER TIME

Figure 1. Number of Events with an Alert Sent by Healthix.

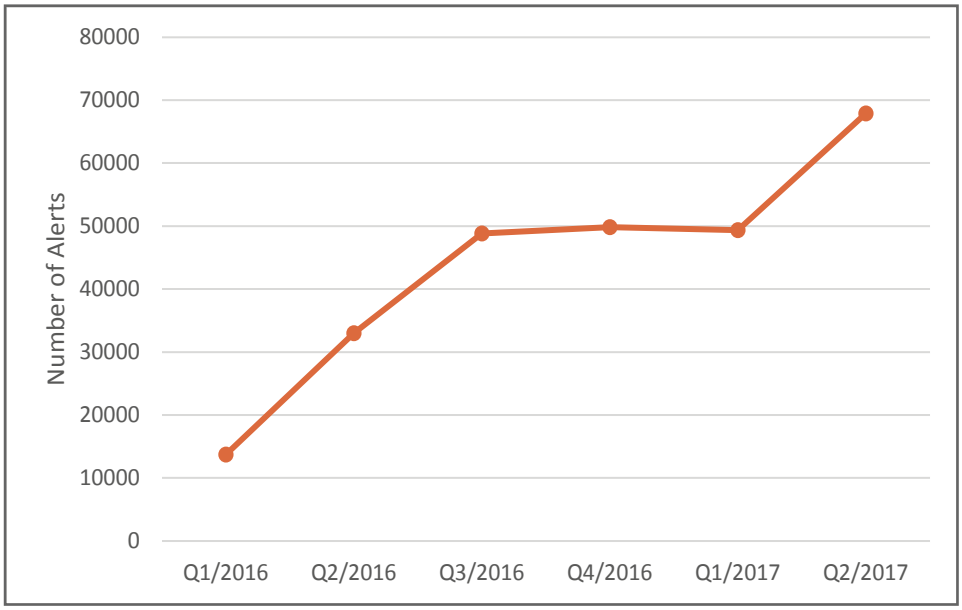
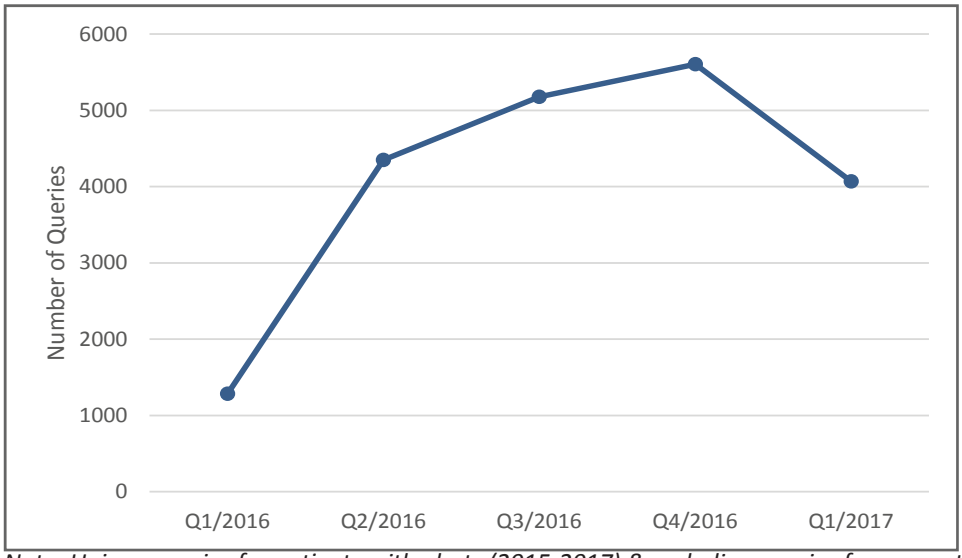


Figure 2. Number of Queries to Healthix's Patient Record System.



Note: Unique queries for patients with alerts (2015-2017) & excluding queries for consent only.

- The number of alerts being sent for patients with alerts is increasing over time.
- The number of queries is generally increasing over time, however query usage decreases with the inclusion of CCDs (see Table 5).

KEY FINDING #2: CHARACTERISTICS ASSOCIATED WITH ALERTS

Table 1. Patient Characteristics Associated with Alerts from Healthix.

	N	%
Patient Gender		
Male	125,449	40.6
Female	166,086	53.7
Other/Unknown	17,584	5.7
Patient Age		
< 18	14,135	4.6
18 - 29	30,517	9.9
30 - 44	45,020	14.5
45 - 64	104,102	33.7
65+	115,345	37.3

Table 2. Patient Characteristics Associated with Alerts from Healthix.

	N	%
Alert Timing		
Admit	126,335	40.9
Discharge	125,690	40.6
Both	57,094	18.5
Alert Setting		
Emergency Department	161,232	52.2
Inpatient	105,379	34.1
Both	42,508	13.7
Alert Source Type		
General Hospital	307,554	99.5
Specialty Hospital	1,565	0.5
Alert Source Location		
Downstate Metropolitan	309,119	100.0
Direct to EHR		
Yes	286,708	92.8
No	22,411	7.2
CCD Attached		
Yes	286,708	92.8
No	22,411	7.2

- Alerts are more likely to be sent for women than men.
- More alerts are sent for individuals that were 65 or older.
- Alerts are about equally likely to be sent when a patient had been admitted or discharged from an emergency department or an inpatient setting.
- A majority of alerts are sent directly to the end users' electronic health record systems (other methods of delivery include secure email or other messaging) with a Continuity of Care Document (CCD) attached.

KEY FINDING #3: LONG TERM CARE/HOME HEALTH ORGANIZATIONS ARE THE LARGEST RECIPIENTS OF ALERTS

Table 3. Types of Organizations that Received Alerts from Healthix.

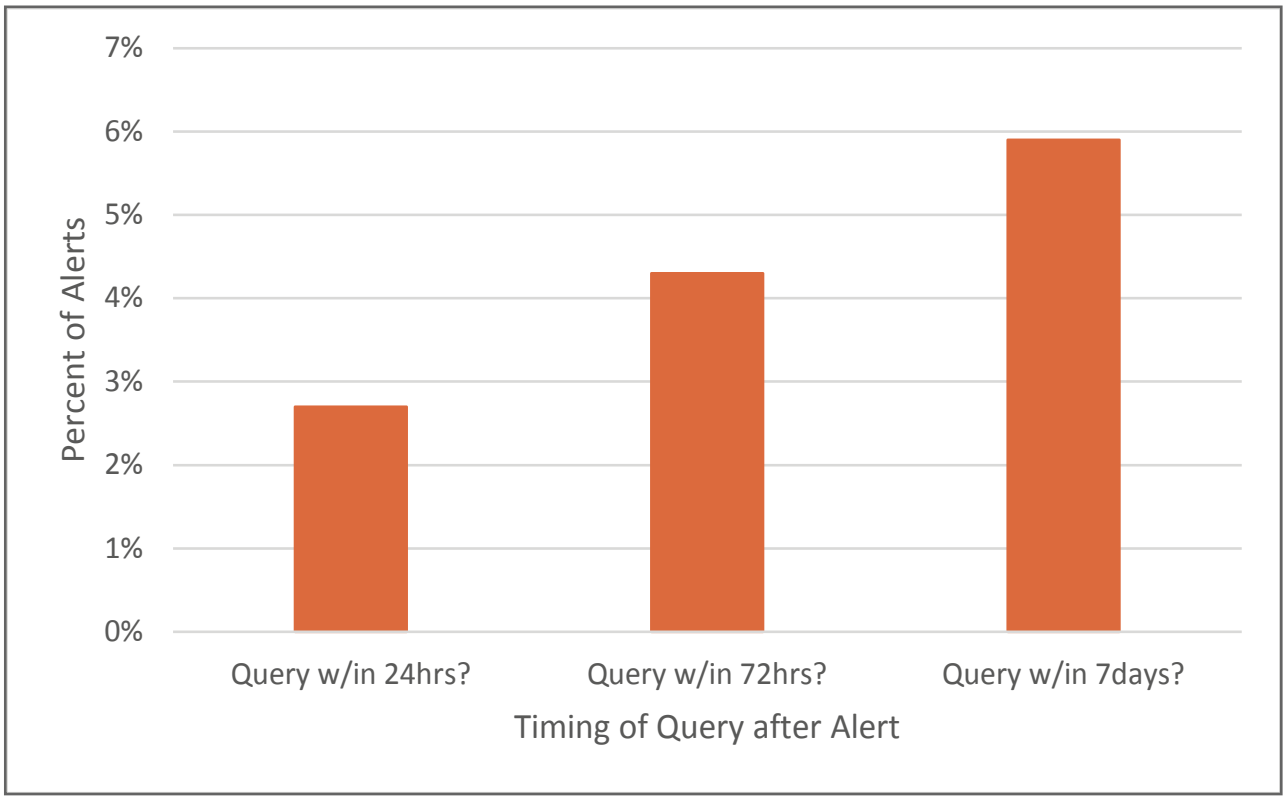
	N	%
Receiving Organization Type		
Primary Care Clinic[1]	48,817	15.8
Federally Qualified Health Center	47,138	15.3
Specialty/Multi-Specialty Clinic[2]	19,183	6.2
Long Term Care/Home Health	102,082	33.0
Health Home	80,338	26.0
Behavioral Health	1,644	0.5
Payer	8,355	2.7

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.

- Long Term Care/Home Health organizations received the largest number of alerts.
- Health Homes, Primary Care Clinics, and Federally Qualified Health Centers were the next most common recipients of alerts.

KEY FINDING #4: PROVIDERS USE QUERY-BASED EXCHANGE IN RESPONSE TO ALERTS

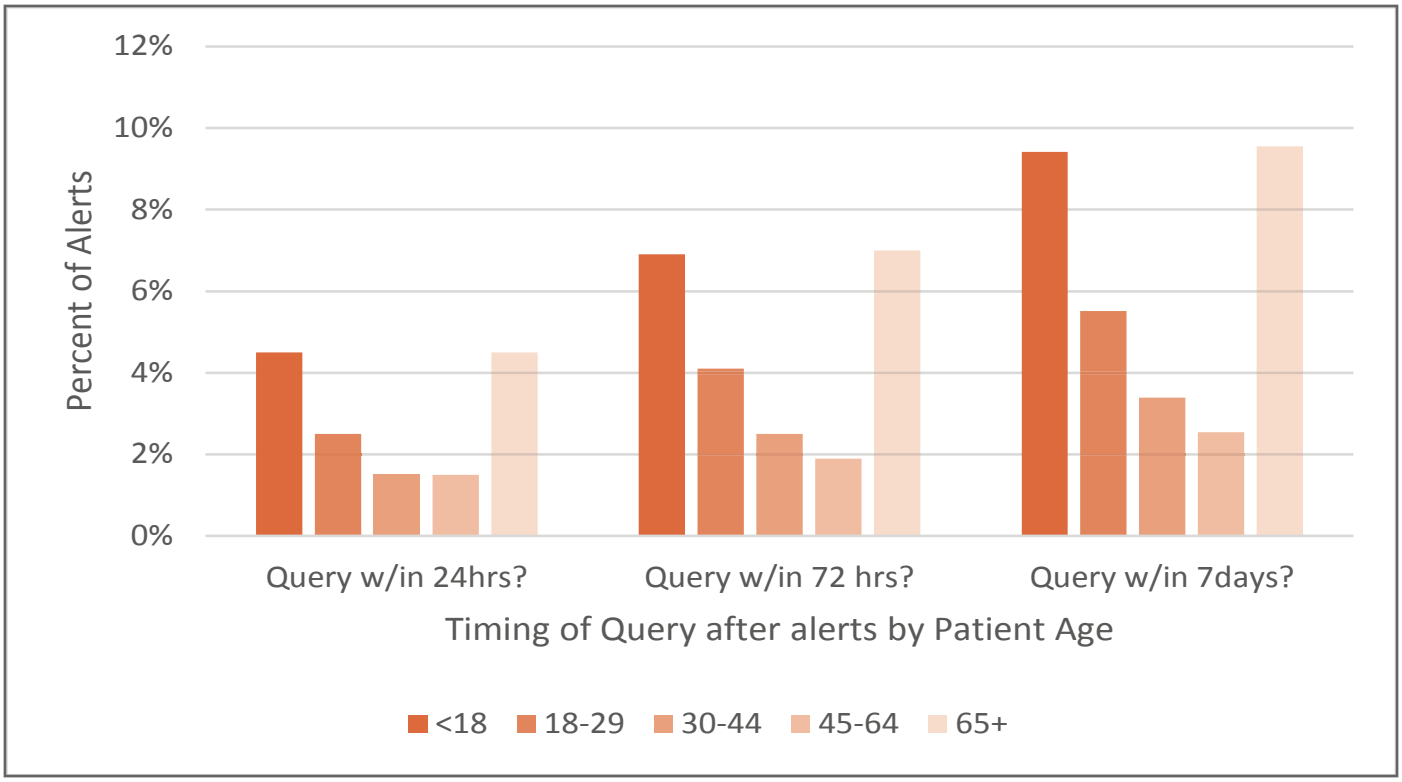
Figure 3. Percent of Alerts from Healthix with a Query within 24 hours, 72 hours, and 7 days.



- Both alerts and query-based information exchange are supported by New York State and the Federal Government.
- Within 24 hours, a little less than 3% of alerts resulted in end users accessing query portals for additional patient information.
- Within 7 days, about 6% of alerts resulted in query access.

KEY FINDING #5: QUERIES AFTER ALERTS ARE RECEIVED ARE LESS COMMON FOR OLDER AND YOUNGER PATIENTS

Figure 4. Percent of Alerts from HEALTHeLINK with a Query Within 24 hours, 72 hours, and 7 days by Patient Age.



- Organizations are most likely to access Qualified Entities' query-based portal services if they received an alert for younger (<18) and older patients (65+).

KEY FINDING #6: QUERIES AFTER AN ALERT IS RECEIVED ARE MOST COMMON IN SPECIALTY AND MULTI-SPECIALTY CLINICS

Table 4. Organizational Characteristics Associated with Utilization of Query-Based Services Following an Alert from Healthix.

	Total number of alerts received (n)	Query w/in 24hrs?	Query w/in 72hrs?	Query w/in 7days?
		Y	Y	Y
All Alerts	309,119	2.7	4.3	5.9
Receiving Organization Type				
Primary Care Clinic[1]	48,817	2.5	4.0	5.2
Federally Qualified Health Center	47,138	1.3	2.3	3.3
Specialty/Multi-Specialty Clinic[2]	19,183	31.8	50.0	68.3
Long Term Care/Home Health	102,082	0.2	0.3	0.3
Health Home	80,338	0.0	0.0	0.0
Behavioral Health	1,644	1.0	1.3	3.8
Payer	8,355	4.1	6.1	7.5
Other[3]	1,562	0.4	0.5	0.5

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.

- Specialty and Multi-specialty clinics are more likely to use query-based portals than other types of providers.
- Organizations classified as others are the next group most likely to use query-based portals, followed by payers, and then primary care clinics.

KEY FINDING #7: QUERIES WITHIN 24 HOURS ARE MOST COMMON WHEN A PATIENT HAD BEEN DISCHARGED OR WAS SEEN IN BOTH AN ED AND INPATIENT SETTING

Table 5. Characteristics Associated with Utilization of Query-Based Services Following an Alert from Healthix.

	Total number of alerts received (n)	Query w/in 24hrs?	Query w/in 72hrs?	Query w/in 7days?
		Y(%)	Y(%)	Y(%)
All Alerts	309,119	2.7	4.3	5.9
Alert Timing				
Admit	126,335	2.7	4.6	6.7
Discharge	118,830	2.9	4.4	5.5
Both	57,094	2.4	3.7	5.1
Alert Setting				
Emergency Department	161,232	1.9	3.1	4.2
Inpatient	105,379	3.6	5.4	7.2
Both	42,508	3.9	6.4	9.1
Direct to EHR				
Yes	286,708	2.4	3.9	5.3
No	22,411	6.6	10.5	13.6
CCD Attached				
Yes	286,708	2.4	3.9	5.3
No	22,411	6.6	10.5	13.6

- Alerts sent after an individual had been discharged from an emergency department or inpatient setting were most likely to result in an organization accessing QE query-based portal services within 24 hours.
- Alerts that were sent when a patient had been to both the ED and inpatient setting in the same day were most likely to result in an organization accessing QE query-based portal services across all times.
- Alerts that were sent direct to an EHR with a CCD attached were less likely to result in a query across all times.

Appendix C. Rochester Report

KEY FINDING #1: USAGE OF SUBSCRIPTION ALERT SERVICES AND QUERY-BASED EXCHANGE INCREASED OVER TIME

Figure 1. Number of Alerts Sent by Rochester RHIO.

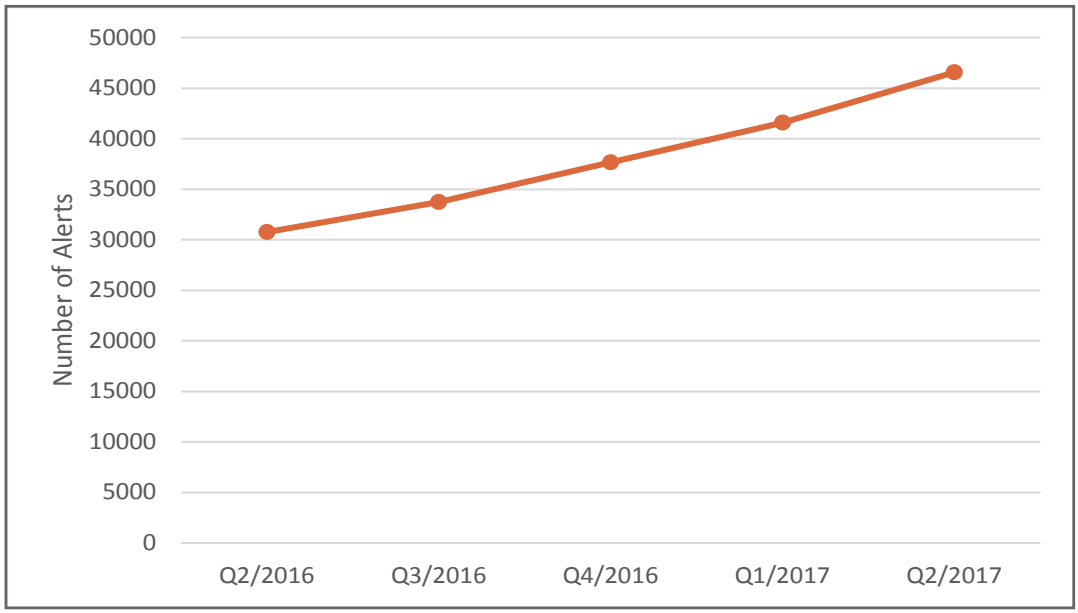
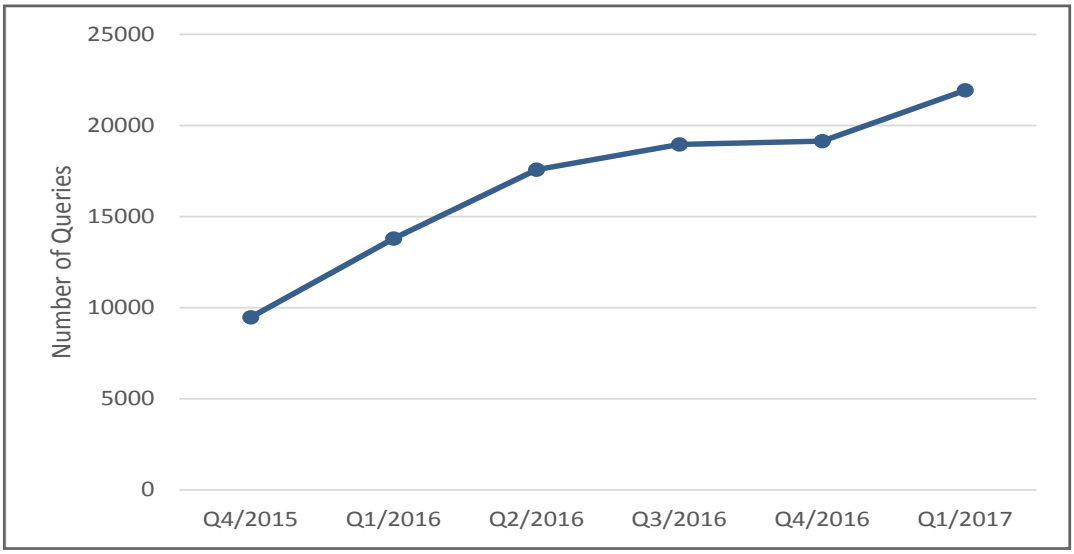


Figure 2. Number of Queries to Rochester RHIO's Patient Record System.



Note: Unique queries for patients with alerts (2015-2017) & excluding queries for consent only.

- The number of alerts being sent for patients with alerts is increasing over time.
- The number of queries is increasing over time.

KEY FINDING #2: CHARACTERISTICS ASSOCIATED WITH ALERTS

Table 1. Patient Characteristics Associated with Alerts from Rochester RHIO.

	N	%
Patient Gender		
Male	69,119	36.3
Female	113,092	59.4
Other/Unknown	8,130	4.3
Patient Age		
< 18	8,128	4.3
18 - 29	17,620	9.3
30 - 44	33,135	17.4
45 - 64	66,530	34.9
65+	64,928	34.1

Table 2. Patient Characteristics Associated with Alerts from Rochester RHIO.

	N	%
Alert Timing		
Admit	63,982	33.6
Discharge	56,939	29.9
Both	69,402	36.5
Alert Setting		
Emergency Department	137,601	72.3
Inpatient	46,536	24.4
Both	6,204	3.3
Alert Source Type		
General Hospital	190,341	100.0
Specialty Hospital	0	0.0
Alert Source Location		
Upstate Metropolitan	168,019	88.3
Micropolitan	17,669	9.3
Rural	4,653	2.4
Direct to EHR		
Yes	14,135	7.5
No	176,026	92.5

- Alerts are more likely to be sent for women than men.
- More alerts are sent for individuals between the ages of 45-64 and those that were 65 or older.
- Alerts are most commonly sent when a patient had been admitted or discharged from an emergency department than an inpatient setting.

KEY FINDING #3: LONG TERM CARE/HOME HEALTH ORGANIZATIONS ARE THE LARGEST RECIPIENTS OF ALERTS

Table 3. Types of Organizations that Received Alerts from Rochester RHIO.

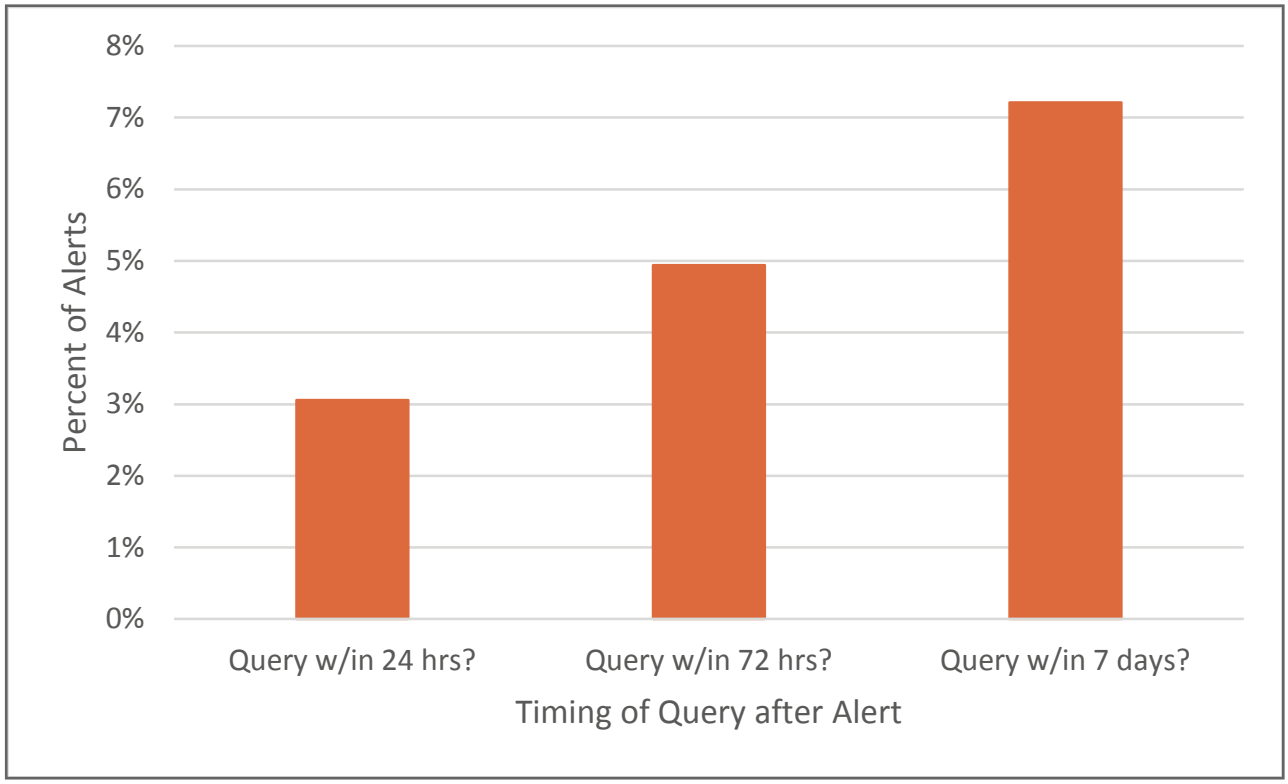
	N	%
Receiving Organization Type		
Primary Care Clinic[1]	8,746	4.6
Federally Qualified Health Center	62,774	33.0
Specialty/Multi-Specialty Clinic[2]	534	0.3
Long Term Care/Home Health	75,672	39.8
Health Home	14,285	7.5
Behavioral Health	8,284	4.4
Other[3]	20,046	10.5

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.
[3]"Other" includes social services, community services, and other non-clinical care settings.

- Long Term Care/Home Health received the largest number of alerts.
- Federally Qualified Health Centers were the next most common recipients of alerts.

KEY FINDING #4: PROVIDERS USE QUERY-BASED EXCHANGE IN RESPONSE TO ALERTS

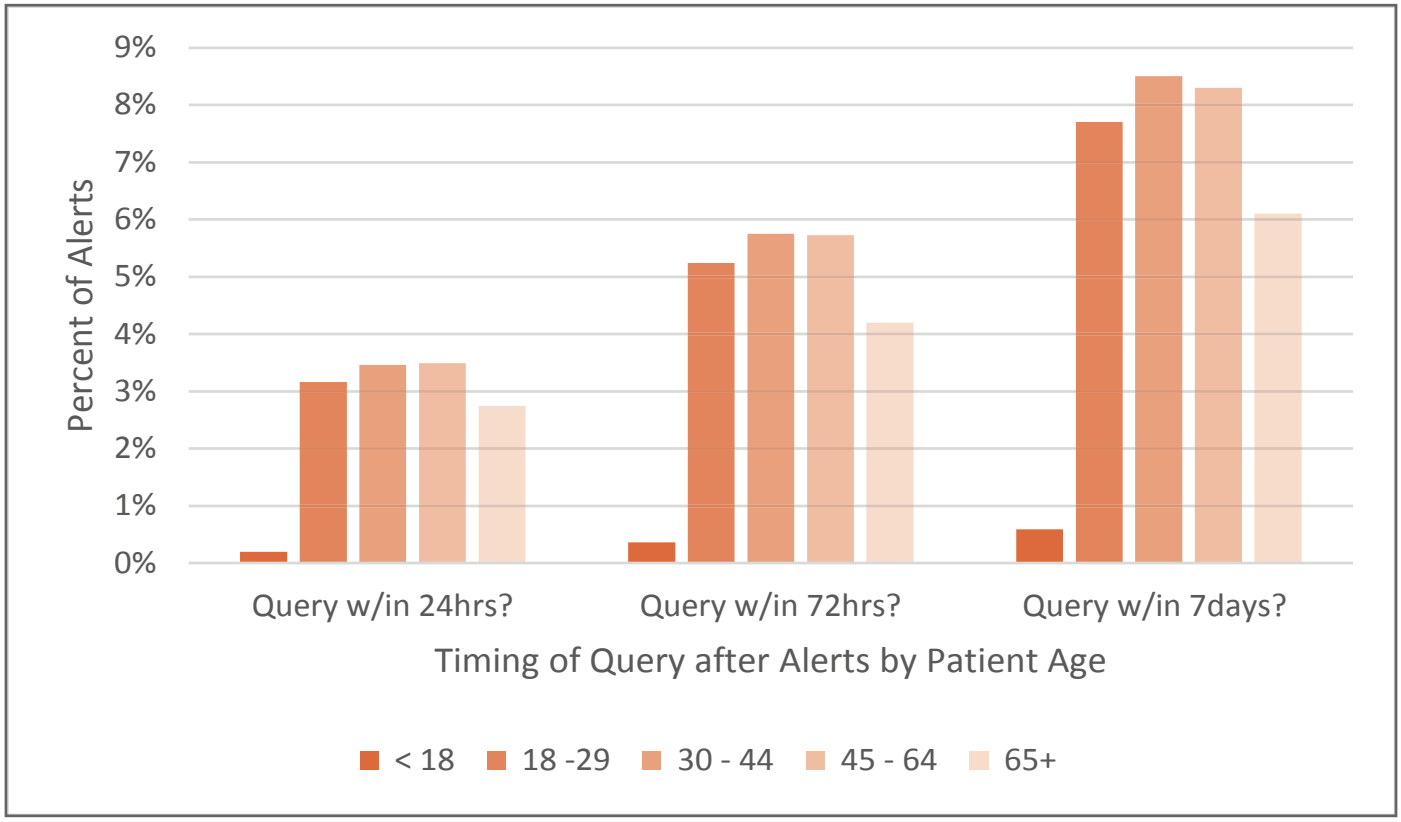
Figure 3. Percent of Alerts from Rochester RHIO with a Query within 24 hours, 72 hours, and 7 days



- Both alerts and query-based information exchange are supported by New York State and the Federal Government.
- Within 24 hours, approximately 3% of alerts resulted in end users accessing query portals for additional patient information.
- Within 7 days, more than 7% of alerts resulted in query access.

KEY FINDING #5: QUERIES AFTER ALERTS ARE RECEIVED ARE MOST COMMON FOR ADULT PATIENTS

Figure 4. Percent of Alerts from Rochester RHIO with a Query within 24 hours, 72 hours, and 7 days by patient age.



- Organizations are most likely to access Qualified Entities' query-based portal services if they received an alert for patients that were 30-64 years old.

KEY FINDING #6: QUERIES AFTER AN ALERT IS RECEIVED ARE MOST COMMON IN FEDERALLY QUALIFIED HEALTH CENTERS

Table 4. Organizational Characteristics Associated with Utilization of Query-Based Services Following an Alert from Rochester RHIO.

	Total number of alerts received (n)	Query w/in 24hrs?	Query w/in 72hrs?	Query w/in 7days?
		Y	Y	Y
All Alerts	190,341	3.1	4.9	7.2
Receiving Organization Type				
Primary Care Clinic[1]	8,746	3.8	6.6	9.6
Federally Qualified Health Center	62,774	5.6	9.2	13.7
Specialty/Multi-Specialty Clinic[2]	534	0.0	0.0	0.0
Long Term Care/Home Health	75,672	0.9	1.2	1.8
Health Home	14,285	0.0	0.0	0.0
Behavioral Health	8,284	3.8	6.5	13.8
Other[3]	20,046	4.0	6.5	8.9

[1]Primary care clinics include hospital-based clinics.
[2]Specialty/Multi-Specialty clinics may include primary care services offered as part of multi-specialty practices.
[3]"Other" includes social services, community services, and other non-clinical care settings.

- Federally Qualified Health Centers are more likely to use query-based portals within 24 hours than other types of providers.

KEY FINDING #7: QUERIES WITHIN 24 HOURS ARE MOST COMMON WHEN A PATIENT HAD BEEN DISCHARGED OR WAS SEEN IN AN INPATIENT SETTING

Table 5. Characteristics Associated with Utilization of Query-Based Services Following an Alert from Rochester RHIO.

	Total number of alerts received (n)	Query w/in 24hrs? Y(%)	Query w/in 72hrs? Y(%)	Query w/in 7days? Y(%)
All Alerts	190,341	3.1	4.9	7.2
Alert Timing				
Admit	63,892	2.8	4.9	7.6
Discharge	56,939	3.6	5.2	7.2
Both	69,420	2.9	4.8	6.8
Alert Setting				
Emergency Department	137,601	2.8	4.8	7.0
Inpatient	44,836	3.7	5.3	7.6
Both	6,204	3.4	6.0	9.6
Alert Source Location				
Metropolitan	168,019	2.9	4.6	6.7
Micropolitan	17,669	4.6	7.9	11.4
Rural	4,468	4.0	6.3	10.2
Direct to EHR				
Yes	14,315	0.0	0.0	0.0
No	176,026	3.3	5.3	7.8

- Alerts sent after an individual had been discharged from an emergency department or inpatient setting were most likely to result in an organization accessing QE query-based portal services within 24 hours.
- Alerts that were sent when a patient had been to both the ED and inpatient setting in the same day were most likely to result in an organization accessing QE query-based portal services within 72 hours and 7 days.

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TECHNICAL & SUPPLEMENTAL INFORMATION

Data: Healthix, HEALTHeLINK, and the Rochester Regional Health Information Organization provided records of alerts from inpatient and emergency departments from their participating hospitals and health systems. The alert records included: patient demographics (age and gender), sending facility type (general medicine or specialty hospital), sending facility location (metropolitan, micropolitan, or rural), the timing (admit, discharge, both admit and discharge), and setting (ED, inpatient, both inpatient and ED) of the alert and the delivery method of the alert (direct to EHR or not). One QE attached continuity of care documents (CCD) to their alerts. To be consistent across the QEs, we excluded all records from sending facilities that were not hospitals or health systems and alerts that were not for an admission/discharge from a hospital or emergency department. Because more than one alert may be sent per health care encounter, we reduced all records into unique sender-recipient combinations for a single patient per day. Due to changes in systems or software upgrades, QEs supplied data for slightly different historical periods. All QEs provided data for Quarter 2, 2016 to Quarter 2, 2017. These consistent data are presented in Figure 1, which illustrates the cumulative number of alerts. However, for our descriptive analyses we used all the data available, which includes all alerts from Quarter 1, 2015 to Quarter 4, 2017.

In addition to alert notifications, our analyses also included the QE's query-based exchange systems user access log files. We included all queries for patients that had received an alert within the study period. All query records without any associated alerts were excluded from the analysis. We matched queries to alerts based on patient ID, the receiving facility, and dates. Based on feedback from NYeC and the QEs, we identified queries that occurred within 24 hours, 72 hours, and 7 days of an alert being sent. The QEs also provided us with information about the types of organizations that are enrolled in their alert and query-based exchange services and are currently receiving alerts. We did have patient consent information for both alert and query-based exchange services; however, due to inconsistencies in how current consent was identified across QEs, we did not include it in our analyses.

Quotes were obtained through interviews with QE end users.

Analyses: The unit of analysis was the alert. We described the overall sample, and by QE, using frequencies and percentages. We conducted stratified analyses to describe differences in the frequency of querying within 24 hours, 72 hours, and 7 days of an alert.

Notes: Figure 3 shows the overall percent of alerts that result in a query within 24 hours, 72 hours, and 7 days. Figure 4 and Tables 4 and 5 provide additional information about factors that are associated with an organizations likelihood to access query-based exchange services after receiving an alert. This represents the first quantification of the relationship between alerts and query-based exchange (to the best of our knowledge) anywhere. Therefore, we cannot comment on whether the percentages are high, low, or even appropriate as no benchmarks exist for comparison.