



Final Report
Exchange and Interoperability
Measurement Community of Practice

Measuring Nationwide
Progress: Interoperability
and Exchange of
Health Information

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Executive Summary

As the U.S. makes strides toward nationwide interoperability in the arena of electronic health information, it has become an increasingly important priority to monitor our progress and define what constitutes success. Both Congress and the Office of the National Coordinator for Health Information Technology (ONC) have promulgated interoperability goals and objectives. As the nation works toward the Congressional goal of achieving widespread exchange of health information through interoperable certified electronic health record (EHR) interoperable technology throughout the U.S. by the end of 2018, Congress is also requiring Health and Human Services (HHS) to establish metrics by July 1, 2016 to measure the extent to which the nation is achieving this objective. Given the priority of measuring the nation's progress, the ONC Interoperability Roadmap includes a section on the proposed Measurement and Evaluation Framework which outlines a core set of measures that require ongoing measurement to monitor success in achieving exchange and interoperability. These measures are in three domains: (1) capability for interoperable exchange; (2) information flow and usage of interoperable information; and (3) impacts of exchange and interoperability on improved health care, outcomes, and population health, as well as the cost of care.

To stimulate further progress in measurement, ONC contracted with Venesco LLC to convene, facilitate, support, and document the key insights from a national Community of Practice (CoP) addressing Exchange and Interoperability Measurement in early 2015. This final report documents the following: the purpose, goals, and timeline of the CoP, the major measurement themes addressed by the diverse CoP membership in their five months of webinars, the current state of exchange measurement in each of the three measurement domains and the associated challenges, the types of specific measures that are in current use, and a discussion of the cross-cutting challenges that are associated with measuring progress in exchange and interoperability.

Venesco's general findings based on insights and presentations from the CoP membership are:

- Current measurement is generally limited to the Capabilities realm and the Information Flow and Usage realm (adoption and usage)
- Usage metrics, which primarily consist of transaction measures, are not standardized and vary across organizations, preventing aggregation for assessing progress overall
- Impact and outcomes measures are just now being explored by Health Information Exchanges (HIEs), researchers, and others to examine and determine the causal link between HIE access and improved care, costs, and outcomes for patients.
- Improved outcomes in the Triple Aim (improved patient care/experience, better patient outcomes and population health, and lower costs) are often considered the Holy Grail sought by the nation in its quest for interoperability and exchange. However, such outcomes measurement is costly, complex, and typically requires access to research expertise and data sources that are often not readily available and are subject to privacy restrictions.

- Instead, there is interest and work to develop metrics that assess whether and how information that was exchanged from outside sources was used to inform decisions. For example, was the information that was received new? Did it result in a change in how care was delivered? Such measures are closely linked to interoperability and may be less cumbersome to measure compared to outcome measures.

This document concludes with profiles of a series of interoperability and exchange measures in current use among the CoP member organizations to serve as a useful guide for HIEs, Health Information Service Providers (HISPs), and other stakeholders and as a point of departure for the Health and Human Services (HHS) metrics being developed to comply with the 2016 Congressional mandate.

1 Introduction

As the U.S. makes strides toward nationwide interoperability in the arena of electronic health information, it has become an increasingly important priority to monitor our progress and define what constitutes success. Both Congress and the Office of the National Coordinator for Health Information Technology have promulgated interoperability goals and objectives. ONC has issued its Shared Nationwide Interoperability Roadmap: The Journey to Better Health and Care¹, which proposes a series of goals to move the nation along this journey: (1) the initial goal is to get information flowing such that the nation will be sending, finding, receiving, and using essential health information by the end of 2017; (2) by the end of 2020, it is anticipated that we will be using information to improve healthcare quality and lower costs; and (3) by 2024, the nation will have a Learning Health System in which we will use a broad range of interoperable health data to inform our health system and expand into such areas as social services, which are significantly related to health.

Complementing ONC's Interoperability Roadmap goals, Congress has declared it a national objective to achieve widespread exchange of health information through interoperable certified EHR technology nationwide by December 31, 2018. To assure that we measure the degree to which the nation is achieving these objectives, Congress has required that the Secretary of Health and Human Services, in consultation with stakeholders, shall establish metrics no later than July 1, 2016 to be used to determine if and to what extent the Congressional objective has been achieved.

The ONC Roadmap includes a section on the proposed Measurement and Evaluation Framework which outlines a core set of measures that require ongoing measurement to monitor success in achieving exchange and interoperability. These measures are in three domains: (1) capability for interoperable exchange; (2) information flow and usage of interoperable information; and (3) impacts of exchange and interoperability on improved health care, outcomes, and population health, as well as the cost of care.

One key issue that has arisen as ONC and its stakeholders have considered the best metrics and the best approaches to measurement has been confusion concerning the definition of interoperability and how best to operationalize its measurement. As ONC's Doug Fridsma commented in a blog entry in January 2013, the terms "health information exchange" and "interoperability" are often used interchangeably, but it is important to recognize that they are in fact two different things. He noted that interoperability has two parts: one is the ability to exchange information and the second is the ability to use the information that has been exchanged. The Institute for Electrical and Electronics Engineering (IEEE) has defined interoperability as: "the ability of two or more systems or components to exchange information and to use the information that has been exchanged."

1.1 Creation of the Exchange and Interoperability Measurement Community of Practice

In 2014, ONC had decided to initiate a number of Communities of Practice (CoP) workgroups in key areas of interest to ONC and its key stakeholders throughout the nation, many of which are of significant relevance to the ONC Interoperability Roadmap. Given the emergence of measurement as a national priority in order to monitor the nation's progress in exchange and interoperability, ONC leaders selected the Measurement of Exchange and Interoperability as one of the three ONC Communities of Practice that were initiated in fiscal year 2014-2015. This final report was developed by Venesco LLC, under contract with ONC, and reflects Venesco's analysis and synthesis of the best practices and insights provided by the membership of the Measurement Community of Practice. **It documents the purpose, goals, deliverables, membership, and challenges of the Measurement CoP, the major measurement themes the CoP addressed, identification of the status of different types of measurement activities, and the cross-cutting measurement challenges that continue to confront the nation. This report also provides a spreadsheet of profiles of example exchange and interoperability measures that are currently in use to serve as a point of departure for further measure development.**

2 Overview of Measurement Community of Practice

Planning for the Measurement Community of Practice began in early 2015, and the official Kick Off Launch webinar was conducted in late April. Highlights of its organizing charter are provided below.

2.1 Purpose

The original purpose for the Measurement CoP was to:

- Gain better situational awareness of what measurement is happening across the nation and what is working well in the field
- Work to synthesize, prioritize, and standardize measures in a logical, unifying, and strategic way.
- Assess and pilot test measures in the proposed ONC Interoperability Roadmap to determine which measures are useful and feasible
- Identify potential candidates for pilot testing novel metrics that could be used nationwide
- Leverage existing resources, such as the draft Interoperability Roadmap, the Federal Health IT Strategic Plan, the ONC State HIE Program Measurement Dashboard, ONC survey data, CMS Meaningful Use Stage 2 data, data from governance and governance-like organizations, and external survey data (eHealth Initiative and Robert Wood Johnson Foundation)

It should be noted that the original purpose had to be modified due to the brief time period available to the Measurement CoP, so only certain aspects are reported in this document.

2.2 Overarching Goals

The overarching goals of the Measurement CoP included:

- Promotion of information and insight sharing concerning HIE/HIT measurement
- Identification and documentation of current successful approaches to measurement
- Measurement gaps and how to address them
- Identification of useful local or regional metrics that could be tested for national use
- Development of a resource inventory of measures

2.3 Leadership and Membership

ONC provided support to the Measurement CoP, including a health information exchange measurement subject matter expert. The ONC Team and the CoP were supported by two ONC contractors provided by Venesco, LLC, who facilitated the webinars, developed the agendas, minutes, and reports, and provided other support functions as needed by the CoP. In early 2015, Venesco and the ONC Team worked diligently to identify and recruit an intentionally diverse group of CoP members whose organizations are listed in the Appendix of this report. The CoP membership included representatives of 25 health-related organizations with in-depth knowledge and interest in the measurement of exchange and interoperability, including HIEs (both state and enterprise), HISP experts, developers, integrated delivery systems, and measurement/evaluation experts, among other stakeholders.

2.4 Challenges

As Venesco and ONC leaders contemplated the creation of the Measurement CoP, they became aware of a significant number of industry challenges in the measurement arena, including:

- Varied industry measurement definitions and interpretation of these definitions during implementation
- Varied industry measurement priorities
- Potential reporting limitations for various stakeholders
- Lack of clarity on the necessary data sources and authorization for access
- Lack of measurement standards in the field to ensure meaningful and accurate comparisons and ability to monitor progress effectively
- Lack of knowledge concerning how measurement data is to be shared across different healthcare environments
- Lack of clarity about what is working well and not working well in the field
- Need to identify additional data sources
- Need for better understanding concerning what measurement data is needed to inform policy and strategic planning efforts
- Need to define what measures are feasible in the near-term, mid-term, and long-term and how to prioritize them

2.5 Timeline and Deliverables

Another significant challenge for Venesco, ONC, and the CoP was the fact that the Measurement CoP had a shorter timeline (a total of 7 meetings of the CoP were held from late April through August, 2015) during which to achieve its ambitious goals and objectives. The primary deliverable was proposed to be a final report synthesizing the findings across the following areas:

- Situational awareness findings from workgroup participants
- Ground-up perspective on measurement activity that is working well in the field
- Inventory of industry measurement reports, templates, and related resources currently in use
- Feedback to allow more detail in the Interoperability Roadmap measurement section
- Feedback on testing proposed measures in the Roadmap

Given the brief and ambitious timeline of the Measurement CoP and the evolving state of measurement in the nation, this final report will address some but not all of the areas originally intended for inclusion in the final report.

3 Major Themes from the Measurement Community of Practice

This document is the final deliverable for the Measurement CoP and is organized around the Interoperability measurement framework’s three measurement domains outlined in the ONC Interoperability Roadmap and their specific measurement challenges: Capability; Movement of Information; and Outcomes Measures. The starting point in measuring exchange and interoperability is to assess the capability of infrastructure and services needed to support the next step, which is the actual flow of information and usage, which is in turn intended to have measurable impacts on the key processes that will improve health care and health outcomes, and reduce costs.

As Venesco and ONC sought to work with the CoP members to identify current measurement practices in the field and any gaps, they noted the complex “**Measurement Challenge**”: whether to measure interoperability OR the impacts of interoperability. That is, should the focus be on the measurement of providers exchanging real-world data or on measuring the role of interoperability in achieving desired outcomes? While outcome measures are highly valued by stakeholders, it is typically difficult to determine what factors—HIE access or other changes—actually “moved the needle.”

In addition to discussing the above issue, the Venesco/ONC team posed a number of questions to the CoP membership, including:

- What meaningful measures are your organizations currently using and finding useful?
- What is the best strategy to address the Measurement Challenge (that is, how best to move toward HIE-sensitive outcome measures)?
- What concepts are missing from the Roadmap framework and which concepts are the most important to measure?
- How should we prioritize—focus on certain use cases, priority populations, or at certain levels (e.g., encounter, patient, provider, organization)?
- What data sources are proving to be useful, especially those beyond the current ones, and how does one access these data sources?
- What role do HISPs play and how can we measure the exchange that they enable?

3.1 Theme I: Measures of Capability to Exchange Information in an Interoperable Manner

Overall, most current measurement is in the area of adoption and use. Examples of capability measures include the degree of adoption of specific technologies, standards, infrastructure, and policies to ensure secure exchange of interoperable data as well as the capabilities of providers across the care continuum to securely exchange data in an interoperable manner. The CoP members shared presentations, experience, and insights concerning capability measures throughout the course of the CoP.

The eHealth Initiative (eHI) representative on the CoP brought together a focus group of nine mature HIEs who participate in eHI to discuss what measures they collect. These HIEs are

primarily collecting information on adoption and usage, which they characterize as Phase 1. The adoption measures include: volume of data as a percentage of the number of organizations connected, how many EHRs are connected, how many office-based providers and hospitals, and number of beds connected.

CRISP, the mature HIE serving Maryland which is represented on the CoP, has emphasized measurement throughout its tenure beginning in 2009 and this measurement is now focused on the HIE’s three core services: (1) the Query Portal, (2) the Electronic Notification System, and (3) the CRS Reporting System. The HIE tracks the following adoption measures that relate to participation and uptake of services offered (See Fig. 1)

- **In-bound Connectivity Tracking.** These measures show the sources of data by facility (hospitals and long-term care facility) and reflect the various data types by date, including encounter information, lab results, radiology results, ENS (electronic notification system) admit reasons, ENS discharge reasons, etc. The ENS admit reason is used to improve the value of the notification service. CCDA tracking will be added soon.
- **Weekly Scorecard Tracking.** This scorecard involves the tracking of such measures as Total Patients Searched in the Query Portal, the number of notifications sent (tracking outbound CCDs), the number of Opt Outs, how many providers have reached the Regional Extension Center Milestones, the number of patients in the Master Person Index, etc., (see Fig. 2).
- **Tracking of implementation of “single sign on” service,** which allows faster and more efficient access to the query portal through an EHR.

Figure 1. Key Performance Indicators

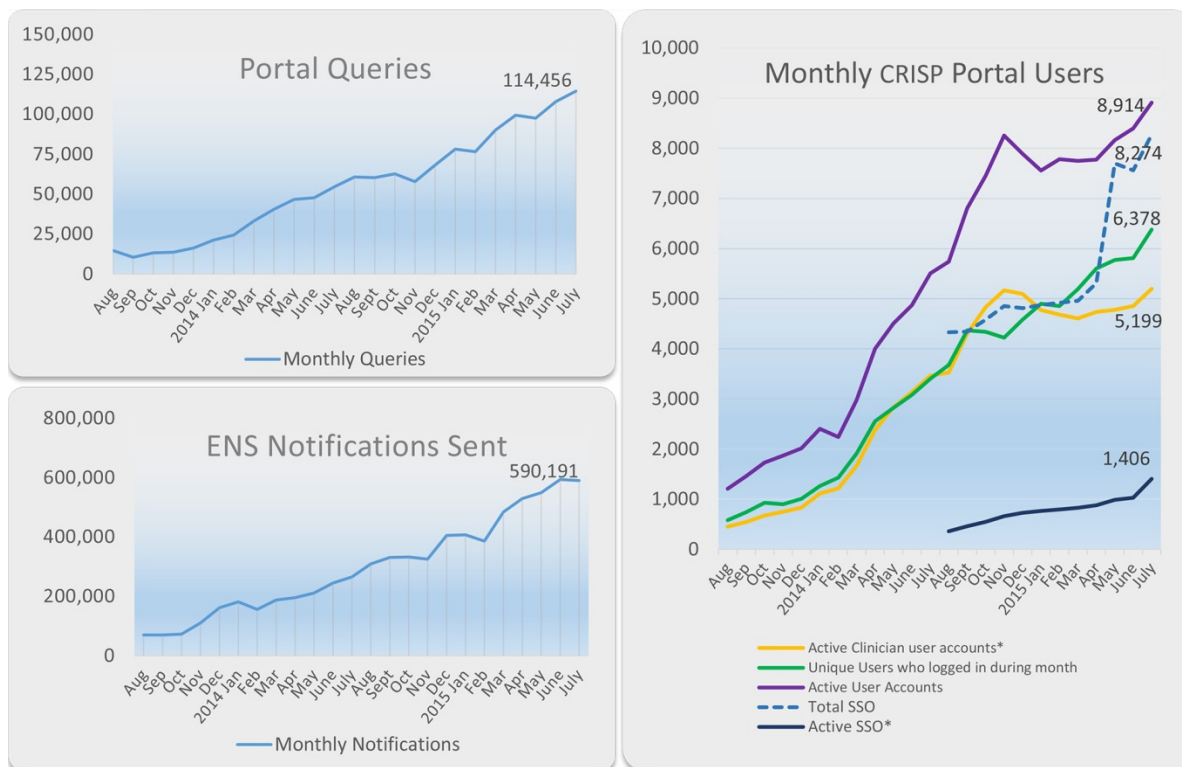


Figure 2. Weekly Scorecard Tracking

CRISP Weekly Scorecard 2015		Key: highest number for this metric to-date (new record) / get note for consideration or improvement needed cause for concern or large improvement needed		
Business Engines	Metric	6/22/2015-6/28/2015	6/29/2015-7/5/2015	7/6/2015-7/12/2015
Query Portal				
	Total Logins	14,838	17,361	19,960
	Unique Users Logins	3,387	3,725	3,747
	Total Patients Searched	24,691	24,113	27,098
	non-SSO	22,603	21,138	22,766
	SSO	2,088	2,975	4,332
	Total Patients Found	21,669	21,006	23,737
	Patient Success Rate	88%	87%	88%
	Clinical Documents Opened	14,805	13,461	15,471
	PDMP Patient Record Accesses	20,965	19,362	20,638
	Medication History Total Searches	n/a	n/a	n/a
	(Docs Opened + Medication History)	n/a	n/a	n/a
ENS				
	Notifications Sent	135,041	128,922	136,461
	Q3 ENS Live/ Total Live ENS Practices	447	450	463
	Direct Users	1,053	1,060	1,081
REC				
	Milestone 1	1,766	1,766	1,766
	Milestone 2	1,456	1,456	1,456
	Milestone 3	1,085	1,085	1,085
	Milestone Conversion 1-3	61%	61%	61%
Privacy and Security				
	Patients in the MPI	12,022,272	12,042,646	12,116,424
	Opt Outs	4,698	4,743	4,772
	Opt Outs Percentage	0.03908%	0.03939%	0.03938%
Data Feeds				
	Clinical Data Feeds	201	212	212
	CCD Feeds	n		

3.2 Theme II: Measures of Information Flow and Usage

Currently most measurement is occurring within this domain. Examples of potential measures of information flow and usage include measures of exchange activity; availability of information to inform decision making; rates of accessing available data (usage); interoperability of data, EHRs, and other systems; ability to easily integrate data across multiple sources; and the reliability, trustworthiness, and utility of the information exchanged.

Measures of information flow and usage at the current time are primarily transaction measures, according to the information shared by our CoP experts. For example, the monthly usage measures reported by participants of eHI include: number of pulls for query-based exchange, number of documents pulled, tracking the number of messages, the number of ADT alerts sent to providers, and the number of Direct messages sent and received. The HIEs also monitor results delivery: how many EHRs are being delivered to, number of practices these EHRs support—as well as such measures as the opt-out rate and whether CCDs can be integrated into an EHR. A mature HIE described usage and exchange metrics related to the services it provided. These included the following measures: portal queries, electronic notifications sent, and monthly HIE portal users. Additionally, they measure the number of CCDs delivered to a provider on discharge.

Another mature HIE represented on the CoP, the Delaware Health Information Network, shared measures related to facilitating care transitions, such as those following discharge to home health care or to skilled nursing facilities or from hospital to primary care, and in public health applications as well. These included:

- Adoption (both data senders and data receivers/end users)
- Growth in the adoption of services

- Utilization of notification alerts, image sharing, HIE-to-HIE exchange
- Electronic immunization reporting
- Data “push” information reported to Public Health
- Data “pull” utilization of its Community Health Record by state agencies, including the Department of Corrections, Epidemiology, and the State Cancer Registry.
- Utilization of its Community Health Record by skilled nursing facilities to facilitate care transitions and by behavioral health facilities.

The behavioral health access measure sparked interest and questions among the CoP members, who asked for further clarification. The response was that this referred to access by behavioral health providers to information on the physical health data of their patients. This HIE does not receive any behavioral health data from their participating organizations, since the state is an “all-or-none” from the standpoint of consent, so organizations are not currently sharing their behavioral health data with the HIE. However, the access to physical health information for patients of behavioral health providers is reportedly quite useful in improving patient care for those patients.

Other transactional measures presented in the CoP included measures for Direct Secure Messaging, EHR developer-based measures, and care transition uses. The CoP’s real-world experience in each of these areas is described below.

3.2.1 Measures for Direct Secure Messaging

Presentations concerning the measurement of Direct Secure Messaging were provided by two HISP providers and one ONC consultant. Insights from their Direct measurement initiatives are described below.

1. What role do HISPs play and how can we measure the exchange they enable?

This has been a key measurement question for ONC and others as Direct secure messaging has spread throughout the nation. Recent interviews of HISP respondents conducted by an ONC measurement consultant over the past 18 months shed some light on this little-understood area.

A member of the CoP, her research indicated that measures that can be measured today or in the near term include: (1) the volume of transactions within a HISP, rather than between HISPs; (2) volume of transactions within and between organizations for inter-organizational exchange (a key goal of both Direct and HIEs); and (3) volume of Direct transactions within the trust community and within a one-to-one trust partnership (are trust communities achieving the goal of scalable trust?). Her recommendation from a measurement perspective is to collect these measures from entities included in the HISP denominator. Concerning future measures, the ONC consultant indicates that we will be able to measure the volume of active Direct addresses in the near term; the volume of Direct transactions by use case in the moderate term, and the impact of Direct transactions on care quality and efficiency in the long term.

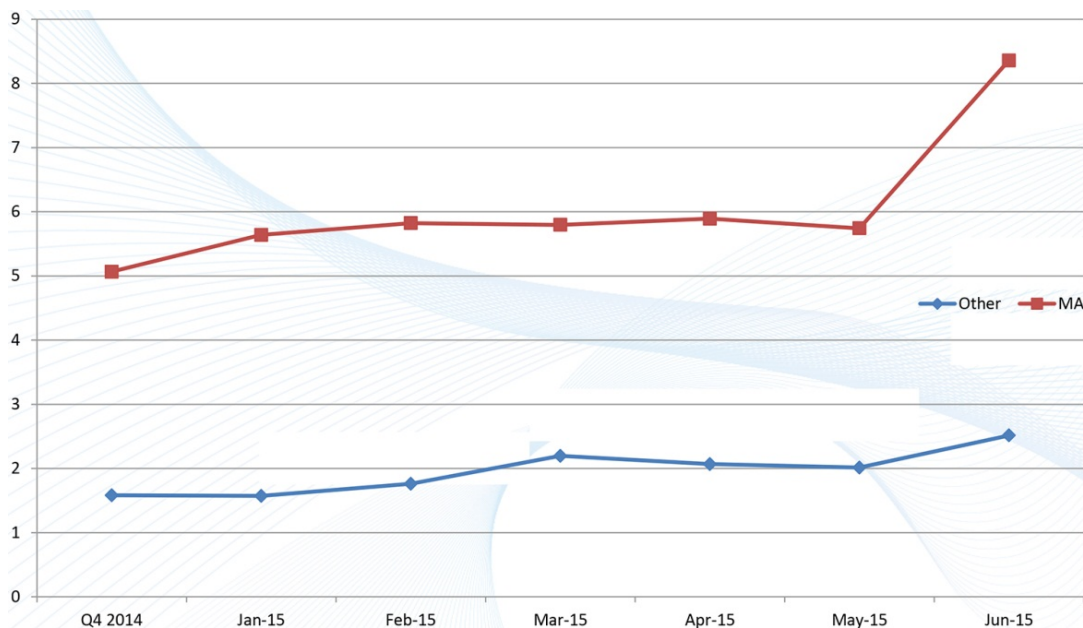
2. Examples of Real-World Measurement in HISPs

The CoP included a number of HISP experts and leaders in addition to the ONC consultant, and they provided useful insights concerning the rapidly evolving world of Direct secure messaging and its measurement. One is a national HISP, MedAllies, which is headquartered in the Hudson Valley region, a diverse 10-county region located north of New York City, and the other is DirectTrust, a national non-profit trade alliance dedicated to the growth of Direct exchange at a national level. Both concurred that their measures indicate the rapid growth of Direct exchange in the nation since 2013, with dramatic growth in the past year.

Measurement of Direct exchange is generally limited, given the recency of active adoption of Direct. Measures at DirectTrust have monitored the rapid growth in its national membership and accreditation, in the number and diversity of the types of organizations which are now joining it, and in the growing reliability of interoperability among member organizations exchanging data.

The MedAllies HISP, which connects with a provider directory of 300,000 across the nation, has also found that there are now far fewer problems with HISP-to-HISP interoperability than in the early stage 18 months ago. The MedAllies HISP monitors the following adoption and use measures: active MU Stage 2 providers, transactional volume, and transactional volume per MU 2 provider per month. The latter rate is currently low (see Fig. 3), but is increasing and is expected to increase much more quickly in the coming months when the clinical transformation team is fully deployed in stimulating more active use.

Figure 3. Message/MU 2 Provider Ratio



There is interest among the HISP providers in determining whether there is “real” usage, such as how many providers are doing referrals to and from primary care and between hospitals and primary care and in being able to measure when the use of Direct results in a

positive change in care or outcomes or the avoidance of a bad outcome. The expectation is that as there is increasing traffic between organizations, there will be increased care coordination.

A 2015 HIMSS survey² has shed further light on issues surrounding the adoption of Direct, with results showing that: there is substantial use of Direct in care coordination use cases and broad availability to a provider directory, but great variability in the method of access. 67% of survey respondents reported Direct as their method of choice for exchanging data; 51% agreed that the benefit of information exchange is worth the cost of using Direct; and 67% of Health Information Organizations (HIOs) are part of a scalable trust network, such as DirectTrust, NATE, and HealtheWay. The perceived high cost was listed by respondents as one of the significant challenges of using Direct.

3. **Challenges.** The barriers and challenges to HISP measurement include the following:

- Need for a standard set of measures for HISPs to use for reporting. This standard set would allow the measures to be rolled up on a national basis.
- Need to address rates per provider of these Direct transactions. The volume of Direct transactions per provider is currently low, although HISP experts anticipate that it will increase significantly in the near term. The HISP experts agree that this is an important question, and they are still in the early stages of assessing this.
- Difficulty in determining what the denominator is for transactional-based measures, which is important in calculating a meaningful rate of messages/provider/month.
- Continuing to deal with the remaining interoperability “bugs” in the HISP-to-HISP transactions
- Reluctance of providers to share their data for measurement purposes beyond their internal organization
- Difficulty in accurately measuring the number of Direct messages due to under-reporting of messages by busy providers and variations in the ways different HISPs are measuring.
- It is important to understand that HISP measures provide insights on only one dimension of total interoperability, so should be understood within that context

3.2.2 Developer-based Measures

EHR and other HIT developers were an important category of representatives on the Measurement CoP, since their software design is central to obtaining and extracting the needed measurement data from EHRs and across EHRs in an interoperable and comprehensible way. The CoP included a representative of the Epic electronic health record developer who also represented the Electronic Health Record Association as well as a representative of athenahealth, another well-known EHR developer. Both presented to the CoP on their approach to measurement and relevant insights.

1. Primacy of developer interest in addressing and measuring interoperability.

Both of the developer representatives commented on the complexity of the interoperability issue. A central focus for the EHR Association and its developer members has been how to measure progress toward interoperability. One key interest among developers is to monitor longitudinal trends in measures—how they change over time--in order to examine progress in interoperability. Key issues that are prerequisites to measurement are definitions of interoperability, the prioritization of use cases, the ease of data collection, and when the use of proxy measures is useful and cost-effective. It was noted that EHR developers have varying levels of direct access to data on deployment and usage. The EHRA has discussed measurement examples and shared that thinking with the CoP. Two examples are described below: one for the data collection and measurement issues involved in various scenarios in Immunization Registry Transmission, and another a report on Patient Record Exchange Statistics.

Example Considerations: Immunization Registry Transmission. The discussion emphasized the importance of defining scenarios, such as sending immunizations from a registry to an EHR vs. querying a registry for immunization history or receiving an immunization forecast from a registry. There are many relevant measurement questions for even a relatively simple scenario: What HL7 or other technical standards are supported by the system being used in the transmission? How should one measure the deployment/usage and transaction measures? In the data collection realm, who would have this data? Are there existing methods that already collect this data (e.g., MU attestation)?

Example Report: Patient Record Exchange Statistics. Epic shared an example set of statistics that a healthcare organization using their software might monitor (see Figure 4). These statistics depict the trends in the number of records exchanged over time among the practices, where the patients are going and coming from, the top exchange partners in the most recent year, and other graphs that track longitudinal trends over time.

Figure 4. Patient Record Exchange Statistics



2. Interoperability vs. Interoperation

One of the developer representatives posed the central question of “What should we be measuring?” and commented on the importance of the difference between interoperability and interoperation. Interoperability was defined in this context as the ability of two systems to exchange information while interoperation refers to the actual exchange of information. Since the desired outcome is actual information sharing, it is important to focus on measuring interoperation: is information actually flowing? Although it is important to measure current efforts in exchange and interoperability, it was argued that it is important to keep an eye on catching up on interoperability, which is characterized by three levels:

- Level 1: “Intra-organization”, which requires such standards as HL7 and is sufficient for demographics, synchronization, lab orders, and lab results within a single system.
- Level 2: “Inter-organization”, whose requirements include MU standards (CCDA, Direct, etc.), single sign-on, and political will (sufficient for document-based exchange across health systems)
- Level 3: “Open Platform”, which requires lightweight, modular web services, such as SMART and FHIR, which allows discrete use case-specific applications, such as “ mash up” of 23andMe and an EHR. It was the CoP’s sense that more progress needs to be made toward Level 3: Open Platform.

Tracking Current Interoperation. As an example of measurement of actual, meaningful information exchange that is currently happening, one of the developer representatives showed a slide of the Closed Loop Order Rates for the developer’s EHR during June, 2015. The measure involved the order count for a number of activities requiring data access, such as consults, imaging, labs, prescriptions, procedures, and surgery. However, it was noted that it is not meaningful to just know that a high volume of orders is going out and back. For the data to be meaningful, one should know not just how many orders, but also for how many providers—to have a transaction volume per provider. For example, if there were 5 million closed loop orders, it is impressive if that number is across 1,000 providers, but less impressive if it is across 1 million providers. What one really wants to know is how many closed loop orders were there per provider per month, which will allow one to compare numbers meaningfully across EHR systems. The EHR industry can then compare: transaction volume across providers, percent orders/documents sent to a different EHR system, and percent orders/documents sent to a different health system.

How are Providers Using the Data? Whether and how providers are actually using external data is of increasing interest to developers, HIEs, and measurement experts. CoP members noted that there is an important distinction between sharing data for the sake of sharing vs. actually being able to use the information to improve care. Developers and others are beginning to measure what providers do with inbound data that either conflicts with chart data or is new. The key questions are:

- How often do providers override chart data with inbound data? That is, how often do providers incorporate and/or reconcile chart data with inbound data?
- How often do providers decide to incorporate inbound data into the chart?

Other important questions are:

- How are we using the data to help us determine which sources contain the most useful/least useful data?
- Which standards give providers the best access to useful data?
- What can EHR developers do to make the outbound data more useful?
- Do certain specialists value certain data types over others?

It was noted that the Intermountain Health System in Utah is currently conducting a study to measure what percent of the incoming data is rejected as not being relevant to the clinical issue at hand.

3. Challenges

- The complexity of working toward interoperability across multiple developers and many different types of providers and other key stakeholders can inhibit the pace of interoperability progress.
- The need to better understand whether providers and others are acting on the information. While it is important to characterize the sending and receiving of information, ONC and others are interested in knowing to what extent people are acting on the information accessed—which queries return results, from whom, and which data did they look at?
- There is little consensus in the industry concerning how to standardize measurement. It is important for the industry to reach a level of consensus on what to measure at what level of detail and specificity so that can be programmed.
- There is considerable variation in data access relationships between different developers and their sites. Some developers have extensive direct access to transactional data, some provide reports for healthcare organizations to monitor transactional data, some provide tools that healthcare organizations can use to determine what is important to them and report on it, and some do all three. Thus, the variability and extent to which EHRs and their sites are useful data sources is one issue in the larger challenge of access to data sources for measurement and monitoring of progress.

3.3 Theme III: Measures of Impact and Outcomes

Similar to other stakeholders, HIEs are interested in measuring outcomes, however, few of them have been able to successfully measure HIE impact on improvements to date. Such outcome measurement has typically been limited to public health (lab reporting and immunizations) and to examining the impact on readmissions. One of the key issues for the HIEs is how to tie a measure credibly to an actual outcome. Nonetheless, the HIEs very much want to know the impact of HIE access, since it is important to them to show HIE value in their state or region.

They see this as a Phase 2 activity and are specifically interested in such measures as readmission prevention, alerting, medication reconciliation, home health, and patient engagement through use of Personal Health Records (PHRs).

The CRISP HIE in Maryland reported access to both claims data and EHR data and uses its MPI to link the two types of data for individual patients, which allows them to offer data analysis services to providers throughout the state for a variety of purposes, including evaluation of pre-post impact of interventions and to examine the impact of the HIE's services. An example of the value of this measurement: HIE analysts found that the critical time period for decreasing readmissions is to have a follow up visit with a provider within 7 days of hospital discharge.

Sample impact measures include the support of key processes, such as care delivery, value-based payment, public health surveillance and response, care coordination and transitions of care across care settings, and learning health system and research. Outcome measures include patient experience with healthcare delivery systems, reducing costs and increasing efficiency of care, and improving the health of populations. These measures are what some in healthcare have referred to as the "Holy Grail" that the nation is seeking, since the desired payoff associated with exchange and interoperability is its anticipated and hoped-for positive impact on the Triple Aim measures: improved patient care and experience, reduced costs of care, and improved population health. Yet these impact/outcomes measures are clearly the most difficult and elusive to measure, especially in establishing the causal link between the improved provider and patient access to relevant data through HIEs and Direct and any downstream improvements in patient care, costs, or health of populations. One of the key issues discussed by the CoP was how to move from capability/use measures to outcome measures.

1. Experiences in Measuring HIE Usage and Impact

Some members of the CoP are experts in the field of measurement and evaluation and have taken on the thorny issue of linking HIE use to improved outcomes. Several of these experts, including Dr. Joshua Vest and Dr. Lisa Kern, are affiliated with Weill Cornell Medical College and shared with the CoP outcomes-related presentations and publications. Dr. Kern led a research team that identified HIE-sensitive outcome measures based on expectations in the literature. This literature sought to identify what outcomes one could expect that HIE access could improve. For example, immediate effects of new knowledge on the care process could include avoidance of a repeat diagnostic test, improved selection of an appropriate test, avoidance of a repeat radiology procedure, etc. Possible effects on outcomes could include such improvements as reduced adverse events, reduced admissions or length of stay, reduced diagnostic tests, and reduced provider time^{3,4,5}.

Dr. Joshua Vest presented on his experience in measuring HIE impact in New York State. As part of this, he emphasized the distinction between measurement vs. evaluation: a good measure does not assure an evaluation that can support inferences. The issue is how a measure fits into an evaluation and supports inferences concerning causation. Dr. Vest and his colleagues are interested in using data and measures of the actual usage of HIE systems they studied in New York in such a way that the causal link is "very tight". They examined the association between

usage and outcomes such as admissions via the ED, 30-day hospital readmissions, and repeat imaging procedures^{6,7}. He reported on the use of four data sources in conducting the Rochester NY RHIO analyses. The four data sources were: System User Logs (users, dates, patients accessed); User Characteristics (clusters of users with similar job titles and grouping users in common locations); Healthcare Claims Data (for outcomes measures and patient demographic, utilization, and comorbidity data); and Facility Characteristics (organizational factors, case mix). Their usage studies relied on system logs and users. Their cluster analyses demonstrated that different types of users (e.g., doctors and nurses) access data very differently. Some accessed only clinical information, some only demographic information, some only the most recent encounters. They were also able to identify the number of clinical documents shared between different organizations and represent these patterns graphically.

It was also noted by Dr. Kern that a key issue is demonstrating the increased likelihood of causality. It is important to connect HIE usage and subsequent utilization in time, to increase the likelihood that it was in fact the HIE access that led to the improved outcome rather than other factors. An example would be hospitalizations following an ER visit, the rate of which was reduced following HIE access. (Note: a list of Drs. Vest's and Kerns' publications and other relevant outcomes research publications are provided in the Appendix at the end of this report.)

2. Challenges

As noted elsewhere in this report, impact and outcomes measurement represents at once the most difficult interoperability challenge and the most important to HIE uptake and sustainability. Associated challenges are described below.

- Establishing the causal link between greater interoperability (e.g., exchange of health information) and improved outcomes
- How does one identify and access needed data sources, such as healthcare claims, systems user logs, facility characteristics, user characteristics?
- How are providers using data in providing care? Do providers actually change their care plan in response to HIE data? (Intermountain Health Care in Utah is currently investigating this issue.)
- Expertise in research, evaluation, and analytics is important in conducting credible outcome studies, but both the real-world relationships and funding to support such research are typically lacking.

4 Cross-Cutting Key Challenges

While we have discussed various issues and challenges specific to different types of exchange and interoperability measurement—relevant to capabilities, the flow and usage of data, or impact on outcomes—there are certain issues and barriers that cut across levels and types of measurement and are common to all. These cross-cutting challenges, listed and discussed below, must be addressed or overcome if the nation is to be able to measure and monitor its success in meeting the interoperability goals outlined by Congress and in the ONC Roadmap.

- **Need for broader and more accessible data sources.** This includes the need to shift from extensive reliance on self-reported survey data (which has known deficiencies and biases) to transactional data. Reliance on self-reported survey data has been largely due to limited access to transactional data sources.
- **Need to shift measurement focus from assessing volume to calculating rates.** Volume measurement alone does not provide an adequate basis for calculating trends and comparisons, unlike rates. However, the calculation of credible rates requires the use of standard definitions of both denominators and numerators (e.g., what constitutes an “active user”?), and these standards are still lacking.
- **Privacy and security issues impeding access to data needed for measurement.** All states and regions are subject to the federal privacy regulations, including HIPAA. However, there are also varying state privacy regulations, some of which are more restrictive than HIPAA. In addition, some HIE Business Associates Agreements do not allow the use of the data for secondary purposes such as measurement, which is another significant impediment to the use of transactional data in measurement.
- **Defining and standardizing measures across domains** to permit accurate comparisons across organizations and at local, regional, and national levels, including operationalizing the definition of interoperability to allow its effective measurement
- **Determining what measures could be useful for both local and national monitoring of progress**
- Determining who should bear the **costs of measurement**, and of developing, implementing, and testing new measures
- Determining the process that should be used to **facilitate data sharing** by data holders (e.g., payers) to facilitate measurement of impact and outcomes
- How to obtain the data necessary to support the value proposition of measurement for various stakeholders, e.g., the benefits to payers vs. benefits to HIEs
- There are variations in the types of data sources available for measurement due to varying HIE models across states and other market variations.
- The evolving mechanisms of exchange and evolving technology will have ramifications for the measurement of exchange and interoperability over time.

5 Future Measurement Development

As the nation seeks to monitor its progress in accomplishing exchange and interoperability, a number of organizations have been exploring how to measure the central issues of whether, how, and to what degree healthcare providers are actually using the external information when they have access to it. These are the issues to be explored in future measurement development. Organizations such as Intermountain Healthcare and athenahealth are exploring such key questions as:

- To what extent is the external information actually new (not already available to them in their internal settings)?
- To what extent is the information relevant to the care of a specific patient?
- To what extent is the external information incorporated into the patient's chart?
- To what extent is the provider using the data to alter/improve the care provided or to reduce unnecessary care?
- To what extent does this altered care improve the patient's outcome?

6 List of Measures to Track Exchange/Interoperability

The Measurement CoP members provided information for the measures they are currently using in their organizations to track exchange and interoperability. The spreadsheet of those measures and their characteristics is provided in the Appendix of this report. This list of measures is provided as useful examples of measures in current use and is not intended to be a comprehensive list.

7 References Cited

1. “Connecting Health and Care for the Nation: A Shared Nationwide Interoperability Roadmap”. Draft Version 1.0. Office of the National Coordinator for Health Information Technology. January, 2015.
2. 2015 HIMSS HIE and Direct Messaging Survey. HIMSS Health Information Exchange (HIE) Committee and Interoperability & Standards (I&S) Committee, July 2015.
3. Kern LM, Wilcox A, et. al . Measuring the Effects of Health Information Technology on Quality of Care: A Novel Set of Proposed Metrics for Electronic Quality Reporting. *Joint Commission Journal on Quality and Patient Safety*. 2009, vol 35(7)
4. Kern LM, Wilcox A, et. al . Which Components of Health Information Technology Will Drive Financial Value? *Am J Manag Care*. 2012;18(8):438-445
5. Kern LM, Wilcox A, et. al . Measuring the Effects of Health Information Technology on Quality of Care: A Novel Set of Proposed Metrics for Electronic Quality Reporting. *Joint Commission Journal on Quality and Patient Safety*. 2009, vol 35(7)
6. Vest JR, Kern LM, et al. Association between Use of a Health Information Exchange System and Hospital Admissions. *Applied Clinical Informatics* 5 (1), 219, 2014
7. Vest JR, Kaushal R, et al. Health Information Exchange and the Frequency of Repeat Imaging. *Am J Manag Care*. 2014;20(11 Spec No 17):eSP16-eSP24

Appendix A: Member Organizations of the Measurement Community of Practice

ABQ HealthPartners (New Mexico)

athenahealth

California HIE Association

Chesapeake Regional Information System for our Patients (CRISP-Maryland)

Colorado Regional Health Information Organization (CORHIO)

Delaware Health Information Network (DHIN)

DirectTrust (HISP association)

eHealth Initiative

Electronic Health Records Association

Intermountain Health Care

Johns Hopkins University

Kaiser

Kentucky HIE

MedAllies (HISP)

MedChi Accountable Care Organization

Medicity

Minnesota Department of Health-Office of Health IT

New York eHealth Collaborative

Pennsylvania eHealth Authority

RAND

Rhode Island Quality Institute

University of Michigan

Utah Health Information Network

Weill Cornell Medical College

Appendix B: Additional References and Measurement Resources

HIE Measurement Articles—Joshua Vest ONC Measurement Community of Practice

[Using a health information exchange system for imaging information: patterns and predictors.](#)

Vest JR, Grinspan ZM, Kern LM, Champion TR Jr, Kaushal R; HITEC Investigators.

AMIA Annu Symp Proc. 2013 Nov 16;2013:1402-11. eCollection 2013.

PMID: 24551416

[Free PMC Article](#)

[Patient encounters and care transitions in one community supported by automated query-based health information exchange.](#)

Champion TR Jr, Vest JR, Ancker JS, Kaushal R; HITEC Investigators.

AMIA Annu Symp Proc. 2013 Nov 16;2013:175-84. eCollection 2013.

PMID: 24551330

[Free PMC Article](#)

[Applications of health information exchange information to public health practice.](#)

Kierkegaard P, Kaushal R, Vest JR.

AMIA Annu Symp Proc. 2014 Nov 14;2014:795-804. eCollection 2014.

PMID: 25954386

[Free PMC Article](#)

[Adoption of clinical data exchange in community settings: a comparison of two approaches.](#)

Champion TR Jr, Vest JR, Kern LM, Kaushal R; HITEC investigators.

AMIA Annu Symp Proc. 2014 Nov 14;2014:359-65. eCollection 2014.

PMID: 25954339

[Free PMC Article](#)

[Use of a health information exchange system in the emergency care of children.](#)

Vest JR, Jaspersen 'S, Zhao H, Gamm LD, Ohsfeldt RL.

BMC Med Inform Decis Mak. 2011 Dec 30;11:78. doi: 10.1186/1472-6947-11-78.

PMID: 22208182

[Free PMC Article](#)

[How are health professionals using health information exchange systems? Measuring usage for evaluation and system improvement.](#)

Vest JR, Jaspersen 'S.

J Med Syst. 2012 Oct;36(5):3195-204. doi: 10.1007/s10916-011-9810-2. Epub 2011 Nov 30.

PMID: 22127521

[Free PMC Article](#)

[Factors associated with health information exchange system usage in a safety-net ambulatory care clinic setting.](#)

Vest JR, Gamm LD, Ohsfeldt RL, Zhao H, Jaspersen 'S.

J Med Syst. 2012 Aug;36(4):2455-61. doi: 10.1007/s10916-011-9712-3. Epub 2011 Apr 27.

PMID: 21523428

[Free PMC Article](#)

[Factors motivating and affecting health information exchange usage.](#)

Vest JR, Zhao H, Jasperson J, Gamm LD, Ohsfeldt RL.

J Am Med Inform Assoc. 2011 Mar-Apr;18(2):143-9. doi: 10.1136/jamia.2010.004812. Epub

2011 Jan 24. Erratum in: J Am Med Inform Assoc. 2011 May 1;18(3):348. Jasperson, Jon

[corrected to **Jasperson, Jon**].

PMID: 21262919

[Free PMC Article](#)

[What should we measure? Conceptualizing usage in health information exchange.](#)

Vest JR, Jasperson J.

J Am Med Inform Assoc. 2010 May-Jun;17(3):302-7. doi: 10.1136/jamia.2009.000471. Review.

PMID: 20442148

[Free PMC Article](#)

[Related citations](#)

Appendix C: List of Measures to Track Exchange and Interoperability from Measurement Community of Practice

[See Excel File for spreadsheet.](#)