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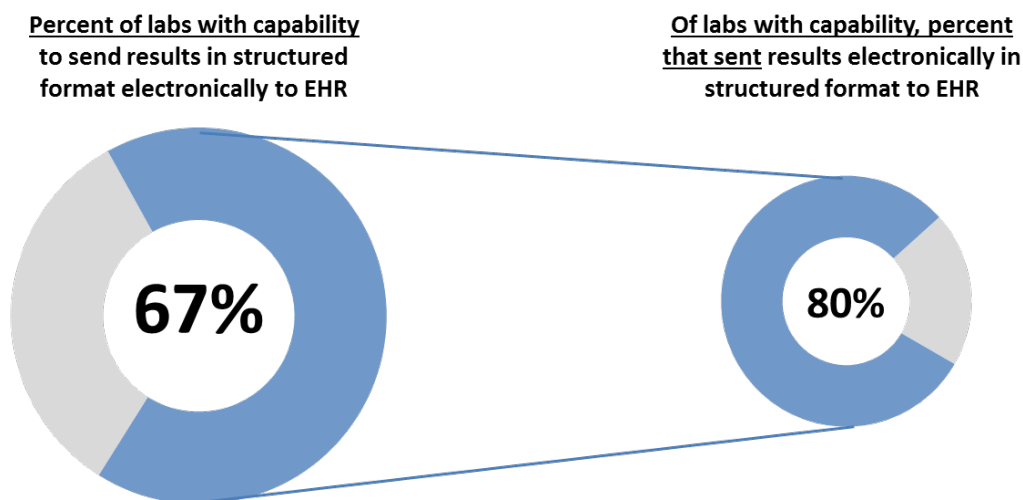
Health Information Exchange among Clinical Laboratories

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Incorporating clinical laboratory test results into certified electronic health record (EHR) technology as structured data is a core requirement for eligible hospitals and professionals under Stage 2 of the Medicare and Medicaid EHR Incentive Programs. Currently, there is limited information concerning the readiness of clinical laboratories to deliver structured test results. To address this gap in knowledge, the Office of the National Coordinator for Health IT (ONC) sponsored a national survey of independent and hospital laboratories. This brief describes the capability and extent to which these laboratories send test results as structured data to ordering practitioners' EHR systems.

**Two-thirds of clinical laboratories reported the capability to send a structured test result to an ordering practitioner's EHR in 2012.**

Figure 1: Percent of clinical laboratories with the capability to send results in a structured format electronically to an ordering provider's EHR and the percent of clinical laboratories with that capability that reported sending structured test results to an ordering provider's EHR: 2012



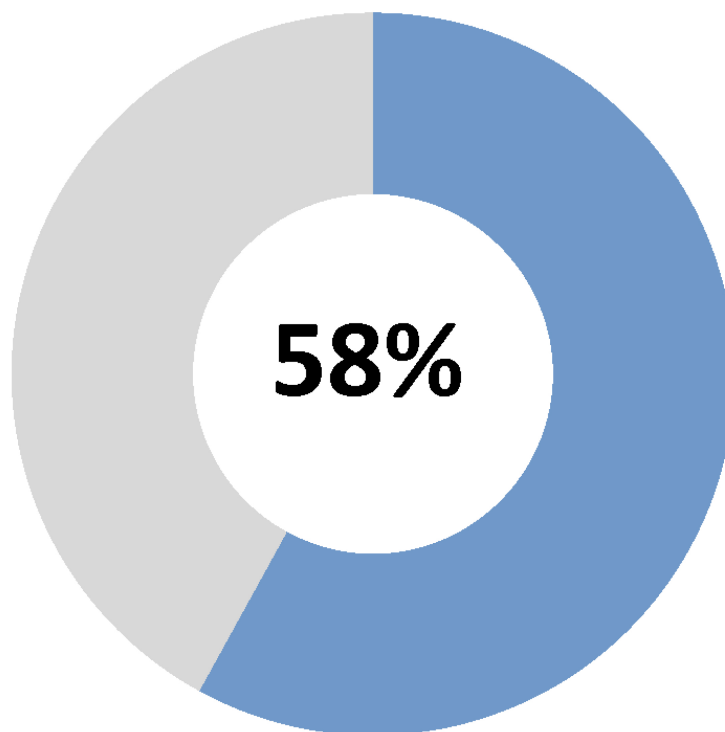
NOTES: Definition for structured format is reported at the end of the document.

SOURCE: ONC analysis of data from National Survey on Health Information Exchange in Clinical Laboratories, 2012

- ★ In 2012, 67 percent of clinical laboratories reported the capability to send structured test results to an ordering provider's EHR (Figure 1).
- ★ Among clinical laboratories reporting the capability to send structured test results, four in five (80 percent) reported that they sent structured results to an ordering provider's EHR.

**The majority of laboratory test results were sent electronically in a structured format to an ordering practitioner's EHR in 2012.**

Figure 2: Percent of test results that were sent electronically in structured format by clinical laboratories to an order practitioner's EHR: 2012



NOTES: Estimate based on the ratio of total tests processed as reported by clinical laboratories to the number of test results sent electronically in a structured format to ordering practitioners using electronic health records. More details on how this estimate was derived are included in the appendix.

SOURCE: ONC analysis of data from National Survey on Health Information Exchange in Clinical Laboratories, 2012

- ★ According to the Centers for Medicare & Medicaid Services (CMS) Online Survey, Certification and Reporting (OSCAR) database, roughly 7.5 billion test results were processed in 2012 by hospital and independent laboratories.<sup>1</sup> The survey results indicate that approximately 58 percent of test results processed by clinical labs in 2012 were sent electronically (Figure 2).

**The capability of clinical laboratories to send structured results electronically to an EHR and the proportion of results sent electronically varied significantly from the national average in some states.**

Table 1: Percent of clinical laboratories capable of sending structured test results to ordering provider's EHR and percent of test results sent electronically by U.S. state and territory: 2012

| State                | Capable,<br>% | Results<br>Sent,<br>% | n(N)                      | State          | Capable,<br>% | Results<br>Sent,<br>% | n(N)       |
|----------------------|---------------|-----------------------|---------------------------|----------------|---------------|-----------------------|------------|
| <b>United States</b> | <b>67%</b>    | <b>58%</b>            | <b>4,737<br/>(11,601)</b> | Montana        | 78%           | 63%                   | 48(78)     |
| Alabama              | 66%           | 46%§                  | 103(219)                  | Nebraska       | 61%           | 63%                   | 74(126)    |
| Alaska               | 44%           | 68%                   | 20(39)                    | Nevada         | 59%           | 75%†                  | 28(80)     |
| Arizona              | 72%           | 57%                   | 82(187)                   | New Hampshire  | 75%           | 61%                   | 22(46)     |
| Arkansas             | 70%           | 57%                   | 57(140)                   | New Jersey     | 64%           | 34%§                  | 55(178)    |
| California           | 64%           | 49%§                  | 390(1,074)                | New Mexico     | 75%           | 62%                   | 30(79)     |
| Colorado             | 65%           | 69%†                  | 95(174)                   | New York       | 71%           | 54%                   | 164(415)   |
| Connecticut          | 85%†          | 45%§                  | 52(149)                   | North Carolina | 68%           | 62%                   | 114(315)   |
| Delaware             | 65%           | 56%                   | 9(26)                     | North Dakota   | 64%           | 75%†                  | 30(57)     |
| District of Columbia | 54%*          | 38%*                  | 9(27)                     | Ohio           | 65%           | 60%                   | 159(378)   |
| Florida              | 67%           | 62%                   | 216(678)                  | Oklahoma       | 62%           | 66%                   | 91(191)    |
| Georgia              | 61%           | 63%                   | 103(295)                  | Oregon         | 79%†          | 65%                   | 62(149)    |
| Hawaii               | 81%           | 48%*                  | 10(49)                    | Pennsylvania   | 69%           | 57%                   | 157(414)   |
| Idaho                | 69%           | 39%§                  | 41(64)                    | Puerto Rico    | 54%§          | 29%§                  | 312(703)   |
| Illinois             | 68%           | 55%                   | 159(376)                  | Rhode Island   | 61%*          | 84%†                  | 8(36)      |
| Indiana              | 63%           | 61%                   | 100(254)                  | South Carolina | 71%           | 55%                   | 50(135)    |
| Iowa                 | 81%†          | 68%†                  | 101(159)                  | South Dakota   | 69%           | 76%†                  | 50(88)     |
| Kansas               | 62%           | 61%                   | 119(201)                  | Tennessee      | 70%           | 55%                   | 106(269)   |
| Kentucky             | 73%           | 61%                   | 84(181)                   | Texas          | 59%§          | 54%                   | 361(1,037) |
| Louisiana            | 68%           | 62%                   | 95(296)                   | Utah           | 68%           | 51%                   | 47(94)     |
| Maine                | 95%†          | 66%                   | 22(57)                    | Vermont        | 100%†         | 59%                   | 8(25)      |
| Maryland             | 62%           | 54%                   | 70(176)                   | Virginia       | 73%           | 59%                   | 72(203)    |
| Massachusetts        | 81%†          | 56%                   | 106(276)                  | Washington     | 67%           | 69%†                  | 109(240)   |
| Michigan             | 77%†          | 55%                   | 129(263)                  | West Virginia  | 85%†          | 49%                   | 37(74)     |
| Minnesota            | 72%           | 78%†                  | 93(183)                   | Wisconsin      | 70%           | 71%†                  | 98(195)    |
| Mississippi          | 56%           | 60%                   | 54(166)                   | Wyoming        | 76%           | 65%                   | 29(47)     |
| Missouri             | 73%           | 53%                   | 97(240)                   |                |               |                       |            |

NOTES: The percent of clinical labs capable of sending results electronically and proportion of test results sent electronically within a state may vary based upon whether high-volume laboratories are engaging in electronic result reporting. Five percent of laboratories were excluded from the proportion of 'results sent' estimates due to missing data. n = survey respondents; N = laboratories sampled. More information on sampling criteria can be found below in the Data Source and Methods.

\*Estimate does not meet standards of reliability

†Significantly higher than national average ( $p < 0.05$ )

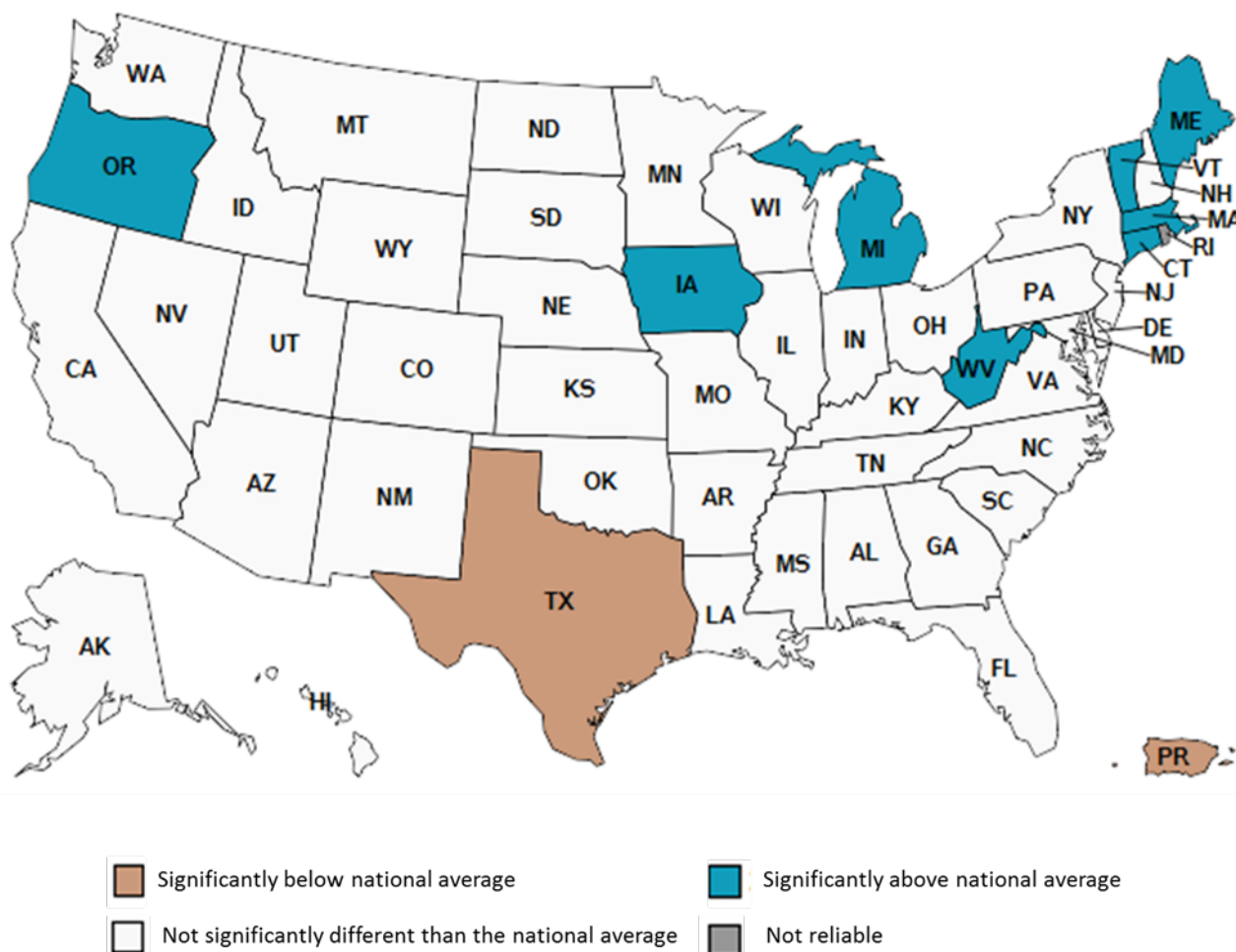
§Significantly lower than national average ( $p < 0.05$ )

SOURCE: ONC analysis of data from National Survey on Health Information Exchange in Clinical Laboratories, 2012

- ★ State level estimates of laboratories' capability to electronically send structured test results to an EHR ranged from 44 percent (Alaska) to 100 percent (Vermont) (Table 1).
- ★ The proportion of test results sent electronically to an EHR at the state level ranged from 29 percent (Puerto Rico) to 84 percent (Rhode Island).

**The proportion of clinical laboratories capable of sending structured test results was significantly higher than the national average in eight states and territories.**

Figure 3: Percent of clinical laboratories with the capability to send structured test results by state and territory compared to the national average (67 percent): 2012

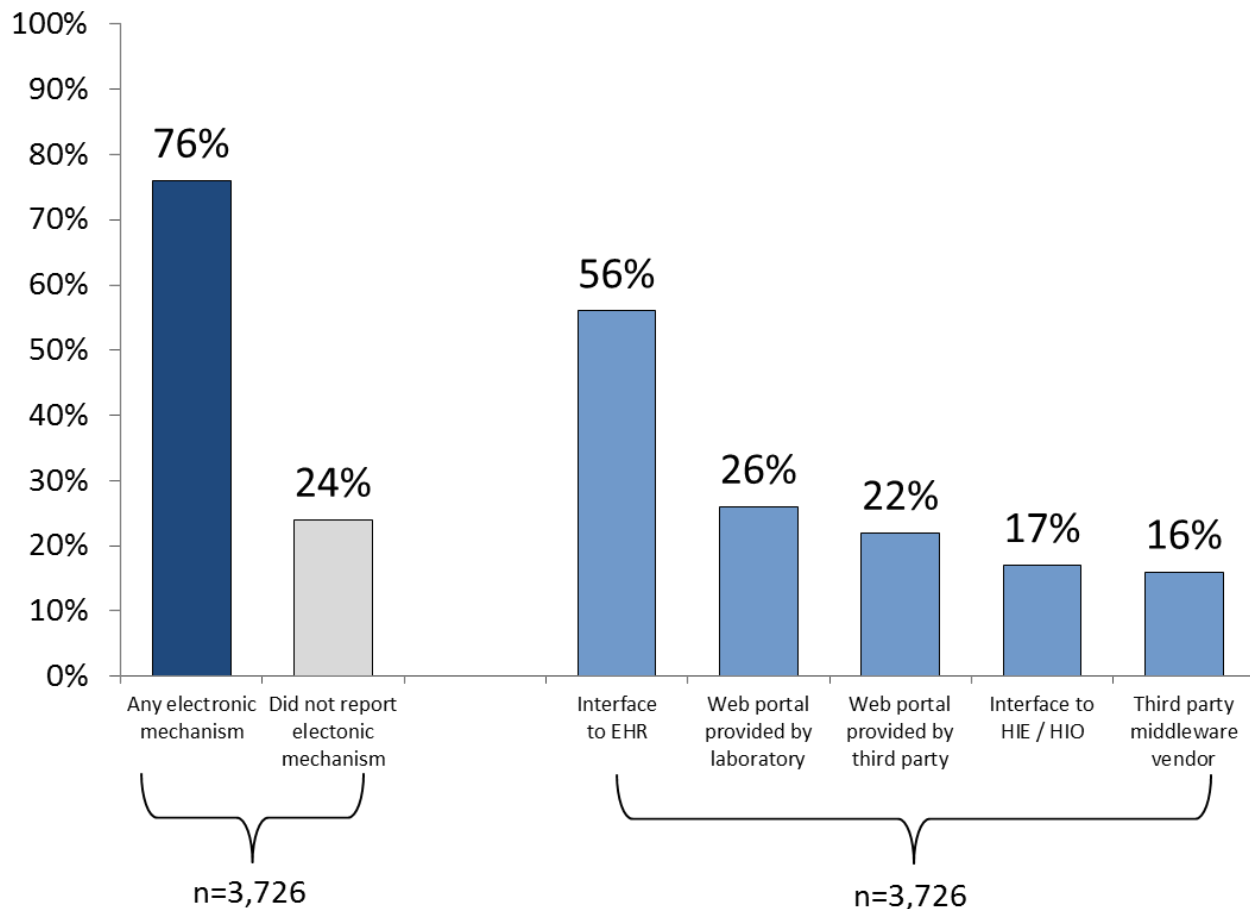


SOURCE: ONC analysis of data from National Survey on Health Information Exchange in Clinical Laboratories, 2012

- ★ The proportion of capable laboratories was significantly higher than the national average in eight states (Oregon, Iowa, Michigan, West Virginia, Connecticut, Massachusetts, Vermont, and Maine) (Figure 3).
- ★ The proportion of capable laboratories was significantly lower than the national average in Puerto Rico and Texas.

**Three-quarters of clinical laboratories reported sharing test results electronically, which includes data that is both structured and unstructured.**

Figure 4: Mechanism used by clinical laboratories to share results electronically.



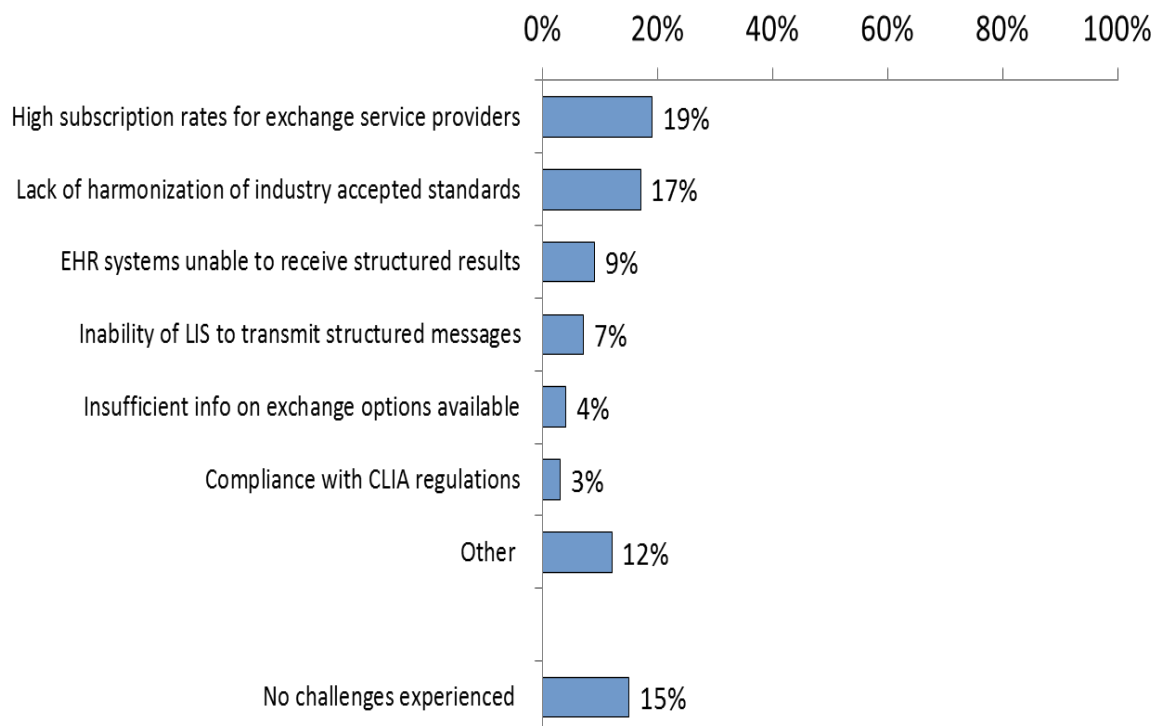
NOTES: The category “any electronic mechanism” is a composite of laboratories that answered “yes” to at least one of the five electronic mechanisms, which are displayed in this figure on the right. HIE/HIO is Health Information Exchange/Health Information Organization. Five percent of laboratories were excluded from estimates due to unreliable data.

SOURCE: ONC analysis of data from National Survey on Health Information Exchange in Clinical Laboratories, 2012

- ★ Three-quarters (76 percent) of laboratories reported using an electronic mechanism to share either structured or unstructured test results (Figure 4).
- ★ The most common electronic mechanism for sharing test results was through an interface to an EHR (56 percent).
- ★ Other common mechanisms for sharing test results electronically included a web portal provided by the laboratory (26 percent) or a third party (22 percent).

**High subscription rates for exchange service providers and the lack of harmonization of industry accepted standards were the most commonly reported barriers to sending test results electronically in a structured format.**

Figure 5: Challenges among clinical laboratories for sending test results electronically in a structured format.



NOTES: Results do not add up to 100 percent. Respondents were asked to select one response as their primary challenge, however, many respondents selected more than one response. LIS is a laboratory information system. CLIA refers to the Clinical Laboratory Improvement Amendments. Estimates based on long form survey respondents only (n=3,953).

SOURCE: ONC analysis of data from National Survey on Health Information Exchange in Clinical Laboratories, 2012

- ★ Roughly one in five labs reported high subscription rates for exchange services providers (19 percent) and the lack of harmonization of industry accepted standards (17 percent) as their primary challenge for sending test results electronically in a structured format (Figure 5).
- ★ Approximately one in ten (9 percent) labs reported that their primary challenge was EHR systems are unable to receive structured test results.



## Summary

To date, there has been little information publicly available on the health information exchange capabilities of clinical laboratories. ONC's national survey of independent and hospital labs provides an overview on clinical laboratories' capabilities, activity, mechanisms for sending the results and challenges related to sending structured test results electronically to an EHR in 2012. Two-thirds of clinical laboratories reported the capability to send structured test results to an ordering practitioner's EHR. However, one in five laboratories with this capability did not report exchanging structured test results. When examining the electronic delivery of structured test results based upon the volume of test results sent, we estimate that over half (58 percent) of test results that were processed in 2012 by hospital and independent laboratories were sent electronically to ordering practitioners.

The capability to electronically exchange structured data by clinical laboratories varied at the state-level, as the proportion of clinical laboratories with this capability ranged from 44 percent to 100 percent. Rates of laboratories with this capability were significantly above the national average in eight states and significantly below the national average in two states. The proportion of test results sent electronically to an EHR based upon the volume of all test results processed also varied at the state level, ranging from 29 percent to 84 percent.

Three-quarters of clinical laboratories shared test results electronically as structured or unstructured data. The most common mechanism for sharing test results was through an interface to an EHR (56 percent), followed by web portals, either provided by the laboratory (26 percent) or a third party (22 percent). Less common methods of exchange were interfaces to a HIO or third party middleware vendor.

The two most common challenges reported by clinical laboratories for sending test results electronically in a structured format were high subscription rates for exchange services providers (19 percent) and the lack of harmonization of industry accepted standards (17 percent).

Laboratory tests are a critical aspect of patient care that may influence between 70 to 80 percent of clinical decisions,<sup>2</sup> and test results that are incorporated as structured data into a provider's EHR can be used to in a variety of ways to enhance care. Stage 2 of the EHR Incentive Programs requires incorporating laboratory results into an EHR in a structured format. Findings from this national survey suggest that in 2012 about two-thirds of labs had the capability to support eligible professionals and hospitals trying to meet this requirement.



## Definitions

Clinical laboratory: Includes hospital and independent laboratories processing test results for clinical purposes and located within the 50 states, the District of Columbia, and Puerto Rico. Laboratories conducting tests of minimal complexity were ineligible for the survey. In-scope laboratories were identified from the CMS Online Survey, Certification and Reporting (OSCAR) database based on laboratory type, laboratory type description, and state.

Ordering practitioners: A physician or, when appropriate, a non-physician practitioner who orders services for the patient.

Test results: A laboratory test that is (1) ordered by a provider; (2) performed on received specimens; and (3) finalized and results have been produced. The laboratory has incorporated and calculated reference data to produce the results referenced.

Structured format: Documentation of discrete data using controlled vocabulary, creating fixed fields within a record or file, or another method that provides clear structure to information (is not completely free text).

Health Information Exchange: The electronic movement of health-related information among organizations according to nationally recognized standards.

Health Information Organization: An organization that oversees and governs the exchange of health-related information among organizations according to nationally recognized standards.

Portal: Hosted and maintained by a provider or payer organization, without transferring access and control and use of the information to the individual, are not considered PHRs based on this definition.



## Data Source and Methods

Data are from The Office of the National Coordinator's (ONC) National Survey on Health Information Exchange in Clinical Laboratories. The survey was conducted by NORC at the University of Chicago as part of the evaluation of the State HIE Program.

The source for the sampling frame was the CMS Online Survey, Certification and Reporting (OSCAR) database, which contains information on over 225,000 laboratories in the United States, and contains 29 different categories of laboratories, of which two, hospital and independent, were in scope for this survey. Laboratories conducting tests of minimal complexity, that is, waived tests<sup>1</sup>, were ineligible for the survey.

A stratified random sample design was utilized for the survey, with strata defined on the basis of state (50 states, D.C., Puerto Rico), category (hospital and independent laboratory), and, for independent laboratories, ownership (LabCorp, Quest, other). LabCorp and Quest laboratories were sampled with certainty given the large volume of tests conducted by these two organizations, and data collection for these laboratories was carried out through headquarters rather than through the individual laboratories. The strata were defined to support estimates and analyses at the state by category level and provide data collection efficiency for the large chain independent laboratories, LabCorp and Quest.

Respondents were directed to have the individual most knowledgeable about the laboratory's information exchange capacities complete the survey, which could include the lab director, the lab manager, laboratory information specialist, or IT staff. Non-respondents received follow-up mailings and phone calls to encourage response. The survey was fielded to 11,601 clinical laboratories from January through May 2013. The survey was administered through the mail, with an abridged eight-question survey administered via phone for non-responders.

The weighted response rate for clinical laboratories was 43.2%. Laboratories were weighted through a multiple step process, which included the application of base weights (inverse of probability of selection); nonresponse adjustment; and, ratio adjustment to population totals within stratum. Given the need for estimates related to proportion of laboratories with some characteristic and proportion of laboratory results that are handled in some manner, three sets of weights were derived for both for independent and hospital labs: one for use in estimating characteristics associated with laboratories, one for use in estimating characteristics associated with laboratory test results, and one for respondents to the mail survey, as opposed to the abridged phone survey. The proportion of test results sent electronically estimate was derived through a multistep process, which included multiple imputations and the weight application.

Estimates considered unreliable had a relative standard error adjusted for finite populations greater than 0.30. Responses with missing values were assigned zero values. Significant differences were tested using  $p < 0.05$  as the threshold. Robust standard errors are estimated using adjustments for survey design and the additional variance introduced by variable level imputation.

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<sup>1</sup> As defined by CLIA, waived tests are categorized as "simple laboratory examinations and procedures that have an insignificant risk of an erroneous result."

## References

1. Based off analysis of the CLIA Provider of Service File. 2012. Files can be requested from the Centers for Medicare & Medicaid Services (CMS) from:  
<http://www.cms.gov/Research-Statistics-Data-and-Systems/Files-for-Order/NonIdentifiableDataFiles/ProviderofServicesFile.html>
2. The Lewin Group. Laboratory Medicine: A National Status Report. May 2008. Available at <http://www.lewin.com/publications/publication/343/>

## About the Authors

The authors are with the Office of the National Coordinator for Health Information Technology, Office of Economic Analysis, Evaluation and Modeling.

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