Harmonized Use Case
for
Electronic Health Records
(Laboratory Result Reporting)

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Office of the National Coordinator for Health Information Technology (ONC)

Table of Contents

American Health Information Community
Initial Electronic Health Record Use Case Area
(Laboratory Results Reporting)
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Background:
Driving adoption of Electronic Health Records (EHRs) requires reducing the loss and risk physicians face when investing in EHRs. This risk can be reduced by ensuring EHR products comply with minimal standards for functionality, security and interoperability; and helping provide implementation support to doctors so they can re-engineer their business processes with information technology.

Broad Area:
Support the implementation of interoperable, certified EHRs, minimizing integration issues for providers.

Specific Use Case Area:
Deploy standardized, widely available, secure solutions for accessing laboratory results and interpretations in a patient-centric manner for clinical care by authorized parties.

1. Introduction to Electronic Health Records (Laboratory Results Reporting) Harmonized Use Case

In order to advance the Administration's goal of expanded adoption of health information technology (HIT), the Department of Health and Human Services (HHS) released a series of contracts in the fall of 2005 to support critical processes in the areas of standard harmonization, certification of HIT, and the development of a Nationwide Health Information Network.

A key step to ensure coordination of these processes was the identification and development of use cases. The use cases provide a common focus for the different activities and help lead to specific requirements, architecture, standards and policy discussions. Analysts typically develop use cases to convey specific business processes and indicate ways that systems should interact with users and with other systems to achieve specific goals. These harmonized use cases do not define policies and strive to not define technical approaches any more than is necessary. The harmonized use cases are intended to help structure subsequent work in these areas.

The American Health Information Community helped frame these use cases by defining "breakthroughs areas" in which specific, near term value to the health care consumer could be realized. Based on this guidance, the Office of the National Coordinator for Health Information Technology (ONC) directed its portfolio of contractors to develop and submit for review use case areas in: (1) biosurveillance, (2) consumer empowerment, and (3) electronic health records.

Following the submission of the contractor's use cases on January 18, 2006, ONC launched a process to integrate the individual contributions into "harmonized" use cases. With the assistance of health information technology experts from across the federal government and guidance from the American Health Information Community and its Workgroups, ONC has completed the harmonization of the three use cases. While leaving flexibility for different implementation models, the harmonized use cases provide detailed guidance on the functions needed to advance critical efforts for the accelerated adoption of health information technology.

From the American Health Information Community's perspective, the harmonized use cases will yield valuable insights into the Community's continuing efforts to identify and remove barriers to adoption of health information technology.

For the nationwide health information network consortia, the harmonized use cases provide a foundation for the identification of critical architecture elements and establish the expectations of their prototype architectures.

For the Health Information Technology Standards Panel, the harmonized use cases scope its efforts to develop named standards and implementation level guidance necessary for interoperable solutions.

For the Certification Commission for Health Information Technology, the harmonized use cases provide insight into criteria for the certification of electronic health records and other aspects of the health IT landscape.

2. Description of Electronic Health Records (Laboratory Results Reporting) Harmonized Use Case

In July 2004, the Department of Health and Human Services released a Strategic Framework report entitled *The Decade of Health Information Technology: Delivering Consumer-centric and Information-rich Health Care*. The framework outlines four major goals to be pursued by public and private health sectors in order to shape a vision to utilize information technology in health. Simply, these four goals are as follows: (1) inform clinical practice, (2) interconnect clinicians, (3) personalize care, and (4) improve population health.

An important element of these goals is the widespread adoption of interoperable electronic health records (EHRs). Effective use of EHRs has the potential to positively influence both the quality and cost of health care for the nation. The EHR can improve quality by presenting clinical information and comprehensive patient data to the clinician at the point of care. This allows more informed decisions in a shorter time frame. Additionally, the cost of care can be decreased by streamlining data collection, decreasing the likelihood and associated cost of medical errors and by reducing resources used for duplicative or unnecessary information capture and testing.

The complete EHR will bring together multiple types of clinical information. However, this specific Electronic Health Record Harmonized Use Case addresses only the sharing of lab results and interpretations as described above by the American Health Information Community.

Laboratories commonly communicate laboratory test results to clinicians via fax. Sometimes the patient serves as the courier. In any event, laboratory test results are rarely in a form that allows direct integration into an EHR. Further, getting historical laboratory test results that have been ordered by other clinical care providers is complicated: often the patient may be the only source regarding what laboratory tests have been performed, where, and the name of the clinician who ordered them.

The goal of this use case is to allow a clinician to electronically obtain laboratory test results that he or she has ordered and to electronically obtain historical and other relevant test results for the purpose of the clinical care of a patient. This use case describes interoperability between clinical care providers' systems (which may include electronic health records), laboratory systems and the necessary supporting network, information and security services. The use case is defined from the perspective of patients, clinical care providers, sources of laboratory results, and supporting services systems.

The focus of the use case is on widely-available, well-standardized methods that will support the secure access to laboratory results and interpretations for clinical care by authorized parties.

3. Scope of Electronic Health Record (Laboratory Results Reporting) Harmonized Use Case

Wide-spread adoption of certified EHRs is a goal of the American Health Information Community. To achieve this, the Electronic Health Record Harmonized Use Case focuses on the deployment of standardized, widely available and secure solutions for accessing current and historical laboratory results and interpretations by authorized parties.

The use case will be driven by requirements for timely electronic access to ordered, referred and historical lab results, making use of services that manage patient identity, result delivery and notification, and that guarantee confidentiality, integrity and patient privacy.

This use case is relevant to clinical care providers who wish to have laboratory test results and laboratory interpretations electronically available for patients for whom they are providing care. Laboratory test results and interpretations are available for integration into an electronic health record (EHR, local or remote) or another clinical system.

An ordering clinician receives lab test results as a result of the order. The specifics of the ordering process is outside the scope of this use case. The test results are sent directly to the clinician's EHR system (local or remote) or another clinical data system in support of the provisioning of historical results and results for non-ordering, providers of care. "Other providers of care" are clinicians who have a clinician/patient relationship with respect to a specific patient (and did not order the specified test result). Providers of care may receive test results (that they did not order) in the EHR system (local or remote) or another clinical data system or receive notification of the results (for later retrieval).

The use case does not prescribe a specific model defining whether results are sent or notification given. The results are marked to indicate the ordering clinician – the results or notification is serving as a carbon copy function. When notification is received, the clinician may then retrieve the test results.

A clinician accesses historical test results related to a specific patient by first discovering the data and then retrieving or receiving the data. The use case does not prescribe whether the data are automatically sent to the clinician's EHR system (local or remote) upon selection, or whether the clinician must separately request the test results (perhaps from a separate data repository).

The use case will provide the following functionality for laboratory results reporting and notification, and is applicable to many types of laboratory tests, including but not limited to: clinical chemistry, hematology, serology, and microbiology.

1. transmission of complete, preliminary, final and updated lab results to the EHR system (local or remote) of the ordering clinician;

2. transmission of complete, preliminary, final and updated (or notification) to the EHR system (local or remote) or other clinical data system of designated providers of care (with respect to a specific patient);

3. retrieval of historical lab results by providers of care;

4. clinician access to test results respects privacy concerns, sensitivity designations or other attributes.

5. clinician access to results respects access rules determined by policy (e.g., certain results categorized as sensitive and not normally made available); and

6. sending and accepting appropriate acknowledgement of receipt for interactions.

The use case will provide the following functionality in delivering necessary services:

1. provide patient identity matching based on shared patient identity, patient identity mapping algorithm, or patient traits;

2. provide authentication service to authenticate all parties in information exchanges, recognizing that requestors may reside at various locations;

3. provide authorization service to determine appropriate clinician access to notification results, respecting patient privacy and consent rights;

4. ensure technical infrastructure that will support availability of historical test results; and

5. ensure secure electronic transport from data store to EHR system.

Organizations other than the laboratory may perform the services of securely storing and sending lab results and notifications to clinicians' systems, and provide other services such as locator services for historical test results, patient identity matching, and security policy enforcement. These organizations will need to operate under the appropriate information-sharing policies and procedures. This defines the need for commonly-agreed to policies and procedures for information sharing and access by participants in the use case.

The following functionality and types of information are excluded from this use case:

1. delivering information to the clinician with customized formatting specific to the rendering device currently being used (i.e., PDA or other device with unique rendering requirements);

2. results and interpretations from other diagnostic testing (e.g., radiology, cardiology, and neurology); and

3. emergency situations that require use of a "break the glass" function.

This use case defines areas where interactions occur between connected systems. Systems and services are discussed in the context of providing functionality necessary for information sharing and the interaction with common services. Certain systems are scoped to include only that functionality necessary for interoperability – other functionality in these systems, primarily which provide internal processing or user input/output, is not included in the use case.

The following systems and a definition of the features they offer are considered outside the scope of the use case except where specific functionality is referenced:

1. web applications for result viewing (only the functionality necessary to communicate between systems is included in the use case);

2. electronic health records (only the functionality necessary to communicate with the Locator Service and the Data Repository is included in the use case).

4. Stakeholders for Electronic Health Record (Laboratory Results Reporting) Harmonized Use Case

The following list of stakeholders and their definitions are for discussion purposes within the context of the use case.

Stakeholder	Working Definition
Consumers/Patients	Members of the public who require health care services and present in ambulatory and emergency room environments for the provision health care. May also include a person or person(s) who have been granted authority to act on a consumer's behalf regarding actions taken with the personal health record.
Clinicians	Health care providers with direct patient care responsibilities, including physicians, first responders, nurses, and clinical supervisors and their delegates. In this use case, clinicians are further delineated by ordering clinicians and providers of care.
Health care delivery organization	Organizations, such as hospitals, physician practices, which manage the delivery of care.
Laboratory organization	Medical laboratories, in either in a hospital, ambulatory, or clinician office environment, which analyze specimens as ordered by clinicians to assess the health status of patients.
Regional network infrastructure provider	An organization that supports secure and reliable network transmission between health delivery agencies involved in the management of health information and provides indexing of patient identifiers and metadata on clinical information sources.
Data providers	Systems or networks that provide laboratory data or associated patient information (e.g., maintains master patient index).
Administrators	Administrators, broadly speaking, engage in a common set of functions to meet the health care organization's goals. These may include planning, staffing, data collection, etc.
Terminology and interface experts	Perform data mapping and technical activities to support the overall functioning of the system.

5. Pre-Conditions for Electronic Health Record (Laboratory Results Reporting) Harmonized Use Case

Pre-conditions are the conditions that must be in place before the start of the use case. This includes, but is not limited to, the state of a stakeholder, data that must be available somewhere, or an action that must have occurred. This section also includes triggers for the initiation of the use case and discussions of important assumptions made about the use case during its development.

1. Established network and policy infrastructure to enable consistent, appropriate, and accurate information exchange across clinician systems, laboratories, data repositories and locator services. This includes, but is not limited to:
    a. methods to identify and authenticate users;
    b. methods to identify and determine providers of care;
    c. methods to enforce data access authorization policies;
    d. methods to ensure the veracity of data; and
    e. methods to correctly match patients across systems.

2. Clinicians securely access lab test results either through an EHR system (local or remote) or a clinical data system.

3. Security and privacy policies, procedures and practices are commonly implemented to support acceptable levels of patient privacy and security.

4. Appropriate standards protocols; patient identification methodology; consent; privacy and security procedures; coding, vocabulary and normalization standards have been agreed to by all relevant participants.

5. Legal and governance issues regarding data access authorizations, data ownership, and data use are in effect.

6. Obstacles to Implementation of Electronic Health Record (Laboratory Results Reporting) Harmonized Use Case

In general, the absence of the prerequisites described in the previous section presents obstacles to implementation of the use case. Additional obstacles are provided below.

1. Variations in local, state and national security and privacy regulations.

2. Lack of harmonization among data interoperability standards including vocabulary and laboratory and other messaging standards.

3. Matching patients across system and organizational boundaries.

4. Identifying and authenticating clinicians across system and organizational boundaries.

5. Issues regarding physician responsibility and legal liability with respect to automatically receiving laboratory test results as a provider of care in a copy-to manner.

6. Lack of automated procedures for patients to indicate which clinicians may have access and to which data.

7. Post-Conditions for Electronic Health Record Harmonized (Laboratory Results Reporting) Use Case

Post-conditions are the conditions that will be a result or output of the use case. This includes, but is not limited to, the state a stakeholder upon conclusion of the use case, data that was created or now available, and identification of actions that may serve as pre-conditions for other use cases.

1. Clinician received the requested electronic lab results in a form that may be used for clinical decision-making.

2. Lab results were available for use in clinical care in a timely way.

3. Lab results were either stored in the clinician EHR system or were viewable via a web application.

8. Detail of Electronic Health Record (Laboratory Results Reporting) Harmonized Use Case Perspectives and Scenarios

The following entity-driven perspectives will be part of the use case:

1. **Patient** (or patient proxy).

2. **Clinician** may be an individual, an organization or "system." When appropriate the clinician perspective is further specified as an 'ordering clinician' (responsible for ordering the lab test) or a 'provider of care' (providing care to the patient, but not the ordering clinician).

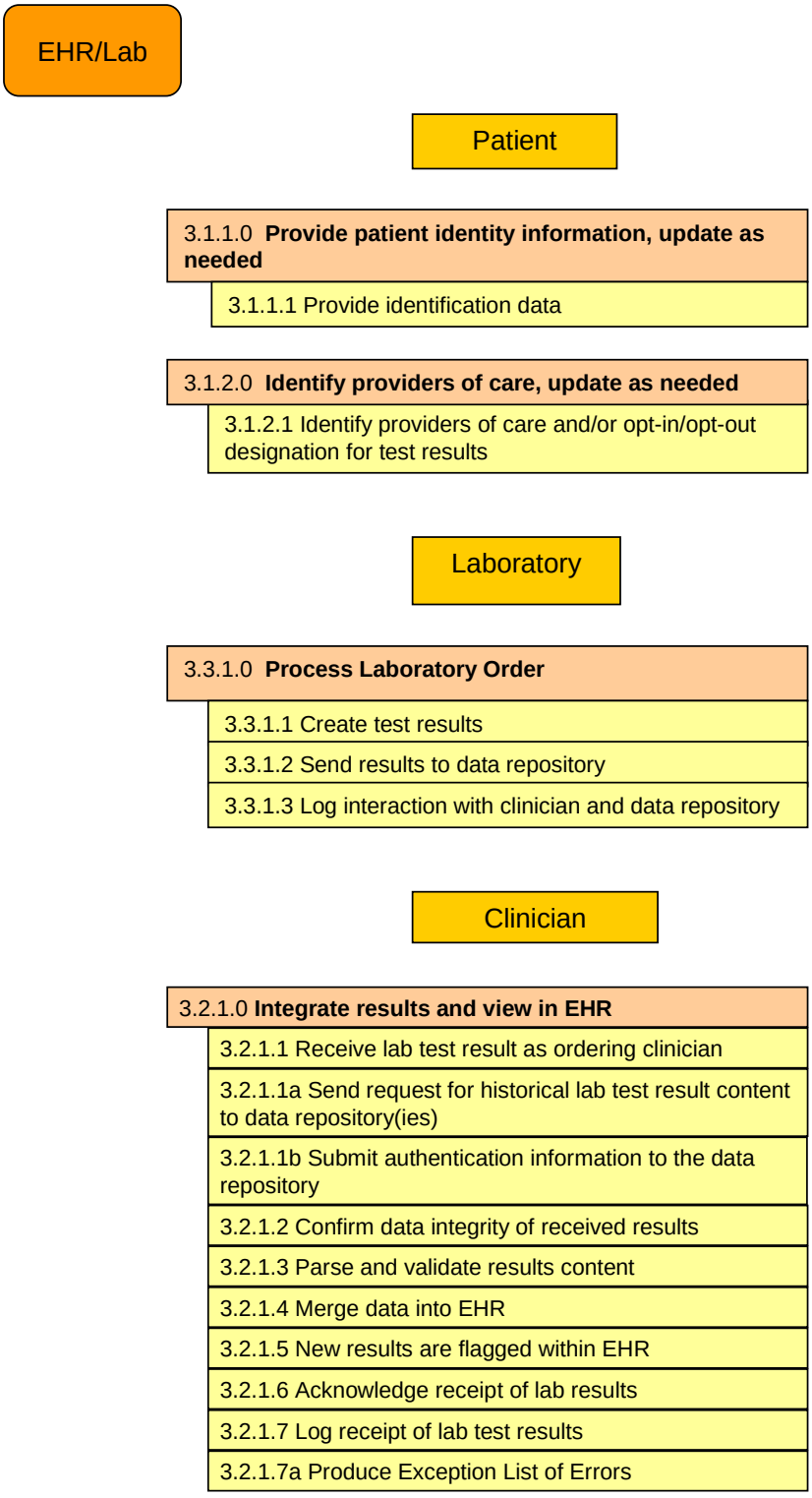
3. **Laboratory Organization** produces the laboratory results. Organizations operating as the clinician perspective may also operate under the laboratory perspective if laboratory testing services are performed by the organization.

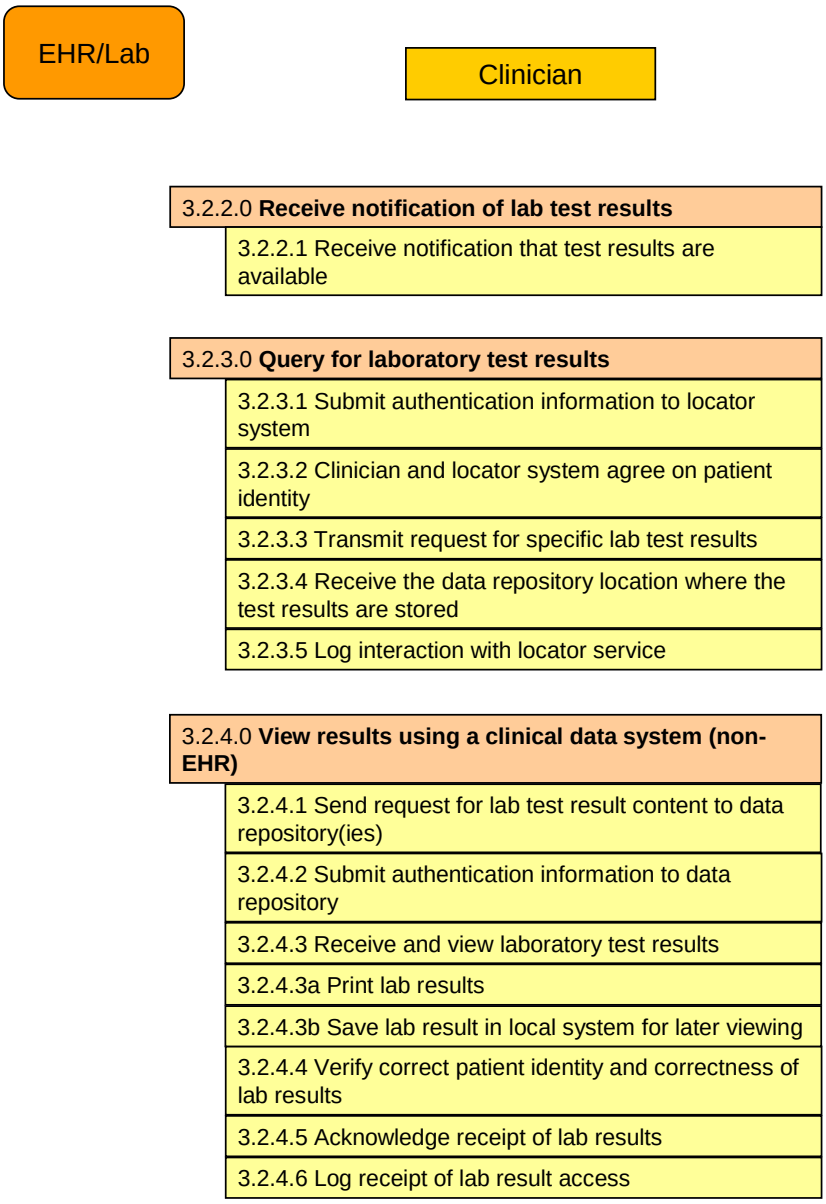
4. **Locator Service** indexes all laboratory test results and serves as locator function (necessary for finding lab results or data sources if not known). The locator service responds to queries for the test results by providing the list of available test results and their locations within data repositories. The locator service may also serve requests for other types of clinical information.

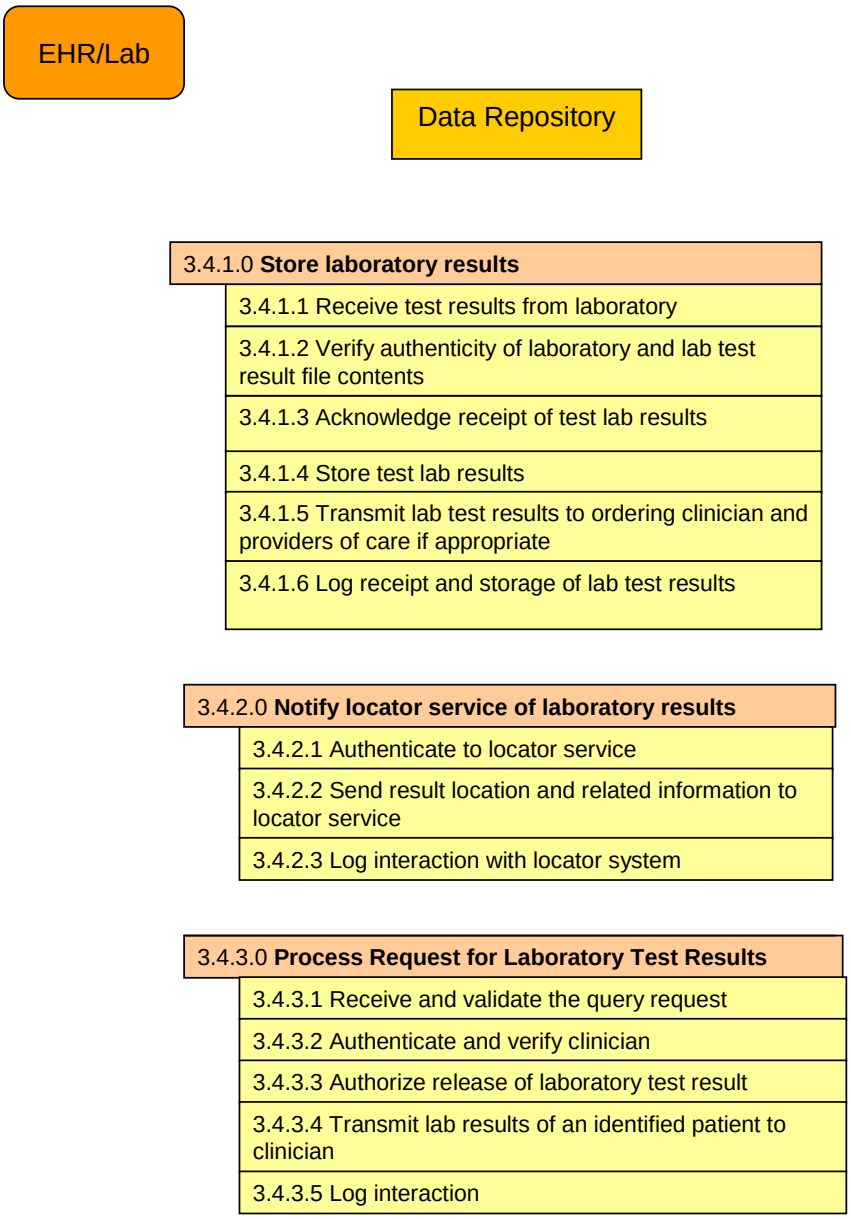
5. Lab Result **Data Repository** is the system that provides the laboratory test results. The data repository includes and the data store function (that stores and sends the data results) and the viewing capability. The data repository may also store other types of clinical information.

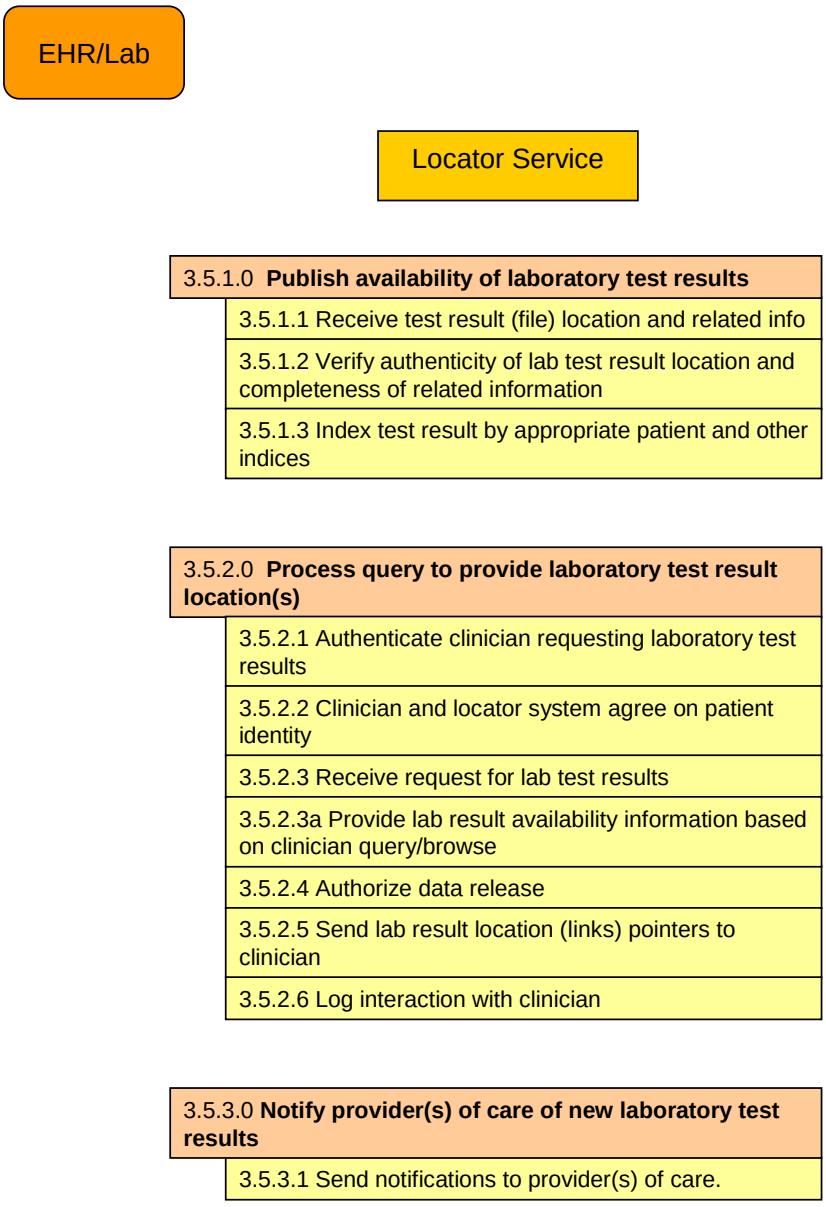
Note: Many implementations of this use case may have the Locator Service and the Data Repository services within the same organization or be tightly related to provide these services in an integrated fashion. There is a need for *shared* policies and procedures for authentication, authorization, patient consent and information sharing across these perspectives. Stakeholders (from the Stakeholder list in Section 4) that may provide the functionality of the Locator Service and Data Repository perspectives include regional health information organizations, health information network services, laboratories, data sources, clinical data management systems and other data services and repositories.

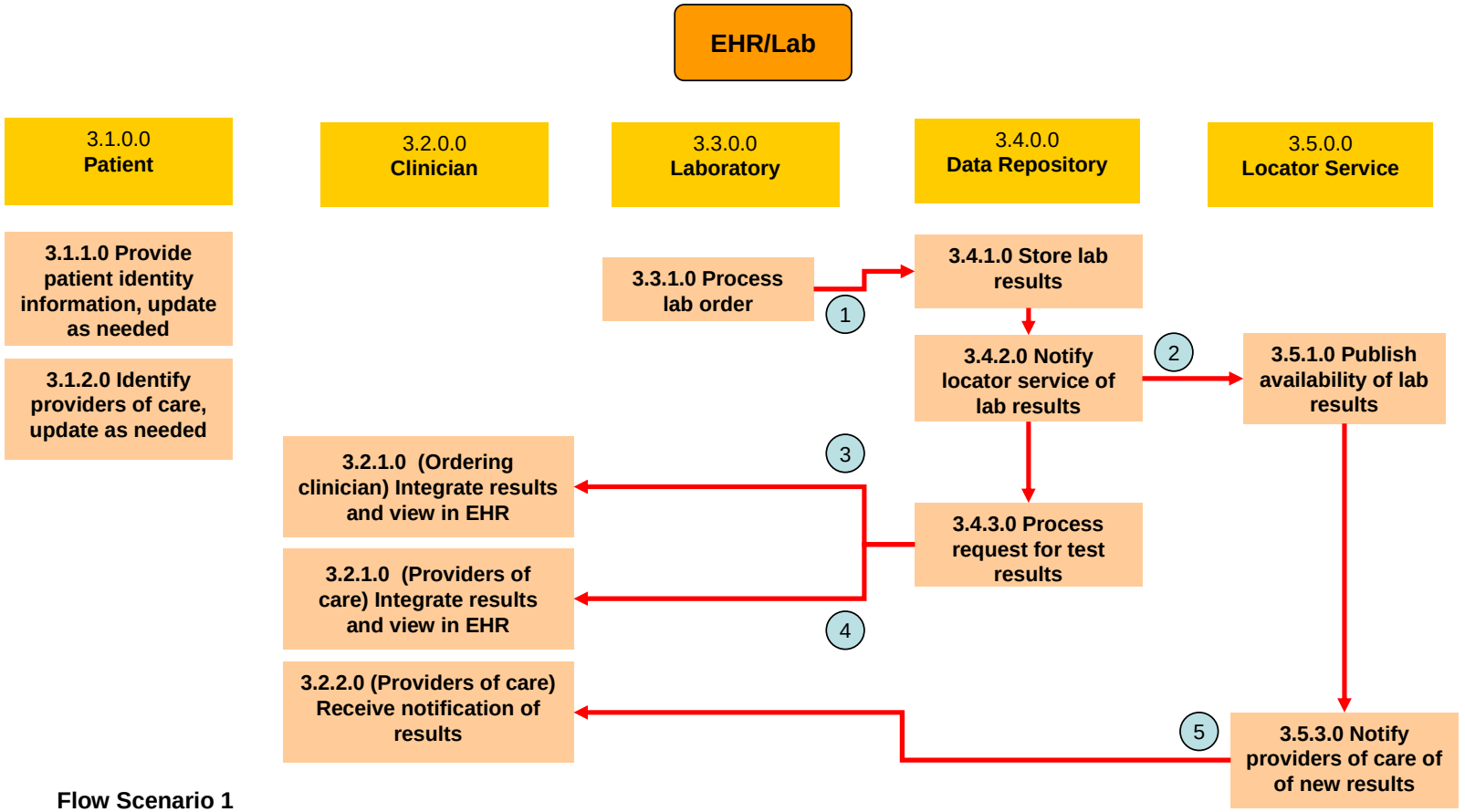
The diagrams on the following pages delineate the events of the use case from the perspectives.


EHR/Lab
Patient
3.1.1.0 Provide patient identity information, update as needed
3.1.1.1 Provide identification data
3.1.2.0 Identify providers of care, update as needed
3.1.2.1 Identify providers of care and/or opt-in/opt-out designation for test results
Laboratory
3.3.1.0 Process Laboratory Order
3.3.1.1 Create test results
3.3.1.2 Send results to data repository
3.3.1.3 Log interaction with clinician and data repository
Clinician
3.2.1.0 Integrate results and view in EHR
3.2.1.1 Receive lab test result as ordering clinician
3.2.1.1a Send request for historical lab test result content to data repository(ies)
3.2.1.1b Submit authentication information to the data repository
3.2.1.2 Confirm data integrity of received results
3.2.1.3 Parse and validate results content
3.2.1.4 Merge data into EHR
3.2.1.5 New results are flagged within EHR
3.2.1.6 Acknowledge receipt of lab results
3.2.1.7 Log receipt of lab test results
3.2.1.7a Produce Exception List of Errors


EHR/Lab
Clinician
3.2.2.0 Receive notification of lab test results
3.2.2.1 Receive notification that test results are available
3.2.3.0 Query for laboratory test results
3.2.3.1 Submit authentication information to locator system
3.2.3.2 Clinician and locator system agree on patient identity
3.2.3.3 Transmit request for specific lab test results
3.2.3.4 Receive the data repository location where the test results are stored
3.2.3.5 Log interaction with locator service
3.2.4.0 View results using a clinical data system (non-EHR)
3.2.4.1 Send request for lab test result content to data repository(ies)
3.2.4.2 Submit authentication information to data repository
3.2.4.3 Receive and view laboratory test results
3.2.4.3a Print lab results
3.2.4.3b Save lab result in local system for later viewing
3.2.4.4 Verify correct patient identity and correctness of lab results
3.2.4.5 Acknowledge receipt of lab results
3.2.4.6 Log receipt of lab result access

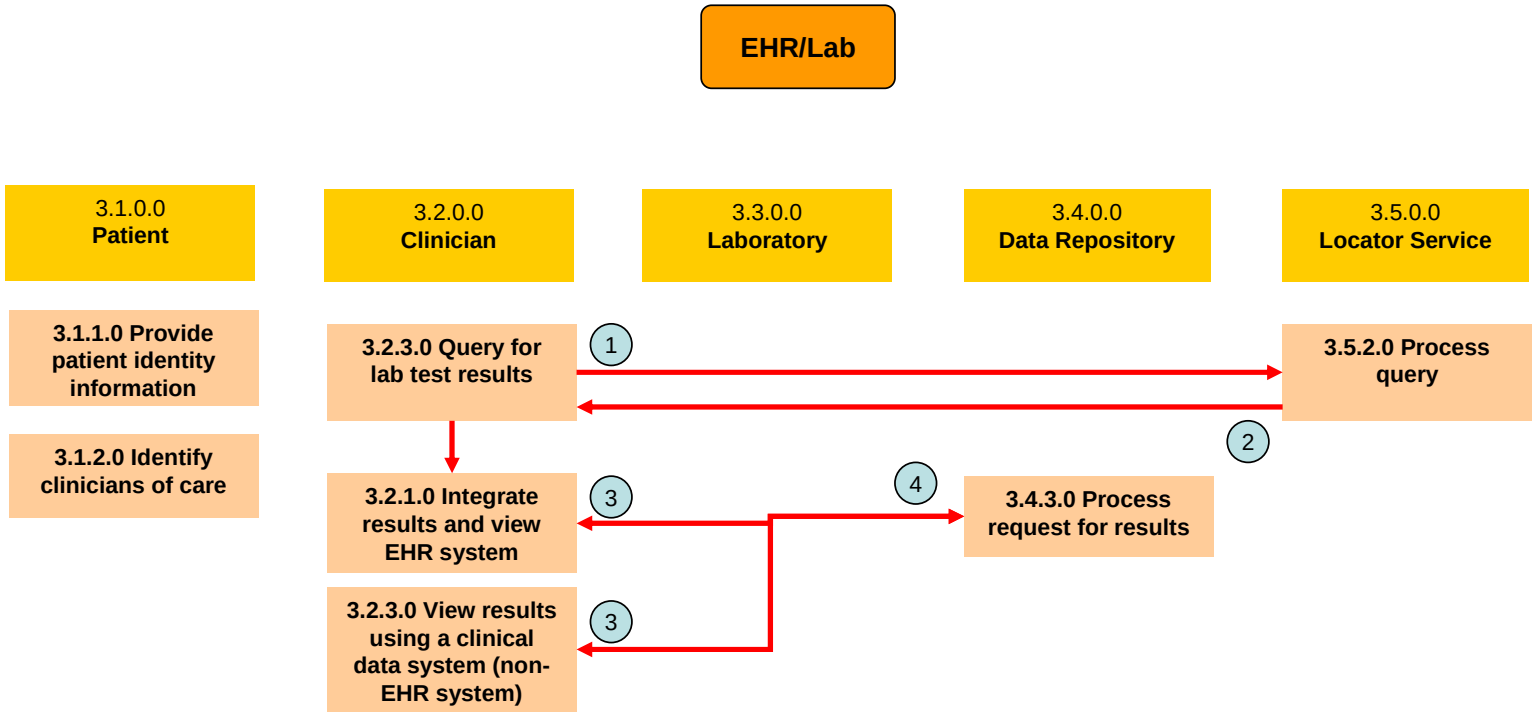

EHR/Lab
Data Repository
3.4.1.0 Store laboratory results
3.4.1.1 Receive test results from laboratory
3.4.1.2 Verify authenticity of laboratory and lab test result file contents
3.4.1.3 Acknowledge receipt of test lab results
3.4.1.4 Store test lab results
3.4.1.5 Transmit lab test results to ordering clinician and providers of care if appropriate
3.4.1.6 Log receipt and storage of lab test results
3.4.2.0 Notify locator service of laboratory results
3.4.2.1 Authenticate to locator service
3.4.2.2 Send result location and related information to locator service
3.4.2.3 Log interaction with locator system
3.4.3.0 Process Request for Laboratory Test Results
3.4.3.1 Receive and validate the query request
3.4.3.2 Authenticate and verify clinician
3.4.3.3 Authorize release of laboratory test result
3.4.3.4 Transmit lab results of an identified patient to clinician
3.4.3.5 Log interaction


EHR/Lab
Locator Service
3.5.1.0 Publish availability of laboratory test results
3.5.1.1 Receive test result (file) location and related info
3.5.1.2 Verify authenticity of lab test result location and completeness of related information
3.5.1.3 Index test result by appropriate patient and other indices
3.5.2.0 Process query to provide laboratory test result location(s)
3.5.2.1 Authenticate clinician requesting laboratory test results
3.5.2.2 Clinician and locator system agree on patient identity
3.5.2.3 Receive request for lab test results
3.5.2.3a Provide lab result availability information based on clinician query/browse
3.5.2.4 Authorize data release
3.5.2.5 Send lab result location (links) pointers to clinician
3.5.2.6 Log interaction with clinician
3.5.3.0 Notify provider(s) of care of new laboratory test results
3.5.3.1 Send notifications to provider(s) of care.



Flow Scenario 1
Ordering clinician receives results integrated into the EHR; providers of care receive test results or notification of test results

1. Lab sends test results to the data repository.
2. Data repository sends to the locator service the location of the results in the repository.
3. Data repository sends the test results to ordering clinician's EHR system (local or remote) or other clinical data system.
4. Data repository sends the test results to the providers of care who can accept the results in an EHR system (local or remote).
5. Locator service notifies the providers of care who don't have an EHR system that can accept lab results.



Flow Scenario 2
Clinician queries for historical test results and receives results either integrated into the EHR or viewed using a clinical data system (non-EHR system)

1. Clinician queries locator service for patient and relevant test results
2. Locator service sends to the clinician the location(s) of the test results in the data repository.
3. The clinician sends a request for test results to the data repository.
4. The data repository sends the test results to the clinician's EHR (local or remote) or other clinical data system.

3.1 Consumer/Patient Perspective

Code	Description	Comment
3.1.1.0	**Event: Provide patient identity information, update as needed**	Patient or Patient Proxy some form of demographics, patient trait or identifier information. This event does not occur each time a clinician orders lab tests or queries for historical results. The information is updated as needed.
3.1.1.1	**Action:** Provide identification data	
3.1.2.0	**Event: Identify providers of care, update as needed**	Clinicians are designated as 'ordering clinicians' and 'other providers of care'. The ordering clinician orders the laboratory tests; other providers of care are those clinicians who may be able to access data due to their clinician/patient relationship with respect to a specific patient. The patient may provide a list of their providers of care. This list could be used to provide the patient's providers of care with notification of new test results. The list of providers of care could be known to all other perspectives: the clinician, laboratory, the data repository and the locator service. This could define the need for tightly bound policies and information sharing among the data repository and locator service.
3.1.2.1	**Action:** Provide list of providers of care	

Code	Description	Comment
3.1.2.1a	**Alternate Action:** Indicate that test results should not be made available to other providers of care	The determination of whether a lab test result (data) is available to a clinician with respect to a specific patient is based on many factors including the sensitivity of the data, clinician access designations, patient privacy restrictions, and policy or regulation considerations. This use case does not prescribe any model for determining whether a test result is available to a clinician; rather it seeks to identify some of the factors, such as sensitive data and provider of care restrictions that may be considered by others to model the use case. Data may be designated as sensitive for a variety of reasons. There may be a range of sensitivity categories indicating data that some data are hightly sensitive and some less sensitive. This use case does not prescribe a model to dictate sensitivity levels, nor types of data for any level. This use case does not prescribe who is responsible for defining or assigning sensitivity. Sensitivity is addressed in the use case by calling for the need to determine if access should be granted based on many factors, including sensitivity. With respect to a specific patient, some data may be available to all clinicians, some data may not be available to any clinicians, and some data may be available to some clinicians based, in part, on the clinician/patient relationship such as specialty of clinician and the type of the test result. Patients can, in part, provide information used to determine access. Patients may use opt-in/out designations to further delineate their desires for clinician access by allowing full access to all data, full restriction to all data, or access/restrictions to specific data. The opt-in/opt-out function may also designate whether the function applies to all types of clinical data or only test result data. The approach taken with respect to sensitivity designations and opt-in/opt-out functionality is dependent on the supporting architecture and infrastructure. The list designating providers of care, the sensitivity restriction and the opt-in/opt-out designation may all be applied to determine restriction of use.

3.2 Clinician Perspective

Code	Description	Comment
3.2.1.0	**Event: Integrate results and view in EHR**	
3.2.1.1	**Action:** Receive lab test result as ordering clinician or provider of care	New test results, upon completion, may be sent directly to the clinician's EHR system (local or remote) without an intermediate request action.
3.2.1.1a	**Alternate Action:** Send request for historical lab test result content to data repository(ies)	The clinician selects data repository(ies) from which to retrieve lab test results and sends a request(s). The request may be sent from the EHR system or via web application.
3.2.1.1b	**Alternate Action:** Submit authentication information to the data repository	
3.2.1.2	**Action:** Confirm data integrity of received results	Upon receiving the test result set (messages), the EHR system confirms that the message was received in a complete and unchanged format.
3.2.1.3	**Action:** Parse and validate results content	The EHR system opens and parses each electronic result. Individual records are checked for appropriate information, completeness, proper codes, and patient identifying information.
3.2.1.4	**Action:** Merge data into EHR	The EHR aggregates patient data from each data repository. Each received record is processed and correlated to a patient in the EHR system. Where new results cannot be unequivocally matched with a patient, an exception list should be produced to allow human resolution
3.2.1.5	**Action:** New results are flagged within EHR	The EHR system should provide a clear indicator as to the status the review process of all results by clinicians
3.2.1.6	**Action:** Acknowledge receipt of lab results	A message is sent to the lab data repository indicating which results were successfully processed and indicates any results that were undeliverable and unprocessed.
3.2.1.7	**Action:** Log receipt of lab test results	Include patient consent information in log.
3.2.1.7a	**Alternate Action:** Produce exception list of errors	Where inbound lab results records cannot be unequivocally matched with the EHR, an exception list is produced to allow human resolution

Code	Description	Comment
3.2.2.0	**Event: Receive notification of lab test results**	A provider of care receives notification that new test results are available. Notification of new test results may be sent in conjunction with test results if results are sent to the clinician's EHR upon receipt by data repository. Notification can also be sent to other providers of care in a copy-to manner. The list of providers of care could be based on the copy-to request in the lab test order, may be provided by the patient or may be compiled through known patient-clinician relationships as part of a community or regional service.
3.2.2.1	**Action:** Receive notification that test results are available	
3.2.3.0	**Event: Query for laboratory (historical) test results**	The clinician queries the locator service for the availability and location of lab test results for a specified patient and receives the location of the results. Queries to the locator service could be accomplished either through the EHR user interface directly or through another clinical data system.
3.2.3.1	**Action:** Submit authentication information to locator system	Establish clinician's identity and verify whether clinician is a provider of care Note that the clinician may be an individual, an organization or "system". The nature of the identification/authentication will be different in each case. One of many authentication methods could be used (biometrics, card, token or user ID and password, cryptographic techniques).

Code	Description	Comment
3.2.3.2	**Action:** Clinician and locator system agree on patient identity through patient trait matching	The clinician and locator system must verify that they are interacting about the same patient. Patient identity may be agreed upon by a number of means including demographic information, agreed-to mapping of patient IDs, or shared patient ID. The means is dependent on whether the locator service is provided by a third-party, or part of available community or regional services. A set of traits (such as name, DOB, gender, etc.) may be used by a locator service to perform a probabilistic match. Business rules could be established across a community or region to determine minimum acceptable combinations of traits (for example, name-only searches not allowed without a DOB). Alternate Actions 3.2.3.2a-b provide the functionality for a priori agreed to identifiers by the clinician and locator service and lab data repository.
3.2.3.2a	**Alternate Action:** Clinician and locator system agree on patient identity based on shared MPI	If the entity to which the clinician is affiliated (hospital, HMO, private physician practice, etc.) has already registered the patient internally and uploaded the entry into a shared MPI, the provider can capture and submit the entity's internal identifier for that patient (e.g., the patient's medical record number for that hospital) to a locator service. In this case, the provider would not need to manually enter demographic traits (name, date of birth [DOB], etc.) since that data are already present in the MPI.
3.2.3.2b	**Alternate Action:** Clinician and locator system agree on patient identity based on patient identifier matching	The locator system matches the patient identifiers supplied by the clinician with patient identifiers known within the locator service.
3.2.3.3	**Action:** Transmit request for specific lab test results based on order number or other unique test result identification	The clinician may request specific test results based on a unique identification number, eliminating the need for browsing through all available test results. This can be performed through a web application or through a standards-based query request from the clinician’s EHR.

Code	Description	Comment
3.2.3.3a	**Alternate Action:** Browse, select and confirm the relevant test results for the correct patient and transmit request	Based on the patient information provided by the clinician (either the entity identifier or demographic traits), a list of candidate patient matches will be retrieved from the locator service. This list should contain demographic data that will help the clinician determine which of the potential matches actually corresponds to the patient. From the list of candidates previously retrieved, the clinician will select and confirm the entry or entries that correspond to the patient and those applicable to reason for query (e.g. date range, test groups, etc.). The clinician may also determine that none of the candidates in the list are correct matches.
3.2.3.4	**Action:** Receive the data repository location where the test results are stored	The locator service provides pointer (i.e., links) to the location(s) where the test result(s) are stored. The clinician uses these locations to retrieve the test results.
3.2.3.5	**Action:** Log interaction with locator service	
3.2.4.0	**Event: View results using another clinical data system (non-EHR system)**	Not all clinicians will initially have an EHR to view lab test results. The clinician may view lab test results using a clinical data system (non-EHR).
3.2.4.1	**Action:** Send request for lab test result content to data repository(ies)	The clinician selects data repository(ies) from which to retrieve lab test results and sends a request(s). The request is sent via a web application.
3.2.4.2	**Action:** Submit authentication information to data repository	Establish clinician's identity and authorization. Note that clinician may be an individual, an organization or "system." The nature of the identification/authentication will be different in each case. One of many authentication methods could be used (biometrics, card, token or user ID and password, cryptographic techniques).
3.2.4.3	**Action:** Receive and view laboratory test results	Lab results are viewed through a clinical data system.
3.2.4.3a	**Alternate Action:** Print lab results	
3.2.4.3b	**Alternate Action:** Save lab results in local system for viewing at a later time	This action assumes that no EHR system is available. The clinician may wish to save lab results to the local system to review at a later time. This is distinct from importing the data into the EHR

Code	Description	Comment
3.2.4.4	**Action:** Verify correct patient identity and correctness of lab results and error correct if necessary	Upon review of the result, a clinician may see suspect data (e.g. that should be confidential, or may be erroneous).
3.2.4.5	**Action:** Acknowledge receipt of lab results	The clinician formulates a message to the lab data repository indicating which results were successfully processed and indicates any results that were undeliverable and unprocessed.
3.2.4.6	**Action:** Log interaction with data repository	

3.3 Laboratory Organization Perspective

Code	Description	Comment
3.3.1.0	**Event: Process Laboratory Order**	Laboratory creates the test results and sends the results to the data repository for availability to the ordering clinician and other providers of care, if appropriate.
3.3.1.1	**Action:** Create test results	
3.3.1.2	**Action:** Send results to data repository	The laboratory transmits the results to the data repository with appropriate metadata necessary for indexing and browse/query response. Results update or error corrections should also be sent. The data repository may be within the laboratory, may be a separate entity, or may be part of a community or regional service provider.
3.3.1.3	**Action:** Log creation of test results	

3.4 Data Repository Perspective

Code	Description	Comment
3.4.1.0	**Event: Store laboratory results**	
3.4.1.1	**Action:** Receive test results from laboratory	The laboratory test results as well as any pertinent information necessary for indexing and browse/query should be provided. Proper action should be taken when results updates are sent for error correction, completeness, etc.
3.4.1.2	**Action:** Verify authenticity of laboratory and lab test result file contents	Verify integrity of test result (file) contents and that the results came from the identified source. The test results should contain appropriate patient information and other information per agreed to standards and policies. Providers of care should be known.
3.4.1.3	**Action**: Acknowledge receipt of test lab results	Send acknowledgment to laboratory that integrity, authenticity and completeness of results are found.
3.4.1.4	**Action:** Store test lab results	Store lab results in data repository system and note any restrictions for use (e.g., providers of care list, patient consent restrictions, or sensitivity restrictions).
3.4.1.5	**Action:** Transmit lab test results to ordering clinician and other providers of care if appropriate	
3.4.1.6	**Action:** Log receipt and storage of lab test results	
3.4.2.0	**Event: Notify locator service of laboratory results**	
3.4.2.1	**Action:** Authenticate to locator service	
3.4.2.2	**Action:** Send result location and related information to locator service	This should contain appropriate patient information and other information per agreed to standards and policies. Restrictions for use should also be provided by data repository (from laboratory) if not provided through supporting community or regional services.
3.4.2.3	**Action:** Log interaction with locator system	

Code	Description	Comment
3.4.3.0	**Event: Process Request for Laboratory Test Results**	The data repository receives a request for test result content and verifies the authenticity of the clinician, the integrity of the request, and any restrictions for use. The data repository either sends the test results for integration into the clinician's EHR, or sends the content to an other clinical data system for viewing. The secrecy of the content is maintained during transmission.
3.4.3.1	**Action:** Receive and validate the query request	Parse, validate, and acknowledge received data query requests.
3.4.3.2	**Action:** Authenticate and verify as ordering clinician or provider of care	May include provider identification and validation of credentials, privileges and/or other authorization. Authentication and verification may be provided through community or regional services. This may include a trust relationship whereby the clinician is authenticated and authorized once by the community or regional service. The authentication and verification is then carried through the query/retrieval processes.
3.4.3.3	**Action:** Authorize release of laboratory test results	Test results released to clinician based on verification as ordering clinician or provider of care status and other appropriate restrictions for use.
3.4.3.4	**Action:** Transmit lab results of an identified patient to an ordering clinician or provider of care	The means of transport will vary depending on whether an EHR system is available to receive the results, or if a web application is used.
3.4.3.5	**Action:** Log interaction	

3.5 Locator Service

Code	Description	Comment
3.5.1.0	**Event: Publish availability of laboratory test results**	
3.5.1.1	**Action:** Receive test result (file) location information and related information	Related information may include appropriate patient information and other information per agreed to standards and policies. Providers of care or restrictions for use should also be provided by the data repository if not provided through supported community or regional services.
3.5.1.2	**Action:** Verify authenticity of lab test result location and completeness of related information	Verify that the location of the test results is accurate and that related information necessary for indexing is correct.
3.5.1.3	**Action:** Index test result by appropriate patient and other indices	Test result info must be indexed so that it can be queried.
3.5.2.0	**Event: Process query to provide laboratory test result location(s)**	
3.5.2.1	**Action:** Authenticate clinician requesting laboratory test results	Establish clinician's identity and verify status as ordering clinician or provider of care. Note that the clinician may be an individual, an organization or "system." The nature of the identification/authentication will be different in each case. One of many authentication methods could be used (biometrics, card, token or user ID and password, cryptographic techniques).

Code	Description	Comment
3.5.2.2	**Action:** Clinician and locator system agree on patient identity	The clinician and locator system must verify that they are interacting about the same patient. Patient identity may be agreed upon by a number means including demographic information, agreed-to mapping of patient IDs, or shared patient ID. The means is dependent on whether the locator service is provided by a third-party, or part of available community or regional services. A set of traits (such as name, DOB, gender, etc.) may be used by a locator service to perform a probabilistic match. Business rules could be established across a community or region to determine minimum acceptable combinations of traits (for example, name-only searches not allowed without a DOB).
3.5.2.3	**Action:** Receive request for lab test results based on lab order number or other unique lab test identifier	The clinician may request specific test results based on a unique identification number, eliminating the need for browsing through all available test results. This can be performed through a web application or through a standards-based query request from the clinician's EHR.
3.5.2.3a	**Alternate Action:** Provide lab result availability information based on clinician query/browse	
3.5.2.4	**Action:** Authorize data release	Test result information released to clinician based on verification as ordering clinician or provider of care status and other appropriate restrictions for use.
3.5.2.5	**Action:** Send lab result location (links) pointers to authorized clinician.	The location pointers will be used by the clinician to retrieve the lab test results for either viewing or integration into the EHR.
3.5.2.6	**Action:** Log interaction with clinician	
3.5.3.0	**Event: Notify provider(s) of care of new laboratory test results**	
3.5.3.1	**Action:** Send notification to clinician	Notification may be sent to providers of care when new test results are available. The list of providers of care could based on the copy-to request in the lab test order, may be provided by the patient or may be compiled through known patient-clinician relationships as part of a community or regional service.