

ASSOCIATION OF COMMUNITY
CANCER CENTERS

EHR Integration: Effective
Practices to Facilitate Timely and
Comprehensive Biomarker Testing

LANDSCAPE ANALYSIS

TABLE OF CONTENTS

Executive Summary	3
Introduction	4
Health Technology Systems	5
Biomarker Testing	5
Reflex Biomarker Testing	6
Biomarker Test Ordering	7
Test Results	10
The Role of Genetic Counselors in Precision Oncology	11
Examples of EHR/Reference Lab Solutions	12
Other Solutions	14
Conclusion	14
References	14
Acknowledgements	16

Thank you to our supporters:



EXECUTIVE SUMMARY

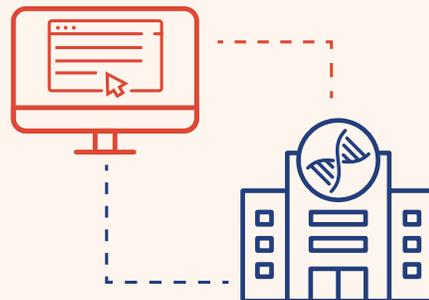
This landscape analysis has been prepared to provide an overview of current health technology performance and interoperability as it relates to biomarker testing and results. While the cancer care community has seen a rapid increase in utilization of guideline-concordant biomarker testing, several operational inefficiencies hinder how care teams order tests and how quickly results can be used to guide treatment planning for patients with cancer.

In 2023, the Association of Community Cancer Centers (ACCC)—with its project partner LUNGeivity and with support from AstraZeneca and Genentech—launched an education program **EHR Integration: Effective Practices to Facilitate Timely and Comprehensive Biomarker Testing**. In part with this program, ACCC reviewed literature, interviewed several cancer programs, and reviewed data from previous projects to outline key challenges surrounding the use of electronic health record (EHR) systems to order biomarker tests and access test results. Certain EHR vendors and send-out reference labs have made progress integrating test ordering and results reporting, however, these solutions may only be available to certain EHR users and require an investment of informational technology (IT) time and resources to establish and maintain integrations with specific reference labs. Moreover, the administrative burden associated with test ordering and processing may hinder clinical workflows and cause delays in testing.

Key issues identified include:

- Lack of access to computerized order entry in EHR systems for biomarker testing
- Lack of clarity and ability to track multiple types of tests (eg, somatic vs germline; tissue vs blood; predictive vs prognostic)
- Inefficiencies in communication between departments
- Logistical challenges related to entry and retrieval of results within EHR systems

As cancer programs face staffing shortages and clinician burnout, it remains critical to find and establish more effective ways to leverage technology to ensure timely, comprehensive, and equitable biomarker testing for patients with cancer.



EHR Integration refers to the creation of interfaces between the EHR and reference labs performing biomarker testing.

Such integrations may enable clinicians to place orders for tests directly through the EHR and/or to have test results go directly into the EHR either as a PDF report and/or discrete data elements.

INTRODUCTION

While the use of EHR systems in the clinical workflow has generally improved efficiency and streamlined many processes for cancer programs, hurdles have emerged in the biomarker testing workflow, from ordering processes to reviewing results. The following landscape analysis briefly examines how community cancer programs are using EHRs, add-on modules, and integrations with other services (eg, reference labs) to achieve operational efficiencies around biomarker testing. The primary focus of this analysis is on predictive biomarker tests such as multigene next-generation sequencing (NGS) panels to identify actionable genomic alterations in somatic and/or germline samples (tissue and/or blood).

Biomarker Testing

Note: The term *biomarker testing* referenced in this report includes a broad range of prognostic and predictive tests used to tailor treatment plans for patients with cancer. Testing may be performed on tissue and/or blood. Samples may be somatic and/or germline. Some tests may be performed in-house while others may be sent out to reference labs.

Examples of cancer biomarker tests include:

- Single gene tests, limited gene panels, protein expression tests (eg, HER2 or PD-L1 by immunohistochemistry [IHC])
- Broad multigene panels by NGS (tissue and blood)
- Multigene expression prognostic NGS assays (eg, Oncotype, MammaPrint)
- Hereditary genetic tests (eg, germline: Ambry, Invitae, GeneDx, Myriad)
- Cytogenetics and other molecular tests in patients with hematologic malignancies
- Tests used to detect minimal residual disease (MRD) or monitor effectiveness of therapy
- And other ancillary tests used to inform treatment decisions

Although certain biomarker testing may occur when patients are hospitalized, this report focuses on outpatient biomarker test ordering and results. Since most biomarker tests are ordered by oncologists or pathologists, this report examines how they are placing orders and accessing or communicating test results. Board-certified genetic counselors (CGCs) often order germline

testing, but their roles are also evolving (see section below on CGCs) as precision medicine programs expand to encompass the coordination of somatic and germline testing.

EHR Interfaces

While this landscape analysis provides specific examples of EHR systems and reference labs, this report is not intended to endorse nor promote any specific product, company, or technology solution.

This paper is not intended to dive into the technical details behind data interfaces and interoperability. However, a few brief definitions are included for context and background¹:

- HL7 is a common standard point-to-point approach for system integration and EHR interoperability.
- FHIR (HL7 Fast Healthcare Interoperability Resources), pronounced fire, is a newer interoperability standard designed to streamline how electronic information is exchanged. FHIR has enabled many recent advances in EHR interoperability.
- An API (application programming interface) refers to a set of protocols that enable different software applications to communicate.
- There are emerging software packages for certain EHRs, such as Epic, which simplifies Aura integration time through a Turbocharger package.

Based on insights gained from prior projects, ACCC has observed that many cancer programs lack direct integration with reference labs that perform biomarker testing. This is often due to the technical expertise and dedicated hours needed to implement and maintain an EHR integration. In recent years, more cancer programs have achieved EHR integrations, so this paper will include several examples. On average, it may take 4 to 6 months for the IT team to perform a point-to-point integration with a single reference lab. After the integration, ongoing updates as tests continue to add new components are often necessary.

Some third-party solutions and software (eg, navigation, tumor board, clinical decision support, clinical trial matching, and self-service reporting tools) may also be used by clinicians to track, monitor, and organize biomarker test results. Patient portals may provide patients with their results when tests are performed in-house. When tests are sent out, results may be accessible to patients via a portal or other digital health solution.

HEALTH TECHNOLOGY SYSTEMS

According to ACCC member research and data from other education programs, EHR systems commonly used by ACCC member programs include Epic and Cerner in the inpatient setting. In the outpatient setting, Epic, Oracle Cerner, Flatiron's OncoEMR, and McKesson's iKnowMed are commonly used systems while Allscripts, MEDITECH, Athenahealth, MOSAIQ, eClinicalWorks, and others are less common.

Although many pathology departments use a laboratory information system (LIS) that aligns with the hospital's EHR system, some laboratories use an LIS that is different from the inpatient EHR system. Pathology reports are created in the LIS and biomarker test results may be added to the pathology

report (sometimes as an addendum). Interoperability limitations between the LIS and EHR may affect the type of information that is shared, the ease of finding patient information, and the formatting of test reports.

Certain send-out test results (eg, liquid biopsy) do not require solid tissue specimen and may not enter the LIS, so pathologists may not be aware of those results. For example, an oncologist may order a liquid biopsy on a patient diagnosed with advanced NSCLC. The blood sample is drawn in the office and sent out. If the test reveals an EGFR mutation, the result may only appear in the outpatient EHR.

BIOMARKER TESTING

Across ACCC member programs, certain biomarker tests are often performed in-house by pathology while other tests are sent out to reference labs. Many community cancer programs rely heavily on send-out biomarker testing (especially as more patients receive multigene NGS panels), and there is significant variation regarding the utilization of send-out tests in clinical practice.² Moreover, some tests are only available as send-out tests (eg, multigene expression prognostic assays or hereditary genetic tests).

For example, IHC testing for ER/PR/HER2 breast cancer may be performed in-house but multigene expression prognostic NGS assays (eg, Oncotype, MammaPrint) may only be available as a send-out test.³ Even when some biomarker tests can be performed in-house, oncologists may prefer to have a reference lab perform the test. For example, a local pathology lab may be able to perform ALK testing as an in-house test, but the oncologist may order a send-out multigene NGS panel.

The 2022 ASCO Provisional Clinical Opinion on somatic genomic testing in patients with advanced cancer lists several issues that impact the rapidly evolving field of cancer biomarker testing:⁴

- Multigene testing is preferred whenever patients are eligible for more than one biomarker-linked therapy. As a growing number of tumor-agnostic targeted therapies and immunotherapies become available, more patients with advanced cancers will receive multigene testing.

- Other topics that may impact testing include: cell-free DNA such as circulating tumor DNA (ctDNA); testing for MRD; pharmacogenomic biomarkers; testing cancers of unknown primary (CUP); mutational signatures; methylomes, homologous recombination deficiency (HRD) assays; tumor mutation burden (TMB), microsatellite instability (MSI), the diagnostic and prognostic value of NGS; intertumoral and intratumoral heterogeneity (ITH); assessing genomic coalterations; and rationale for repeat genetic testing.
- Authors also emphasize the need to provide equitable testing for all patients with respect to social determinants of health, recognizing that disparities in access to care should be measured with quality goals to improve equity.
- Patient out-of-pocket costs may vary depending on the types of testing ordered, insurance coverage, in-network vs out-of-network, etc.

As send-out testing in oncology becomes more complex—especially with the growing use of liquid biopsy, the evolving role of serial testing (eg, repeating tests over time to identify resistance mutations), the growing number of test types, and the need for testing increases—cancer programs must find more effective and efficient ways to order tests appropriately and use results for treatment planning. In addition, there is the challenge of how to store results of multiple and longitudinal tests in the EHR and ensure accessibility to the most relevant or most recent test.

REFLEX BIOMARKER TESTING

Some cancer programs have established “reflex” biomarker testing protocols, where pathologists are responsible for ordering the tests (or they may enter an “oncologist of record” for the test order).⁵ Reflex testing can reduce testing delays and may be governed by a protocol defined by members of the multidisciplinary team. **Table 1** outlines the key steps for a pathology-driven reflex testing process.

Table 1. Critical Steps for a Pathology-Driven Reflex Testing Process



Criteria are met for reflex testing	Pathologist orders test	Pathology processes order	Test results become available
<p>A patient diagnosed with cancer meets criteria to receive reflex testing.</p> <p>Pathology initiates the reflex test.</p>	<p>Pathology enters the test order (or enters an “oncologist of record”) into the EHR and/or LIS.</p>	<p>Pathology follows the reflex protocol and performs the test in-house or sends the sample out to a reference lab.</p>	<p>When test results are available, the results are added to the EHR.</p> <p>Pathology may also include results to the pathology report (sometimes as an addendum).</p>

EHR, electronic health record; FISH, fluorescence in situ hybridization; IHC, immunohistochemistry; LIS, laboratory information system; MMR, mismatch repair; MSI, microsatellite instability; PCR, polymerase chain reaction.

Examples of “reflex” testing in solid tumors include:

- Breast cancer: ER/PR/HER2 by IHC with FISH
- Colorectal cancer: MSI by PCR or MMR by IHC
- Advanced non–small cell lung cancer (NSCLC): PD-L1 by IHC and a multigene NGS panel

Examples of “reflex” testing in hematologic malignancies include:

- Cytogenetics, flow cytometry, and/or molecular testing on bone marrow biopsies when certain hematologic malignancies are diagnosed

Pathology-driven reflex testing can offer greater efficiency, as oncologists do not have to spend time entering test orders, and testing can often take place sooner with greater consistency. A reflex testing process also better ensures equitable testing since all patients who meet diagnostic criteria would receive testing. However, reflex testing requires coordination and buy-in across members of the multidisciplinary team while adding time and responsibility for the pathology team.

While reflex testing may be easier to establish when testing is performed in-house, reflex testing for send-out tests may be difficult to establish, especially when oncologists have different preferences regarding reference lab selection. Some institutions may place certain restrictions on send-out reflex testing protocols to control utilization. If reflex testing includes germline analysis or may identify hereditary conditions, then patient consent and pretest counseling are important considerations that may need to be incorporated into the diagnostic and testing process.

BIOMARKER TEST ORDERING

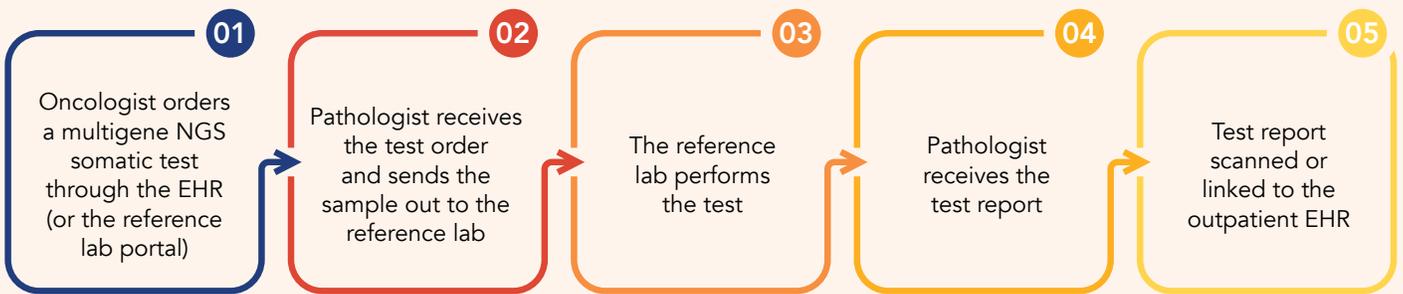
ACCC has identified many examples of how biomarker tests are ordered by oncologists. When an EHR system has been integrated with a reference lab, computerized provider order entry (CPOE) may be possible. In other settings, the order may be placed directly through the reference lab portal (and no order is entered in the EHR system). Some institutions have standardized common orders to reduce the likelihood of errors or unwanted variations in test ordering.⁶ For example, all biomarker tests for advanced NSCLC may be a send-out test to reference lab X for a specific lung multigene panel.

When oncologists have different preferences for send-out reference labs, the workload for pathology increases significantly since each lab has specific order forms and

processes. Moreover, the IT team may need to build separate orders for each reference lab test to enable computerized order entry from the EHR system. When orders are not entered correctly, testing may get delayed and the reference lab and/or pathology may need to spend time contacting oncologists for clarification of missing patient data to process the order. For these reasons, clear communication between the ordering oncologist and pathologist as well as direct ordering (either via online portal or integrated through the EHR) ensures accurate and timely order processing.

Some of the key steps in the biomarker testing process are outlined in **Figure 1**.

Figure 1. Important Steps in the Biomarker Testing Process



EHR, electronic health record; NGS, next-generation sequencing.

Table 2. Key Differences Between Testing Processes in Settings with Integration vs Nonintegration

	Oncologist orders test	Pathology processes order	Test results become available
EHR/reference lab integration	<p>Outpatient EHR has an integrated order transmitting to specific send-out test.</p> <p>Oncologist enters the computerized order in the EHR, and it is sent directly to pathology and the reference lab.</p>	<p>Pathology receives the order for tissue specimen, reviews for tumor content, and processes the order.</p>	<p>Test results are linked to the original order.</p> <p>Test results may appear as a PDF report and/or as discrete data elements, depending on the type of integration.</p>
No integration between the EHR and reference lab	<p>Oncologist uses something like a “miscellaneous send-out test” order in the EHR.</p>	<p>Pathology often needs to obtain more information from oncology to correctly process the order. In the case of QNS, alternate sample needs to be considered.</p>	<p>Test results may get scanned as a PDF in a “media tab.” Reports may be misclassified, which can lead to difficulty finding the report when needed.</p>

EHR, electronic health record; QNS, quantity not sufficient.

Building electronic orders is a process that may be streamlined in some institutions and labor-intensive in others. If a cancer program works with multiple reference labs, then orders often need to be built for each reference lab and type of test. Even after EHR/reference lab integration occurs, ongoing IT updates, customizations, and modifications are needed, especially after a reference lab begins offering new testing components.

Table 3. Oncologist/Staff Orders Test Using Reference Lab Portal
(often used when there is no integration between the EHR and reference lab)

Oncologist orders test	Pathology processes order	Test results become available
Oncologist places the order directly through the reference lab portal with no documentation in the EHR.	Reference lab contacts pathology to identify the appropriate specimen and process the order.	Test results are sent directly to the ordering provider (eg, by fax or email as a PDF). Results may also be sent to pathology. Results may never be entered to EHR.
Oncologist contacts pathology to request an NGS test.	Pathology obtains more information from oncology to correctly identify appropriate specimens and process the order.	Test results are often entered as a PDF scanned into the media tab or linked to a shell order in the lab tab. Some results may never be entered into EHR.

EHR, electronic health record.

Other Examples of Biomarker Test Ordering

Sometimes, the oncologist may place a verbal order by calling pathology and requesting a specific test. Or, the oncologist may send a direct message to the pathologist and request a specific test.

In some cancer programs, the biomarker test order may be entered by a nurse, navigator, nurse practitioner or physician assistant, or other member of the cancer care team. If the order is entered incorrectly or is incomplete, testing may be delayed. Some cancer programs still use paper order forms and may fax the order.

Prior authorization is often required when biomarker tests are ordered, so this administrative work further burdens clinicians. Some reference labs perform some of the prior authorization work.

TEST RESULTS

In many instances (particularly with send-out tests), the test report may be faxed or scanned into the outpatient EHR, often with inconsistent file names. These reports may get misfiled, mislabeled, or buried amidst countless other scanned documents with no way to filter or search for them. When oncologists are unable to find these reports efficiently, patients may miss opportunities to receive targeted therapies. As new therapies become FDA-approved, there is no efficient way for oncologists to reference older test results to consider new therapy applications.

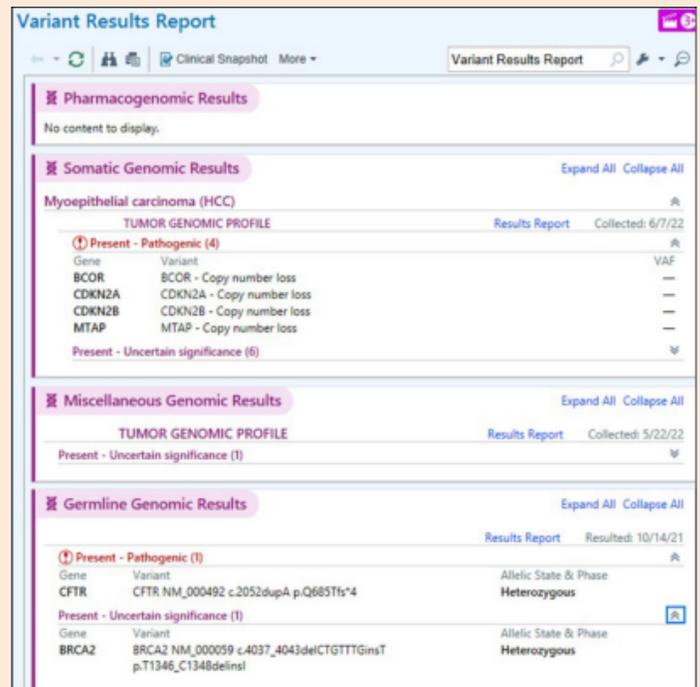
Furthermore, oncologists may have difficulty keeping track of multiple types of tests (eg, somatic vs germline, tissue vs blood, prognostic vs predictive) for individual patients. This may lead to duplicate test orders, missed testing opportunities, or wasted time searching for reports.

One potential solution for organizing test results is to use the variant results summary to list all tests that have been performed along with any positive results. A dashboard-type of page in the EHR is another potential way to organize the results (Figure 2).

Figure 3 is an example of a customized Cerner EHR that includes a genomics tab.

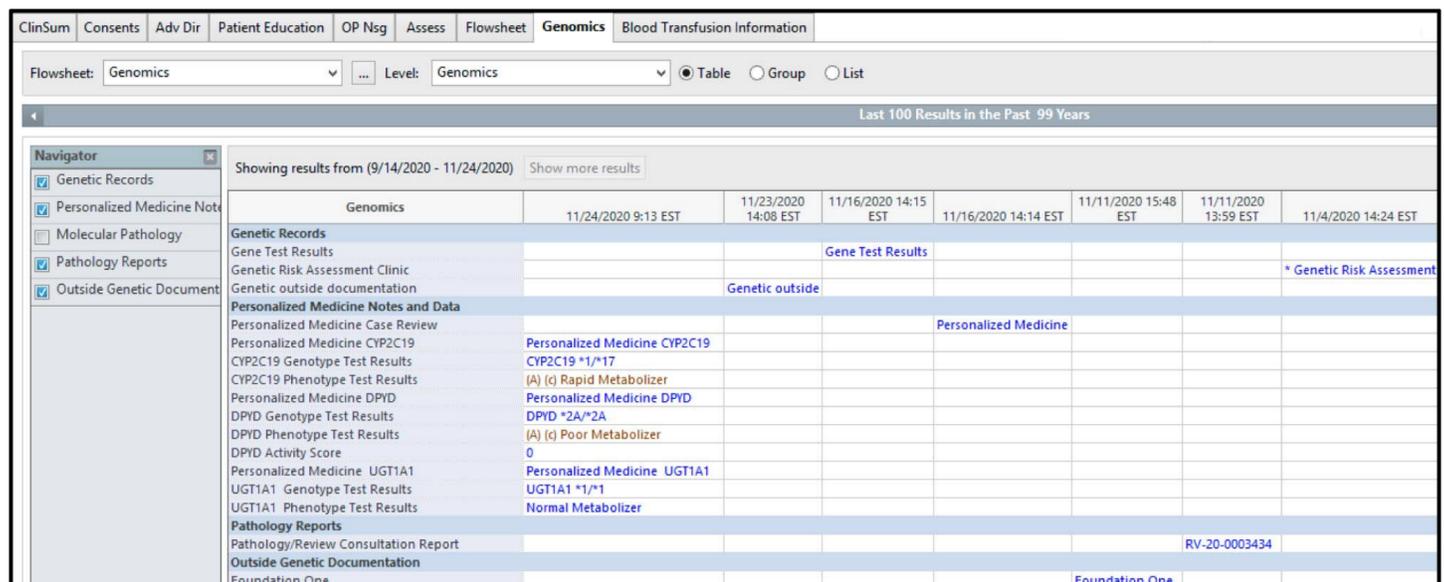
Figure 2. EPIC Genomics Model Example

Users of the EPIC genomics module have found ways to organize somatic genomic, germline genomic, miscellaneous genomic, and pharmacogenomic results.



acc-cancer.org/ehr-resource

Figure 3. Cerner Electronic Health Record With Genomics Tab



doi:10.1200/PO.20.00513

Numerous methods may be used to return NGS test results. While a PDF report is a common format, it does not provide ease of use to search for reports or identify inclusion cohorts. **Table 4**⁷ lists the various file types for NGS results.

Table 4. NGS File Types and Considerations for Use⁹

File name	File extension	Description	Considerations for Use
FASTQ	.fastq	Text-based sequence file that stores both raw and sequencing data and quality scores	Demultiplexing converts base calls into raw sequencing data and quality scores in FASTQ format Analyses are needed to effectively use these files, but local methods may be different from reference lab methods resulting in discordant results
SAM	.sam	Text-based format for storing biologic sequences aligned to a reference sequence	Raw sequencing reads are aligned to the reference genome assembly, resulting in alignments stored in SAM or BAM format
BAM	.bam	Binary version of an SAM file	Typically the starting point for many downstream genetic variation analyses
VCF	.vcf	Text-based format for storing gene sequence variations	Tool uses alignments in SAM or BAM to identify sequence variations and output in VCF This could contain the test provider results, including indication of whether a variant is included in the clinical report
gVCF	.gvcf	Text-based format for storing sequencing information on both variant and nonvariant positions; set of conventions applied to standard VCF	Tool uses alignments in SAM or BAM format to identify variations and nonvariations and output in gVCF accounting for the entire genome as variant, reference, or missing More precise than VCF, but not as widely used
Structured text file	.xml .json .yaml .txt	Text file with defined structure. Can be a standardized format (eg, XML)	Formatted output of mutation calling and filtering The information content is not standardized and typically defined by the reference laboratory Each reference laboratory's text file requires importation with separate parsers, with clear documentation of the parsers by the reference laboratory needed

BAM, Binary Alignment Map; gVCF, Genomic Variant Call Format; NGS, next-generation sequencing; SAM, Sequence Alignment Map; VCF, Variant Call Format; XML, Extensible Markup Language.

Key points regarding test results:

- In an ideal setting, test results would be entered as discrete data and searchable in the EHR. This is not often the case for multigene NGS panels and other biomarker tests.
- Even when an EHR is integrated with a reference lab, the results may be a PDF report linked to the test order. Certain add-ons (eg, EPIC genomics module) may enable discrete data elements to facilitate trending, searching, reporting, etc.

THE ROLE OF GENETIC COUNSELORS IN PRECISION ONCOLOGY

ACCC has found that some cancer programs have involved their licensed and board-certified genetic counselors (CGCs) in their precision medicine initiatives. Although CGCs have historically focused on hereditary (germline) testing, some have been involved overseeing, managing, ordering, or coordinating somatic testing. Some sites have paired tumor/germline testing where both are ordered by genetic counselors. Sometimes somatic test reports may indicate a genomic alteration (gene variant) that is suggestive of a germline mutation. Yap TA et al demonstrated that the prevalence of germline findings among patients undergoing tumor/normal matched sequencing is about 7.3%. In some instances, oncologists may order paired somatic-germline testing.⁹

Cancer programs that have involved their CGCs in their precision medicine programs have seen the value of coordinating all their testing efforts and reducing confusion

about different types of tests (eg, somatic vs germline). Genetic counselors understand the needs of the clinical interface as providers and can help technical teams understand the unique ways that genomic information is described or used in clinical practice. Moreover, CGCs may also help oncologists understand the clinical significance of uncommon test results. Genetic counselors are a good resource in building clinical decision making for incidental germline results. For example, with the Epic genomics module, incidental germline mutations (eg, BRCA2) can become “genomic indicators” that trigger best practice alerts and care gaps such as referral to genetic counseling or for gynecology oncology with gene-based and guideline-based algorithms. Given these multiple contributions, it is important to include genetic counselors in the EHR integration process from the start of implementation through ongoing customizations.

Precision Medicine Stewardship

Recognizing that many patients in the community receive suboptimal biomarker testing, ACCC launched the Precision Medicine Stewardship program and explored how some cancer programs have designated a precision medicine steward—a navigation lead who serves as the point person for removing barriers to testing so all eligible patients are appropriately tested. Precision medicine stewards may be CGCs, nurses, navigators, advanced practice providers, or other members of the multidisciplinary cancer care team who act as the central liaison between oncologists, patients, pathology, and reference labs to ensure timely and appropriate biomarker testing.

accancer.org/precision-medicine-stewardship

EXAMPLES OF EHR/REFERENCE LAB SOLUTIONS

ACCC has identified several examples of EHR solutions and integrations that streamline test ordering and resulting in **Table 5**.

Table 5. Examples of EHR Solutions and Integrations for Efficiencies in Test Ordering and Resulting

	Test ordering and resulting
EPIC	<p>The EPIC Orders and Results Anywhere (ORA) Network (also called Aura) is a process designed to enable interfaces between test orders from the EHR and results from reference labs. Some of the reference labs that are live on the network include Exact Sciences, Natera, Foundation Medicine, Tempus, Guardant, and Caris.¹⁰</p> <p>EPIC also offers a genomics module that enables discrete genomic results and a central page that consolidates genomic test results. As of June 2022, about 8 cancer centers across the country had fully integrated the genomics module. One such center is TriHealth Cancer & Blood Institute in Cincinnati, Ohio, where the Epic genomics module was strategically implemented simultaneously with the first EMR integration in December 2020.¹¹ Another example is Ochsner Cancer Institute in New Orleans, Louisiana.¹²</p> <p>In a 2023 National Comprehensive Cancer Network abstract, authors from Vanderbilt Ingram Cancer Center in Tennessee wrote how they used the genomics module to map results from several different NGS test report formats. This enabled them to quickly identify patients who may be eligible for new targeted therapies.¹³</p> <p>In 2020, Penn Medicine - University of Pennsylvania Health System (UPHS) in Pennsylvania wrote about their experience integrating EPIC with Ambry.¹⁴ Researchers at Penn Medicine expanded their research to find time savings when orders were entered via the EHR vs online laboratory-specific portals.¹⁵</p>
Cerner	<p>The Cerner Reference Lab Network (RLN) is designed to interface with multiple reference labs.¹⁶ Although RLN was announced in 2011, ACCC could not find many references to its recent use with labs specializing in cancer biomarker testing.</p>
MEDITECH	<p>Golden Valley Memorial Healthcare in Missouri was the first organization to go live with MEDITECH's Expanse Genomics, a solution that integrates genetic data with the EHR.¹⁷</p> <p>In 2022, a news story mentioned how Frederick Health James M Stockman Cancer Institute in Maryland will be integrating MEDITECH's Expanse Genomics with Caris Life Sciences, Ambry Genetics, Foundation Medicine, Pro-Genex, and NeoGenomics.¹⁸</p>

Several reference labs have recently announced different types of integration offerings with specific EHR systems to improve test ordering and resulting (Table 6).

Table 6. Labs Using Integrations with EHR Systems to Improve Test Ordering and Resulting

Year	Reference lab	EHR
2021	Foundation Medicine	Integrate with EPIC for test ordering ¹⁹
2021	Foundation Medicine	Integrate with Flatiron’s OncoEMR for test ordering ²⁰
2021	Tempus	Integrate with EPIC’s genomics module ²¹
2022	Caris	Integrate Caris with EPIC’s Orders and Results Anywhere (ORA, also called Aura) network ²²
2022	Caris	Integrate with Flatiron’s OncoEMR for test ordering ²³
2022	Guardant	Integrate with EPIC ²⁴
2022	Myriad	Integrate with EPIC ²⁵
2023	Invitae	Integrate with EPIC ²⁶

**Integrations may include CPOE capabilities, results entering the EHR as scanned PDFs, and/or results entering the EHR as discrete data elements.

Examples of Reference Lab Websites Summarizing Electronic Health Record Integrations

- **Caris:** <https://www.carislifesciences.com/caris-resources/ehr-integrations>
- **Foundation Medicine:** <https://www.foundationmedicine.com/info/detail/digital-reporting-online-ordering-and-system-integrations>
- **NeoGenomics:** <https://neogenomics.com/client-services/online-orders>
- **Myriad:** <https://myriad.com/integrations>
- **Tempus:** <https://www.tempus.com/oncology/ehr-integration>

OTHER SOLUTIONS

Some reference labs have also recently expanded their digital health solutions that may include patient portals, mobile apps, online interfaces, and interactive reports. Cancer programs may also utilize clinical decision support (CDS) to guide treatment planning decision based on test results. Clinical pathways, treatment order sets, and other digital solutions may help clinicians order the right biomarkers and provide more consistent care.

CONCLUSIONS

As more cancer programs utilize send-out biomarker tests, the need to identify practical ways to streamline the workflow and reduce any administrative burden associated with test ordering and resulting is growing. EHR/reference lab integrations require investment of technical support that is not always feasible, so innovative solutions are needed to ensure timely and accurate test ordering and consistent results. Even after a cancer program achieves an EHR/reference lab integration, ongoing IT work is needed to build new test orders, make system updates, and customize clinical interface. Add-on modules like the EPIC genomics module enable discrete data elements, but similar examples appear to be lacking for other EHR systems.

As EHR vendors and reference labs work to build and streamline test ordering and resulting integrations, cancer programs need to know how to vet these solutions, prioritize IT projects, and demonstrate the return of investment with the added value these integrations offer consistent care.

REFERENCES

1. HealthIT.gov. Acronyms. Accessed August 29, 2023. healthit.gov/topic/acronyms
2. Schwartzberg L, Kim ES, Liu D, Schrag D. Precision oncology: who, how, what, when, and when not?. *Am Soc Clin Oncol Educ Book*. 2017;37:160-169. doi:10.1200/EDBK_174176
3. Sun L, Wu A, Bean GR, Hagemann IS, Lin CY. Molecular testing in breast cancer: current status and future directions. *J Mol Diagn*. 2021;23(11):1422-1432. doi:10.1016/j.jmoldx.2021.07.026
4. Chakravarty D, Johnson A, Sklar J, et al. Somatic genomic testing in patients with metastatic or advanced cancer: ASCO Provisional Clinical Opinion. *J Clin Oncol*. 2022;40(11):1231-1258.
5. Gosney JR, Paz-Ares L, Jänne P, et al. Pathologist-initiated reflex testing for biomarkers in non-small-cell lung cancer: expert consensus on the rationale and considerations for implementation. *ESMO Open*. 2023;8(4):101587. doi:10.1016/j.esmoop.2023.101587
6. Waterhouse DM, Ward P, Arnal S, et al. Closing the testing gap: standardization of comprehensive biomarker testing for metastatic non-small-cell lung cancer in a large community oncology practice. *JCO Oncol Pract*. 2023;19(6):e951-e956. doi:10.1200/OP.22.00817
7. Hicks JK, Howard R, Reisman P, et al. Integrating Somatic and Germline Next-Generation Sequencing Into Routine Clinical Oncology Practice. *JCO Precis Oncol*. 2021;5:PO.20.00513. doi:10.1200/PO.20.00513
8. Yap TA, Ashok A, Stoll J, et al. Prevalence of germline findings among tumors from cancer types lacking hereditary testing guidelines. *JAMA Netw Open*. 2022;5(5):e2213070. doi:10.1001/jamanetworkopen.2022.13070
9. Henson JW. Paired tumor-germline testing as a driver in better cancer care. *JAMA Netw Open*. 2022;5(5):e2213077. doi:10.1001/jamanetworkopen.2022.13077

10. EpicShare.org. Q: Is there a simpler, more cost-effective way to connect to specialty diagnostic labs? A: Yes, join the Orders & Results Anywhere Network. June 6, 2022. Accessed August 30, 2023. epicshare.org/tips-and-tricks/orders-and-results-anywhere-connects-health-systems-and-specialty-diagnostic-labs
11. EpicShare.org. Actionable, accessible genetic data makes personalized medicine possible. June 27, 2022. Accessed August 30, 2023. epicshare.org/share-and-learn/trihealth-tempus-precision-oncology
12. Rath D. Ochsner first to deploy epic genomics order integration. Healthcare Innovation. August 31, 2022. Accessed August 30, 2023. hcinnovationgroup.com/clinical-it/genomics-precision-medicine/news/21279355/ochsner-first-to-deploy-epic-genomics-order-integration
13. Vento J, Osterman T. BIO23-019: precision oncology: integrating structured genomic data into the electronic health record via the EPIC genomics module. *J Natl Compr Canc Netw.* 2023; 21(3.5): BIO23-019. doi:10.6004/jnccn.2022.7165
14. Lau-Min KS, Asher SB, Chen J, et al. Real-world integration of genomic data into the electronic health record: the PennChart Genomics Initiative. *Genet Med.* 2021;23(4):603-605. doi:10.1038/s41436-020-01056-y
15. Lau-Min KS, McKenna D, Asher SB, et al. Impact of integrating genomic data into the electronic health record on genetics care delivery. *Genet Med.* 2022;24(11):2338-2350. doi:10.1016/j.gim.2022.08.009
16. Cerner builds reference lab network. News release. GlobeNewswire; September 29, 2011. Accessed August 30, 2023. globenewswire.com/news-release/2011/09/29/457368/10862/en/Cerner-Builds-Reference-Lab-Network.html
17. Golden Valley Memorial Healthcare goes LIVE with MEDITECH Expanse Genomics. News release. Meditech. June 17, 2022. Accessed August 30, 2023. ehr.meditech.com/news/golden-valley-memorial-healthcare-goes-live-with-meditech-expanse-genomics
18. Meditech installs EHR genomics add-on at health systems in pursuit of precision medicine. News release. GenomeWeb. April 13, 2022. Accessed August 30, 2023. genomeweb.com/informatics/meditech-installs-ehr-genomics-add-health-systems-pursuit-precision-medicine
19. Foundation Medicine announces partnership with Epic to streamline access to genomic insights for precision cancer care. News release. Foundation Medicine. August 21, 2021. Accessed August 30, 2023. foundationmedicine.com/press-releases/a319c9ce-9025-4170-a376-de22b5c99481
20. Foundation Medicine and Flatiron Health announce first-of-its-kind integration of genomic profiling into OncoEMR/. News release. release. Foundation Medicine. June 29, 2021. Accessed August 30, 2023. foundationmedicine.com/press-releases/ba49795c-659b-4b11-9e4c-57faed61fda4

ACKNOWLEDGEMENTS

ACCC is grateful to the Advisory Committee, partner organizations, and others who graciously gave their knowledge and time to contribute to this publication.

Advisory Committee and Faculty

Crystal Enstad, MBA, BSN, RN, OCN
Oncology Nurse Navigator Genomics
Sanford USD Medical Center, Sanford Cancer Center
Sioux Falls, SD

Karen Huelsman, MS, LGC
Precision Oncology Lead, Genetic Counselor
TriHealth Cancer and Blood Institute
Cincinnati, OH

Sandra Kurtin, PhD, ANP-C, AOCN
Assistant Professor of Clinical Medicine and Adjunct Clinical Assistant
Professor of Nursing
University of Arizona Cancer Center
Tucson, AZ

Christopher McNair, PhD
Associate Director for Data Science
Sidney Kimmel Cancer Center – Jefferson Health
Philadelphia, PA

Gregg Shepard, MD
Medical Oncologist
Tennessee Oncology
Nashville, TN

Kevan Simms, MBA, PMP
Assistant Vice President of Precision Medicine
Ochsner Health
New Orleans, LA

Eric Vail, MD
Director, Molecular Pathology and Assistant Professor, Pathology and
Laboratory Medicine
Cedars-Sinai
Los Angeles, CA

Wendi Waugh, RT (R)(T), CMD, CTR
Administrative Director of SOMC Cancer Services and Community
Health and Wellness
Southern Ohio Medical Center
Portsmouth, OH

Partner Organization

Nikki Martin, MA
Senior Director, Precision Medicine Initiatives
LUNGEVITY
Chicago, IL

ACCC Staff

Leigh Boehmer, PharmD, BCOP
Chief Medical Officer

Rania Emará
Senior Editor, Editorial Content & Strategy

Caroline Offit, MS
Program Manager, Oncology Education

Elana Plotkin, CMP-HC
Director, Education Programs

In partnership with:



Thank you to our supporters:



Association of Community Cancer Centers

A publication from the ACCC education program, EHR Integration: Effective Practices to Facilitate Timely and Comprehensive Biomarker Testing. Learn more at acc-cancer.org/ehr-integration.

The **Association of Community Cancer Centers (ACCC)** is the leading education and advocacy organization for the cancer care community. For more information, visit acc-cancer.org.

© 2023. Association of Community Cancer Centers. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means without written permission.