Tumor Marker Genetics

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Policy

The Medical Management Department reviews referral requests for authorization of tumor marker genetic testing.

Prior authorization requests must be submitted by the staff in the Genetics Department or Clinical Experts in the medical field for which testing is requested.

This Medical Policy does not constitute medical advice. When deciding coverage, the enrollee's specific plan document must be referenced. The terms of an enrollee's plan document (Certificate of Coverage (COC) or Summary Plan Description (SPD)) may differ from this Medical Policy. In the event of a conflict, the enrollee's specific benefit plan document supersedes this Medical Policy. All reviewers must first identify enrollee eligibility, any federal or state regulatory requirements, and the plan benefit coverage prior to use of this Medical Policy. Other Policies and Coverage Determination Guidelines may apply. Quartz reserves the right, in its sole discretion, to modify its Policies and Guidelines as necessary.

Procedure

A. General Criteria (For genetic tests NOT listed in Section C of this policy):

1. **Documentation**
   In order to facilitate the authorization process, referral requests **MUST** include the following:
   a. Clinical record of patient's personal and family history along with genetic counseling;
   b. Record of appropriate conventional clinical diagnostic studies/tests/interventions including results of those tests, and also results of previously completed genetic testing;
   c. Request should include name of accredited lab performing the test (e.g., College of American Pathologist/American College of Medical Genetics);
   d. An estimate of the patient's probability of having the disorders being tested;
   e. The ordering providers statement of how the patient's medical treatment plan will be directed by the requested genetic testing whether testing results are positive or negative;
   f. Genetic counseling must be performed by a qualified, appropriately trained practitioner with **ONE** of the following backgrounds:
      i. Board certified/Board eligible (BC/BE) genetics counselor;
      ii. BC/BE medical geneticist;
      iii. Genetic nurse credentialed as either a genetic clinical nurse or advanced practice nurse in genetics;
      iv. Specialist with expertise in cancer genetics to include an oncologist, surgical oncologist, or other physician or advanced practice professional with documented training and expertise in cancer genetics.
      v. Diagnosis related specialist or advanced practice professional with experience or documented training and expertise in genetics related to the patient's condition.

vi. The person providing the counseling cannot be employed by a commercial genetic testing laboratory except those employed by/contracted by a laboratory that is part of an integrated health system which routinely delivers health care services beyond just the laboratory test itself.

2. **General Criteria for Medical Necessity**

Genetic testing is medically necessary if **ALL** of the following criteria are met:

a. The test is appropriate for the patient by meeting **ONE** of the following:
   i. The patient has signs or symptoms of the disorder in question **AND** a definitive diagnosis cannot be made using conventional medical tests **AND** the test results will be used to change medical management; **OR**
   ii. The test results will provide prognostic information **OR** predict response to treatment (pharmacogenetics) that will be used to change medical management; **OR**
   iii. The patient's family history indicates that the patient is at risk or a carrier of a disease-causing genetic mutation/variant, or a mutation/variant that causes increased risk, **AND** the test results will be used to make decisions regarding medical management or reproductive decisions; **AND**

b. A specific mutation, or set of mutations, has been identified, that specifically identifies the genetic disorder with a high degree of validity and reliability; **AND**

c. The genetic test has been cleared or approved by the FDA or it will be performed in a CLIA certified laboratory; **AND**

d. The genetic disorder cannot be identified through other types of biochemical testing; **AND**

e. The ordered genetic test should be accompanied by genetic counseling by a qualified, appropriately trained practitioner (see Documentation section above).

B. For Specific Genetic Tests listed in Section C of this policy:

1. **Documentation**

In order to facilitate the authorization process, referral requests **MUST** include the following:

a. Clinical record of patient's personal and family history;

b. Record of appropriate conventional clinical diagnostic studies/tests/interventions including results of those tests, and also results of previously completed genetic testing;

c. The ordering provider's statement of how the patient's medical treatment plan will be directed by the requested genetic testing whether testing results are positive or negative.

2. **Medical Necessity Criteria for Specific Genetic Tests listed in Section C of this policy:**

Genetic testing is medically necessary if **ALL** of the following criteria are met:

a. The test is appropriate for the patient by meeting **ONE** of the following:
   i. The patient has signs or symptoms of the disorder in question **AND** a definitive diagnosis cannot be made using conventional medical tests **AND** the test results will be used to change medical management; **OR**
   ii. The test results will provide prognostic information **OR** predict response to treatment (pharmacogenetics) that will be used to change medical management; **OR**
   iii. The patient's family history indicates that the patient is at risk or a carrier of a disease-causing genetic mutation/variant, or a mutation/variant that causes increased risk, **AND** the test results will be used to make decisions regarding medical management or reproductive decisions; **AND**

b. A specific mutation, or set of mutations, has been identified, that specifically identifies the genetic disorder with a high degree of validity and reliability; **AND**

c. The genetic test has been cleared or approved by the FDA or it will be performed in a CLIA certified laboratory; **AND**

d. The genetic disorder cannot be identified through other types of biochemical testing; **AND**

e. The ordered genetic test should be accompanied by genetic counseling by a qualified, appropriately trained practitioner (see Documentation section above).

C. Medical Necessity Criteria for Specific Genetic Tests:

1. **1p19q codeletion molecular cytogenetic analysis (FISH, tissue)** is medically necessary for prognosis and treatment decision making in patients with astrocytomas and gliomas.

2. **Acute Lymphoblastic Leukemia (ALL)**
   The following tests are considered medically necessary for the diagnosis of Acute Lymphoblastic Leukemia:
   a. Conventional cytogenetics;
   b. ALL FISH panel (B-ALL/B-lymphoblastic leukemia/lymphoma FISH or T-ALL FISH as indicated);
   c. Ph-like B-ALL FISH panel;
   d. BCR-ABL1 (usually included in FISH);
   e. KMT2A (MLL) rearrangement (usually included in FISH);
   f. t(1;19);TCF3(E2A)-PBX1 (usually included in FISH);
   g. MYC rearrangement (usually included in FISH);
   h. t(9:22)(q34.1;q11.2) testing;

3. **Acute Myeloid Leukemia (AML)**
   The following tests are considered medically necessary for the diagnosis, risk stratification, treatment and prognosis of Acute Myeloid Leukemia:
   a. Conventional cytogenetics;
   b. AML FISH panel;
   c. t(8;21) (usually included in FISH);
   d. inv(16) (usually included in FISH);
   e. MLL rearrangement (usually included in FISH);
   f. T(15;17) FISH (if suspicion for acute promyelocytic leukemia);
   g. FLT3 mutation analysis;
   h. AML gene panels by next generation sequencing or single gene panels to include ASXL1, CEBPA, DNMT3A, IDH1, IDH2, KIT, NPM1, NRAS, FLT3, RUNX1, TP53.

4. **ALK gene rearrangement** testing is medically necessary for **diffuse large B cell lymphoma**, **peripheral T-cell lymphoma**, and **post-transplant lymphoproliferative disorder (PTLD).**

5. **APC testing for Familial Adenomatous Polyposis**
   Adenosis polyposis coli (APC) genetic testing (81201, 81203) is medically necessary for patients who meet the criteria found in *Policy C.6.07 Genetics Testing*.

6. **BRAF V600 mutation** is medically necessary for indeterminate thyroid nodules, anaplastic thyroid carcinoma, hairy cell leukemia, gastrointestinal stromal tumors, melanoma, Lynch syndrome testing in persons meeting Lynch criteria.

7. **B-cell lymphoma (non-Hodgkin lymphoma): Aggressive, Burkitt, Diffuse Large B-cell lymphomas**
   The following tests are considered medically necessary for the diagnosis of suspected aggressive, Burkitt, or diffuse large B-cell lymphoma:
   a. BCL2 and BCL6 rearrangements by FISH;

b. IRF4/MUM1 by FISH;
c. *MYC* break apart FISH;
d. *IGH/MYC* FISH;

The following tests are considered medically necessary for the diagnosis of suspected aggressive, Burkitt, or diffuse large B-cell lymphoma in patients who are *MYC* negative:

a. ***IGK/MYC* and *IGL/MYC D-FISH*** for pediatric patients or high suspicion for Burkitt lymphoma;
b. **11q23 aberrancy and 11q24-ter deletion testing by chromosomal microarray**.

8. Chronic Lymphocytic Leukemia (CLL)/Small Lymphocytic Leukemia (SLL)

The following tests are considered medically necessary for the diagnosis of suspected CLL/SLL and prognosis and treatment of CLL/SLL:

a. Conventional cytogenetics;
b. Chromosome analysis including CpG stimulated metaphase karyotype for complex karyotype;
c. CLL FISH panel;
d. FISH – deletion 17p13.1, TP53;
e. TP53 somatic mutation (81405-TP53);
f. IGHV (immunoglobulin heavy chain variable region gene) mutation status, B-cell CLL IGHV somatic hypermutation analysis (81263-IGH).

CD49d status is medically necessary in patients with CLL/SLL who are unable to have IGHV testing performed.

9. Chronic Myelogenous Leukemia (CML)

The following tests are medically necessary for the diagnosis and treatment of chronic myelogenous leukemia.

a. Conventional cytogenetics;
b. Quantitative BCR-ABL1 FISH panel;
c. Kinase domain mutation analysis.

10. DecisionDx-UM gene expression panel is medically necessary for prognosis risk stratification for patients with an established diagnosis of **localized (non-metastatic) uveal melanoma**.

11. Essential Thrombocythemia Diagnosis (JAK2, CALR or MPL mutation)

a. Genetic testing for JAK2 V617F mutation (81270-JAK2) is medically necessary for patients with clinical, laboratory and pathologic findings suggesting a diagnosis of Essential Thrombocythemia.

Genetic testing for CALR (calreticulin, 81219-CALR) and MPL (myeloproliferative leukemia virus oncogene, thrombopoietin receptor, 81403-MPL) mutations are medically necessary for patients undergoing evaluation for Essential Thrombocythemia in whom initial testing for JAK2/JAK2 V617F testing is negative or very low positive (0.06-0.6%).

12. Gastric MALT Lymphoma

The following tests are considered medically necessary for Gastric MALT lymphoma diagnosis:

a. FISH for t(11;18);
b. MALT1 translocation FISH;
c. Immunoglobulin gene rearrangement.

13. Hairy cell leukemia

The following tests are considered medically necessary for Hairy cell leukemia:

a. BRAF V600E mutational analysis;
b. IGH somatic mutation analysis.

14. Hereditary Non-polyposis Colorectal Cancer (HNPCC); Also known as Lynch Syndrome:

Genetic testing for Hereditary nonpolyposis colorectal cancer/Lynch syndrome (MLH1, MSH2, MSH6, PMS2 sequence/deletion analysis **AND** Epithelial cell adhesion molecule (EPCAM) deletion analysis) is medically necessary for patients who meet the criteria found in *Policy C.6.07 Genetics Testing*.

Genetic testing for **MLH1 hypermethylation testing** is medically necessary for **colon** and **endometrial tumors** being screened for Lynch syndrome that are IHC-abnormal with loss of expression of MLH1 protein products.

15. IDH1 and IDH2 gene mutation analysis are medically necessary for diagnosis and treatment decision-making in **acute myeloid leukemia, chondrosarcoma, and gliomas & glioblastoma.**

16. IGHV (immunoglobulin heavy chain variable region gene) mutation

Genetic testing for IGHV mutation is medically necessary for patients with Chronic Lymphocytic Leukemia/Small lymphocytic lymphoma (CLL/SLL).

17. Janus Kinase 2 (JAK2, JAK2^{V617F}, JAK2 Exon 12 mutation):

Genetic testing for the Janus Kinase 2 (JAK2; JAK2^{V617F} (81270-JAK2)) gene mutation is medically necessary for initial diagnostic assessment of adults presenting with clinical, laboratory, or pathological findings suggesting classic forms of **ANY** of the following myeloproliferative disorders (MPD)/myeloproliferative neoplasms (MPN):

a. Any myeloproliferative disorder including polycythemia vera (PV); **OR**
b. Essential thrombocythemia (ET); **OR**
c. Primary myelofibrosis (PMF).

Genetic testing for the Janus Kinase 2 Exon 12-15 mutation is medically necessary for diagnosis of polycythemia vera in persons in whom testing for JAK2^{V617F} is negative.

Genetic testing for the Janus Kinase 2 (JAK2; JAK2^{V617F}) gene mutation is not medically necessary for any indication other than those outlined above, including but not limited to **EITHER** of the following:

a. Diagnostic assessment of myeloproliferative disorders (MPD)/myeloproliferative neoplasms (MPN) in children; **OR**
b. Quantitative assessment of JAK2^{V617F} allele burden subsequent to qualitative detection of JAK2^{V617F}.

18. Lymphoplasmacytic lymphoma (LPL) / Waldenstrom macroglobulinemia OR IgM Monoclonal gammopathy of undetermined significance (MGUS)

The following genetic tests are medically necessary for the diagnosis of Lymphoplasmacytic lymphoma (LPL) / Waldenstrom macroglobulinemia OR IgM Monoclonal gammopathy of undetermined significance (MGUS):

a. MYD88 L265P somatic gene mutation;
b. CXCR4 mutation analysis.

19. MammaPrint 70-gene breast cancer recurrence assay:
Genetic testing of tissue for MammaPrint is medically necessary to guide the need for adjuvant chemotherapy in women of any age with recently diagnosed ductal, lobular, mixed or metaplastic breast cancer when **ALL** of the following criteria are met:

a. Newly diagnosed breast tumor stage 1 or 2 with tumor size less than or equal to 5cm diameter; **AND**
b. Lymph node-negative (pN0), **AND**
c. Breast tumor is estrogen receptor positive (ER+) or negative (ER-); **AND**
d. Breast tumor is HER2-receptor positive or negative; **AND**
e. No evidence of distant metastatic breast cancer; **AND**
f. Patient has high clinical risk as assessed by the modified Adjuvant! Online risk calculator (which considers ER status, HER2 status, tumor grade, node status, and tumor size, **AND**
g. Patient has agreed to use the results of the test to decision making for chemotherapy when chemotherapy is an option.

NOTE: The use of more than one type of test to determine the necessity of adjuvant chemotherapy in a woman with breast cancer for the same breast cancer is not medically necessary.

20. Mantel cell Lymphoma
The following genetic tests are considered medically necessary for diagnosis/prognosis of Mantel cell lymphoma:

a. B-cell lymphoma FISH or CLL lymphoma FISH;
b. 17p/TP53 deletion and MYC rearrangement by FISH.

21. Mastocytosis
The following tests are medically necessary for the diagnosis of mastocytosis:

a. KIT D816V mutational analysis.

22. Microsatellite instability (MSI) testing or **Mismatch Repair (MMR) testing** of tumors is considered medically necessary as an initial test in patients with

a. Colorectal, or rectal cancer,
b. Locally advanced, recurrent or metastatic Gastric carcinoma, esophageal adenocarcinoma, esophagogastric junction cancer, pancreatic cancer,
c. Unresectable or metastatic penile cancer;
d. Recurrent, progressive or metastatic cervical cancer;
e. Endometrial/uterine cancer;
f. Advanced prostate cancer with regional or distant metastatic disease;
g. Metastatic testicular cancer.

23. Multiple Myeloma
The following genetic tests are considered medically necessary for diagnosis/prognosis of Multiple Myeloma:

a. Metaphase cytogenetics;
b. Plasma cell myeloma FISH (aka plasma cell proliferative disorder FISH);
c. Retesting for 17p deletion, 1q gain and MYC rearrangement by FISH in subsequent bone marrows.

24. Myelodysplastic syndromes (MDS)

The following tests are medically necessary for the diagnosis of myelodysplastic syndromes:

a. Conventional cytogenetics;
b. TP53 mutation analysis;
c. For patients with chronic myelomonocytic leukemia (CMML): 5q31-33 translocations and PDGFRbeta gene rearrangements.

25. Oncotype DX Breast Recurrence Score (21-gene RT-PCR assay):

Genetic testing of tissue for Oncotype DX is medically necessary to guide the need for adjuvant chemotherapy in women with recently diagnosed ductal, lobular, mixed or metaplastic breast cancer when **ALL** of the following criteria are met:

a. Newly diagnosed breast tumor stage pT1, pT2 **OR** pT3; **AND**
b. Axillary node-negative (pN0), **or** has axillary-node micrometastasis no greater than 2.0 millimeters (pN1mi); **or** if postmenopausal, one to three (1-3) involved ipsilateral axillary lymph nodes; **AND**
c. Breast tumor is estrogen receptor positive; **AND**
d. Breast tumor is HER2-receptor negative or HER2-receptor positive and tumor is less than 1cm in diameter; **AND**
e. No evidence of distant metastatic breast cancer; **AND**
f. Patient has agreed to use the results of the test to decision making for chemotherapy when chemotherapy is an option.

NOTE:

- Oncotype DX genetic testing is not covered for any other clinical evaluation. Other assays of genetic expression in tumor tissue (e.g., Breast Cancer Gene Expression Ratio, HERmark® Breast Cancer Assay, Rotterdam Signature 76-Panel, EndoPredict, Breast Cancer Assay, and Prosigna) are not covered because each is considered experimental, investigational or unproven.
- Repeat Oncotype Dx Breast Recurrence Score testing of same tumor is not medically necessary.
- Oncotype Dx Breast Recurrence Score testing of multiple tumor sites is not medically necessary unless the tumors are histologically distinct and separately meet above criteria.
- The OncoGeneDx panel should not be confused with the Oncotype DX Breast Recurrence Score panel – these are different tests.
- The use of more than one type of test to determine the necessity of adjuvant chemotherapy in a woman with breast cancer for the same breast cancer is not medically necessary.

26. Phosphatase and Tensin Homolog (PTEN gene):

PTEN Gene Testing is medically necessary in patients with a suspected or known clinical diagnosis of Cowden syndrome (CS) /PTEN Hamartoma Tumor syndrome (PTHS) or Bannayan-Riley-Ruvalcaba syndrome (BRR), or a known family history of a PTEN mutation who meet the criteria found in *Policy C.6.07Genetics Testing*.

27. Primary Myelofibrosis Diagnosis

a. Genetic testing for JAK2/JAK2 ^{V617F} is medically necessary for patients with clinical, laboratory and pathologic findings suggesting a diagnosis of Primary Myelofibrosis to make a definitive diagnosis if unclear.

b. Genetic testing for CALR (calreticulin gene) and MPL (thrombopoietin receptor) mutations are medically necessary for patients undergoing evaluation for Primary Myelofibrosis in whom initial testing for JAK2 is negative.
c. Genetic testing for JAK2/JAK2 ^{V617F}, CALR (calreticulin gene) and MPL (thrombopoietin receptor) mutation allele burden quantification is NOT medically necessary for treatment selection or monitoring patients with Primary Myelofibrosis.
d. Genetic testing for ASXL1, EZH2, TET2, IDH1/IDH2, SRSF2, SF3B1 mutations are medically necessary for patients undergoing evaluation for Primary Myelofibrosis in whom initial testing for JAK2, CALR and MPL mutations are negative.

28. Thyroid Nodule Testing

Genetic testing using Afirma Thyroid FNA Analysis or Thyroseq is considered medically necessary to aid in thyroid nodule diagnosis when the Thyroid nodule cytopathologically is classified as **ONE** of the following:

i. Bethesda 3 Diagnostic Category, aka Atypia of undetermined significance or Follicular lesion of undetermined significance (AUS/FLUS); **OR**
ii. Bethesda 4 Diagnostic Category, aka Follicular or Hurthle cell neoplasm or Suspicious for a Follicular neoplasm.

Note:

- Repeat testing of the same thyroid nodule is considered not medical necessary.
- Other tests for indeterminate thyroid nodule diagnosis are considered experimental/investigational/unproven including ThyGenX and ThyraMIR.

29. Von-Hippel Lindau (VHL) Disease

Genetic testing for Von-Hippel Lindau (VHL) disease (known mutation or sequence analysis of VHL gene followed by deletion/duplication analysis if negative) is medically necessary for patients who meet the criteria found in *Policy C.6.07 Genetics Testing*.

30. Other Testing including Multi-Gene Panels

a. Limited gene panels for molecular profiling **BRAF mutations including V600** (81210), **KRAS** (81275), **NRAS** (81311), **HRAS** (81403); **PIK3CA** are considered medically necessary for **metastatic/unresectable colon cancer**.
b. **KRAS** mutation and **BRAF** testing is considered medically necessary for **anal adenocarcinoma** and **small bowel adenocarcinoma**.
c. Limited gene panels for molecular profiling **EGFR gene mutation, ALK gene rearrangements and fusions, ROS1 gene rearrangements, KRAS, BRAF point mutations including V600E, PD-L1, MET amplification, ERBB2** are considered medically necessary for **non-small cell lung cancer** that is metastatic, advanced, or that has recurred despite adequate resection.
d. The fifty-gene limited panel for molecular profiling is considered medically necessary for metastatic pancreatic cancer progressing despite usual regimen and tumor debulking.

D. Genetic Testing considered Experimental, Investigational or not Medically Necessary (Not an all-inclusive list):

1. The following genetic tests are considered experimental, investigational or unproven.
    a. Genetic Testing Panels not listed above including FoundationOne CDx(F1CDx), FoundationOne Liquid and FoundationOne Heme;
    b. Oncotype DX Colon Cancer Assay testing;
    c. Guardant 360® Cancer Assay;

d. Breast Cancer Gene Expression Ratio,
e. HERmark® Breast Cancer Assay,
f. Rotterdam Signature 76-Panel;
g. EndoPredict;
h. Post-biopsy genetic testing for prostate cancer including: 4Kscore Test for prostate cancer; Oncotype DX for prostate cancer; Decipher molecular assay in prostate cancer; ProMark and Prolaris tests;

2. Myeloid malignancy panel for the diagnosis of myelodysplastic syndrome. Genetic testing of NF1 for Neurofibromatosis diagnosis, treatment and management based on café au late marks;
3. Molecular testing for urothelial tumor markers in patients with history of invasive bladder cancer undergoing surveillance for recurrence.
4. Genetic testing for the purposes of surveillance;
5. The use of a genetic Variant of Uncertain Significance (VUS) result to make decisions about further testing of a patient or family member or for clinical decision making regarding evaluation and/or treatment.

References

American Society of Human Genetics. Uncertain results related to patient symptoms: variants of uncertain significance. Available at: https://www.ashg.org/education/csertoolkit/uncertainresults.html Accessed May 22, 2018.

Centers for Medicare and Medicaid Services. Decision Memo for Next Generation Sequencing (NGS) for Medicare Beneficiaries with Advanced Cancer (CAG-00450N)
Published March 16, 2018. Available at: https://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=290&bc=ACAAAAAAQAAA&#Top Accessed October 10, 2018.

Chen S, Fritchie K, Wei S, et al. Diagnostic utility of IDH1/2 mutations to distinguish dedifferentiated chondrosarcoma from undifferentiated pleomorphic sarcoma of bone. Hum Pathol. 2017 Jul;65:239-246.

Gundersen Health Systems. Utilization guidelines and reflex testing for pathology specimens. Hematologic specimens. Version 1.2018, revised August 1, 2018.

Hayes, Inc. Oncotype DX Colon Cancer Assay, 2013. Accessed October 16, 2017.

Hayes, Inc. GTE Overview.

- Oncotype DX Genomic Prostate Score (GPS) Assay (Genomic Health Inc.). Published Sept 15, 2016. Annual Review Jun 18, 2018. Accessed November 7, 2018.
- Pancreatic cancer panel. Published Jan 29, 2015. Annual Review Sept 12, 2018. Accessed November 7, 2018.
- Screening for Lynch Syndrome. December 9, 2014. Archived September 12, 2018. Accessed October 10, 2018.
- ThyGen X and ThyraMIR. Published November 2, 2017. Accessed October 10, 2018.
- ThyroSeq v.2. Published December 26, 2016. Annual review December 29, 2017. Accessed October 10, 2018.

Hayes, Inc. GTE Report.

- Afirma Thyroid FNA Analysis (Veracyte). Published October 19, 2017. Accessed October 10, 2018.
- DecisionDx-UM. Published June 9, 2016. Annual review May 2, 2018. Accessed October 10, 2018.
- Guardant360. Published September 15, 2016. Annual review May 8, 2018. Accessed June 25, 2018.

- MammaPrint 70-gene breast cancer recurrence assay. Published May 12, 2016. Annual review March 16, 2018. Accessed August 27, 2018.

Hayes, Inc. Search and Summary.
- 4Kscore for prostate cancer. Published April 9, 2018. Accessed October 19, 2018.

Loupakis, F., et al, KRAS codon 61, 146, and BRAF mutations predict resistance to cetuximab and irinotecan in KRAS codon 12 and 13, wild type metastatic colorectal cancer. BR J Cancer, 2009. 101(4): p. 715-721.

Mayo Clinic Medical Laboratories. Test Catalog. Available at: https://www.mayomedicallaboratories.com/test-catalog/search Accessed: October 19, 2018.
- Aggressive B-cell Lymphoma Diagnostic Algorithm. September 2018. https://www.mayomedicallaboratories.com/it-mmfiles/Aggressive_B_cell_Lymphoma_Diagnostic_Algorithm.pdf
- B-cell lymphoblastic leukemia/lymphoma algorithm. July 2018. Available at: https://www.mayomedicallaboratories.com/it-mmfiles/B-Lymphoblastic_Leukemia-Lymphoma_Algorithm.pdf Accessed October 31, 2018.
- Gastric MALT Lymphoma Diagnostic algorithm. Sept 2018. Available at: https://www.mayomedicallaboratories.com/it-mmfiles/Gastric_MALT_Lymphoma_Diagnostic_Algorithm.pdf Accessed October 31, 2018.
- Gastric MALT Post-therapy follow-up algorithm. Sept 2018. Available at: https://www.mayomedicallaboratories.com/it-mmfiles/Gastric_MALT_Posttherapy_Follow-up_Algorithm.pdf Accessed October 31, 2018.

National Comprehensive Cancer Network (NCCN); NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines); Available at NCCN.org.
- Acute Lymphoblastic Leukemia. V1.2018-March. Accessed October 10, 2018.
- Acute Myeloid Leukemia. V2.2018-August 1. Accessed October 10, 2018.
- B-cell Lymphomas. V5.2018-October 2; Accessed October 10, 2018.
- Bladder Cancer. V5.2018-July. Accessed October 10, 2018.
- Breast Cancer. V2.2018-Oct Accessed October 10, 2018.
- Central Nervous System Cancers. V1.2018-March 20. Accessed October 10, 2018.
- Cervical Cancer. 4.2019-March. Accessed April 17, 2019.
- Chronic Lymphocytic Leukemia/Small Lymphocytic Lymphoma; V2.2019-October 5, 2018 Accessed October 10, 2018.
- Colon Cancer. V3.2018-. Accessed October 10, 2018.
- Endometrial Carcinoma. V3.2019. Accessed April 22, 2019.
- Esophageal and Esophagogastric Junction Cancer. V1.2019-March. Accessed April 17, 2019.
- Gastric Cancer. V1.2019-March. Accessed April 17, 2019.
- Melanoma. V2.2019-March. Accessed April 17, 2019.
- Multiple myeloma. V1.2019-July. Accessed November 5, 2018.
- Myelodysplastic syndromes. V2.2010-October. Accessed November 5, 2018.
- Myeloproliferative Neoplasms; V2.2018-Sept 7. Accessed May 21, 2018.
- Non-Small Cell Lung Cancer; V1.2019-October. Accessed October 24, 2018.
- Pancreatic Cancer. V2.2019-April. Accessed April 17, 2019.Penile Cancer. V1.2019-Dec. Accessed April 17, 2019.
- Prostate Cancer. V2.2019-April. Accessed April 22, 2019.
- Testicular Cancer. 1.2019-October. Accessed April 22, 2019.
- Thyroid Carcinoma; V1.2019-March 28. Accessed June 12, 2019.

- Uveal Melanoma; v.1.2018-March 15. Accessed October 10, 2018.

National Comprehensive Cancer Network (NCCN); NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines); Genetic/Familial High-Risk Assessment: Available at NCCN.org.
- Colorectal; Version 3.2017-October 10, 2017; NCCN.org. Accessed October 16, 2017.
- Breast and Ovarian; Version 2.2019-July;. Accessed October 24, 2018.

Seider, MI. Molecular prognostics for uveal melanoma. Retina. 2018;38(2): 211-219

Takeuchi S, Doi M, Ikari N, Yamamoto M, Furukawa T. Mutations in *BRCA1*, *BRCA2*, and *PALB2*, and a panel of 50 cancer-associated genes in pancreatic ductal adenocarcinoma. Scientific Reports. 2018;8. Published online at: https://www.nature.com/articles/s41598-018-26526-x Accessed October 24, 2018.

Vaughn, C.P., et al, Frequency of KRAS, BRAF, and NRAS Mutations in Colorectal Cancer. Genes, Chromosomes, and Cancer, 2011, 501(5): p. 307-312.