
Genetic Testing: Genetic Expression Profile Testing for Melanoma

MEDICAL POLICY NUMBER: 252

Effective Date: 11/1/2022	COVERAGE CRITERIA	2
Last Review Date: 9/2022	POLICY CROSS REFERENCES.....	3
Next Annual Review: 9/2023	POLICY GUIDELINES.....	3
	CLINICAL EVIDENCE AND LITERATURE REVIEW	5
	BILLING GUIDELINES AND CODING	17
	REFERENCES.....	18
	POLICY REVISION HISTORY.....	20

INSTRUCTIONS FOR USE: Company Medical Policies serve as guidance for the administration of plan benefits. Medical policies do not constitute medical advice nor a guarantee of coverage. Company Medical Policies are reviewed annually and are based upon published, peer-reviewed scientific evidence and evidence-based clinical practice guidelines that are available as of the last policy update. The Company reserves the right to determine the application of medical policies and make revisions to medical policies at any time. The scope and availability of all plan benefits are determined in accordance with the applicable coverage agreement. Any conflict or variance between the terms of the coverage agreement and Company Medical Policy will be resolved in favor of the coverage agreement. Coverage decisions are made on the basis of individualized determinations of medical necessity and the experimental or investigational character of the treatment in the individual case. In cases where medical necessity is not established by policy for specific treatment modalities, evidence not previously considered regarding the efficacy of the modality that is presented shall be given consideration to determine if the policy represents current standards of care.

SCOPE: Providence Health Plan, Providence Health Assurance, Providence Plan Partners, and Ayin Health Solutions as applicable (referred to individually as “Company” and collectively as “Companies”).

PLAN PRODUCT AND BENEFIT APPLICATION

Commercial

Medicaid/OHP*

Medicare**

*Medicaid/OHP Members

Oregon: Services requested for Oregon Health Plan (OHP) members follow the OHP Prioritized List and Oregon Administrative Rules (OARs) as the primary resource for coverage determinations. Medical policy criteria below may be applied when there are no criteria available in the OARs and the OHP Prioritized List.

**Medicare Members

This *Company* policy may be applied to Medicare Plan members only when directed by a separate *Medicare* policy. Note that investigational services are considered “**not medically necessary**” for Medicare members.

COVERAGE CRITERIA

Uveal Melanoma

- I. The DecisionDx-UM™ gene expression profile (GEP) test may be considered **medically necessary** in patients with a confirmed diagnosis of primary, localized uveal melanoma with no evidence of metastasis.
- II. GEP test(s) for uveal melanoma are considered **not medically necessary and not covered** for patients that do not meet the above criterion I., including but not limited to:
 - A. Patients who do not have a confirmed diagnosis of uveal melanoma
 - B. Patients whose uveal cancer that has spread from another site in the body
 - C. Patients whose uveal melanoma has already metastasized
 - D. Use of GEP test other than DecisionDx-UM™

Cutaneous Melanoma

- III. Gene expression profile tests for cutaneous melanoma are considered **not medically necessary and not covered in all situations**, including but not limited to:
 - A. To guide initial biopsy decisions (e.g., Pigmented Lesion Assay [PLA])
 - B. To evaluate or aid in the diagnosis of atypical/indeterminate lesions (e.g., myPath Melanoma, DiffDx-Melanoma)
 - C. To determine metastatic risk (e.g., DecisionDx-Melanoma)

POLICY CROSS REFERENCES

- [Genetic Counseling](#), MP316

The full Company portfolio of current Medical Policies is available online and can be [accessed here](#).

POLICY GUIDELINES

DOCUMENTATION REQUIREMENTS

In order to determine the clinical utility of a genetic test, the following documentation must be provided at the time of the request. Failure to submit complete documentation may affect the outcome of the review.

- Specific gene, trade or proprietary name of the test, or if a custom-built test, include every gene(s) and/or component of the test
- Name of laboratory where the testing is being conducted or was conducted
- Clinical notes to include the following:
 - Documentation of genetic counseling as required in the policy criteria below which includes how test results will impact clinical decision making
 - Reason (indication) for performing test, including the suspected condition
 - Existing signs and/or symptoms related to reason for current test request
 - Prior test/laboratory results related to reason for current test request
 - Family history, if applicable
 - How results from current test request will impact clinical decision making
- All relevant CPT/HCPCS codes billed

BACKGROUND

Background

Uveal (Intraocular) Melanoma

Melanoma of the uveal tract is the most common primary intraocular malignancy in adults. The incidence of uveal melanoma (UM) in the United States is approximately 4.3 new cases per million people, with males having a higher incidence than females. The incidence has been relatively stable of the last 30 years.¹

Uveal melanomas can arise in the anterior (iris) or the posterior (ciliary body or choroid) uveal tract. Most uveal tract melanomas originate in the choroid, whereas the least common site of origin is the iris. Iris melanomas have the best prognosis, whereas melanomas of the ciliary body have the least favorable prognosis.¹

There are a number of factors influence prognosis. Important factors include cell type, tumor size, location of the anterior margin of the tumor, degree of ciliary body involvement, and extraocular extension.¹ However, more recently, gene expression profile (GEP) testing has been developed as a means of determining risk of metastasis and aid in the management of UM patients.

Cutaneous Melanoma

Skin cancer is the most common malignancy diagnosed in the United States, with 5.4 million cancers diagnosed in 2012. Melanoma, a malignant tumor of melanocytes, represents about 1% of skin cancers but results in most deaths. Although most melanomas arise in the skin, they may also arise from mucosal surfaces. The incidence has been increasing over the past 30 years, with elderly men being at the highest risk.²

Diagnosis of a suspicious lesions includes a biopsy, preferably by local excision, with specimens being examined by an experienced pathologist to allow for microstaging. Of note, studies show that distinguishing between benign pigmented lesions and early melanomas can be difficult, and even experienced dermatopathologists can have differing opinions. Therefore, the development of additional tools, including GEP tests, are currently underway and are proposed to be used as adjuncts to standard clinical and histopathological staging, particularly for indeterminate lesions.

Prognosis is affected by the characteristics of primary and metastatic tumors, with important factors including thickness and/or level of invasion of the melanoma, mitotic index, ulceration or bleeding at the primary site, number of regional lymph nodes involved, and systemic metastasis. Although these factors provide some information for disease management, they have limited predictive power.³ The development of additional tools, including GEP tests, that may provide more accurate information regarding metastatic risk is, therefore, an area of active research.

Gene Expression Profile (GEP) Tests

DecisionDx-UM (Uveal Melanoma) (Castle Biosciences, Inc.)

According to Castle Biosciences, the DecisionDx-UM test is a gene expression profile (GEP) test that is intended to determine 5-year risk based on the activity or “expression” of 15 genes, as determined by quantitative real-time PCR (qRT-PCR).⁴ The DecisionDx-UM prognostic test reports Class 1A, Class 1B and Class 2 phenotype:

- Class 1A: Very low risk, with a 2% chance of the eye cancer spreading over the next five years;
- Class 1B: Low risk, with a 21% chance of metastasis over five years;
- Class 2: High risk, with 72% odds of metastasis within five years.

The DecisionDx-UM test can be performed on uveal melanoma specimens obtained from either a fine needle biopsy (FNAB) performed prior to radiation therapy (plaque or proton beam), on a globe immediately post-enucleation, or on tumor specimen obtained from an adequately preserved formalin-fixed, paraffin-embedded globe (FFPE specimen).

Per Castle Biosciences, “the GEP test can only be appropriately used when the diagnosis of primary uveal melanoma has already been established. If it is in question, measures should be taken to confirm that the tissue being provided for analysis is uveal melanoma, as this test is for prognosis only and is unable to distinguish between uveal melanoma and other tumors of the eye.”

myPath® Melanoma (Myriad)

According to Myriad, the myPath® Melanoma test is intended to be used as an adjunct to histopathology when the distinction between a benign nevus and a malignant melanoma cannot be made confidently by histopathology alone.⁵ The test measures the expression of 23 genes by qRT-PCR methodology and is purported to distinguish between malignant melanoma and benign nevi. An algorithm is applied that combines the measurements of gene expression, assigns a weight to each gene component, and reports a numerical score that classifies a melanocytic lesion as ‘likely benign’, ‘likely malignant’, or ‘indeterminate’. The test may be performed on a tissue block or unstained slides.

Pigmented Lesion Assay (PLA) (DermTech)

According to DermTech, the PLA is a non-invasive option to potentially identify clinically atypical pigmented lesions (or moles) at high risk for melanoma.⁶ This gene expression ‘signature’ test that detects the expression of two specific genes, LINC00518 and PRAME, which are reported elevated in melanoma. Gene expression results are summarized in a molecular pathology report. The test uses specially designed adhesive patches to collect stratum corneum tissue rather than a surgical biopsy with a scalpel.

DecisionDx-Melanoma (Cutaneous Melanoma) (Castle Biosciences, Inc.)

According to Castle Biosciences, the DecisionDx-Melanoma test is a GEP test intended to be used to determine metastatic risk in Stage I, II, and III cutaneous melanoma patients.⁷ The test is a qRT-PCR test that analyzes the expression of 31 genes associated with melanomas and uses the expression results to stratify tumors as low risk (Class 1) or high risk (Class 2). The test may be performed on formalin-fixed, paraffin embedded primary tumor tissue from either biopsy or excision.

DecisionDx DiffDx-Melanoma (Cutaneous Melanoma) (Castle Biosciences, Inc.)

According to Castle Biosciences, the DecisionDx DiffDx-Melanoma test is intended to be used in conjunction with myPath Melanoma after an intermediate result to perform gene expression profiling on 35 additional genes involved with cell differentiation and signaling. The test purports to help clinicians differentiate between a benign nevus and a malignant melanoma

CLINICAL EVIDENCE AND LITERATURE REVIEW

EVIDENCE REVIEW

A review of the ECRI, Hayes, Cochrane, and PubMed databases was conducted regarding the use of genetic expression profile (GEP) tests as a tool for the evaluation of melanoma or suspected melanoma. Below is a summary of the available evidence identified through August 2022.

DecisionDx-UM (Uveal Melanoma)

Systematic Reviews

- In 2020 (updated 2022), Hayes published a Molecular Test Assessment on the DecisionDX-UM test and found 3 studies in their evidence review that were deemed appropriate for review.⁸ One study by Plasseraud and colleagues addressed analytical validity and found a 5-year technical assessment rate of 96% for the assay.⁹ The study failed to include parameters such as sensitivity, linearity, or amplification efficiency, and did not address the intratumor heterogeneity of the samples, and was considered a very low body of evidence by Hayes. For clinical validity, 7 studies were identified and one study by Demirci and colleagues was included for analysis.¹⁰ The retrospective clinical data analysis included 293 patients and found that DecisionDx-UM risk class association was associated with 3-year metastasis-free survival. The study's limitations included a short follow up and retrospective design. One study by Plasseraud and colleagues was identified that assessed clinical utility.¹¹ An interim analysis was conducted on the prospective CLEAR trial, which tracks clinical application of DecisionDX-UM assay results and associated patient outcomes. The results found an association between clinical management decisions and DecisionDx-UM risk classes, although physician decisions were not clear. Hayes reported that there was a very low quality body of evidence supporting clinical utility of the test.

Hayes ultimately assigned a "D2" rating, stating "there is insufficient evidence to support the use of the DecisionDx-UM test to identify the likelihood of metastasis within 5 years in patients with UM. Although an established assay process is in place, the validity of the test and the impact on patient management is unclear; additional data are needed to support the use of this test."⁸

- In 2017, ECRI published a genetic test product brief on the DecisionDx-UM GEP test, including six studies on clinical validity, all of which provided some clinical utility data, and one study that focused solely on utility (Plasseraud et al.).¹² This brief concluded that DecisionDx-UM can effectively identify patients with UM who are at low risk of metastasis (Class 1) from those at higher risk (Class 2) when used with standard clinical/pathologic factors, thus aiding in risk-appropriate patient management."

Clinical Validity: Key Studies

In 2012, Onken et al. published the results of a large, prospective, multiinstitutional study reporting on clinical validation of the DecisionDx-UM assay in 459 patients with primary melanoma.¹³ This study is referenced in the NCCN guidelines, where the classes determined by the GEP test are listed as prognostic factors in the guideline. Median follow-up of this was 17.4 months (mean, 18.0 months). Metastasis was detected in 3 (1.1%) class 1 cases and 44 (25.9%) class 2 cases ($P < 10^{-14}$). The GEP demonstrated superior prognostic accuracy over the presence of monosomy of chromosome 3 ($P = 0.0001$). Using multivariate analysis, GEP class had a stronger independent association with metastasis than any other prognostic factor ($P < 0.0001$). At three years follow-up, the net reclassification improvement of GEP over TNM classification was 0.43 ($P = 0.001$) and 0.38 ($P = 0.004$) over chromosome 3 status.

- Additional clinical validity studies with similarly large sample sizes (n=299, 399, 609) have been reported previously and included in the reviews, and will not be summarized here. Collectively, the

large clinical validity studies have rates of metastasis of patients with a Class 1 GEP result ranged from 1.1% - 6%, while the rates for those categorized as Class 2 ranged from 25.9% to 39.6%.

Clinical Utility

- In 2014, Aaberg et al. addressed the impact of using the 15 GEP results on treatment decisions in a study in which ocular oncologists were queried regarding their use of the test to guide treatment decisions.¹⁴ One component of this study was to review the medical records on 191 patients on whom GEP was performed. In this group, 58% had a class 1 signature and 42% had a class 2 signature. Of these patients, 88 (46%) had detailed treatment plans in their records (total, n=88; 48 class 1 and 40 class 2 patients). All class 1 patients received a low-intensity surveillance plan, whereas all class 2 patients received a high-intensity surveillance plan (including more frequent liver function tests and more frequent liver imaging and/or systemic evaluations). In addition, 36 patients had information regarding referrals; all class 2 (n=23) were referred to medical oncology and none of the class 1 patients (n=13) were referred (P<0.0001). Ultimately, the authors had no health outcome data but suggested that outcomes in class 2 patients might be improved by using more intensive surveillance.

The second component of this study was based on a 2012 survey of the treating physicians. Of the 54 physicians surveyed, 29 (74%) changed metastasis surveillance based on GEP and cytogenetic information, 8 (21%) did not use GEP results to manage patients, 2 (5%) referred patients to medical oncology, 6 (15%) recommended prophylactic therapy, and 9 (23%) referred patients to a clinical trial or initiated investigational therapy.

- In 2016, Plausseraud et al. conducted a prospective, multicenter study of 70 patients to document patient management differences and clinical outcomes associated with low-risk Class 1 (Class 1A) and high-risk Class 2 results indicated by DecisionDx-UM testing.¹¹ Thirty-seven patients in the prospective study were Class 1 and 33 were Class 2. Class 1 patients had 100% 3-year metastasis-free survival compared to 63% for Class 2 ($p = 0.003$) with 27.3 median follow-up months. Class 2 patients received significantly higher-intensity monitoring and more oncology/clinical trial referrals compared to Class 1 patients ($p = 2.1 \times 10^{-13}$ and $p = 0.04$, resp.). The investigators concluded that the “results of this study provide additional, prospective evidence in an independent cohort of patients that Class 1 and Class 2 patients are managed according to the differential metastatic risk indicated by DecisionDx-UM.” Strengths of this study included a relatively large population given the rarity of the condition, and an association between management strategies and clinical outcomes. However, it is not clear which outcome measures were prespecified or how data was collected, making the risk of bias high.
- Clinical Application of DecisionDx-UM Gene Expression Assay Results (CLEAR) is a 5-year study designed to document the clinical application of results from DecisionDX-UM assays through physician treatment plans and to determine time to metastasis for patients with uveal melanoma. In 2020, Scheffler and colleagues published results from the CLEAR II trial on 138 patients from 9 centers who were tested with the DecisionDX-UM assay.¹⁵ Ninety-three (67%) patients were determined to have class 1 tumors by the assay, and 45 (33%) patients had class 2 tumors. Forty-two (93%) class 2 patients were referred to medical oncology specialists compared to 47 (51%) class 1 patients ($p < 0.0001$). Physicians recommended more frequent metastatic surveillance screening for class 2 patients compared to class 1. Class 2 patients were 4.1 times more likely to be

followed with high-intensity surveillance compared to class 1 ($p < 0.001$). This study found that the DecisionDx-UM assay influenced physician treatment plans, yet it did not report on patient outcomes and no survival data was evaluated.

Cutaneous Melanoma

myPath® Melanoma (Castle Biosciences)

Systematic Reviews

In 2018 (reviewed in 2022), Hayes published a review of the use of myPath® Melanoma as an adjunct diagnostic tool to distinguish between benign nevi and malignant melanoma in patients with primary melanocytic lesions.¹⁶ The review included one (industry sponsored) study for analytical validity, four clinical validity studies, and two clinical utility studies for the myPath Melanoma test. Four studies provided preliminary evidence of the clinical validity of the test reported high sensitivity and specificity of the score to aid in the diagnosis of melanocytic lesions. However, these results were derived from samples that may not represent real-world samples or indications for testing. In addition, conclusions were limited by the exclusion of indeterminate or atypical cases in some studies and the utilization of consensus histopathologic diagnoses as the standard reference in most studies. The two studies evaluating clinical utility included physician surveys and reported that the test *may* increase definitive diagnoses and impact treatment. These clinical utility studies had several limitations:

- Lack of documentation of actual treatments chosen,
- The small subsets of specific types of lesions within the study cohorts,
- Treatment changes were not solely modified by myPath Melanoma test scores, as evidenced by the lack of alignment of scores to posttest recommendations in some cases.
- Uncertainty as to the weight of the test result in the final pathology report and in treatment decisions,
- Two different groups of physicians completed the pre-test and post-test surveys (dermatopathologists for the pre-test and dermatologists for the post-test),
- Actual health outcomes were not reported.

Hayes concluded that there was insufficient evidence to support the use of the myPath Melanoma test as a diagnostic adjunctive tool to distinguish benign nevi from melanoma for indeterminate lesions. In addition, there was insufficient evidence to support the clinical use of myPath Melanoma as a guide to manage treatment decisions. Hayes graded the overall quality of evidence as very low and rated the myPath Melanoma test as a “D2”.

Clinical Validity

Two studies reporting on the analytical and clinical validity of the myPath Melanoma GEP test were identified after the publication of the Hayes review above.

- In 2018, Reimann et al., compared the myPath Melanoma test with histopathology, fluorescence in situ hybridization, and SNP array for the classification of melanocytic neoplasms.¹⁷ The myPath test was compared to morphologic diagnosis in 198 unequivocal cases, and to morphologic diagnosis and fluorescent in situ hybridization (FISH) in 70 morphologically indeterminate cases. In the unequivocal

group, FISH and myPath showed 69% inter-test agreement. In addition, the myPath assay showed 75% agreement with morphologic diagnosis, with 67% sensitivity and 81% specificity. In the indeterminate group, agreement with histopathologic interpretation was 74% for myPath. Sensitivity and specificity of FISH was 61 and 100%, respectively. However, the sensitivity and specificity of myPath was 50% and 93% for myPath, respectively. This is in contrast to the manufacturer's reported sensitivity and specificity of myPath of 90-94% and 91-96%, respectively.⁵ The authors concluded that although there is good correlation between myPath and consensus diagnoses, discordant results did occur. Of note, this study was the only study identified that did not appear to be industry-sponsored. Studies reporting long-term outcomes within specific indeterminate lesion subsets are required to establish the accuracy of this test.

- In 2019, Ko et al., published an industry-sponsored retrospective analysis on 127 archived lesion samples that underwent myPath testing.¹⁸ myPath results were compared to histopathological diagnoses and development of local recurrence, sentinel lymph node metastases, and distant metastases. Of the 65 lesions diagnosed histopathologically as melanoma, myPath results indicated that 61 of 65 (93.8%) lesions (including all lesions that metastasized) were confirmed as malignant (sensitivity). Two of the 65 (3.1%) of the histologically diagnosed lesions were determined to be benign by myPath (false negative). Of the 62 lesions diagnosed as benign by histopathology, myPath confirmed 48 of 62 (77.4%) to be benign (true negative), and 7 of 62 (11.3%) as malignant (false positive). All 14 lesions that metastasized were correctly identified by the myPath test as malignant.
- A similar 2020 industry-sponsored study by Clarke et al evaluated the accuracy of myPath in 181 melanocytic lesions.¹⁹ Seven dermatopathologists who were blinded to gene expression test results and clinical outcomes examined the lesions to identify diagnostically uncertain cases. There were 125 cases determined to fulfill the criteria of diagnostic uncertainty. Test sensitivity for myPath in these 125 cases was 90.4% (95% CI: 79.0 -96.8%) and percent negative agreement was 95.5% (95% CI: 87.3 – 99.1%). While this study showed high sensitivity and percent negative agreement, there were a number of limitations. The sample was limited to single slides of archived melanocytic neoplasms from a previous investigation, and the investigators did not have access to complete clinical and demographic information. The retrospective design of the study prevents analysis of how the assay will influence treatment and patient-centered outcomes.

DiffDx-Melanoma

- In 2020, Estrada and colleagues published a clinical validity study assessing a diagnostic 35-gene expression profile test (DecisionDx - *DiffDx-Melanoma*) for ambiguous or difficult-to-diagnose suspicious pigmented skin lesions.²⁰ Diagnostic utility of 76 genes was assessed with quantitative RT-PCR; neural network modeling and cross-validation were utilized for diagnostic gene selection using 200 benign nevi and 216 melanomas for training. Validation of the 35-GEP was performed in an independent set of 273 benign and 230 malignant lesions. The test demonstrated 99.1% sensitivity, 94.3% specificity, 93.6% positive predictive value and 99.2% negative predictive value. 96.4% of cases received a differential result and 3.6% had intermediate-risk. Limitations include author conflicts of interest with the test manufacturer and a lack of evidence demonstrating clinical utility.

Pigmented Lesion Assay (PLA) (DermTech)

Systematic Reviews

In 2020 (reviewed in 2022), Hayes conducted a molecular test assessment on DermTech's PLA to help rule out melanoma without the need for a surgical biopsy of atypical lesions.²¹ The evidence review included data published on osr before September 3, 2019. Eight studies were deemed appropriate for this report. Three studies were evaluated for analytical validity and demonstrated that PLA is reproducible, the assay process is optimized, and adhesive patch collection is a reliable method to collect samples, with a sample failure rate of 14%. Hayes concluded that there is moderate quality of evidence for the analytical validity of the PLA test.

From their database search, Hayes reviewers found 3 studies that were deemed appropriate to determine PLA's clinical validity (see summary of the Gerami et al study in the Clinical Validity section below). Hayes prefaces their analysis of clinical validity by explaining the importance of both sensitivity and specificity in a test to determine presence of melanoma while also emphasizing the importance of high sensitivity for this population. False negatives will delay diagnosis and treatment, potentially leading to disease progression. The 3 studies suggested that PLA has a high sensitivity and a high negative predictive value when no gene expression is detected, and dual LINC00518- and PRAME-positive lesions may be more likely to be melanoma than LINC00518- or PRAME-only positive lesions. The studies had a number of limitations: they lacked parallel comparative statistics for standard assessment and histopathology, did not clearly show that PLA improves upon primary histology reader performance, and had small sample sizes. Therefore, Hayes concluded that there is an overall low quality of evidence to support the clinical validity of the PLA test.

Hayes found 3 studies that addressed clinical utility of PLA for biopsy decision making for determining with a lesion is melanoma. Results of these studies indicated that PLA may reduce frequency of lesion biopsies for suspicion of melanoma and increase physician confidence, yet there were some limitations and obvious biases. The sample sizes were small, there was poor compliance, the studies were retrospective in design and likely suffered from selection bias, and the industry-funded studies were authored in part by employees or affiliates of the assay's manufacturer, DermTech. Hayes determined there was low-quality evidence supporting clinical utility of the PLA.

Hayes gave PLA for ruling out melanoma a C rating, stating that evidence suggests the assay can reduce the number of benign lesions biopsied and help rule out melanoma, but more long-term studies are needed to determine that PLA is noninferior or superior to current standard of expert visual assessment followed by surgical biopsy and histopathology as needed. Furthermore, more studies are needed to better understand PRAME expression optimization and the association of dual-gene-positive versus single-gene-positive PLA results and melanoma diagnosis.

Clinical Validity

- In 2017, Gerami et al., published clinical validity measures for the PLA test on a validation cohort of adults that had a clinically suspicious pigmented lesion of at least 4 mm in diameter.²² In total, the PLA test was evaluated and validated in 555 pigmented lesions (157 training (80 melanomas and 77 non-melanomas) and 398 validation samples (87 melanomas and 311 non-melanomas)). Results were compared with standard histopathologic assessment in lesions with consensus diagnosis. In 398 validation samples (87 melanomas and 311 non-melanomas), LINC00518 and/or PRAME expression via the PLA test appropriately differentiated melanoma from non-melanoma samples with a sensitivity of 91% and a specificity of 69%.

The study had a number of limitations, including:

- Previous testing history was not reported.
- The test was not compared to dermoscopy, which is another commonly used diagnostic tool.
- It was unclear whether the samples were all independent or multiple samples from the same patient.
- Sample selection criteria (e.g., consecutive, random) was not reported.
- The authors did not indicate if the histopathologic diagnosis was blinded to the results of the PLA.
- Dates of data collection were not reported.
- Clinical characteristics such as risk factors for melanoma and presenting symptoms were not reported.
- Short-term follow-up for the natural history of the disease.

Of note, several other industry-sponsored validation studies have been published but were not included in this evidence review for the reasons listed below:

- Gerami et al., 2014: Reported results of the development cohort and did not use the version of the test currently available on the market.²³
- Wachsman et al., 2011: Did not use the version of the test currently marketed.²⁴

The Gerami et al. clinical validity study had many methodological and reporting limitations. Therefore, the performance characteristics of the PLA test are not well characterized. In summary, additional high quality studies are needed to establish clinical validity of this test.

Clinical Utility

Direct evidence of clinical utility is provided by studies that have compared health outcomes for patients managed with and without test. No direct evidence of clinical utility was identified for the PLA test.

- However, one study by Ferris et al. in 2017 was identified that reported indirect evidence of clinical utility. This study assessed the potential impact of PLA on physicians' biopsy decisions in patients.²⁵ Forty-five dermatologists evaluated 60 clinical and dermoscopic images of atypical pigmented lesions (8 melanoma, 52 non-melanoma). In the first round, dermatologists did not have PLA test results and in the second round, dermatologists did have access to PLA test results with the order of cases being scrambled. The dermatologists were asked whether the lesions should be biopsied after each round. Therefore, the corresponding number of biopsy decisions should be $45 \times 60 \times 2 = 5400$. Data were collected in 2014 and 2015. Results were reported for 4680 decisions with no description of the disposition of the remaining decisions. Of the 4680 reported decisions, 750 correct biopsy decisions were made without PLA results while 1331 were made with PLA results and 1590 incorrect biopsy decisions were made without PLA results while 1009 incorrect biopsy decisions were made with PLA results.
- A 2020 industry-funded study by Brouha and colleagues investigated the effect of PLA physician decision to biopsy skin lesions clinically suspicious for melanoma.²⁶ The registry study found that of 3,418 pigmented skin lesions analyzed, 324 lesions (9.48%) were PLA positive and 3,094 (90.52%) were PLA negative. Among the PLA positive lesions, 316 (95.53%) were surgically biopsied. Among the PLA negative lesion, 2 (0.06%) were biopsied while the rest were monitored. This study only touches on physician influence. It does not collect data on clinical outcomes or biopsy results.

Similar to the Ferris et al 2017 study, it does not offer further information on clinical utility beyond physician decision making.

DecisionDx-Melanoma (Castle Biosciences)

Systematic Reviews

- In 2021, ECRI gene conducted an evidence review on DecisionDX-Melanoma for evaluating prognosis and guiding management of cutaneous melanoma.²⁷ The review identified 8 clinical validity studies and 3 clinical utility studies published between January 2011 and March 2019. One retrospective study by Vetto et al (2019) investigated DecisionDx-Melanoma assay as a tool to predict sentinel lymph node (SLN) biopsy results. The study (n= 1421) found that patients 55 years and older with a class 1A profile had SNL positivity rates of 1.6%-4.9% and class 2B patients had SLN positivity rates of 11.9%-30.8%.²⁸ The study concluded that the assay identifies patients who could potentially avoid SLN biopsy. ECRI found that the study is a high risk of spectrum bias due to the high percentage of enrolled patients with T1a melanoma who underwent SLN biopsy. The participant group was therefore not representative of the typical screening population. Seven studies on clinical validity assessed the assay as a prognostic tool for rates of recurrence, metastasis, and survival. ECRI found that the majority of these studies suffered from spectrum bias, partial verification bias, and limitations due to retrospective design. Most of the studies that assesses risks of recurrence, metastasis and death reported interim data at a median follow up of 2 years or less. They concluded that data show potential for clinical value but higher-quality prospective studies with long term follow up must be conducted to enable conclusions.

Among the 3 clinical studies, 2 were retrospective cohort studies reported on clinical management recommendation based on GEP results. One prospective cohort study by Dillon et al. compared clinical management plans before and after testing with DecisionDx-Melanoma.²⁹ No studies assessed the effect of using the assay on patient health outcomes such as overall survival or quality of life. ECRI concluded that the evidence for DecisionDX-Melanoma is inconclusive and more data are needed to determine effectiveness of the test.

- In 2021 (reviewed in 2022), Hayes published a review that evaluated the analytic validity, clinical validity and the clinical utility of the DecisionDx-Melanoma test to predict risk of metastasis and guide treatment decisions in patients with stage I or II primary cutaneous melanoma.³ The review identified only one study reporting analytical validity, five clinical validity studies, and two clinical utility studies, all of which were industry sponsored to some degree. Hayes noted that most studies included patients not in the intended test population (stages I and II) as defined by the laboratory, although this is inaccurate as the DecisionDx-Melanoma test is designed for patients with Stage I, II, and III melanoma. Hayes also noted that the studies did not compare gene expression profile results with the standard of care staging features used in clinical practice. Two studies on clinical utility reported that test results had an impact on the management decisions of treating physicians. However, at this time, it is not clear whether DecisionDx-Melanoma adds enough prognostic information to current clinicopathological staging factors to change patient management decisions and ultimately improve outcomes.

Hayes rated the test as a “D2” and concluded that there was insufficient evidence “to support the DecisionDx-Melanoma test’s analytical validity, clinical validity, and clinical utility to predict risk of

metastasis and guide treatment decisions in patients with stage I or II primary cutaneous melanoma is insufficient. Studies available do not evaluate whether the test results provide accurate, clinically actionable information resulting in improved patient outcomes.”

- In 2020, Greenhaw and colleagues published an industry funded meta-analysis to determine the prognostic value of the assay by comparing clinical outcome metrics from DecisionDx-Melanoma with American Joint Committee on Cancer staging.³⁰ Three studies were included in the analysis, along with data from a novel cohort of 211 patients. Class 1A patients had 5-year recurrence-free rate of 91.4% and a distant metastasis-free survival rate of 94.1%. Class 2B patients had recurrence-free and metastasis-free rates of 43.6% and 55.5%, respectively. The analysis found that Class 2 was significantly associated with recurrences (hazard ratio: 2.90; P < 0.0001) and that considering both DecisionDx-Melanoma results and sentinel lymph node biopsy results, sensitivity and negative predictive value for distant metastasis-free survival were both improved. The study had a number of limitations. Raw data from a novel cohort was used in the analysis, yet no information was offered on the source of the data and methods of collection. The three studies included in the analysis were at high risk of bias. No studies has a randomized controlled trial design or comparator groups. One study and the raw data came from archival, retrospective data from previous studies. The studies had short median follow-up and low event rates. Study designs were dissimilar and therefore patient characteristics were likely incongruent.
- In 2020, Litchman and colleagues published a systematic review aimed to determine prognostic validity, analytic validity, and clinical utility of GEPs for primary cutaneous melanoma.³¹ Twenty-nine studies were reviewed and 6 studies were included in the meta-analysis. DecisionDX-Melanoma was found to be a strong predictive test for recurrence, distant metastasis, overall survival, and sentinel lymph node biopsy positivity. The 6 studies included in the meta analysis were reviewed in both Hayes and ECRI reports and found to have high risk of bias. They are all non-comparator studies, most retrospectively conducted. A high level of heterogeneity was found between studies in terms of design, patient characteristics, and results.

Clinical Validity

In 2021, Hsueh and colleagues published results from a multi-center prospective cohort evaluating the prognostic 31-gene expression profile for cutaneous melanoma (DecisionDx-Melanoma).³² Results from 323 patients with stage I-III cutaneous melanoma were reported at 3.2 years median follow-up. Primary end points were 3-year recurrence-free survival (RFS), distant metastasis-free survival (DMFS), and overall survival (OS). The 31-GEP was significant for RFS, DMFS, and OS in a univariate analysis and was a significant, independent predictor of RFS, DMFS, and OS in a multivariable analysis. GEP class 2 results were significantly associated with lower 3-year RFS, DMFS, and OS in all patients and those with stage I-IIA disease. Patients with stage I-IIA CM and a class 2 result had recurrence, distant metastasis, and death rates similar to patients with stage IIB-III CM. Combining 31-GEP results and AJCC staging enhanced sensitivity over each approach alone. Authors concluded that these data provide a rationale for using the 31-GEP along with AJCC staging, and suggest that patients with stage I-IIA CM and a class 2 31-GEP signature may be candidates for more intense follow-up. Limitations included the author conflicts of interest with the test manufacturer, lack of data on cause of death in some cases, and lack of long-term follow-up. As investigators noted, additional events not captured by the 3.2 year follow-up may affect recurrence rates and survival estimates.

CLINICAL PRACTICE GUIDELINES

Uveal Melanoma

National Comprehensive Cancer Network (NCCN)

In 2022, the NCCN published guidelines addressing uveal melanoma (V2.2021).³³ In the recommendations for initial work-up and staging, authors recommended that providers “*consider* biopsy for prognostic analysis for risk stratification.”³³ The guidelines further state that “biopsy of the primary tumor may provide prognostic information that can help inform frequency of follow-up and may be needed for eligibility for clinical trials.”³³

In addition, follow-up after primary treatment includes an algorithm to determine risk of distant metastases that specifically includes the class determined by the DecisionDx-UM assay in each category of risk. NCCN cites a pivotal prospective validation study (Onken et al., 2012),¹³ as the basis for this recommendation. (See summary of the Onken study in the evidence section above.)

Cutaneous Melanoma (CM)

National Comprehensive Cancer Network (NCCN)

In 2022, the NCCN published guidelines addressing cutaneous melanoma.³⁴ The guidelines mention gene expression profile tests in the context of initial evaluation of suspicious lesions and work-up after clinical staging.³⁴ In the recommendations section of the guideline, the panel states the following:

“The use of GEP testing according to specific AJCC-8 melanoma stage (before or after SLNB) requires further prospective investigation in large, contemporary data sets of unselected patients. Prognostic GEP testing to differentiate melanomas at low versus high risk for metastasis should not replace pathologic staging procedures. Moreover, since there is a low probability of metastasis in stage I melanoma and a higher proportion of false-positive results, GEP testing should not guide clinical decision-making in this subgroup.”³⁴

“Commercially available GEP tests are marketed as being able to classify cutaneous melanoma into separate categories based on risk of metastasis. However, it remains unclear whether these tests provide clinically actionable prognostic information when used in addition to or in comparison with known clinicopathologic factors or multivariable nomograms that incorporate patient sex, age, tumor location, and thickness, ulceration, mitotic rate, lymphovascular invasion, microsatellites, and SLNB status. Furthermore, the impact of these tests on treatment outcomes or follow-up schedules has not been established.”³⁴

“While there is interest in newer prognostic molecular techniques such as gene expression profiling to help differentiate benign from malignant neoplasms, or to help distinguish melanomas at low- versus high-risk for metastasis, routine (baseline) genetic testing of primary cutaneous melanomas (before or following SLN biopsy [SLNB]) is not recommended outside of a clinical study.”³⁴

Authors also stated that ancillary tests to detect genetic alterations in indeterminate melanocytic neoplasms, including gene expression profiling, may facilitate interpretation of cases that are diagnostically uncertain or controversial by histopathology. Authors recommended that these tests “should be used as adjuncts to clinical and expert dermatopathologic examination and therefore be interpreted within the context of these findings.”³⁴

American Academy of Dermatology (AAD)

In 2019, the American Academy of Dermatology (AAD) published updated guidelines on management of primary cutaneous melanoma.³⁵ Regarding molecular testing for CM, the guidelines state:

“Diagnostic molecular techniques [including GEP tests] are still largely investigative and may be appropriate as ancillary tests in equivocal melanocytic neoplasms, but they are not recommended for routine diagnostic use in CM.”

Regarding prognostic evaluation of CM, the guidelines state,

“In the opinion of the WG [workgroup], there is also insufficient evidence of benefit to recommend routine use of currently available prognostic molecular tests, including GEP, to provide more accurate prognosis beyond currently known clinicopathologic factors”.

“Routine molecular testing, including GEP, for prognostication is discouraged until better use criteria are defined. The application of molecular information for clinical management (eg, sentinel lymph node eligibility, follow-up, and/or therapeutic choice) is not recommended outside of a clinical study or trial.”

National Melanoma Prevention Working Group (MPWG)

In 2020, the MPWG published a non-evidence-based consensus statement assessing the clinical benefit of prognostic gene expression profiling in cutaneous melanoma.³⁶ Authors concluded the following:

“More evidence is needed to support using GEP testing to inform recommendations regarding sentinel lymph node biopsy (SLNB), intensity of follow-up or imaging surveillance, and postoperative adjuvant therapy. The MPWG recommends further research to assess the validity and clinical applicability of existing and emerging GEP tests. Decisions on performing GEP testing and patient management based on these results should only be made in the context of discussion of testing limitations with the patient or within a multidisciplinary group.”³⁶

National Society for Cutaneous Medicine (NSCM)

In 2019, the NSCM published appropriate use criteria for the integration of diagnostic and prognostic gene expression profile assays into the management of cutaneous malignant melanoma.³⁷

Recommendations were not evidence-based and were drafted on the basis of expert panel consensus. Authors gave a level “A” recommendation (consistent, good-quality patient-oriented evidence) for the use of the myPath (Castle Biosciences) for differentiation of a nevus from melanoma in an adult patient when the morphologic findings are ambiguous by light microscopic parameters. Authors also gave a level “A” recommendation for the use of DecisionDx-Melanoma for integrating DecisionDx-Melanoma results into subsequent management of patients who are sentinel node negative. Eight of the 12

authors reported conflicts of interest with Castle Biosciences – the manufacturer of both the myPath and DecisionDx-Melanoma tests.

National Institute for Health and Care Excellence (NICE)

In 2022, the National Institute for Health and Care Excellence (NICE) published guidelines on the assessment and management of melanoma.³⁸ They recommended offering genetic testing if targeted systemic therapy is a treatment option using:

- a secondary melanoma tissue sample if there is adequate cellularity or
- a primary melanoma tissue sample if a secondary sample is not available or is of inadequate cellularity

Regarding BRAF analysis of primary melanoma tissue samples, NICE had the following recommendations:

- Do not offer BRAF analysis of melanoma tissue samples from people with stage IA or IB primary melanoma at presentation except as part of a clinical trial
- Consider BRAF analysis of melanoma tissue samples from people with stage IIA or IIB primary melanoma
- Carry out BRAF analysis of melanoma tissue samples from people with state IIC to IV primary melanoma
- When doing BRAF analysis, consider immunohistochemistry as the first test for BRAF V600E, if available
- If BRAF V600E immunohistochemistry is negative or inconclusive, use a different BRAF genetic test

EVIDENCE SUMMARY

Uveal Melanoma

Although the body of evidence has some limitations, there is sufficient evidence that the DecisionDX-UM™ genetic expression profile (GEP) test can determine metastatic risk and guide surveillance and referral to specialists for follow-up. Identification of high-risk patients allows early referral to a medical oncologist and changes in management, including intensified surveillance and/or intervention, and stratification for entry into clinical trials. In addition, current NCCN guidelines now include DecisionDX-UM risk classes in their metastatic risk algorithm in order to determine appropriate follow-up evaluation and imaging after treatment of primary disease.

There is insufficient evidence that the DecisionDX-UM™ GEP test can be useful to measure metastatic risk in patients who do not meet the criteria above in this medical policy, including but not limited to patients who do not have a confirmed diagnosis of uveal melanoma, those whose uveal cancer that has spread from another site in the body, and those whose uveal melanoma has already metastasized. Of note, the medically necessary criteria outlined above is reflective of the manufacturer's current intended use for the test.

Cutaneous Melanoma

There is insufficient published evidence to make reliable conclusions regarding the clinical validity and clinical utility of gene expression assays for cutaneous melanoma. The body of evidence for each of the commercially available GEP tests for cutaneous melanoma (including myPath Melanoma, Pigmented Lesion Assay, and DecisionDx-Melanoma) require additional clinical validity studies with prospectively collected samples and appropriate comparator tests. In addition, no direct evidence of clinical utility was identified for any commercially available GEP test. Indirect evidence of clinical utility rests on clinical validity, and since acceptable test performance for GEP tests for cutaneous melanoma has not been demonstrated, no inferences can be made about the clinical utility of these tests. Furthermore, current clinical practice guidelines, including those published by the National Comprehensive Cancer Network (NCCN) and American Academy of Dermatology (AAD), do not recommend gene expression profiling for cutaneous melanomas in any circumstance. Both NCCN and the AAD consider GEP tests to be emerging and still require studies that demonstrate clinical utility.

BILLING GUIDELINES AND CODING

CODES*		
CPT	0089U	Oncology (melanoma), gene expression profiling by RTqPCR, PRAME and LINC00518, superficial collection using adhesive patch(es)
	0090U	Oncology (cutaneous melanoma), mRNA gene expression profiling by RT-PCR of 23 genes (14 content and 9 housekeeping), utilizing formalin-fixed paraffin-embedded (FFPE) tissue, algorithm reported as a categorical result (ie, benign, indeterminate, malignant)
	0314U	Oncology (cutaneous melanoma), mRNA gene expression profiling by RT-PCR of 35 genes (32 content and 3 housekeeping), utilizing formalin-fixed paraffin-embedded (FFPE) tissue, algorithm reported as a categorical result (i.e., benign, intermediate, malignant)
	81401	Molecular pathology procedure, Level 2 (eg, 2-10 SNPs, 1 methylated variant, or 1 somatic variant [typically using nonsequencing target variant analysis], or detection of a dynamic mutation disorder/triplet repeat)
	81479	Unlisted molecular pathology procedure
	81529	Oncology (cutaneous melanoma), mRNA, gene expression profiling by real-time RT-PCR of 31 genes (28 content and 3 housekeeping), utilizing formalin-fixed paraffin-embedded tissue, algorithm reported as recurrence risk, including likelihood of sentinel lymph node metastasis
	81552	Oncology (uveal melanoma), mRNA, gene expression profiling by real-time RT-PCR of 15 genes (12 content and 3 housekeeping), utilizing fine needle aspirate or formalin-fixed paraffin-embedded tissue, algorithm reported as risk of metastasis
	81599	Unlisted multianalyte assay with algorithmic analysis
	84999	Unlisted chemistry procedure
HCPCS	None	

***Coding Notes:**

- The above code list is provided as a courtesy and may not be all-inclusive. Inclusion or omission of a code from this policy neither implies nor guarantees reimbursement or coverage. Some codes may not require routine review for

medical necessity, but they are subject to provider contracts, as well as member benefits, eligibility and potential utilization audit.

- All unlisted codes are reviewed for medical necessity, correct coding, and pricing at the claim level. If an unlisted code is submitted for non-covered services addressed in this policy then it will be **denied as not covered**. If an unlisted code is submitted for potentially covered services addressed in this policy, to avoid post-service denial, **prior authorization is recommended**.
- See the non-covered and prior authorization lists on the Company [Medical Policy, Reimbursement Policy, Pharmacy Policy and Provider Information website](#) for additional information.
- HCPCS/CPT code(s) may be subject to National Correct Coding Initiative (NCCI) procedure-to-procedure (PTP) bundling edits and daily maximum edits known as “medically unlikely edits” (MUEs) published by the Centers for Medicare and Medicaid Services (CMS). This policy does not take precedence over NCCI edits or MUEs. Please refer to the CMS website for coding guidelines and applicable code combinations.

REFERENCES

1. National Cancer Institute. Intraocular (Uveal) Melanoma Treatment (PDQ®)—Health Professional Version. <https://www.cancer.gov/types/eye/hp/intraocular-melanoma-treatment-pdq>. Published 2021. Accessed 8/16/2022.
2. National Cancer Institute. Melanoma Treatment (PDQ®)—Health Professional Version. <https://www.cancer.gov/types/skin/hp/melanoma-treatment-pdq>. Published 2021. Accessed 8/16/2022.
3. Hayes Inc. DecisionDx-Melanoma (Castle Biosciences Inc.). <https://evidence.hayesinc.com/report/gte.decision2107>. Published 2021. Accessed 8/15/2022.
4. Castle Biosciences Inc. DecisionDx-UM product summary page. . <https://myuvealmelanoma.com/>. Published 2021. Accessed 8/16/2022.
5. Castle Biosciences Inc. myPath® Melanoma and DiffDx™-Melanoma Overview. <https://castlebiosciences.com/products/mypath-melanoma-and-diffdx-melanoma/>. Published 2021. Accessed 8/16/2022.
6. DermTech. Pigmented Lesion Assay (PLA). <https://dermtech.com/physicians/>. Published 2021. Accessed 8/12/2021.
7. Castle Biosciences Inc. DecisionDx-Melanoma Overview. <https://skinmelanoma.com/health-care-professionals/decisiondx-melanoma-summary/>. Published 2021. Accessed 8/15/2022.
8. Hayes Inc. DecisionDx-UM (Castle Biosciences Inc.). <https://evidence.hayesinc.com/report/gte.decision2107>. Published 2020 (updated 2021). Accessed 8/15/2022.
9. Plasseraud KM, Wilkinson JK, Oelschlager KM, et al. Gene expression profiling in uveal melanoma: technical reliability and correlation of molecular class with pathologic characteristics. *Diagnostic Pathology*. 2017;12(1):59.
10. Demirci H, Niziol LM, Ozkurt Z, et al. Do largest basal tumor diameter and the American Joint Committee on Cancer's cancer staging influence prognostication by gene expression profiling in choroidal melanoma. *Am J Ophthalmol*. 2018;195:83-92.
11. Plasseraud KM, Cook RW, Tsai T, et al. Clinical Performance and Management Outcomes with the DecisionDx-UM Gene Expression Profile Test in a Prospective Multicenter Study. *J Oncol*. 2016;2016:5325762.
12. ECRI. DecisionDx-UM (Castle Biosciences, Inc.) for Assessing Metastatic Risk in Patients with Uveal Melanoma. <https://www.ecri.org/components/ECRIgene/Documents/EG0099.pdf>. Published 2017. Accessed 8/15/2022.

13. Onken MD, Worley LA, Char DH, et al. Collaborative Ocular Oncology Group report number 1: prospective validation of a multi-gene prognostic assay in uveal melanoma. *Ophthalmology*. 2012;119(8):1596-1603.
14. Aaberg TM, Jr., Cook RW, Oelschlager K, Maetzold D, Rao PK, Mason JO, 3rd. Current clinical practice: differential management of uveal melanoma in the era of molecular tumor analyses. *Clin Ophthalmol*. 2014;8:2449-2460.
15. Scheffler AC, Skalet A, Oliver SCN, et al. Prospective evaluation of risk-appropriate management of uveal melanoma patients informed by gene expression profiling. *Melanoma Management*. 2020;7(1):MMT37.
16. Hayes Inc. myPath Melanoma (Myriad Genetics). <https://evidence.hayesinc.com/report/gte.mypath3689>. Published 2018 (updated 2022). Accessed 8/15/2022.
17. Reimann JDR, Salim S, Velazquez EF, et al. Comparison of melanoma gene expression score with histopathology, fluorescence in situ hybridization, and SNP array for the classification of melanocytic neoplasms. *Mod Pathol*. 2018;31(11):1733-1743.
18. Ko JS, Clarke LE, Minca EC, Brown K, Flake DD, 2nd, Billings SD. Correlation of melanoma gene expression score with clinical outcomes on a series of melanocytic lesions. *Hum Pathol*. 2019;86:213-221.
19. Clarke LE, Mabey B, II DDF, et al. Clinical validity of a gene expression signature in diagnostically uncertain neoplasms. *Personalized Medicine*.0(0):null.
20. Estrada S, Shackelton J, Cleaver N, et al. Development and validation of a diagnostic 35-gene expression profile test for ambiguous or difficult-to-diagnose suspicious pigmented skin lesions. *SKIN The Journal of Cutaneous Medicine*. 2020;4(6):506-522.
21. Hayes Inc. Pigmented Lesion Assay (DermTech). <https://evidence.hayesinc.com/report/gtb.dermtech4425>. Published 2020 (updated 2022). Accessed 8/15/2022.
22. Gerami P, Yao Z, Polsky D, et al. Development and validation of a noninvasive 2-gene molecular assay for cutaneous melanoma. *J Am Acad Dermatol*. 2017;76(1):114-120 e112.
23. Gerami P, Alsobrook JP, 2nd, Palmer TJ, Robin HS. Development of a novel noninvasive adhesive patch test for the evaluation of pigmented lesions of the skin. *J Am Acad Dermatol*. 2014;71(2):237-244.
24. Wachsmann W, Morhenn V, Palmer T, et al. Noninvasive genomic detection of melanoma. *Br J Dermatol*. 2011;164(4):797-806.
25. Ferris LK, Jansen B, Ho J, et al. Utility of a Noninvasive 2-Gene Molecular Assay for Cutaneous Melanoma and Effect on the Decision to Biopsy. *JAMA Dermatol*. 2017;153(7):675-680.
26. Brouha B, Ferris LK, Skelsey MK, et al. Real-World Utility of a Non-Invasive Gene Expression Test to Rule Out Primary Cutaneous Melanoma: A Large US Registry Study. *J Drugs Dermatol*. 2020;19(3):257-262.
27. ECRI. DecisionDx-Melanoma (Castle Biosciences, Inc.) for Evaluating Prognosis and Guiding Management of Cutaneous Melanoma. <https://www.ecri.org/components/ECRIgene/Documents/EG0098.pdf>. Published 2021. Accessed 8/15/2022.
28. Vetto JT, Hsueh EC, Gastman BR, et al. Guidance of sentinel lymph node biopsy decisions in patients with T1-T2 melanoma using gene expression profiling. *Future Oncol*. 2019;15(11):1207-1217.
29. Dillon LD, Gadzia JE, Davidson RS, et al. Prospective, Multicenter Clinical Impact Evaluation of a 31-Gene Expression Profile Test for Management of Melanoma Patients. 2018. 2018;2(2):11.

30. Greenhaw BN, Covington KR, Kurley SJ, et al. Molecular risk prediction in cutaneous melanoma: A meta-analysis of the 31-gene expression profile prognostic test in 1,479 patients. *J Am Acad Dermatol*. 2020.
31. Litchman GH, Prado G, Teplitz RW, Rigel D. A Systematic Review and Meta-Analysis of Gene Expression Profiling for Primary Cutaneous Melanoma Prognosis. *2020*. 2020;4(3):17.
32. Hsueh EC, DeBloom JR, Lee JH, et al. Long-Term Outcomes in a Multicenter, Prospective Cohort Evaluating the Prognostic 31-Gene Expression Profile for Cutaneous Melanoma. *JCO Precision Oncology*. 2021;5:589-601.
33. National Comprehensive Cancer Network. Uveal Melanoma. Version 2.2022. https://www.nccn.org/professionals/physician_gls/pdf/uveal.pdf. Published 2022. Accessed 8/16/2022.
34. National Comprehensive Cancer Network. Melanoma: Cutaneous. Version 03.2022. https://www.nccn.org/professionals/physician_gls/pdf/cutaneous_melanoma.pdf. Published 2022. Accessed 8/16/2022.
35. Swetter SM, Tsao H, Bichakjian CK, et al. Guidelines of care for the management of primary cutaneous melanoma. *J Am Acad Dermatol*. 2019;80(1):208-250.
36. Grossman D, Okwundu N, Bartlett EK, et al. Prognostic Gene Expression Profiling in Cutaneous Melanoma: Identifying the Knowledge Gaps and Assessing the Clinical Benefit. *JAMA Dermatology*. 2020;156(9):1004-1011.
37. Berman B, Ceilley R, Cockerell C, et al. Appropriate use criteria for the integration of diagnostic and prognostic gene expression profile assays into the management of cutaneous malignant melanoma: an expert panel consensus-based modified delphi process assessment. *SKIN The Journal of Cutaneous Medicine*. 2019;3(5):291-306.
38. National Institute for Health and Care Excellence. Melanoma: assessment and management. <https://www.nice.org.uk/guidance/ng14>. Published 2022. Accessed 8/15/2022.

POLICY REVISION HISTORY

DATE	REVISION SUMMARY
2/2023	Converted to new policy template.