

CONCERT GENETICS GENETIC TESTING: PHARMACOGENETICS

See [Important Reminder](#) at the end of this policy for important regulatory and legal information.

OVERVIEW

Pharmacogenetic tests are germline genetic tests that are developed to aid in assessing an individual's response to a drug treatment or to predict the risk of toxicity from a specific drug treatment. Testing may be performed prior to initiation of treatment to identify if an individual has genetic variants that could either affect response to a particular drug and/or increase the risk of adverse drug reactions. Testing may also be performed during treatment to assess an individual who has had an adverse drug reaction or to assess response to treatment. Test methodology includes genotyping and single nucleotide variant testing.

POLICY REFERENCE TABLE

Coding Implications

This clinical policy references Current Procedural Terminology (CPT[®]). CPT is a registered trademark of the American Medical Association. All CPT codes and descriptions are copyrighted 2023, American Medical Association. All rights reserved. CPT codes and CPT descriptions are from the current manuals and those included herein are not intended to be all-inclusive and are included for informational purposes only. Codes referenced in this clinical policy are for informational purposes only. Inclusion or exclusion of any codes does not guarantee coverage. Providers should reference the most up-to-date sources of professional coding guidance prior to the submission of claims for reimbursement of covered services.

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The tests and associated laboratories and CPT codes contained within this document serve only as examples to help users navigate claims and corresponding criteria; as such, they are not comprehensive and are not a guarantee of coverage or non-coverage. Please see the [Concert Genetics Platform](#) for a comprehensive list of registered tests.

| Criteria Sections | Example Tests (Labs) | Common CPT Codes | Common ICD Codes | Ref |
|---|--|----------------------------|--|---------------------|
| Pharmacogenetic Panel Tests | GeneSight Psychotropic (Myriad Genetics) | 0345U | B20, C00.0-C96.9, D00.0-D49.9, E75.22, F01-F99, G10, G71.14, G89.0-G89.4, I20.0, I21.01-I22.9, I24.1, I25.110, I26.01-I26.99, I48.0, I60.00-I66.99, I73, I82.210-I82.91, K50.00-K50.019, K51.00-K51.319, R52, R79.9, T46.6X1A-T46.6X6S, Z13.71-Z13.79, Z80.3, Z81.8, Z82.49, Z85.3, Z86.000, Z86.59, Z86.71-Z86.79 | 1, 2, 3, 4, 5, 6 |
| | Professional PGX (formerly Genecept Assay) (Genomind) | 81418 | | |
| | PGxOne (Admera Health) | | | |
| | Genomind Professional PGX Express CORE | 0175U | | |
| | Cytochrome P450 Genotyping Panel (ARUP Laboratories) | 81418 | | |
| | OneOme RightMed Pharmacogenomic Test (OneOme) | 0347U, 0348U, 0349U, 0350U | | |
| | Focused Pharmacogenomics Panel (Mayo Clinic Laboratories) | 0029U | | |
| | Psych HealthPGx Panel, (RPRD Diagnostics) | 0173U | | |
| | CNT Genotyping Panel (RPRD Diagnostics) | 0286U | | |
| | PersonalisedRX (Lab Genomics LLC) | 0380U | | |
| | Serotonin Receptor Genotype (HTR2A and HTR2C), (Mayo Medical Laboratories) | 0033U | | |
| | EffectiveRX Comprehensive Panel (GENETWORx) | 0438U | | |
| | RightMed Gene Test Exclude F2 and F5 | 0434U | | |

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| | (OneOme LLC) | | | |
| | Genomind Pharmacogenetics Report (Genomind, Inc) | 0423U | | |
| | Tempus nP (Tempus) | 0419U | | |
| | IDgenetix (Castle Biosciences) | 0411U | | |
| | Medication Management Neuropsychiatric Panel (RCA Laboratory) | 0392U | | |
| <u>Pharmacogenetic Single Gene Tests</u> | | | | |
| <u>BCHE Variant Analysis</u> | BCHE Single Gene Test (Blueprint Genetics) | 81479 | Z01.81, Z01.810, Z01.811, Z01.818, Z01.89 | 8 |
| <u>CYP2C9 Variant Analysis</u> | Cytochrome P450 2C9 Genotype (Quest Diagnostics) | 81227 | E78.00, E78.1, G35, I21.0- I22.9, I26.01-I26.99, I48.0, I60.00-I66.99, I82.210- I82.91, Z86.71-Z86.79 | 8 |
| <u>CYP2C19 Variant Analysis</u> | CYP2C19 Single Gene Test (Blueprint Genetics) | 81225 | C64, F32, I21.0-I22.9, I24.9, I26.01-I26.99, I48.0, I60.00-I66.99, I82.210- I82.91, K21.9, L20, Q85.83, R56.9, R68.82, Z86.71-Z86.79 | 8 |
| <u>CYP2D6 Variant Analysis</u> | CYP2D6 (ARUP Laboratories) | 81226 | C50.011-C50.929, C79.81, D05.00-D05.92, D07.30- D07.39, E11.9, E75.22, F11, F20.9, F31, F33, F84.0, F90, F95.2, G10, G24, G47.419, I10, I20.0, I21.01-I22.9, I24.1, I25.110, I48, I63.50- I63.549, I66.01-I66.9, I73, K21.9, R42, R52, T75.3, Z13.71-Z13.79, Z80.3, Z85.3, Z86.000 | 7, 8 |
| | CYP2D6 Common Variants and Copy Number (Mayo Clinic Laboratories) | 0070U | | |
| | CYP2D6 Full Gene Sequencing (Mayo Clinic Laboratories) | 0071U | | |
| | CYP2D6-2D7 Hybrid Gene Targeted Sequence Analysis (Mayo Clinic Laboratories) | 0072U | | |
| | CYP2D7-2D6 Hybrid Gene Targeted Sequence Analysis (Mayo Clinic Laboratories) | 0073U | | |
| | CYP2D6 CYP2D6 Nonduplicated Gene | 0074U | | |

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| | Analysis (Mayo Clinic Laboratories) | | | |
| | CYP2D6 5' gene duplication/multiplication targeted sequence analysis (Mayo Clinic Laboratories) | 0075U | | |
| | CYP2D6 3' gene duplication/multiplication targeted sequence analysis (Mayo Clinic Laboratories) | 0076U | | |
| CYP3A5 Variant Analysis | CYP3A5 single gene test (Blueprint Genetics) | 81231 | T86, Z79.6, Z94 | 8 |
| CYP4F2 Variant Analysis | CYP4F2 Single Gene Test (Blueprint Genetics) | 81479 | I21.0-I22.9, I26.01-I26.99, I48.0, I60.00-I66.99, I82.210-I82.91, Z86.71-Z86.79 | 8 |
| DPYD Variant Analysis | DPD 5-Fluorouracil Toxicity (Labcorp) | 81232 | C00.0-C96.9, D00.0-D49.9 | 8 |
| HLA-B*15:02 Variant Analysis | HLA-B*15:02, Carbamazepine Sensitivity (Labcorp) | 81381 | G40 | 8 |
| HLA-B*57:01 Variant Analysis | HLA B*57:01 Abacavir Hypersensitivity (Labcorp) | 81381 | B20, Z21 | 8 |
| NAT2 Variant Analysis | NAT2 single gene test (Blueprint Genetics) | 81479 | G73, M35.9 | 8 |
| TPMT and NUDT15 Variant Analysis | Thiopurine S-Methyltransferase (TPMT) Genotype (Quest Diagnostics) | 81335 | C91.0, K50.00-K50.90, K51.00-K51.319, M35.9, M05-M06.9, C85.90 | 8 |
| | TPMT and NUDT15 (ARUP Laboratories) | 81335, 81306 | | |
| | Thiopurine Methyltransferase (TPMT) and Nudix Hydrolase (NUDT15) Genotyping (Mayo Clinic Laboratories) | 0034U | | |
| | NT (NUDT15 and TPMT) genotyping panel (RPRD) | 0169U | | |

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| | Diagnostics) | | | |
| UGT1A1 Variant Analysis | UGT1A1 Irinotecan Toxicity (Labcorp) | 81350 | B20, C18, C19, C20, C50, C84, E80.4 | 8 |
| UGT2B17 Variant Analysis | UGT2B17 Single Gene (Fulgent Genetics) | 81479 | C25, C64, C71, C72, Q85.83 | 8 |
| VKORC1 Variant Analysis | VKORC1 Single Gene Test (Blueprint Genetics) | 81355 | I21.0-I22.9, I26.01-I26.99, I48.0, I60.00-I66.99, I82.210-I82.91, Z86.71-Z86.79 | 8 |
| Warfarin Sensitivity Analysis Panels | Warfarin Response Genotype (Mayo Medical Laboratories) | 0030U | I21, I26, I48 | 8, 9 |
| | Accutype Warfarin (Quest) | 81227, 81355 | | |
| Other Single Gene Variant Analysis | Catechol-O-Methyltransferase (COMT) Genotype (Mayo Clinic Laboratories) | 0032U | F01-F69, F80-F99, G20, Z81.8, Z86.59 | 8 |
| | COMT single gene test (Blueprint Genetics) | 81479 | | |
| | Cytochrome P450 1A2 Genotype (Mayo Clinic Laboratories) | 0031U | F01-F69, F80-F99, Z81.8, Z86.59 | |
| | CYP1A2 single gene test (Blueprint Genetics) | 81479 | | |
| | Cardio IQ KIF6 Genotype (Quest Diagnostics) | 81479 | E78.0-E78.9, R79.9, Z82.49 | |
| | Opioid Receptor, mu OPRM1 Genotype, 1 Variant (ARUP Laboratories) | 81479 | G89.0-G89.4 | |
| | SLCO1B1, 1 Variant (ARUP Laboratories) | 81328 | E78.00-E78.5, G71.14, R79.9, T46.6X1A-T46.6X6S, Z82.49 | |
| | TYMS Single Gene (Sequencing & Deletion/Duplication) | 81479 | C00.0-C96.9, D00.0-D49.9 | |

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| | (Fulgent Genetics) | | | |
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OTHER RELATED POLICIES

This policy document provides coverage for tests that determine the dosage of or the selection of a specific drug based on pharmacogenetic testing. For other related testing, please refer to:

- ***Oncology: Molecular Analysis of Solid Tumors and Hematologic Malignancies*** for criteria related to DNA testing of a solid tumor or a blood cancer.
- ***Genetic Testing: Hematologic Conditions (non-cancerous)*** for criteria related to diagnostic testing for non-cancerous genetic blood disorders.
- ***Genetic Testing: Multisystem Inherited Disorders, Intellectual Disability, and Developmental Delay*** for criteria related to diagnostic testing for cystic fibrosis, and related therapies.
- ***Genetic Testing: Metabolic, Endocrine, and Mitochondrial Disorders*** for criteria related to *MTHFR* testing.
- ***Genetic Testing: General Approach to Genetic and Molecular Testing*** for criteria related to pharmacogenetic testing that are not specifically discussed in this or other specific policies.

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CRITERIA

It is the policy of health plans affiliated with Centene Corporation® that the specific genetic testing noted below is **medically necessary** when meeting the related criteria:

PHARMACOGENETIC PANEL TESTS

- I. The use of pharmacogenetic testing panels (81418, 0029U, 0033U, 0173U, 0175U, 0286U, 0345U, 0347U, 0348U, 0349U, 0350U, 0380U, 0392U, 0411U, 0419U, 0423U, 0434U, 0438U) is considered **investigational*** for all indications.

*See *HLA-B*15:02* and *HLA-A*31:01* Variant Analysis and *TPMT* and *NUDT15* Variant Analysis below for criteria. These tests involve analysis of more than one gene, but are not considered experimental/investigational as a panel (“panel” defined as a genetic test analyzing more than one gene)

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PHARMACOGENETIC SINGLE GENE TESTS

***BCHE* Variant Analysis**

- I. *BCHE* variant analysis (81479) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with either of the following:
 1. Mivacurium¹ (e.g., Mivacron), **OR**
 2. Succinylcholine¹ (e.g., Anectine, Suxamethonium).
- II. *BCHE* variant analysis (81479) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly used as a muscle relaxant during surgery or intubation.

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***CYP2C9* Variant Analysis**

- I. *CYP2C9* variant analysis (81227) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with any of the following:
 1. Siponimod¹ (e.g., Mayzent), **OR**
 2. Celecoxib² (e.g., Celebrex, Elyxyb), **OR**
 3. Dronabinol³ (e.g., Marinol, Syndros), **OR**
 4. Erdafitinib⁴ (e.g., Balversa), **OR**
 5. Flurbiprofen⁵ (e.g., Ansaid), **OR**
 6. Fosphenytoin⁶ (e.g., Cerebyx, Sesquient), **OR**

7. Meloxicam⁷ (e.g., Anjeso, Mobic, Vivlodex, Qmiiz ODT), **OR**
8. Nateglinide⁸ (e.g., Starlix), **OR**
9. Phenytoin⁹ (e.g., Dilantin, Phenytek), **OR**
10. Piroxicam¹⁰ (e.g., Feldene), **OR**
11. Warfarin¹¹ (e.g., Coumadin, Jantoven).

II. *CYP2C9* variant analysis (81227) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed for individuals diagnosed with multiple sclerosis

² Commonly prescribed for treating pain or inflammation

³ Commonly prescribed for treating loss of appetite and severe nausea and vomiting

⁴ Commonly prescribed for treatment of bladder cancer

⁵ Commonly prescribed for treatment of pain or inflammation

⁶ Commonly prescribed for preventing or controlling seizures

⁷ Commonly prescribed for treating pain, inflammation, or severe pain

⁸ Commonly prescribed for blood sugar control in individuals with type II diabetes

⁹ Commonly prescribed for treatment of seizures

¹⁰ Commonly prescribed to treat pain or inflammation

¹¹ Commonly prescribed to reduce the formation of blood clots

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***CYP2C19* Variant Analysis**

I. *CYP2C19* variant analysis (81225) to determine drug metabolizer status is considered **medically necessary** when:

A. The member/enrollee is being considered for or is currently undergoing treatment with any of the following:

1. Clopidogrel¹ (e.g., Plavix), **AND**

a) The member/enrollee meets all of the following:

(1) Will be undergoing percutaneous coronary intervention (PCI), **AND**

(2) Has acute coronary syndromes (ACS), **AND**

(3) Is at high risk for poor outcomes (e.g., urgent PCI for an ACS event, elective PCI for unprotected left main disease or last patent coronary artery), **OR**

2. Abrocitinib² (e.g., Cibinqo), **OR**
3. Belzutifan³ (e.g., Welireg), **OR**
4. Brivaracetam⁴ (e.g., Briviact, Brivajoy), **OR**
5. Citalopram⁵ (e.g., Celexa), **OR**
6. Cobazam⁶ (e.g., Onfi), **OR**
7. Flibanserin⁷ (e.g., Addyi), **OR**
8. Pantoprazole⁸ (e.g., Protonix).

II. *CYP2C19* variant analysis (81225) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed after a angina or cardiac arrest to lower risk of stroke and blood clots

² Commonly prescribed for eczema

³ Commonly prescribed to treat tumors in individuals with Von Hippel-Lindau syndrome

⁴ Commonly prescribed to treat seizures

⁵ Commonly prescribed for treatment of depression and major depressive disorder

⁶ Commonly prescribed for treatment of seizures caused by Lennox-Gastaut syndrome

⁷ Commonly prescribed for low libido in pre-menopausal women

⁸ Commonly prescribed for treatment of erosive esophagitis caused by GERD, and Zollinger-Ellison syndrome

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CYP2D6 Variant Analysis

- I. *CYP2D6* variant analysis (81226, 0070U, 0071U, 0072U, 0073U, 0074U, 0075U, 0076U) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with any of the following:
 1. Eliglustat¹ (e.g., Cerdelga), **OR**
 2. Tetrabenazine² (e.g., Xenazine), **OR**
 3. Amphetamine³ (e.g., Adzenys, Dyanavel, Evekeo), **OR**
 4. Aripiprazole⁴ (e.g., Abilify, Abilify Maintena), **OR**
 5. Aripiprazole lauroxil⁵ (e.g., Aristada), **OR**
 6. T Atomoxetine⁶ (e.g., Strattera), **OR**
 7. Brexpiprazole⁷ (e.g., Rexulti), **OR**
 8. Clozapine⁸ (e.g., Versacloz, FazaClo, Clozaril), **OR**
 9. Deutetrabenazine⁹ (e.g., Austedo), **OR**
 10. Gefitinib¹⁰ (e.g., Iressa), **OR**
 11. Iloperidone¹¹ (e.g., Fanapt), **OR**
 12. Lofexidine¹² (e.g., Lucemyra), **OR**
 13. Meclizine¹³ (e.g., Antivert, Bonine, Dramamine, Verticalm, Zentrip), **OR**
 14. Metoclopramide¹⁴ (e.g., Reglan), **OR**
 15. Oliceridine¹⁵ (e.g., Olinvyk), **OR**
 16. Pimozide¹⁶ (e.g., Orap), **OR**
 17. Pitolisant¹⁷ (e.g., Wakix), **OR**
 18. Propafenone¹⁸ (e.g., Rythmol), **OR**
 19. Thioridazine¹⁹ (e.g., Mellaril), **OR**

- 20. Tramadol²⁰ (e.g., ConZip, Ultram), **OR**
- 21. Valbenazine²¹ (e.g., Ingrezza), **OR**
- 22. Venlafaxine²² (e.g., Effexor), **OR**
- 23. Vortioxetine²³ (e.g., Trintellix, Brintellix), **OR**
- 24. Codeine²⁴

II. *CYP2D6* variant analysis (81226, 0070U, 0071U, 0072U, 0073U, 0074U, 0075U, 0076U) to determine drug metabolizer status is considered **investigational** for all other indications, including:

A. For the purpose of managing treatment with tamoxifen for women at high risk for or with breast cancer.

¹ Commonly prescribed for treatment of Gaucher disease

² Commonly prescribed for treatment of involuntary movements (chorea) caused by Huntington disease

³ Commonly prescribed for treatment of hyperactivity, impulse control, and attention deficit hyperactivity disorder (ADHD)

⁴ Commonly prescribed for schizophrenia, bipolar I disorder, and major depressive disorder

⁵ Commonly prescribed for schizophrenia

⁶ Commonly prescribed for treatment of attention deficit hyperactivity disorder (ADHD)

⁷ Commonly prescribed for treatment of schizophrenia and major depressive disorder

⁸ Commonly prescribed for treatment of schizophrenia

⁹ Commonly prescribed for treatment of involuntary muscle movements (chorea) caused by Huntington disease, and tardive dyskinesia

¹⁰ Commonly prescribed for treatment of non-small cell lung cancer

¹¹ Commonly prescribed for treatment of schizophrenia

¹² Commonly prescribed for treatment of opioid withdrawal symptoms

¹³ Commonly prescribed for treatment of motion sickness and vertigo

¹⁴ Commonly prescribed for treatment of heartburn caused by GERD, gastroparesis, nausea and vomiting, and to aid in certain medical procedures involving the stomach or intestines

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- ¹⁵ Commonly prescribed for treatment of severe pain
- ¹⁶ Commonly prescribed for treatment of Tourette's syndrome
- ¹⁷ Commonly prescribed for treatment of excessive daytime sleepiness or sudden loss of muscle strength (cataplexy) related to narcolepsy
- ¹⁸ Commonly prescribed for treatment of heart rhythm disorders
- ¹⁹ Commonly prescribed for treatment of schizophrenia
- ²⁰ Commonly prescribed for treatment of moderate to severe pain
- ²¹ Commonly prescribed for treatment of tardive dyskinesia
- ²² Commonly prescribed for treatment of major depressive disorder, anxiety, and panic disorder
- ²³ Commonly prescribed for treatment of major depressive disorder
- ²⁴ Commonly prescribed for treatment of mild to moderately severe pain, and to help reduce coughing

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***CYP3A5* Variant Analysis**

- I. *CYP3A5* variant analysis (81231) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with tacrolimus¹ (e.g., Protopic, Envarsus, Astagraf, Prograf).
- II. *CYP3A5* variant analysis (81231) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed to individuals who have undergone a heart, kidney, liver, or lung transplant

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***CYP4F2* Variant Analysis**

- I. *CYP4F2* variant analysis (81479) to determine drug metabolizer status is considered **medically necessary** when:

- A. The member/enrollee is being considered for or is currently undergoing treatment with warfarin¹ (e.g., Coumadin, Jantoven).
- II. *CYP4F2* variant analysis (81479) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed to reduce the formation of blood clots

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***DPYD* Variant Analysis**

- I. *DPYD* variant analysis (81232) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with either of the following:
 - 1. Fluorouracil¹ (e.g., Adrucil), **OR**
 - 2. Capecitabine¹ (e.g., Xeloda).
- II. *DPYD* variant analysis (81232) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed for individuals diagnosed with colorectal, breast, and aerodigestive tract tumors

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***HLA-B*15:02* Variant Analysis**

- I. *HLA-B*15:02* variant analysis (81381) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with any of the following:
 - 1. Carbamazepine containing therapy¹ (e.g., Tegretol, Carbatrol, Epitol, Equetro), **OR**
 - 2. Phenytoin² (e.g., Dilantin, Phenytek), **OR**

3. Fosphenytoin² (e.g., Cerebyx, Sesquient).

- II. *HLA-B*15:02* variant analysis (81381) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed for individuals with epilepsy, trigeminal neuralgia, or bipolar disorder

² Commonly prescribed for treatment of seizures

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***HLA-B*57:01* Variant Analysis**

- I. *HLA-B*57:01* variant analysis (81381) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with abacavir¹ (e.g., Ziagen).
- II. *HLA-B*57:01* variant analysis (81381) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed for individuals with HIV

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***NAT2* Variant Analysis**

- I. *NAT2* variant analysis (81479) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with amifampridine/amifampridine phosphate¹ (e.g., Firdapse, Ruzurgi).
- II. *NAT2* variant analysis (81479) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed for treatment of Lambert-Eaton myasthenic syndrome

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***TPMT* and *NUDT15* Variant Analysis**

- I. *TPMT* and *NUDT15* variant analysis (81306, 81335, 0034U, 0169U) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with any of the following:
 1. Azathioprine¹ (e.g., Imuran and Azasan), **OR**
 2. Mercaptopurine² (e.g., Purinethol and Purixan), **OR**
 3. Thioguanine³ (e.g., Tabloid), **OR**
 - B. The member/enrollee is on thiopurine therapy and has had abnormal complete blood count results that do not respond to dose reduction.
- II. *TPMT* and *NUDT15* variant analysis (81306, 81335, 0034U, 0169U) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed for treatment of avoiding rejection of a transplanted organ, and rheumatoid arthritis

² Commonly prescribed for treatment of acute lymphoblastic or lymphocytic leukemia

³ Commonly prescribed for treatment of acute nonlymphocytic leukemia

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***UGT1A1* Variant Analysis**

- I. *UGT1A1* variant analysis (81350) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with any of the following:
 1. Irinotecan¹ (e.g., Onivyde, Camptosar), **OR**
 2. Belinostat² (e.g., Beleodaq), **OR**
 3. Sacituzumab govitecan-hziy³ (e.g., Trodelvy).
- II. *UGT1A1* variant analysis (81350) to determine drug metabolizer status is considered **investigational** for all other indications.

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- ¹ Commonly prescribed for treatment of colon and rectal cancers
- ² Commonly prescribed for treatment of peripheral T-cell lymphoma
- ³ Commonly prescribed for treatment of breast and urothelial cancers

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***UGT2B17* Variant Analysis**

- I. *UGT2B17* variant analysis (81479) to determine drug metabolizer status is **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with belzutifan¹ (e.g., Welireg).
- II. *UGT2B17* variant analysis (81479) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed to treat tumors in individuals with Von Hippel-Lindau syndrome

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***VKORC1* Variant Analysis**

- I. *VKORC1* variant analysis (81355) to determine drug metabolizer status is considered **medically necessary** when:
 - A. The member/enrollee is being considered for or is currently undergoing treatment with warfarin¹ (e.g., Coumadin, Jantoven).
- II. *VKORC1* variant analysis (81355) to determine drug metabolizer status is considered **investigational** for all other indications.

¹ Commonly prescribed to reduce the formation of blood clots

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Warfarin Sensitivity Analysis Panels

- I. Multigene panel analysis to determine drug metabolizer status for warfarin¹ sensitivity (81227, 81355, 0030U) is considered **medically necessary** when:
 - A. The member/enrollee is undergoing prophylaxis and treatment of venous thrombosis or pulmonary embolism, **OR**
 - B. The member/enrollee is undergoing prophylaxis and treatment of thromboembolic complications associated with atrial fibrillation and/or cardiac valve replacement, **OR**
 - C. The member/enrollee has a history of previous myocardial infarction, **AND**
 - D. The member/enrollee is being considered for or is undergoing treatment with warfarin, **AND**
 1. The member/enrollee has not reached a therapeutic dose.
- II. Multigene panel analysis to confirm drug metabolizer status for warfarin¹ sensitivity (81227, 81355, 0030U) is considered **investigational** for all other indications.

¹ Commonly prescribed to reduce the formation of blood clots

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Other Single Gene Variant Analysis

- I. Variant analysis of all other genes for drug metabolizer status is considered **investigational**, including but not limited to:
 - A. *COMT* (0032U, 81479)
 - B. *CYP1A2* (0031U, 81479)
 - C. *KIF6* (81479)
 - D. *OPRM1* (81479)
 - E. *SLCO1B1* (81328)
 - F. *TYMS* (81479)

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BACKGROUND AND RATIONALE

Pharmacogenetic Panel Testing

There are no professional society guidelines that address the clinical utility of large pharmacogenetic testing panels for the general population or for a specific population. The US Food and Drug Administration (FDA) also does not address the usage of pharmacogenetic panels.

There are several recent studies that investigated the usefulness of pharmacogenetic panels [for example, Greden et al (2019), Perlis et al (2020), Shan et al (2019), Tiwari et al (2022), Oslin (2022)]. However, these studies had different designs and often conflicting results regarding clinical utility, making it difficult to determine whether there is clinical utility for these types of tests.

A rapid review and meta-analysis by Bunka et al (2023) of 10 randomized controlled trials to evaluate pharmacogenomic-guided care for major depression showed that, while there is likely beneficial effects to adults with moderate to severe major depressive disorder utilizing pharmacogenomic panels, there is “very low certainty in the magnitude of effect.” (p. 1) This analysis also noted the “high risk of bias and inconsistency between trials.” (p. 1)

There are several single gene pharmacogenetic tests in which the FDA describes the clinical utility of the test results for a given gene/drug/testing indication. These are outlined below.

***BCHE* Variant Analysis**

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations, which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, lists the following recommendations for *BCHE*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|-------------------|-------------|-----------------------------------|--|
| Mivacurium | BCHE | intermediate or poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk (prolonged neuromuscular blockade). Avoid use in poor metabolizers. |

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|------------------------|------|-----------------------------------|--|
| Succinylcholine | BCHE | intermediate or poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk (prolonged neuromuscular blockade). Avoid use in poor metabolizers. May administer a test dose to assess sensitivity and administer cautiously via slow infusion. |
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CYP2C9 Variant Analysis

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *CYP2C9*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|---------------------|-------------|-----------------------------------|--|
| Celecoxib | CYP2C9 | poor metabolizers or *3 carriers | Results in higher systemic concentrations. Reduce starting dose to half of the lowest recommended dose in poor metabolizers. Consider alternative therapy in poor metabolizers with juvenile rheumatoid arthritis. |
| Dronabinol | CYP2C9 | intermediate or poor metabolizers | May result in higher systemic concentrations and higher adverse reaction risk. Monitor for adverse reactions. |
| Erdafitinib | CYP2C9 | *3/*3 (poor metabolizers) | May result in higher systemic concentrations and higher adverse reaction risk. Monitor for adverse reactions. |
| Flurbiprofen | CYP2C9 | poor metabolizers or *3 carriers | Results in higher systemic concentrations. Use a reduced dosage in poor metabolizers. |
| Fosphenytoin | CYP2C9 | intermediate or poor metabolizers | May result in higher systemic concentrations and higher adverse reaction risk (central nervous system toxicity). Consider starting at the lower end of the dosage range and monitor serum concentrations. Refer to FDA labeling for specific dosing recommendations. Carriers of CYP2C9*3 alleles may be at increased risk |

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| | | | of severe cutaneous adverse reactions. Consider avoiding fosphenytoin as an alternative to carbamazepine in patients who are CYP2C9*3 carriers. Genotyping is not a substitute for clinical vigilance and patient management. |
| Meloxicam | CYP2C9 | poor metabolizers or *3 carriers | Results in higher systemic concentrations. Consider dose reductions in poor metabolizers. Monitor patients for adverse reactions. |
| Nateglinide | CYP2C9 | poor metabolizers | Results in higher systemic concentrations and may result in higher adverse reaction risk (hypoglycemia). Dosage reduction is recommended. Increase monitoring frequency for adverse reactions. Refer to FDA labeling for specific dosing recommendations. |
| Phenytoin | CYP2C9 | intermediate or poor metabolizers | May result in higher systemic concentrations and higher adverse reaction risk (central nervous system toxicity). Refer to FDA labeling for specific dosing recommendations. Carriers of CYP2C9*3 alleles may be at increased risk of severe cutaneous adverse reactions. Consider avoiding phenytoin as an alternative to carbamazepine in patients who are CYP2C9*3 carriers. Genotyping is not a substitute for clinical vigilance and patient management. |
| Piroxicam | CYP2C9 | intermediate or poor metabolizers | Results in higher systemic concentrations. Consider reducing dosage in poor metabolizers. |
| Siponimod | CYP2C9 | intermediate or poor metabolizers | Results in higher systemic concentrations. Adjust dosage based on genotype. Do not use in patients with CYP2C9 *3/*3 genotype. Refer to FDA labeling for specific dosing recommendations. |
| Warfarin | CYP2C9 | intermediate or poor | Alters systemic concentrations and dosage |

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| | | metabolizers | requirements. Select initial dosage, taking into account clinical and genetic factors. Monitor and adjust dosages based on INR. |
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CYP2C19 Variant Analysis

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *CYP2C19*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|---------------------|------------------------|-----------------------------------|--|
| Abrocitinib | CYP2C19 | poor metabolizers | Results in higher systemic concentrations and may result in higher adverse reaction risk. Dosage adjustment is recommended. Refer to FDA labeling for specific dosing recommendations. |
| Belzutifan | CYP2C19 and/or UGT2B17 | poor metabolizers | Results in higher systemic concentrations and may result in higher adverse reaction risk (anemia, hypoxia). Monitor patients who are poor metabolizers for both genes for adverse reactions. |
| Brivaracetam | CYP2C19 | intermediate or poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk. Consider dosage reductions in poor metabolizers. |
| Citalopram | CYP2C19 | poor metabolizers | Results in higher systemic concentrations and adverse reaction risk (QT prolongation). The maximum recommended dose is 20 mg. |
| Clobazam | CYP2C19 | intermediate or poor metabolizers | Results in higher systemic active metabolite concentrations. Poor metabolism results in higher adverse reaction risk. Dosage adjustment is recommended. Refer to FDA labeling for specific dosing recommendations. |
| Clopidogrel | CYP2C19 | intermediate or poor metabolizers | Results in lower systemic active metabolite concentrations, lower antiplatelet response, and may result in higher cardiovascular risk. Consider use of |

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| | | | another platelet P2Y12 inhibitor. |
| Flibanserin | CYP2C19 | poor metabolizers | May result in higher systemic concentrations and higher adverse reaction risk. Monitor patients for adverse reactions. |
| Pantoprazole | CYP2C19 | intermediate or poor metabolizers | Results in higher systemic concentrations. Consider dosage reduction in children who are poor metabolizers. No dosage adjustment is needed for adult patients who are intermediate or poor metabolizers. |

CYP2D6 Variant Analysis

National Comprehensive Cancer Network (NCCN)

NCCN Breast Cancer guidelines (1.2024) recommend against *CYP2D6* genotype testing for women being considered for tamoxifen treatment. (p. DCIS-2 and p. BINV-K)

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *CYP2D6*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|---------------------|-------------|---------------------------|--|
| Amphetamine | CYP2D6 | poor metabolizers | May affect systemic concentrations and adverse reaction risk. Consider a lower starting dosage or use an alternative agent. |
| Aripiprazole | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk. Dosage adjustment is recommended. Refer to FDA labeling for specific dosing recommendations. |

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|----------------------------------|--------|-------------------------|---|
| Aripiprazole Lauroxil | CYP2D6 | poor metabolizers | Results in higher systemic concentrations. Dosage adjustment is recommended. Refer to FDA labeling for specific dosing recommendations. |
| Atomoxetine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk. Adjust titration interval and increase dosage if tolerated. Refer to FDA labeling for specific dosing recommendations. |
| Brexpiprazole | CYP2D6 | poor metabolizers | Results in higher systemic concentrations. Dosage adjustment is recommended. Refer to FDA labeling for specific dosing recommendations. |
| Clozapine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations. Dosage reductions may be necessary. |
| Codeine | CYP2D6 | ultrarapid metabolizers | Results in higher systemic active metabolite concentrations and higher adverse reaction risk (life-threatening respiratory depression and death). Codeine is contraindicated in children under 12 years of age. |
| Deutetrabenazine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and adverse reaction risk (QT prolongation). The maximum recommended dosage should not exceed 36 mg (maximum single dose of 18 mg). |

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| Eliglustat | CYP2D6 | ultrarapid, normal, intermediate, or poor metabolizers | Alters systemic concentrations, effectiveness, and adverse reaction risk (QT prolongation). Indicated for normal, intermediate, and poor metabolizer patients. Ultrarapid metabolizers may not achieve adequate concentrations to achieve a therapeutic effect. The recommended dosages are based on CYP2D6 metabolizer status. Coadministration with strong CYP3A inhibitors is contraindicated in intermediate and poor CYP2D6 metabolizers. Refer to FDA labeling for specific dosing recommendations. |
| Gefitinib | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk. Monitor for adverse reactions. |
| Iloperidone | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk (QT prolongation). Reduce dosage by 50%. |
| Lofexidine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk. Monitor for orthostatic hypotension and bradycardia. |
| Meclizine | CYP2D6 | ultrarapid, intermediate, or poor metabolizers | May affect systemic concentrations. Monitor for adverse reactions and clinical effect. |
| Metoclopramide | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk. The recommended dosage is lower. Refer to FDA labeling for specific dosing recommendations. |

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|----------------------|--------|-------------------|---|
| Oliceridine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk (respiratory depression and sedation). May require less frequent dosing. |
| Pimozide | CYP2D6 | poor metabolizers | Results in higher systemic concentrations. Dosages should not exceed 0.05 mg/kg in children or 4 mg/day in adults who are poor metabolizers and dosages should not be increased earlier than 14 days. |
| Pitolisant | CYP2D6 | poor metabolizers | Results in higher systemic concentrations. Use the lowest recommended starting dosage. Refer to FDA labeling for specific dosing recommendations. |
| Propafenone | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk (arrhythmia). Avoid use in poor metabolizers taking a CYP3A4 inhibitor. |
| Tetrabenazine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations. The maximum recommended single dose is 25 mg and should not exceed 50 mg/day. |
| Thioridazine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk (QT prolongation). Predicted effect based on experience with CYP2D6 inhibitors. Contraindicated in poor metabolizers. |

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|---------------------|--------|-------------------------|--|
| Tramadol | CYP2D6 | Ultrarapid metabolizers | Results in higher systemic and breast milk active metabolite concentrations, which may result in respiratory depression and death. Contraindicated in children under 12 and in adolescents following tonsillectomy/adenoidectomy. Breastfeeding is not recommended during treatment. |
| Valbenazine | CYP2D6 | poor metabolizers | Results in higher systemic active metabolite concentrations and higher adverse reaction risk (QT prolongation). Dosage reductions may be necessary. |
| Venlafaxine | CYP2D6 | poor metabolizers | Alters systemic parent drug and metabolite concentrations. Consider dosage reductions. |
| Vortioxetine | CYP2D6 | poor metabolizers | Results in higher systemic concentrations. The maximum recommended dose is 10 mg. |

CYP3A5 Variant Analysis

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations, which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, lists the following recommendations for *CYP3A5*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|-------------------|-------------|-------------------------------------|--|
| Tacrolimus | CYP3A5 | intermediate or normal metabolizers | Results in lower systemic concentrations, lower probability of achieving target concentrations and may result in higher rejection risk. Measure drug concentrations and adjust dosage based on trough whole blood tacrolimus concentrations. |

***CYP4F2* Variant Analysis**

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *CYP4F2*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|-----------------|-------------|---------------------------|--|
| Warfarin | CYP4F2 | V433M variant carriers | May affect dosage requirements. Monitor and adjust doses based on INR. |

***DPYD* Variant Analysis**

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *DPYD*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|---------------------|-------------|-----------------------------------|---|
| Capecitabine | DPYD | intermediate or poor metabolizers | Results in higher adverse reaction risk (severe, life-threatening, or fatal toxicities). No dosage has proven safe in poor metabolizers, and insufficient data are available to recommend a dosage in intermediate metabolizers. Withhold or discontinue in the presence of early-onset or unusually severe toxicity. |
| Fluorouracil | DPYD | intermediate or poor metabolizer | Results in higher adverse reaction risk (severe, life-threatening, or fatal toxicities). No dosage has proven safe in poor metabolizers and insufficient data are available to recommend a dosage in intermediate metabolizers. Withhold or discontinue in the presence of early-onset or unusually severe toxicity. |

***HLA-B*15:02* Variant Analysis**

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *HLA-B*15:02*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|----------------------|-------------|---------------------------|--|
| Carbamazepine | HLA-B | *15:02 allele positive | Results in higher adverse reaction risk (severe skin reactions). Avoid use unless potential benefits outweigh risks and consider risks of alternative therapies. Patients positive for HLA-B*15:02 may be at increased risk of severe skin reactions with other drugs that are associated with a risk of Stevens Johnson Syndrome/Toxic Epidermal necrolysis (SJS/TEN). Genotyping is not a substitute for clinical vigilance. |
| Fosphenytoin | HLA-B | *15:02 allele positive | May result in higher adverse reaction risk (severe cutaneous reactions). Patients positive for HLA-B*15:02 may be at increased risk of Stevens Johnson Syndrome/Toxic Epidermal necrolysis (SJS/TEN). Consider avoiding fosphenytoin as an alternative to carbamazepine in patients who are positive for HLA-B*15:02. Genotyping is not a substitute for clinical vigilance and patient management. |
| Phenytoin | HLA-B | *15:02 allele positive | May result in higher adverse reaction risk (severe cutaneous reactions). Patients positive for HLA-B*15:02 may be at increased risk of Stevens Johnson Syndrome/Toxic Epidermal necrolysis (SJS/TEN). Consider avoiding phenytoin as an alternative to carbamazepine in patients who are positive for HLA-B*15:02. Genotyping is not a substitute for clinical vigilance and patient management. |

HLA-B*57:01 Variant Analysis

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *HLA-B*57:01*:

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| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|-----------------|-------|------------------------|---|
| Abacavir | HLA-B | *57:01 allele positive | Results in higher adverse reaction risk (hypersensitivity reactions). Do not use abacavir in patients positive for HLA-B*57:01. |

***NAT2* Variant Analysis**

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations, which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, lists the following recommendations for *NAT2*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|--------------------------------|------|--------------------|--|
| Amifampridine | NAT2 | poor metabolizers | Results in higher systemic concentrations and higher adverse reaction risk. Use lowest recommended starting dosage and monitor for adverse reactions. Refer to FDA labeling for specific dosing recommendations. |
| Amifampridine Phosphate | NAT2 | poor metabolizers | Results in higher systemic concentrations. Use lowest recommended starting dosage (15 mg/day) and monitor for adverse reactions. |

***TPMT* and *NUDT15* Variant Analysis**

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *TPMT* and *NUDT15*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|------|------|--------------------|--------------------------------------|
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|-----------------------|--------------------------|-----------------------------------|---|
| Azathioprine | TPMT and/or NUDT15 | intermediate or poor metabolizers | Alters systemic active metabolite concentration and dosage requirements. Results in higher adverse reaction risk (myelosuppression). Consider alternative therapy in poor metabolizers. Dosage reduction is recommended in intermediate metabolizers for NUDT15 or TPMT. Intermediate metabolizers for both genes may require more substantial dosage reductions. Refer to FDA labeling for specific dosing recommendations. |
| Mercaptopurine | TPMT and/or NUDT15 | intermediate or poor metabolizers | Alters systemic active metabolite concentration and dosage requirements. Results in higher adverse reaction risk (myelosuppression). Initial dosages should be reduced in poor metabolizers; poor metabolizers generally tolerate 10% or less of the recommended dosage. Intermediate metabolizers may require dosage reductions based on tolerability. Intermediate metabolizers for both genes may require more substantial dosage reductions. Refer to FDA labeling for specific dosing recommendations. |
| Thioguanine | TPMT and/or NUDT15 | intermediate or poor metabolizers | Alters systemic active metabolite concentration and dosage requirements. Results in higher adverse reaction risk (myelosuppression). Initial dosages should be reduced in poor metabolizers; poor metabolizers generally tolerate 10% or less of the recommended |

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| | | | dosage. Intermediate metabolizers may require dosage reductions based on tolerability. Intermediate metabolizers for both genes may require more substantial dosage reductions. Refer to FDA labeling for specific dosing recommendations. |
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UGT1A1 Variant Analysis

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *UGT1A1*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|---------------------------------------|-------------|---|--|
| Belinostat | UGT1A1 | *28/*28 (poor metabolizers) | May result in higher systemic concentrations and higher adverse reaction risk. Reduce starting dose to 750 mg/m2 in poor metabolizers. |
| Irinotecan | UGT1A1 | *1/*6, *1/*28 (intermediate metabolizers) or *6/*6, *6/*28, *28/*28 (poor metabolizers) | Results in higher systemic active metabolite concentrations and higher adverse reaction risk (severe or life-threatening neutropenia, severe diarrhea). Closely monitor for neutropenia during and after treatment. Consider reducing the starting dosage by at least one level in poor metabolizers and modify the dosage based on individual patient tolerance. Refer to FDA labeling for specific dosing recommendations. |
| Sacituzumab Govitecan-hziy | UGT1A1 | *28/*28 (poor metabolizers) | May result in higher systemic concentrations and adverse reaction risk (neutropenia). Monitor for adverse reactions and tolerance to treatment. |

UGT2B17 Variant Analysis

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations, which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, lists the following recommendations for *UGT2B17*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|-------------------|------------------------------|---------------------------|--|
| Belzutifan | CYP2C19 and/or UGT2B17 | poor metabolizers | Results in higher systemic concentrations and may result in higher adverse reaction risk (anemia, hypoxia). Monitor patients who are poor metabolizers for both genes for adverse reactions. |

***VKORC1* Variant Analysis**

Food and Drug Administration (FDA)

The FDA published a Table of Pharmacogenetic Associations which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, list the following recommendations for *VKORC1*:

| Drug | Gene | Affected Subgroups | Description of Gene-Drug Interaction |
|-----------------|-------------|---------------------------|---|
| Warfarin | VKORC1 | -1639G>A variant carriers | Alters dosage requirements. Select initial dosage, taking into account clinical and genetic factors. Monitor and adjust dosages based on INR. |

Warfarin Sensitivity Analysis Panels

Food and Drug Administration (FDA)

Per the FDA label, the indications and usage for Warfarin include the following:

- Prophylaxis and treatment of venous thrombosis and its extension, pulmonary embolism
- Prophylaxis and treatment of thromboembolic complications associated with atrial fibrillation and/or cardiac valve replacement
- Reduction in the risk of death, recurrent myocardial infarction, and thromboembolic events such as stroke or systemic embolization after myocardial infarction

The FDA published a Table of Pharmacogenetic Associations, which details possible gene-drug interactions. Section 1, entitled Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, lists the following recommendations for *CYP2C9*, *CYP4F2* and *VKORC1*:

| | | | |
|-----------------|--------|-----------------------------------|---|
| Warfarin | CYP2C9 | intermediate or poor metabolizers | Alters systemic concentrations and dosage requirements. Select initial dosage, taking into account clinical and genetic factors. Monitor and adjust dosages based on INR. |
| | CYP4F2 | V433M variant carriers | May affect dosage requirements. Monitor and adjust doses based on INR. |
| | VKORC1 | -1639G>A variant carriers | Alters dosage requirements. Select initial dosage, taking into account clinical and genetic factors. Monitor and adjust dosages based on INR. |

Other Single Gene Variant Analysis

The Food and Drug Administration (FDA) does not list *COMT*, *CYP1A2*, *KIF6*, *OPRM1*, *SLCO1B1*, or *TYMS* in Section 1 of the Table of Pharmacogenetic Associations (“Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations”).

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| Reviews, Revisions, and Approvals | Revision Date | Approval Date |
|--|---------------|---------------|
| Policy developed. | 03/23 | 03/23 |
| Semi-annual review. Updated title to reflect V1.2024 version. Overview, coding, reference-table, background and references updated. Throughout policy: replaced “coverage criteria” with “criteria. For Policy Reference Table; under Pharmacogenetic Single Gene Tests: added “BCHE Variant Analysis and related content; under CYP2C9 Variant Analysis: added “E78.00, E78.1”; under CYP2C19 Variant Analysis: added “C64, F32”; added “K21.9, L20, Q85.83, R56.9, R68.82”; under CYP2D6 Variant Analysis: added “C50.11-C50.929...”; added CYP3A5 Variant Analysis and related content; added NAT2 Variant Analysis and related content; for UGT1A1 Variant Analysis: added “C50, C84”. For Other Related Policies: added “and Molecular”. For Criteria; added BCHE Variant Analysis and related content; under CYP2C9 Variant Analysis: I.A. added “or is currently undergoing”, added “Siponimod...”; I.B.-I.K. added “The member/enrollee is being considered...”; under | 10/23 | 10/23 |

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|---|--|--|
| <p>II.A. removed “For the purpose of managing...”; added “Commonly prescribed for treating...”; under CYP2C19 Variant Analysis: under I.C.-I.I. “The member/enrollee is being considered...”; added “Commonly prescribed for treating...”; under CYP2D6 Variant Analysis: under I.A. removed “has Gaucher disease”; added “or is currently undergoing”; under I.B. added “or is currently...”; under I.C. added “The member/enrollee is being considered...”; removed “codeine”; added “amphetamine...”; under I.D.-I.X. added “The member/enrollee is being considered...”; added 1-24 “Commonly prescribed for...”; for DPYD Variant Analysis: under I.A. added “or is currently undergoing”; removed “any 5-FU containing...”; added “Fluorouacil”; added “Andrucil...”; added I.B. “The member/enrollee is being considered...”; for HLA-B*15:02 Variant Analysis: under I.A. added “or is currently undergoing”; added “Epitol, Equetro”; under I.B. added “or is currently undergoing”; removed “I. HLA-B*15:02...”; for <i>HLA-B*57:01</i> Variant Analysis: under I.A. added “or is currently undergoing”; for NAT2 Variant Analysis: under I. and II. replaced “HLA-B*58.01” with “NAT2”; replaced “81381” with “81479”; under I.A. added “or is currently undergoing”; removed “allopurinol”; added “amifampridine...”; removed “Aloprim...”; added “Firdapse...”; for TPMT and NUDT15 Variant Analysis: under A. removed “beginning therapy”; added “being considered for...”; removed “mercaptopurine”; added I.B. and I.C. “The member/enrollee is being considered...”; removed “patients with autoimmune...”; added “treatment of avoiding...”; added 2, 3 “Commonly prescribed...”; for UGT1A1 Variant Analysis: under I.A. removed “beginning irinotecan therapy”; added “being considered...”; under I.C. added “The member/enrollee is being considered...”; under 1. Replaced “patients with” with “patients with HIV”; added 2-3 “Commonly prescribed...”; added UGT2B17 Variant Analysis,,,; for VKORC1 Variant Analysis: under I. removed “for the purpose...”; added “to determine drug metabolizer status”; removed “investigational”; added “medically necessary when...”; removed “A. For the purpose...”; added “1. Commonly prescribed...”. For Other Single Gene Variant Analysis: under I.F. removed “81346”. For Background and Rationale: removed “a given patient...”; added “A rapid review...”; removed “where the Clinical Pharmacogenetics...”; added “BCHE Variant Analysis...”; for CYP2C9 Variant Analysis: removed “The FDA approved...”; added “The FDA published a Table...”; removed “The Clinical Pharmacogenetics...”; for <i>CYP2C19</i> Variant Analysis: removed “Clinical Pharmacogenetics...”; added “The FDA published...”; for CYP2D6 Variant Analysis: removed “Clinical Pharmacogenetics...”; removed “American Society...”; removed “CYP4F2 Variant Analysis...”; added “Food and Drug Administration...”; added “CYP3A5 Variant Analysis...”; added “CYP4F2 Variant Analysis...”; for DPYD Variant Analysis: removed “Clinical Pharmacogenetics...”; added “The FDA published...”; for HLA-B*15:02 Variant Analysis: removed :Clinical Pharmacogenetics...”; added “Food and Drug Administration...”; for NAT2 Variant Analysis: removed :Clinical Pharmacogenetics...”; added “Food and Drug Administration...”; for TPMT and NUDT15 Variant Analysis: removed “National Comprehensive Cancer Network...”; added “Food and Drug...”; for UGT1A1 Variant Analysis: removed :Clinical Pharmacogenetics...”; removed “Other Single Gene Variant Analysis...”; added “Food and Drug...”; for UGT2B17 Variant Analysis: added “Food and Drug...”; for</p> | | |
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|--|-------|-------|
| VKORC1 Variant Analysis: added “Food and Drug...”; for Other Single Gene Variant Analysis: added “The Food and Drug...” | | |
| Added CPT codes 0423U, 0434U, 0437U, 0438U to the policy coding reference table and criteria for Pharmacogenetic Panel Tests. | 11/23 | |
| Semi-annual review. Updated title to reflect V2.2024 version. In Warfarin Sensitivity Analysis Panels, clinical criteria section added to allow coverage of small targeted panels for this indication. Minor rewording for clarity throughout. Coding, reference-table, background and references updated. | 04/24 | 04/24 |

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Important Reminder

This clinical policy has been developed by appropriately experienced and licensed health care professionals based on a review and consideration of currently available generally accepted standards of medical practice; peer-reviewed medical literature; government agency/program approval status; evidence-based guidelines and positions of leading national health professional organizations; views of physicians practicing in relevant clinical areas affected by this clinical policy; and other available clinical information. The Health Plan makes no representations and accepts no liability with respect to the content of any external information used or relied upon in developing this clinical policy. This clinical policy is consistent with standards of medical practice current at the time that this clinical policy was approved. “Health Plan” means a health plan that has adopted this clinical policy and that is operated or administered, in whole or in part, by Centene Management Company, LLC, or any of such health plan’s affiliates, as applicable.

The purpose of this clinical policy is to provide a guide to medical necessity, which is a component of the guidelines used to assist in making coverage decisions and administering benefits. It does not constitute a contract or guarantee regarding payment or results. Coverage decisions and the administration of benefits are subject to all terms, conditions, exclusions, and limitations of the coverage documents (e.g., evidence of coverage, certificate of coverage, policy, contract of insurance, etc.), as well as to state and federal requirements and applicable Health Plan-level administrative policies and procedures.

This clinical policy is effective as of the date determined by the Health Plan. The date of posting may not be the effective date of this clinical policy. This clinical policy may be subject to applicable legal and regulatory requirements relating to provider notification. If there is a discrepancy between the effective date of this clinical policy and any applicable legal or regulatory requirement, the requirements of law and regulation shall govern. The Health Plan retains the right to change, amend or withdraw this clinical policy, and additional clinical policies may be developed and adopted as needed, at any time.

This clinical policy does not constitute medical advice, medical treatment, or medical care. It is not intended to dictate to providers how to practice medicine. Providers are expected to exercise

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professional medical judgment in providing the most appropriate care and are solely responsible for the medical advice and treatment of member/enrollees. This clinical policy is not intended to recommend treatment for member/enrollees. Member/enrollees should consult with their treating physician in connection with diagnosis and treatment decisions.

Providers referred to in this clinical policy are independent contractors who exercise independent judgment and over whom the Health Plan has no control or right of control. Providers are not agents or employees of the Health Plan.

This clinical policy is the property of the Health Plan. Unauthorized copying, use, and distribution of this clinical policy or any information contained herein are strictly prohibited. Providers, member/enrollees, and their representatives are bound to the terms and conditions expressed herein through the terms of their contracts. Where no such contract exists, providers, member/enrollees and their representatives agree to be bound by such terms and conditions by providing services to member/enrollees and/or submitting claims for payment for such services.

Note: For Medicaid member/enrollees, when state Medicaid coverage provisions conflict with the coverage provisions in this clinical policy, state Medicaid coverage provisions take precedence. Please refer to the state Medicaid manual for any coverage provisions pertaining to this clinical policy.

Note: For Medicare member/enrollees, to ensure consistency with the Medicare National Coverage Determinations (NCD) and Local Coverage Determinations (LCD), all applicable NCDs and LCDs and Medicare Coverage Articles should be reviewed prior to applying the criteria set forth in this clinical policy. Refer to the CMS website at <http://www.cms.gov> for additional information.

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