MIRA PRECISION PGx™

PATIENT INFORMATION
NAME: VALIDATION MH19
DOB: 01/Jan/1900
SEX AT BIRTH: Unknown
ReviewGx Patient Profile
TreatGx Patient Profile

SPECIMEN DETAILS
BARCODE: MH19
SAMPLE ID: MH19
TYPE: SWAB
COLLECTED: 01/Jan/2024

ORDERED BY
STUBBED PROVIDER
REPORT
AMENDED: 29/Oct/2024 (UTC)

Medication Summary

The Medication Summary is a list of medications with evidence for the use of pharmacogenetic information, organized by their therapeutic area. Medications are further organized based on drug-gene interactions. Health care providers should consider the information contained in the Medication Report before making any clinical or therapeutic decisions.

1 Mild or no known drug-gene interaction
2 Moderate drug-gene interaction
3 Serious drug-gene interaction: avoid/select alternative

Analgesia

1
Celecoxib
Codeine
Desipramine
Flurbiprofen
Hydrocodone
Ibuprofen
Meloxicam
Nortriptyline
Oliceridine
Piroxicam
Tenoxicam
Tramadol
Venlafaxine

2
Amitriptyline
Imipramine

Autoimmune

1
Siponimod
Tacrolimus

Cancer

1
Erdafitinib
Gefitinib
Tamoxifen

Cardiovascular

1
Carvedilol
Clopidogrel
Mavacamten
Metoprolol
Propafenone

2
Atorvastatin
Fluvastatin
Pitavastatin
Pravastatin
Rosuvastatin
Warfarin

3
Lovastatin
Simvastatin

Endocrinology

1
Nateglinide

Gastroenterology

1
Dronabinol
Meclizine
Metoclopramide
Ondansetron

2
Dexlansoprazole

...Gastroenterology

2
Lansoprazole
Omeprazole
Pantoprazole

Infection

2
Voriconazole

Mental Health

1
Amphetamine
Aripiprazole
Aripiprazole lauroxil
Atomoxetine
Brexpiprazole
Clozapine
Desipramine
Fluvoxamine
Iloperidone
Lofexidine
Nortriptyline
Paroxetine
Perphenazine
Pimozide
Sertraline
Thioridazine
Venlafaxine
Vortioxetine

2
Amitriptyline

...Mental Health

2
Citalopram
Clomipramine
Doxepin
Escitalopram
Imipramine
Trimipramine

Neurology

1
Brivaracetam
Clobazam
Deutetrabenazine
Fosphenytoin
Metoprolol
Phenytoin
Pitolisant
Tetrabenazine
Valbenazine
Venlafaxine

2
Amitriptyline

Rheumatology

1
Celecoxib
Flurbiprofen
Ibuprofen
Meloxicam
Piroxicam
Tenoxicam

Urology

Tolterodine

Other

Abrocitinib
Cevimeline
Eliglustat
Flibanserin

Overview

This pharmacogenetic information is based on best evidence compiled from guidelines and databases including the FDA Table of Pharmacogenetic Associations and the Clinical Pharmacogenetics Implementation Consortium (CPIC). In some cases, PharmGKB and the Dutch Pharmacogenetics Working Group (DPWG) may also be referenced.

This document includes:
1. Medication Summary: A list of medications organized by their therapeutic area of use and sorted based on their drug-gene interaction severity.
2. Medication Report: Provides information about factors affecting medication response.
3. Guidelines: A table of guidelines used to produce each interpretation.
4. References: Sources of information used to create this report.
5. Laboratory Report: Contains genetic test results in a technical table.

TreatGx and ReviewGx are clinical decision support tools that expand on the contents on this report.

TreatGx

TreatGx is clinical decision support software for precision prescribing that identifies condition-specific medication options based on multiple patient factors.

ReviewGx

ReviewGx uses patient factors including pharmacogenetics to highlight medication safety issues, help optimize medications, and identify deprescribing opportunities.

Components of the Medication Report

For all medications, clinical factors, medical conditions, lab values, drug-gene and drug-drug interactions may contribute to medication response and should be evaluated for each patient. The kidney and liver icon notations are intended for informational purposes only. The patient's kidney/liver function are not used for the purposes of displaying this information, and the potential interactions for that specific medication may not apply. TreatGx and ReviewGx help integrate this information to support precision prescribing and comprehensive medication management. The final genotype/phenotype call is at the discretion of the laboratory director. Medication changes should only be initiated at the discretion of the patient's healthcare provider after a full assessment.

Example:

Generic Name

Brand Names

Potential Kidney or Liver Interaction

Codeine	Phenotype	Genetic Test	Results	Source/Evidence
Codeine Contin Tylenol with Codeine No. 2/3/4	Poor metabolizer	CYP2D6	*3/*6	CPIC A[6]; FDA 1[34]

CYP2D6 poor metabolizer: greatly reduced metabolism of Codeine may result in decreased response

3 Avoid Codeine use

TreatGx
ReviewGx

Source/Evidence for Drug-Gene Interactions:

For each medication, a source is listed for each drug-gene interaction. This report prioritizes guidance from CPIC if the drug-gene pair is assigned a CPIC Level of A or B. This is the threshold that CPIC defines as having sufficient evidence for at least one prescribing action to be recommended. See cpicpgx.org/prioritization for a full explanation of CPIC Levels for Genes/Drugs.

Pharmacogenetic information from FDA-approved drug labels or the FDA Table of Pharmacogenetic Associations (https://www.fda.gov/medical-devices/precision-medicine/table-pharmacogenetic-associations) is included when available.

If there is no CPIC guideline (level A or B) or FDA guidance, other sources may be referenced, such as DPWG guidelines, PharmGKB clinical annotations, and in some instances, clinical studies. See https://www.pharmgkb.org/page/clinAnnLevels for a full explanation of PharmGKB levels of evidence. Use of any of this information is at the discretion of the health professional.

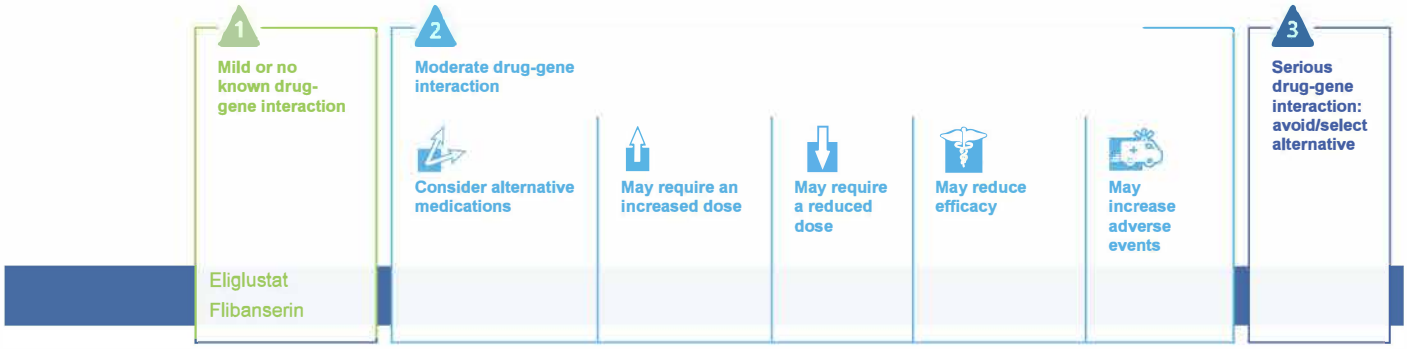
* Other clinical factors, medical conditions and drug-drug interactions may contribute to medication response.

Medication Summary Table

Some medications may appear in multiple columns below due to various possible effects of the drug-gene interaction. For warfarin, several factors influence dosing calculation alongside PGx. See Medication Report for details.

	1 Mild or no known drug-gene interaction	2 Moderate drug-gene interaction: Consider alternative medications	2 Moderate drug-gene interaction: May require an increased dose	2 Moderate drug-gene interaction: May require a reduced dose	2 Moderate drug-gene interaction: May reduce efficacy	2 Moderate drug-gene interaction: May increase adverse events	3 Serious drug-gene interaction: avoid/select alternative
Analgesia	Celecoxib Codeine Desipramine Flurbiprofen Hydrocodone Ibuprofen Meloxicam Nortriptyline Oliceridine Piroxicam Tenoxicam Tramadol Venlafaxine	Amitriptyline Imipramine			Amitriptyline Imipramine	Amitriptyline Imipramine	
Autoimmune	Siponimod Tacrolimus						
Cancer	Erdafitinib Gefitinib Tamoxifen						
Cardiovascular	Carvedilol Clopidogrel Mavacamten Metoprolol Propafenone	Pitavastatin	Warfarin	Atorvastatin Fluvastatin Pitavastatin Pravastatin Rosuvastatin Warfarin	Warfarin	Atorvastatin Fluvastatin Pitavastatin Pravastatin Rosuvastatin Warfarin	Lovastatin Simvastatin
Endocrinology	Nateglinide						
Gastroenterology	Dronabinol Meclizine Metoclopramide Ondansetron		Dexlansoprazole Lansoprazole Omeprazole Pantoprazole		Dexlansoprazole Lansoprazole Omeprazole Pantoprazole		
Infection		Voriconazole			Voriconazole		

	1 Mild or no known drug-gene interaction	2 Moderate drug-gene interaction: Consider alternative medications	2 Moderate drug-gene interaction: May require an increased dose	2 Moderate drug-gene interaction: May require a reduced dose	2 Moderate drug-gene interaction: May reduce efficacy	2 Moderate drug-gene interaction: May increase adverse events	3 Serious drug-gene interaction: avoid/select alternative
Mental Health	Amphetamine Aripiprazole Aripiprazole lauroxil Atomoxetine Brexpiprazole Clozapine Desipramine Fluvoxamine Iloperidone Lofexidine Nortriptyline Paroxetine Perphenazine Pimozide Sertraline Thioridazine Venlafaxine Vortioxetine	Amitriptyline Citalopram Clomipramine Doxepin Escitalopram Imipramine Trimipramine	Citalopram Escitalopram		Amitriptyline Citalopram Clomipramine Doxepin Escitalopram Imipramine Trimipramine	Amitriptyline Clomipramine Doxepin Imipramine Trimipramine	
Neurology	Brivaracetam Clobazam Deutetrabenazine Fosphenytoin Metoprolol Phenytoin Pitolisant Tetrabenazine Valbenazine Venlafaxine	Amitriptyline			Amitriptyline	Amitriptyline	
Rheumatology	Celecoxib Flurbiprofen Ibuprofen Meloxicam Piroxicam Tenoxicam						
Urology	Tolterodine						
Other	Abrocitinib Cevimeline						


1
Mild or no known drug-gene interaction
2
Moderate drug-gene interaction
Consider alternative medications
May require an increased dose
May require a reduced dose
May reduce efficacy
May increase adverse events
3
Serious drug-gene interaction: avoid/select alternative
Eliglustat
Flibanserin

Medication Report

The **Medication Report** provides information on how pharmacogenetic results affect each medication.

Use TreatGx and ReviewGx to explore personalized medication treatment options, dosing information and medication optimization.

Abrocitinib	Phenotype	Genetic Test	Results	Source/Evidence
Cibinqo	Ultrarapid metabolizer	CYP2C19	*17/*17	FDA 1[39]
ReviewGx	FDA PGx Table: no information for this phenotype.			

Amitriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Elavil Levate	Normal metabolizer	CYP2D6	*1/*1	CPIC A[20]
	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[20]
TreatGx ReviewGx	CPIC – CYP2D6 Implication: Normal metabolism of TCAs.			
	CPIC – CYP2C19 Implication: Increased metabolism of tertiary amines compared to normal metabolizers. Greater conversion of tertiary amines to secondary amines may affect response or side effects.			
	2 CPIC – Optional Recommendation: Consider alternative drug not metabolized by CYP2C19. If use is warranted, utilize therapeutic drug monitoring to guide dose adjustment. TCAs without major CYP2C19 metabolism include the secondary amines nortriptyline and desipramine. Recommendations above only apply to higher initial doses of TCAs for treatment of conditions such as depression. Lower dosages are often used for neuropathic pain compared to depressive disorders. There are limited data to support dose recommendations for CYP2C19*17 carriers who are prescribed TCAs at lower doses for neuropathic pain treatment.			

Amphetamine	Phenotype	Genetic Test	Results	Source/Evidence
Adzenys	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]
TreatGx ReviewGx	CYP2D6 alleles do not indicate changes from recommended dose			

Aripiprazole	Phenotype	Genetic Test	Results	Source/Evidence
Abilify	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]
TreatGx ReviewGx	FDA PGx Table: no information for this CYP2D6 phenotype.			

Aripiprazole lauroxil	Phenotype	Genetic Test	Results	Source/Evidence
Aristada	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]
TreatGx ReviewGx	FDA PGx Table: no information for this CYP2D6 phenotype.			

Atomoxetine	Phenotype	Genetic Test	Results	Source/Evidence
Strattera	Normal metabolizer	CYP2D6 (Activity Score)	*1/*1	CPIC A[8]; FDA 1[39]
TreatGx ReviewGx	CYP2D6 alleles do not indicate changes from recommended dose			

Atorvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Lipitor	Decreased function	SLCO1B1	*1/*5	CPIC A[10]

TreatGx
ReviewGx

CPIC – Implication: Increased Atorvastatin exposure as compared with normal function, which may translate to increased myopathy risk.

2 CPIC – Moderate Recommendation: Prescribe ≤40 mg as a starting dose and adjust doses of atorvastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy especially for 40 mg dose. If dose >40 mg needed for desired efficacy, consider combination therapy (i.e., atorvastatin plus non-statin guideline-directed medical therapy).
The potential for drug-drug interactions and dose limits based on renal and hepatic function should be evaluated prior to initiating a statin. The effects of drug-drug interactions may be more pronounced, resulting in a higher risk of myopathy.

Brexpiprazole	Phenotype	Genetic Test	Results	Source/Evidence
Rexulti	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

TreatGx
ReviewGx

FDA PGx Table: no information for this CYP2D6 phenotype.

Brivaracetam	Phenotype	Genetic Test	Results	Source/Evidence
Briviact Brivlera	Ultrarapid metabolizer	CYP2C19	*17/*17	FDA 1[39]

ReviewGx

CYP2C19 alleles do not indicate changes from recommended dose

Carvedilol	Phenotype	Genetic Test	Results	Source/Evidence
Coreg	Normal metabolizer	CYP2D6	*1/*1	FDA 2[39]

TreatGx
ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

Celecoxib	Phenotype	Genetic Test	Results	Source/Evidence
Celebrex	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]; FDA 1[39]

TreatGx
ReviewGx

CYP2C9 alleles do not indicate changes from recommended dose

Cevimeline	Phenotype	Genetic Test	Results	Source/Evidence
Evoxac	Normal metabolizer	CYP2D6	*1/*1	FDA 2[39]

ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

Citalopram	Phenotype	Genetic Test	Results	Source/Evidence
Celexa	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[7]; FDA 1[39]

TreatGx
ReviewGx

Increased metabolism of citalopram and escitalopram to less active compounds when compared with CYP2C19 rapid and normal metabolizers. Lower plasma concentrations decrease the probability of clinical benefit.

2 Consider a clinically appropriate alternative antidepressant not predominantly metabolized by CYP2C19. If citalopram or escitalopram are clinically appropriate, and adequate efficacy is not achieved at standard maintenance dosing, consider titrating to a higher maintenance dose (per CPIC strong recommendation).

Clobazam	Phenotype	Genetic Test	Results	Source/Evidence
Onfi Sympazan	Ultrarapid metabolizer	CYP2C19	*17/*17	FDA 1[39]

FDA PGx Table: no information for this CYP2C19 phenotype.

ReviewGx

Clomipramine	Phenotype	Genetic Test	Results	Source/Evidence
Anafranil	Normal metabolizer	CYP2D6	*1/*1	CPIC B[20]
	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC B[20]

ReviewGx

CPIC – CYP2D6 Implication: Normal metabolism of TCAs.

CPIC – CYP2C19 Implication: Increased metabolism of tertiary amines compared to normal metabolizers. Greater conversion of tertiary amines to secondary amines may affect response or side effects.

2 CPIC – Optional Recommendation: Consider alternative drug not metabolized by CYP2C19. If use is warranted, utilize therapeutic drug monitoring to guide dose adjustment. TCAs without major CYP2C19 metabolism include the secondary amines nortriptyline and desipramine.
Recommendations above only apply to higher initial doses of TCAs for treatment of conditions such as depression. Lower dosages are often used for neuropathic pain compared to depressive disorders. There are limited data to support dose recommendations for CYP2C19*17 carriers who are prescribed TCAs at lower doses for neuropathic pain treatment.

Clopidogrel	Phenotype	Genetic Test	Results	Source/Evidence
Plavix	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[23]; FDA 1[39]

TreatGx
ReviewGx

CYP2C19 alleles do not indicate changes from recommended dose

Clozapine	Phenotype	Genetic Test	Results	Source/Evidence
Clozaril Fazaclo ODT Versacloz	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

FDA PGx Table: no information for this CYP2D6 phenotype.

TreatGx
ReviewGx

Codeine	Phenotype	Genetic Test	Results	Source/Evidence
Codeine Contin Tylenol with Codeine No. 2/3/4	Normal metabolizer	CYP2D6	*1/*1	CPIC A[11]; FDA 1[39]; FDA 2[39]

CPIC – Implication: Expected morphine formation.

CPIC – Strong Recommendation: Use codeine label recommended age-specific or weight-specific dosing.

TreatGx
ReviewGx

Desipramine	Phenotype	Genetic Test	Results	Source/Evidence
Norpramin	Normal metabolizer	CYP2D6	*1/*1	CPIC B[20]

TreatGx
ReviewGx

CPIC – CYP2D6 Implication: Normal metabolism of TCAs.

CPIC – Strong Recommendation: Initiate therapy with recommended starting dose. Patients may receive an initial low dose of a tricyclic, which is then increased over several days to the recommended steady-state dose. The starting dose in this guideline refers to the recommended steady-state dose.

Deutetrabenazine	Phenotype	Genetic Test	Results	Source/Evidence
Austedo	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

Dexlansoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Dexilant	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC B[24]

TreatGx
ReviewGx

CPIC – Implication: Decreased plasma concentrations of PPIs compared with CYP2C19 NMs; increased risk of therapeutic failure.

2 CPIC – Optional Recommendation: Increase starting daily dose by 100%. Daily dose may be given in divided doses. Monitor for efficacy.

Doxepin	Phenotype	Genetic Test	Results	Source/Evidence
Silenor Sinequan	Normal metabolizer	CYP2D6	*1/*1	CPIC B[20]
	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC B[20]

TreatGx
ReviewGx

CPIC – CYP2D6 Implication: Normal metabolism of TCAs.

CPIC – CYP2C19 Implication: Increased metabolism of tertiary amines compared to normal metabolizers. Greater conversion of tertiary amines to secondary amines may affect response or side effects.

2 CPIC – Optional Recommendation: Consider alternative drug not metabolized by CYP2C19. If use is warranted, utilize therapeutic drug monitoring to guide dose adjustment. TCAs without major CYP2C19 metabolism include the secondary amines nortriptyline and desipramine.
Recommendations above only apply to higher initial doses of TCAs for treatment of conditions such as depression. Lower dosages are often used for neuropathic pain compared to depressive disorders. There are limited data to support dose recommendations for CYP2C19*17 carriers who are prescribed TCAs at lower doses for neuropathic pain treatment.

Dronabinol	Phenotype	Genetic Test	Results	Source/Evidence
Marinol Syndros	Normal metabolizer	CYP2C9	*1/*1	FDA 1[39]

ReviewGx

CYP2C9 alleles do not indicate changes from recommended dose

Eliglustat	Phenotype	Genetic Test	Results	Source/Evidence
Cerdelga	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

ReviewGx

Multiple drug-drug interactions may further affect the safety of Eliglustat, refer to drug monograph or FDA labelling for dosing recommendations

Erdafitinib	Phenotype	Genetic Test	Results	Source/Evidence
Balversa	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	FDA 1[39]

ReviewGx

FDA PGx Table: no information for this CYP2C9 star allele result.

Escitalopram	Phenotype	Genetic Test	Results	Source/Evidence
Cipralex Lexapro	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[7]

Increased metabolism of citalopram and escitalopram to less active compounds when compared with CYP2C19 rapid and normal metabolizers. Lower plasma concentrations decrease the probability of clinical benefit.

TreatGx
ReviewGx

2 Consider a clinically appropriate alternative antidepressant not predominantly metabolized by CYP2C19. If citalopram or escitalopram are clinically appropriate, and adequate efficacy is not achieved at standard maintenance dosing, consider titrating to a higher maintenance dose (per CPIC strong recommendation).

Flibanserin	Phenotype	Genetic Test	Results	Source/Evidence
Addyi	Ultrarapid metabolizer	CYP2C19	*17/*17	FDA 1[39]

CYP2C19 alleles do not indicate changes from recommended dose

ReviewGx

Flurbiprofen	Phenotype	Genetic Test	Results	Source/Evidence
Ansaid	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]; FDA 1[39]

CYP2C9 alleles do not indicate changes from recommended dose

TreatGx
ReviewGx

Fluvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Lescol	Normal metabolizer	CYP2C9	*1/*1	CPIC A[10]
	Decreased function	SLCO1B1	*1/*5	CPIC A[10]

CPIC – CYP2C9 Implication: Normal exposure.

CPIC – SLCO1B1 Implication: Increased fluvastatin exposure as compared with normal function; typical myopathy risk with doses ≤40 mg.

TreatGx
ReviewGx

2 CPIC – Moderate Recommendation: Prescribe desired starting dose and adjust doses of fluvastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy especially for doses >40 mg per day.
The potential for drug-drug interactions and dose limits based on renal and hepatic function should be evaluated prior to initiating a statin. The effects of drug-drug interactions may be more pronounced, resulting in a higher risk of myopathy.

Fluvoxamine	Phenotype	Genetic Test	Results	Source/Evidence
Luvox	Normal metabolizer	CYP2D6	*1/*1	CPIC B[7]

Normal CYP2D6 metabolism

TreatGx
ReviewGx

Initiate therapy with recommended starting dose (per CPIC strong recommendation).

Fosphenytoin	Phenotype	Genetic Test	Results	Source/Evidence
Cerebyx	Normal metabolizer	CYP2C9	*1/*1	CPIC A[22]; FDA 1[39]

CYP2C9 normal metabolizer: normal metabolism of Fosphenytoin to less active compounds

CYP2C9 alleles do not indicate changes from recommended dose

ReviewGx

Gefitinib	Phenotype	Genetic Test	Results	Source/Evidence
Iressa	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

ReviewGx

FDA PGx Table: no information for this phenotype.

Hydrocodone	Phenotype	Genetic Test	Results	Source/Evidence
Hysingla Zohydro	Normal metabolizer	CYP2D6	*1/*1	CPIC B[11]

CPIC – Implication: Normal hydromorphone formation.

CPIC – Strong Recommendation: Use hydrocodone label recommended age-specific or weight-specific dosing.

TreatGx
ReviewGx

Ibuprofen	Phenotype	Genetic Test	Results	Source/Evidence
Advil Caldolor Duexis Motrin IB NeoProfen	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]

CYP2C9 alleles do not indicate changes from recommended dose

TreatGx
ReviewGx

Iloperidone	Phenotype	Genetic Test	Results	Source/Evidence
Fanapt	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

FDA PGx Table: no information for this CYP2D6 phenotype.

TreatGx
ReviewGx

Imipramine	Phenotype	Genetic Test	Results	Source/Evidence
Tofranil	Normal metabolizer	CYP2D6	*1/*1	CPIC B[20]
	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC B[20]

TreatGx
ReviewGx

CPIC – CYP2D6 Implication: Normal metabolism of TCAs.

CPIC – CYP2C19 Implication: Increased metabolism of tertiary amines compared to normal metabolizers. Greater conversion of tertiary amines to secondary amines may affect response or side effects.

2 CPIC – Optional Recommendation: Consider alternative drug not metabolized by CYP2C19. If use is warranted, utilize therapeutic drug monitoring to guide dose adjustment. TCAs without major CYP2C19 metabolism include the secondary amines nortriptyline and desipramine.
Recommendations above only apply to higher initial doses of TCAs for treatment of conditions such as depression. Lower dosages are often used for neuropathic pain compared to depressive disorders. There are limited data to support dose recommendations for CYP2C19*17 carriers who are prescribed TCAs at lower doses for neuropathic pain treatment.

Lansoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Prevacid	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[24]

TreatGx
ReviewGx

CPIC – Implication: Decreased plasma concentrations of PPIs compared with CYP2C19 NMs; increased risk of therapeutic failure.

2 CPIC – Optional Recommendation: Increase starting daily dose by 100%. Daily dose may be given in divided doses. Monitor for efficacy.

Lofexidine	Phenotype	Genetic Test	Results	Source/Evidence
Lucemyra	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

ReviewGx

Lovastatin	Phenotype	Genetic Test	Results	Source/Evidence
Altoprev	Decreased function	SLCO1B1	*1/*5	CPIC A[10]

CPIC – Implication: Increased lovastatin acid exposure as compared with normal function, which may translate to increased myopathy risk.

TreatGx
ReviewGx

3 CPIC – Moderate Recommendation: Prescribe an alternative statin depending on the desired potency. If lovastatin therapy is warranted, limit dose to ≤20 mg/day.
The potential for drug-drug interactions and dose limits based on renal and hepatic function should be evaluated prior to initiating a statin. The effects of drug-drug interactions may be more pronounced, resulting in a higher risk of myopathy.

Mavacamten	Phenotype	Genetic Test	Results	Source/Evidence
Camzyos	Ultrarapid metabolizer	CYP2C19	*17/*17	FDA 2[39]

ReviewGx

FDA PGx Table: no information for this phenotype.

Meclizine	Phenotype	Genetic Test	Results	Source/Evidence
Antivert	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

Meloxicam	Phenotype	Genetic Test	Results	Source/Evidence
Anjeso Mobic Qmiiz ODT Vivlodex	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]; FDA 1[39]

CYP2C9 alleles do not indicate changes from recommended dose

TreatGx
ReviewGx

Metoclopramide	Phenotype	Genetic Test	Results	Source/Evidence
Metonia Reglan	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

TreatGx
ReviewGx

Metoprolol	Phenotype	Genetic Test	Results	Source/Evidence
Kapspargo Sprinkle Lopressor Toprol-XL	Normal metabolizer	CYP2D6	*1/*1	CPIC B[13]

CPIC – Implication: Normal metabolism of metoprolol.

CPIC – Strong Recommendation: Initiate standard dosing.

TreatGx
ReviewGx

Nateglinide	Phenotype	Genetic Test	Results	Source/Evidence
	Normal metabolizer	CYP2C9	*1/*1	FDA 1[39]

ReviewGx

FDA PGx Table: no information for this phenotype.

Nortriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Aventyl Pamelor TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*1	CPIC A[20]
	CPIC – CYP2D6 Implication: Normal metabolism of TCAs.			
	CPIC – Strong Recommendation: Initiate therapy with recommended starting dose. Patients may receive an initial low dose of a tricyclic, which is then increased over several days to the recommended steady-state dose. The starting dose in this guideline refers to the recommended steady-state dose.			

Oliceridine	Phenotype	Genetic Test	Results	Source/Evidence
Olinvyk ReviewGx	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]
	FDA PGx Table: no information for this phenotype.			

Omeprazole	Phenotype	Genetic Test	Results	Source/Evidence
Losec Olex Prilosec TreatGx ReviewGx	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[24]
	CPIC – Implication: Decreased plasma concentrations of PPIs compared with CYP2C19 NMs; increased risk of therapeutic failure.			
	2 CPIC – Optional Recommendation: Increase starting daily dose by 100%. Daily dose may be given in divided doses. Monitor for efficacy.			

Ondansetron	Phenotype	Genetic Test	Results	Source/Evidence
Zofran Zuplenz ReviewGx	Normal metabolizer	CYP2D6	*1/*1	CPIC A[5]
	CYP2D6 alleles do not indicate changes from recommended dose			

Pantoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Pantoloc Protonix Tecta TreatGx ReviewGx	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[24]; FDA 1[39]
	CPIC – Implication: Decreased plasma concentrations of PPIs compared with CYP2C19 NMs; increased risk of therapeutic failure.			
	2 CPIC – Optional Recommendation: Increase starting daily dose by 100%. Daily dose may be given in divided doses. Monitor for efficacy.			

Paroxetine	Phenotype	Genetic Test	Results	Source/Evidence
Brisdelle Paxil Pexeva TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*1	CPIC A[7]
	Normal metabolism of paroxetine to less active compounds. Paroxetine-associated phenoconversion of normal metabolizers to intermediate or poor metabolizers due to CYP2D6 autoinhibition may occur and is dose-dependent and greater at steady state concentrations.			
	Initiate therapy with recommended starting dose (per CPIC strong recommendation).			

Perphenazine	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*1	FDA 2[39]
	FDA PGx Table: no information for this CYP2D6 phenotype.			

Phenytoin	Phenotype	Genetic Test	Results	Source/Evidence
Dilantin Tremytoine Phenytek	Normal metabolizer	CYP2C9	*1/*1	CPIC A[22]; FDA 1[39]

CYP2C9 normal metabolizer: normal metabolism of Phenytoin to less active compounds

CYP2C9 alleles do not indicate changes from recommended dose

ReviewGx

Pimozide	Phenotype	Genetic Test	Results	Source/Evidence
Orap	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

TreatGx
ReviewGx

FDA PGx Table: no information for this CYP2D6 phenotype.

Piroxicam	Phenotype	Genetic Test	Results	Source/Evidence
Feldene	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]; FDA 1[39]

TreatGx
ReviewGx

CYP2C9 alleles do not indicate changes from recommended dose

Pitavastatin	Phenotype	Genetic Test	Results	Source/Evidence
Livalo Zypitamag	Decreased function	SLCO1B1	*1/*5	CPIC A[10]

CPIC – Implication: Increased Pitavastatin exposure as compared with normal function, which may translate to increased myopathy risk.

TreatGx
ReviewGx

2 CPIC – Moderate Recommendation: Prescribe ≤2 mg as a starting dose and adjust doses of pitavastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy especially for doses >1 mg. If dose >2 mg needed for desired efficacy, consider an alternative statin or combination therapy (i.e., pitavastatin plus non-statin guideline-directed medical therapy).
The potential for drug-drug interactions and dose limits based on renal and hepatic function should be evaluated prior to initiating a statin. The effects of drug-drug interactions may be more pronounced, resulting in a higher risk of myopathy.

Pitolisant	Phenotype	Genetic Test	Results	Source/Evidence
Wakix	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

FDA PGx Table: no information for this phenotype.

ReviewGx

Pravastatin	Phenotype	Genetic Test	Results	Source/Evidence
Pravachol	Decreased function	SLCO1B1	*1/*5	CPIC A[10]

CPIC – Implication: Increased pravastatin exposure as compared with normal function; typical myopathy risk with doses ≤40 mg.

TreatGx
ReviewGx

2 CPIC – Moderate Recommendation: Prescribe desired starting dose and adjust doses of pravastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy with pravastatin especially with doses >40 mg per day.
The potential for drug-drug interactions and dose limits based on renal and hepatic function should be evaluated prior to initiating a statin. The effects of drug-drug interactions may be more pronounced, resulting in a higher risk of myopathy.

Propafenone	Phenotype	Genetic Test	Results	Source/Evidence
Rythmol	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

TreatGx
ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

Rosuvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Crestor	Decreased function	SLCO1B1	*1/*5	CPIC A[10]

TreatGx ReviewGx

CPIC – SLCO1B1 Implication: Increased rosuvastatin exposure as compared with normal function; typical myopathy risk with doses ≤20 mg.

2 CPIC – Strong Recommendation: Prescribe desired starting dose and adjust doses of rosuvastatin based on disease-specific and population-specific guidelines. Prescriber should be aware of possible increased risk for myopathy especially for doses >20 mg.
The potential for drug-drug interactions and dose limits based on renal and hepatic function and Asian ancestry should be evaluated prior to initiating a statin. The effects of drug-drug interactions may be more pronounced, resulting in a higher risk of myopathy.

Sertraline	Phenotype	Genetic Test	Results	Source/Evidence
Zoloft	Undetermined	CYP2B6	*1/*6 or *1/*9	CPIC B[7]
	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[7]

TreatGx ReviewGx

Small increase in metabolism of sertraline to less active compounds when compared with CYP2C19 normal metabolizers.

Initiate therapy with recommended starting dose (per CPIC strong recommendation).

Simvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Zocor Flolipid	Decreased function	SLCO1B1	*1/*5	CPIC A[10]; FDA 2[39]

CPIC – Implication: Increased simvastatin acid exposure as compared with normal function; increased risk of myopathy.

TreatGx ReviewGx

3 CPIC – Strong Recommendation: Prescribe an alternative statin depending on the desired potency. If simvastatin therapy is warranted, limit dose to <20 mg/day.
The potential for drug-drug interactions and dose limits based on renal and hepatic function should be evaluated prior to initiating a statin. The effects of drug-drug interactions may be more pronounced, resulting in a higher risk of myopathy.

Siponimod	Phenotype	Genetic Test	Results	Source/Evidence
Mayzent	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	FDA 1[39]

ReviewGx

CYP2C9 alleles do not indicate changes from recommended dose

Tacrolimus	Phenotype	Genetic Test	Results	Source/Evidence
Advagraf Astagraf XL Envarsus XR Prograf Protopic	Poor metabolizer	CYP3A5	*3/*3	CPIC A[6]; FDA 1[39]

ReviewGx

CPIC – CYP3A5 Implication: Higher ("normal") dose-adjusted trough concentrations of tacrolimus and increased chance of achieving target tacrolimus concentrations.
CPIC – CYP3A5 Strong Recommendation: Initiate therapy with standard recommended dose. Use therapeutic drug monitoring to guide dose adjustments. This recommendation includes the use of tacrolimus in kidney, heart, lung, and hematopoietic stem cell transplant patients, and liver transplant patients in which the donor and recipient genotypes are identical.

Tamoxifen	Phenotype	Genetic Test	Results	Source/Evidence
Nolvadex Soltamox	Normal metabolizer	CYP2D6 (Activity Score)	*1/*1	CPIC A[17]

ReviewGx

CYP2D6 normal metabolizer: typical metabolism of Tamoxifen to endoxifen

Strong CPIC recommendation for breast cancer therapy: Initiate therapy with recommended standard of care dosing. Avoid moderate and strong CYP2D6 inhibitors.

Tenoxicam	Phenotype	Genetic Test	Results	Source/Evidence
Mobiflex	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]

CYP2C9 alleles do not indicate changes from recommended dose

ReviewGx

Tetrabenazine	Phenotype	Genetic Test	Results	Source/Evidence
Austedo Nitoman Xenazine	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

ReviewGx

Thioridazine	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]

FDA PGx Table: no information for this CYP2D6 phenotype.

Tolterodine	Phenotype	Genetic Test	Results	Source/Evidence
Detrol	Normal metabolizer	CYP2D6	*1/*1	FDA 2[39]

CYP2D6 alleles do not indicate changes from recommended dose

TreatGx
ReviewGx

Tramadol	Phenotype	Genetic Test	Results	Source/Evidence
Conzip Durela Ralivia Ultram Zytram XL	Normal metabolizer	CYP2D6	*1/*1	CPIC A[11]; FDA 1[39]; FDA 2[39]

CPIC – Implication: Expected O-desmethyltramadol (active metabolite) formation.

CPIC – Strong Recommendation: Use tramadol label recommended age specific or weight-specific dosing.

TreatGx
ReviewGx

Trimipramine	Phenotype	Genetic Test	Results	Source/Evidence
Surmontil	Normal metabolizer	CYP2D6	*1/*1	CPIC B[20]
ReviewGx	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC B[20]

CPIC – CYP2D6 Implication: Normal metabolism of TCAs.

CPIC – CYP2C19 Implication: Increased metabolism of tertiary amines compared to normal metabolizers. Greater conversion of tertiary amines to secondary amines may affect response or side effects.

2 CPIC – Optional Recommendation: Consider alternative drug not metabolized by CYP2C19. If use is warranted, utilize therapeutic drug monitoring to guide dose adjustment. TCAs without major CYP2C19 metabolism include the secondary amines nortriptyline and desipramine.
Recommendations above only apply to higher initial doses of TCAs for treatment of conditions such as depression. Lower dosages are often used for neuropathic pain compared to depressive disorders. There are limited data to support dose recommendations for CYP2C19*17 carriers who are prescribed TCAs at lower doses for neuropathic pain treatment.

Valbenazine	Phenotype	Genetic Test	Results	Source/Evidence
Ingrezza	Normal metabolizer	CYP2D6	*1/*1	FDA 1[39]
ReviewGx				

CYP2D6 alleles do not indicate changes from recommended dose

Venlafaxine	Phenotype	Genetic Test	Results	Source/Evidence
Effexor XR	Normal metabolizer	CYP2D6	*1/*1	CPIC B[7]; FDA 1[39]
TreatGx ReviewGx				

Normal CYP2D6 metabolism

Initiate therapy with recommended starting dose (per CPIC strong recommendation).

Voriconazole	Phenotype	Genetic Test	Results	Source/Evidence
Vfend	Ultrarapid metabolizer	CYP2C19	*17/*17	CPIC A[28]; FDA 2[39]
ReviewGx				

CYP2C19 ultrarapid metabolizer: increased metabolism of Voriconazole to less active compounds

Lower plasma concentrations of active drug may reduce response

2 Consider an alternative drug not predominantly metabolized by CYP2C19

Vortioxetine	Phenotype	Genetic Test	Results	Source/Evidence
Trintellix	Normal metabolizer	CYP2D6	*1/*1	CPIC A[7]; FDA 1[39]
TreatGx ReviewGx				

Normal CYP2D6 metabolism

Initiate therapy with recommended starting dose (per CPIC strong recommendation).

Warfarin	Phenotype	Genetic Test	Results	Source/Evidence
Coumadin Jantoven TreatGx ReviewGx	Normal metabolizer	CYP2C9	*1/*1	CPIC A[21]; FDA 1[39]
	Increased response	VKORC1 rs9923231	G/A	CPIC A[21]; FDA 1[39]

2

CPIC – Strong Recommendation for Non-African ancestry/Moderate Recommendation for African ancestry: Calculate initial dose based on validated published pharmacogenetic algorithms, using results for VKORC1-1639G>A and CYP2C9 *2 and *3.
It is important to note that these algorithms do not include CYP4F2, CYP2C9*5, *6, *8 or *11, or rs12777823, and incorporation of these should be added when results are available.

The International Warfarin Pharmacogenetics Consortium (IWPC) dosing algorithm is available online at: https://files.cpicpgx.org/data/guideline/publication/warfarin/2011/IWPC_dose_calculator.xls

Another option http://warfarindosing.org/ contains Gage as the primary algorithm and IWPC as the secondary algorithm, and can adjust for CYP4F2, CYP2C9*5, and *6.

The two algorithms provide very similar dose recommendations. Most algorithms are developed for target INR 2-3.

The IWPC algorithm is available within the TreatGx software (see Atrial Fibrillation – Anticoagulation), accounting for all factors from the IWPC calculation (height, weight, age, VKORC1, CYP2C9*2 and *3, ethnicity/race, drug-drug interactions) along with additional optional adjustments for CYP2C9 *5, *6, *8, *11, CYP4F2 rs2108622, CYP2C rs12777823, smoking, and target INR other than 2-3.

An alternative is to use the FDA-approved warfarin label table, which provides expected maintenance dose ranges based on VKORC1 and CYP2C9 results.

CPIC – Optional Recommendation: For loading dose, a pharmacogenetics-based warfarin initiation dose algorithm could be considered. See the EU-PACT trial for pharmacogenetics-based warfarin initiation (loading) dose algorithm. https://www.nejm.org/doi/full/10.1056/NEJMoa1311386

References

https://www.genxys.com/lab-references

Table of Available References

Drug	Genetic Test	Sources
Abrocitinib	CYP2C19	FDA[31,39]
Amitriptyline	CYP2D6	CPIC[20]; FDA[39]
Amitriptyline	CYP2C19	CPIC[20]
Amoxapine	CYP2D6	FDA[39]
Amphetamine	CYP2D6	FDA[39]
Aripiprazole	CYP2D6	FDA[39]
Aripiprazole lauroxil	CYP2D6	FDA[39]
Atomoxetine	CYP2D6 (Activity Score)	CPIC[8]; FDA[39]
Atorvastatin	SLCO1B1	CPIC[10]; FDA[39]
Avatrombopag	CYP2C9	FDA[39]
Brexpiprazole	CYP2D6	FDA[39]
Brivaracetam	CYP2C19	FDA[39]
Carisoprodol	CYP2C19	FDA[39]
Carvedilol	CYP2D6	FDA[39]
Celecoxib	CYP2C9 (Star Alleles)	CPIC[38]; FDA[39]
Cevimeline	CYP2D6	FDA[39]
Citalopram	CYP2C19	CPIC[7]; FDA[39]
Clobazam	CYP2C19	FDA[39]
Clomipramine	CYP2D6	CPIC[20]; FDA[39]
Clomipramine	CYP2C19	CPIC[20]
Clopidogrel	CYP2C19	CPIC[23]; FDA[39]
Clozapine	CYP2D6	FDA[39]
Codeine	CYP2D6	CPIC[11]; FDA[39]
Darifenacin	CYP2D6	FDA[39]
Desipramine	CYP2D6	CPIC[20]; FDA[39]
Deutetrabenazine	CYP2D6	FDA[39]
Dexlansoprazole	CYP2C19	CPIC[24]; FDA[39]
Diazepam	CYP2C19	FDA[39]
Donepezil	CYP2D6	FDA[39]
Doxepin	CYP2D6	CPIC[20]; FDA[39]
Doxepin	CYP2C19	CPIC[20]; FDA[39]
Dronabinol	CYP2C9	FDA[39]
Elagolix	SLCO1B1	FDA[39]
Eliglustat	CYP2D6	FDA[39]
Erdafitinib	CYP2C9 (Star Alleles)	FDA[39]
Escitalopram	CYP2C19	CPIC[7]; FDA[39]
Esomeprazole	CYP2C19	FDA[39]
Fesoterodine	CYP2D6	FDA[39]
Flibanserin	CYP2C19	FDA[39]
Flurbiprofen	CYP2C9 (Star Alleles)	CPIC[38]; FDA[39]
Fluvastatin	CYP2C9	CPIC[10]
Fluvastatin	SLCO1B1	CPIC[10]
Fluvoxamine	CYP2D6	CPIC[7]; FDA[39]
Fosphenytoin	CYP2C9	CPIC[22]; FDA[39]

Drug	Genetic Test	Sources
Galantamine	CYP2D6	FDA[39]
Gefitinib	CYP2D6	FDA[39]
Hydrocodone	CYP2D6	CPIC[11]
Ibuprofen	CYP2C9 (Star Alleles)	CPIC[38]; FDA[39]
Iloperidone	CYP2D6	FDA[39]
Imipramine	CYP2D6	CPIC[20]; FDA[39]
Imipramine	CYP2C19	CPIC[20]
Lansoprazole	CYP2C19	CPIC[24]; FDA[39]
Lofexidine	CYP2D6	FDA[39]
Lovastatin	SLCO1B1	CPIC[10]
Mavacamten	CYP2C19	FDA[39]
Meclizine	CYP2D6	FDA[39]
Meloxicam	CYP2C9 (Star Alleles)	CPIC[38]; FDA[39]
Metoclopramide	CYP2D6	FDA[39]
Metoprolol	CYP2D6	CPIC[13]
Mirabegron	CYP2D6	FDA[39]
Nateglinide	CYP2C9	FDA[39]
Nebivolol	CYP2D6	FDA[39]
Nortriptyline	CYP2D6	CPIC[20]; FDA[39]
Oliceridine	CYP2D6	FDA[39]
Omeprazole	CYP2C19	CPIC[24]; FDA[39]
Ondansetron	CYP2D6	CPIC[5]
Pantoprazole	CYP2C19	CPIC[24]; FDA[39]
Paroxetine	CYP2D6	CPIC[7]; FDA[39]
Perphenazine	CYP2D6	FDA[39]
Phenytoin	CYP2C9	CPIC[22]; FDA[39]
Pimozide	CYP2D6	FDA[39]
Piroxicam	CYP2C9 (Star Alleles)	CPIC[38]; FDA[39]
Pitavastatin	SLCO1B1	CPIC[10]
Pitolisant	CYP2D6	FDA[39]
Pravastatin	SLCO1B1	CPIC[10]
Propafenone	CYP2D6	FDA[39]
Propranolol	CYP2D6	FDA[39]
Protriptyline	CYP2D6	FDA[39]
Rabeprazole	CYP2C19	FDA[39]
Risperidone	CYP2D6	FDA[39]
Rosuvastatin	SLCO1B1	CPIC[10]; FDA[39]
Sertraline	CYP2B6	CPIC[7]
Sertraline	CYP2C19	CPIC[7]
Simvastatin	SLCO1B1	CPIC[10]; FDA[39]
Siponimod	CYP2C9 (Star Alleles)	FDA[39]
Tacrolimus	CYP3A5	CPIC[6]; FDA[39]
Tamoxifen	CYP2D6 (Activity Score)	CPIC[17]; FDA[39]
Tamsulosin	CYP2D6	FDA[39]
Tenoxicam	CYP2C9 (Star Alleles)	CPIC[38]
Tetrabenazine	CYP2D6	FDA[39]
Thioridazine	CYP2D6	FDA[39]

Drug	Genetic Test	Sources
Tolterodine	CYP2D6	FDA[39]
Tramadol	CYP2D6	CPIC[11]; FDA[39]
Trimipramine	CYP2D6	CPIC[20]; FDA[39]
Trimipramine	CYP2C19	CPIC[20]
Valbenazine	CYP2D6	FDA[39]
Venlafaxine	CYP2D6	CPIC[7]; FDA[39]
Viloxazine	CYP2D6	FDA[39]
Voriconazole	CYP2C19	CPIC[28]; FDA[39]
Vortioxetine	CYP2D6	CPIC[7]; FDA[39]
Warfarin	CYP2C9	CPIC[21]; FDA[39]
Warfarin	VKORC1 rs9923231	CPIC[21]; FDA[39]

Laboratory Report

The **Laboratory Report** contains your genetic results.

Gene	rsID	HGVS	HGVS Reference	Result
ABCB1	rs1045642	c.3645G>A	NC_000007.14	A/G
APOE	rs429358	c.388T>C	NC_000019.10	T/T
APOE	rs7412	c.526C>T	NC_000019.10	C/C
COMT	rs4680	c.472G>A	NC_000022.11	A/A
CYP1A2	rs12720461	c.-10+113C>T	NC_000015.10	C/C
CYP1A2	rs2069514	g.74745879G>A	NC_000015.10	G/G
CYP1A2	rs56107638	g.74753271G>A	NC_000015.10	G/G
CYP1A2	rs72547513	c.558C>T	NC_000015.10	C/C
CYP1A2	rs762551	c.-9-154A>C	NC_000015.10	C/A
CYP2B6	rs28399499	c.983T>C	NC_000019.10	T/T
CYP2B6	rs3745274	c.516G>A/T	NC_000019.10	G/T
CYP2C19	rs12248560	c.-806C>T	NC_000010.11	T/T
CYP2C19	rs28399504	c.1A>G/T	NC_000010.11	A/A
CYP2C19	rs41291556	c.358T>C	NC_000010.11	T/T
CYP2C19	rs4244285	c.681G>A/C/T	NC_000010.11	G/G
CYP2C19	rs4986893	c.636G>A	NC_000010.11	G/G
CYP2C19	rs72552267	c.395G>A	NC_000010.11	G/G
CYP2C19	rs72558186	c.819+2T>A	NC_000010.11	T/T
CYP2C19	rs56337013	c.1297C>T	NC_000010.11	C/C
CYP2C9	rs1057910	c.1075A>C/G	NC_000010.11	A/A
CYP2C9	rs1304490498	c.353_362del	NC_000010.11	A/A
CYP2C9	rs1799853	c.430C>T	NC_000010.11	C/C
CYP2C9	rs28371685	c.1003C>T	NC_000010.11	C/C
CYP2C9	rs28371686	c.1080C>A/G/T	NC_000010.11	C/C
CYP2C9	rs56165452	c.1076T>A/C	NC_000010.11	T/T
CYP2C9	rs72558187	c.269T>C/G	NC_000010.11	T/T
CYP2C9	rs72558190	c.485C>A/T	NC_000010.11	C/C
CYP2C9	rs7900194	c.449G>A/C/T	NC_000010.11	G/G
CYP2C9	rs9332131	c.818del/dup	NC_000010.11	A/A
CYP2C9	rs9332239	c.1465C>T	NC_000010.11	C/C
CYP2D6	dup4125_4133	c.1403_1411dup	NC_000022.11	D/D
CYP2D6	rs1065852	c.100C>T/G	NC_000022.11	G/G
CYP2D6	rs1135840	c.1457G>C/A	NC_000022.11	C/C
CYP2D6	rs16947	c.886C>T/A	NC_000022.11	G/G
CYP2D6	rs201377835	c.181-1G>C	NC_000022.11	G/G
CYP2D6	rs28371706	c.320C>G/A	NC_000022.11	G/G
CYP2D6	rs28371725	c.985+39G>A	NC_000022.11	C/C
CYP2D6	rs35742686	c.775del	NC_000022.11	T/T
CYP2D6	rs3892097	c.506-1G>A	NC_000022.11	C/C
CYP2D6	rs5030655	c.454del	NC_000022.11	A/A
CYP2D6	rs5030656	c.841_843del	NC_000022.11	TCT/TCT (A/A)[1]
CYP2D6	rs5030862	c.124G>A	NC_000022.11	C/C
CYP2D6	rs5030865	c.505G>T/C/A	NC_000022.11	C/C
CYP2D6	rs5030867	c.971A>C	NC_000022.11	T/T
CYP2D6	rs59421388	c.1012G>A	NC_000022.11	C/C
CYP2D6	rs72549353	c.765_768del	NC_000022.11	A/A
CYP2D6	rs72549354	c.635dup	NC_000022.11	D/D
CYP2D6	rs774671100	c.137dup	NC_000022.11	A/A (D/D)[1]

Gene	rsID	HGVS	HGVS Reference	Result
CYP3A4	rs35599367	c.522-191C>T	NC_000007.14	G/G
CYP3A4	rs4987161	c.566T>C	NC_000007.14	A/A
CYP3A4	rs55785340	c.664T>C/A	NC_000007.14	A/A
CYP3A5	rs10264272	c.624G>A	NC_000007.14	C/C
CYP3A5	rs28365083	c.1193C>A	NC_000007.14	G/G
CYP3A5	rs41303343	c.1035dup	NC_000007.14	D/D
CYP3A5	rs776746	c.219-237=	NC_000007.14	C/C
DRD2	rs1800497	c.2137G>A	NC_000011.10	G/G
Factor II	rs1799963	c.*97G>A	NC_000011.10	G/G
Factor V	rs6025	c.1601G>A	NC_000001.11	C/C
GLP1R	rs1042044	c.780C>A	NC_000006.12	C/A
GLP1R	rs2300615	c.510-1135T>G	NC_000006.12	T/T
GLP1R	rs6923761	c.502G>A	NC_000006.12	G/A
MTHFR	rs1801131	c.1409T>G	NC_000001.11	G/T
MTHFR	rs1801133	c.788G>A	NC_000001.11	G/A
OPRM1	rs1799971	c.118A>G	NC_000006.12	A/A
PNPLA5	rs5764010	c.950-169C>T	NC_000006.12	T/C
SLCO1B1	rs4149056	c.521T>C	NC_000012.12	C/T
SULT4A1	rs763120	c.743-374T>C	NC_000022.11	T/C
VKORC1	rs9923231	c.-1639G>T	NC_000016.10	G/A (C/T)[1]

1: Pharmacogenetic testing may occasionally lead to unusual genotypes. In these situations, pharmacogenetic laboratories will sometimes report on alternative genotypes. If this is done, then both genotypes appear in the result table; a genotype in () is the alternative genotype chosen by the lab.

Copy Number Variation

Gene	Reference	Result (Copy/Copies)
CYP2D6	NG_008376.3	2N

Phenotype Table

Gene	Allele Result	Phenotype Result
CYP2D6	*1/*1	Normal Metabolizer
CYP2C9	*1/*1	Normal Metabolizer
CYP2C19	*17/*17	Ultrarapid Metabolizer
SLCO1B1	*1/*5	Decreased Function
CYP2B6	*1/*6 or *1/*9	No CPIC Phenotype*
CYP3A5	*3/*3	Poor Metabolizer
CYP3A4	*1/*1	Normal Metabolizer

*At the time of report generation, guidelines indicate there is no known phenotype associated with these alleles.

Methodology

Agena Bioscience's VeriDose PGx panels use PCR to amplify target regions of interest. After amplification, shrimp alkaline phosphatase (SAP) is added to dephosphorylate any remaining free deoxynucleotides to prevent interference with the iPLEX Pro extension reaction. The iPLEX Pro extension reaction, a method for detecting insertions, deletions, substitutions, and other polymorphisms in amplified DNA, is then performed, allowing the enzymatic addition of a nucleotide into the diagnostic site. The primer is extended by one nucleotide, terminating the primer extension. The iPLEX Pro extension reaction produces allele-specific extension products of different masses depending on the sequence analyzed. Extension products are dispensed onto a support matrix (SpectroCHIP® Array) and loaded into the MassARRAY MALDI-TOF mass spectrometer for data acquisition. The analyte/ matrix co-crystals are irradiated by a laser, inducing their desorption and ionization. The positively charged molecules are accelerated through a flight tube towards a detector. Separation occurs by time-of-flight, which is proportional to the mass of the individual molecules. After data processing, a spectrum is produced with relative intensity on the y[1]axis and mass/charge on the x-axis. Data acquired by the MassARRAY Analyzer is processed using MassARRAY Typer and PGx Report software, and a comprehensive diplotype report for all samples is generated, showing SNP and CNV results in a single report.

Limitations

VeriDose PGx panels and the MassARRAY System are For Research Use Only. Not for use in diagnostic procedures. VeriDose PGx panels, the MassARRAY System, and the associated software tools for obtaining pharmacogenetic genotypes and predicted haplotypes are intended for research use to support haplotyping of high-quality DNA samples (obtained from commonly used purification methods). The determination of genotypes and use of this information for predicting haplotypes with VeriDose PGx panels is based upon the interrogation of a limited number of defined SNP positions in target genes. Users should understand that additional rare variations, even in non-coding sequences, might change haplotypes that may not be detectable with the VeriDose PGx panels. In such cases, the VeriDose PGx panels may provide an incorrect haplotype. Assays in the VeriDose PGx panels use an initial locus-specific DNA amplification step, which requires the correct annealing of the appropriate PCR primers to target genomic sequences. A negative result may be generated if the PCR primers do not anneal correctly due to unexpected rare genomic variations in the PCR priming region. MassARRAY System owners may use Agena Bioscience's online software, Assay Design Suite, to develop additional custom SNP genotyping assays to comprehensively cover such rare or regionally prevalent genetic variations. Sometimes, a single genotype assigns a predicted haplotype (simple assays). Multiple genotype assignments may be analyzed in combination (composite assays) to predict more complex haplotypes. The assignment of haplotypes in VeriDose PGx haplotype tables is based on information provided on publicly available haplotyping schemas as found in current literature and input from experts in the field of pharmacogenetics at the time of product release or the last software update. To ensure the proper performance of VeriDose PGx panels and lookup tables, you must ensure that your MassARRAY System is properly maintained and tuned by Agena Bioscience Customer Support at the suggested service intervals. MassARRAY System owners may use Agena Bioscience's online software, Assay Design Suite, to develop additional custom SNP genotyping assays to comprehensively cover such rare or regionally prevalent genetic variations. Sometimes, a single genotype assigns a predicted haplotype (simple assays). Multiple genotype assignments may be analyzed in combination (composite assays) to predict more complex haplotypes. The assignment of haplotypes in VeriDose PGx haplotype tables is based on information provided on publicly available haplotyping schemas as found in current literature and input from experts in the field of pharmacogenetics at the time of product release or the last software update. To ensure the proper performance of VeriDose PGx panels and lookup tables, you must ensure that your MassARRAY System is properly maintained and tuned by Agena Bioscience Customer Support at the suggested service intervals.

Liability Disclaimer

This test was developed, and Mira Precision Health determined its performance characteristics. The US Food and Drug Administration has not cleared or approved it. The report is not a diagnostic test, and TreatGx is not a prescribing system. You should discuss your pharmacogenetic information with a physician or other health care provider before you act upon the pharmacogenetic information resulting from this report. The medication brand names are not an exhaustive list and do not include combination therapies. Not all medications in this report are included in the TreatGx or ReviewGx software or other GenXys derivative works.

Medical Laboratory Director

Bernadette Mandes Wildemore, MD , Medical Laboratory Director, MB(ASCP), CLIA #36D2194362

29/Oct/2024 (UTC)

Date of Signature