PHD LABORATORY

PATIENT INFORMATION
NAME: PGX1-A 1 PGX1-A 1
DOB: 08/May/2024
SEX AT BIRTH: Unknown

SPECIMEN DETAILS
BARCODE: X241300004
SAMPLE ID: X241300004
TYPE: Saliva
COLLECTED: 08/May/2024

ORDERED BY
[redacted]
REPORT GENERATED: 09/May/2024

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.
Please refer to the Methods, Limitations, and Liability Disclaimer at the end of this report.

Current Medications Impacted In This Report

The medications listed below indicate the patient's **Current Medications** impacted in this report.

No current medications impacted in this report.

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 interaction
2 Moderate gene-drug interaction
3 Serious drug-gene interaction: evaluate and consider alternative medications

Analgesia

1
Alfentanil
Carisoprodol
Celecoxib
Codeine
Fentanyl
Flurbiprofen
Hydrocodone
Ibuprofen
Meloxicam
Morphine
Piroxicam
Tenoxicam
Tramadol
Venlafaxine

2
Desipramine
Nortriptyline

3
Amitriptyline
Imipramine

Autoimmune

1
Azathioprine
Cyclosporine
Mercaptopurine
Siponimod

...Autoimmune

1
Tacrolimus
Thioguanine

Cancer

1
Capecitabine
Erdafitinib
Fluorouracil
Mercaptopurine
Thioguanine

2
Tamoxifen

Cardiovascular

1
Atorvastatin
Carvedilol
Fluvastatin
Lovastatin
Nebivolol
Pitavastatin
Pravastatin
Propranolol
Rosuvastatin
Simvastatin

2
Flecainide
Metoprolol
Propafenone
Warfarin

...Cardiovascular

3
Clopidogrel

Gastroenterology

1
Dronabinol
Metoclopramide
Ondansetron

2
Dexlansoprazole
Lansoprazole
Meclizine
Omeprazole
Pantoprazole

Infection

2
Efavirenz
Voriconazole

Mental Health

1
Alprazolam
Amoxapine
Amphetamine
Aripiprazole lauroxil
Bromazepam
Chlordiazepoxide
Clonazepam
Clorazepate
Diazepam
Flurazepam

...Mental Health

1
Lofexidine
Lorazepam
Nitrazepam
Oxazepam
Protriptyline
Risperidone
Temazepam
Triazolam
Venlafaxine

2
Aripiprazole
Asenapine
Atomoxetine
Brexpiprazole
Cariprazine
Chlorpromazine
Citalopram
Clobazam
Clozapine
Desipramine
Escitalopram
Flupentixol
Fluphenazine
Fluvoxamine
Haloperidol
Iloperidone
Loxapine
Lurasidone
Methotrimeprazine

...Mental Health

2
Molindone
Nortriptyline
Olanzapine
Paliperidone
Paroxetine
Perphenazine
Pimozide
Prochlorperazine
Promethazine
Quetiapine
Sertraline
Thioridazine
Trifluoperazine
Vortioxetine
Ziprasidone

3
Amitriptyline
Clomipramine
Doxepin
Imipramine
Trimipramine
Zuclopenthixol

Neurology

1
Clonazepam
Deutetrabenazine
Diazepam
Donepezil
Fosphenytoin
Galantamine
Phenytoin
Propranolol
Tetrabenazine
Valbenazine
Venlafaxine

...Neurology

2
Brivaracetam
Clobazam
Desipramine
Metoprolol
Nortriptyline

3
Amitriptyline

Respiratory

1
Formoterol
Salmeterol

Rheumatology

1
Azathioprine
Celecoxib
Flurbiprofen
Ibuprofen
Meloxicam
Piroxicam
Tenoxicam

Urology

1
Darifenacin
Fesoterodine
Mirabegron
Tamsulosin
Tolterodine

Other

1
Avatrombopag
Cevimeline
Elagolix
Eltrombopag
Oral contraceptives

...Other

2
Flibanserin

3
Eliglustat

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.

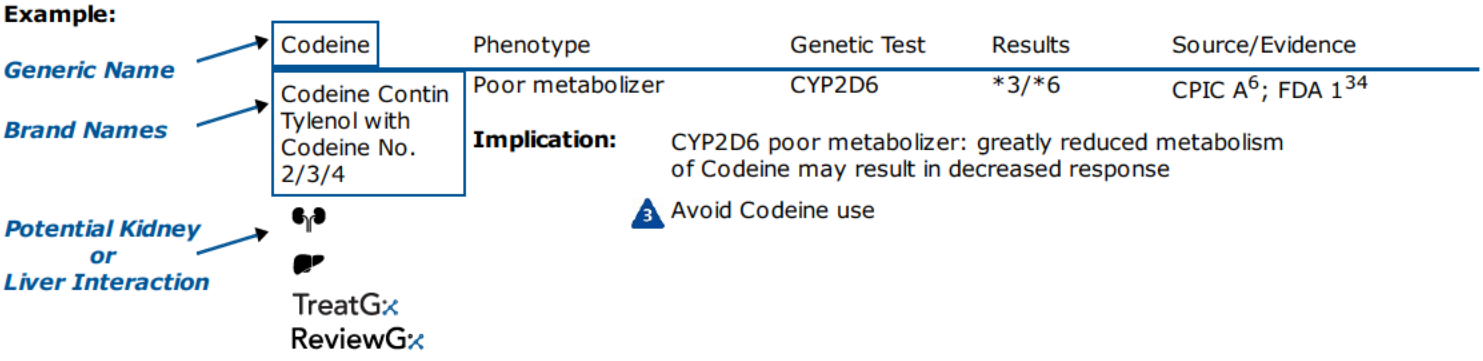
TreatGx
TreatGx is clinical decision support software for precision prescribing that identifies condition-specific medication options based on multiple patient factors.

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:



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 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.

Alfentanil	Phenotype	Genetic Test	Results	Source/Evidence
Alfenta ReviewGx	Typical response	OPRM1 rs1799971	A/A	PharmGKB 3
	Implication:	OPRM1 alleles indicate a typical response to Alfentanil		

Alprazolam	Phenotype	Genetic Test	Results	Source/Evidence
Xanax ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]
	Implication:	CYP2C9 alleles indicate typical risk of Alprazolam-related falls		

Amitriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Elavil Levate TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC A[16]; FDA 3[35]
	Poor metabolizer	CYP2C19	*2/*7	CPIC A[16]
	Implication:	CYP2C19 poor metabolizer: greatly reduced metabolism of Amitriptyline may affect response or adverse drug reactions CYP2D6 intermediate metabolizer: reduced metabolism of Amitriptyline to less active compounds Higher plasma concentrations of active drug may increase the risk of adverse drug reactions		
	3	Avoid Amitriptyline use (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.		

Amoxapine	Phenotype	Genetic Test	Results	Source/Evidence
ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]
	Implication:	CYP2D6 alleles do not indicate changes from recommended dose		

Amphetamine	Phenotype	Genetic Test	Results	Source/Evidence
Adzenys TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
	Implication:	CYP2D6 alleles do not indicate changes from recommended dose		

Aripiprazole	Phenotype	Genetic Test	Results	Source/Evidence
Abilify Aristada TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	DPWG[9]; FDA 1[35]
	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication:	ANKK1 alleles indicate an increased risk of tardive dyskinesia CYP2D6 alleles do not indicate changes from recommended dose HTR2C alleles indicate a typical risk of metabolic syndrome		

Aripiprazole lauroxil	Phenotype	Genetic Test	Results	Source/Evidence
Aristada ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
	Implication: CYP2D6 alleles do not indicate changes from recommended dose			

Asenapine	Phenotype	Genetic Test	Results	Source/Evidence
Saphris TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome			

Atomoxetine	Phenotype	Genetic Test	Results	Source/Evidence
Strattera TreatGx ReviewGx	Intermediate metabolizer (AS 0.25-0.75)	CYP2D6 (Activity Score)	*4/*41	CPIC A[5]; FDA 1[35]
	Implication: CYP2D6 intermediate metabolizer with an activity score of 0.25-0.75: reduced metabolism of Atomoxetine to less active compounds Higher plasma concentrations of active drug may increase the risk of adverse drug reactions 2 Moderate CPIC recommendation[40]: Increase the daily dose only if symptoms fail to improve after 14 days and previous dose is well tolerated, consider obtaining a plasma concentration 2-4 h after dosing. If response is inadequate and concentration is <200 ng/ml, consider a proportional dose increase to achieve a concentration to approach 400 ng/ml.			

Atorvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Lipitor TreatGx ReviewGx	Normal function	SLCO1B1	*1/*37	CPIC A[6]; FDA 3[35]
	Implication: SLCO1B1 alleles indicate typical exposure to Atorvastatin Consider prescribing desired starting dose and adjust based on disease-specific guidelines			

Avatrombopag	Phenotype	Genetic Test	Results	Source/Evidence
Doptelet ReviewGx	Normal metabolizer	CYP2C9	*1/*1	FDA 3[35]
	Implication: CYP2C9 alleles do not indicate changes from recommended dose			

Azathioprine	Phenotype	Genetic Test	Results	Source/Evidence
Azasan Imuran TreatGx ReviewGx	Normal metabolizer	TPMT	*1/*1	CPIC A[30]; FDA 1[35]
	Normal metabolizer	NUDT15	*1/*1	CPIC A[30]; FDA 1[35]
	Implication: For malignant and non-malignant conditions: Start with normal starting dose and adjust doses of Azathioprine based on disease-specific guidelines. Allow 2 weeks to reach steady-state after each dose adjustment.			

Brexpiprazole	Phenotype	Genetic Test	Results	Source/Evidence
Rexulti	Intermediate metabolizer	CYP2D6	*4/*41	DPWG[9]; FDA 1[35]
	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
TreatGx ReviewGx	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

CYP2D6 alleles do not indicate changes from recommended dose

HTR2C alleles indicate a typical risk of metabolic syndrome

Brivaracetam	Phenotype	Genetic Test	Results	Source/Evidence
Briviact Brivlera	Poor metabolizer	CYP2C19	*2/*7	FDA 1[35]

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Brivaracetam to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

ReviewGx

2 Consider a reduction of the recommended dose

2 This drug has an FDA therapeutic recommendation, refer to drug monograph or FDA labelling for dosing recommendations

Bromazepam	Phenotype	Genetic Test	Results	Source/Evidence
ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]

Implication: CYP2C9 alleles indicate typical risk of Bromazepam-related falls

Capecitabine	Phenotype	Genetic Test	Results	Source/Evidence
Xeloda	Normal metabolizer	DPYD	*1/*1	CPIC A[1]; FDA 1[35]

ReviewGx

Implication: DPYD alleles indicate normal DPD activity and typical risk for Capecitabine toxicity

DPYD alleles do not indicate changes from recommended dose

Cariprazine	Phenotype	Genetic Test	Results	Source/Evidence
Vraylar	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
TreatGx ReviewGx	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Carisoprodol	Phenotype	Genetic Test	Results	Source/Evidence
ReviewGx	Poor metabolizer	CYP2C19	*2/*7	FDA 3[35]

Implication: CYP2C19 poor metabolizer: reduced metabolism of Carisoprodol to less active compounds leads to higher plasma concentrations of active drug

There is a potential impact on pharmacokinetic properties. The impact of CYP2C19 variants on the safety of Carisoprodol has not been established

Carvedilol	Phenotype	Genetic Test	Results	Source/Evidence
Coreg	Intermediate metabolizer	CYP2D6	*4/*41	FDA 2[35]
TreatGx ReviewGx	**Implication:** 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[32]; FDA 1[35]
TreatGx ReviewGx	**Implication:** CYP2C9 alleles do not indicate changes from recommended dose			

Cevimeline	Phenotype	Genetic Test	Results	Source/Evidence
Evoxac	Intermediate metabolizer	CYP2D6	*4/*41	FDA 2[35]
ReviewGx	**Implication:** CYP2D6 alleles do not indicate changes from recommended dose			

Chlordiazepoxide	Phenotype	Genetic Test	Results	Source/Evidence
Librium	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]
ReviewGx	**Implication:** CYP2C9 alleles indicate typical risk of Chlordiazepoxide-related falls			

Chlorpromazine	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome			

Citalopram	Phenotype	Genetic Test	Results	Source/Evidence
Celexa	Poor metabolizer	CYP2C19	*2/*7	CPIC A[4]; FDA 1[35]
TreatGx ReviewGx	Reduced response	GRIK4 rs1954787	C/T	PharmGKB 3
	Typical response	HTR2A rs7997012	G/G	PharmGKB 3
	Implication: Reduced metabolism of citalopram and escitalopram to less active compounds when compared with CYP2C19 normal and intermediate metabolizers. Higher plasma concentrations may increase the probability of side effects.			
	2 Consider a clinically appropriate antidepressant not predominantly metabolized by CYP2C19. If citalopram or escitalopram are clinically appropriate, consider a lower starting dose, slower titration schedule, and 50% reduction of the standard maintenance dose as compared with normal metabolizers (per CPIC strong recommendation).			

Clobazam	Phenotype	Genetic Test	Results	Source/Evidence
Onfi Sympazan ReviewGx	Poor metabolizer	CYP2C19	*2/*7	FDA 1[35]

Implication: FDA PGx Table Section 1: Results in higher systemic active metabolite concentrations. Poor metabolism results in higher adverse reaction risk.

2 FDA PGx Table Section 1: Dosage adjustment is recommended. Refer to FDA labeling for specific dosing recommendations.

Clomipramine	Phenotype	Genetic Test	Results	Source/Evidence
Anafranil ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[16]; FDA 3[35]
	Poor metabolizer	CYP2C19	*2/*7	CPIC B[16]

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Clomipramine may affect response or adverse drug reactions

CYP2D6 intermediate metabolizer: reduced metabolism of Clomipramine to less active compounds
Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

3 Avoid Clomipramine use (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.

Clonazepam	Phenotype	Genetic Test	Results	Source/Evidence
Klonopin Rivotril TreatGx ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]

Implication: CYP2C9 alleles indicate typical risk of Clonazepam-related falls

Clopidogrel	Phenotype	Genetic Test	Results	Source/Evidence
Plavix TreatGx ReviewGx	Poor metabolizer	CYP2C19	*2/*7	CPIC A[20]; FDA 1[35]

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Clopidogrel to the active compound

Increased on-treatment platelet reactivity and increased risk for adverse cardiac and cerebrovascular events

3 Avoid Clopidogrel use

Clorazepate	Phenotype	Genetic Test	Results	Source/Evidence
Gen-Xene Tranxene ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]

Implication: CYP2C9 alleles indicate typical risk of Clorazepate-related falls

Clozapine	Phenotype	Genetic Test	Results	Source/Evidence
Clozaril Fazaclo ODT Versacloz TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

CYP2D6 alleles do not indicate changes from recommended dose

HTR2C alleles indicate a typical risk of metabolic syndrome

Codeine	Phenotype	Genetic Test	Results	Source/Evidence
Codeine Contin Tylenol with Codeine No. 2/3/4 TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC A[7]; FDA 1[35]; FDA 2[35]

Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Codeine to active metabolite

CYP2D6 alleles do not indicate changes from recommended dose. If no response to Codeine and opioid use is warranted, consider an opioid other than tramadol or codeine (per CPIC moderate recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.

Cyclosporine	Phenotype	Genetic Test	Results	Source/Evidence
Neoral Sandimmune ReviewGx	Poor metabolizer	CYP3A5	*3/*3	PharmGKB 3

Implication: CYP3A5 alleles do not indicate changes from recommended dose

Darifenacin	Phenotype	Genetic Test	Results	Source/Evidence
Enablex TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Desipramine	Phenotype	Genetic Test	Results	Source/Evidence
Norpramin TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[16]; FDA 3[35]

Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Desipramine to less active compounds
Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

2 Consider a reduction of the recommended dose for Desipramine (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.

Deutetrabenazine	Phenotype	Genetic Test	Results	Source/Evidence
Austedo ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Dexlansoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Dexilant	Poor metabolizer	CYP2C19	*2/*7	CPIC B[22]; FDA 3[35]

TreatGx ReviewGx

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Dexlansoprazole to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

2 Optional CPIC recommendation: Initiate standard starting dose. For chronic therapy (> 12 weeks) and efficacy achieved, consider a 50% reduction in daily dose.

Diazepam	Phenotype	Genetic Test	Results	Source/Evidence
Diastat Valium	Poor metabolizer	CYP2C19	*2/*7	FDA 3[35]
	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]

TreatGx ReviewGx

Implication: CYP2C9 alleles indicate typical risk of Diazepam-related falls

CYP2C19 poor metabolizer: reduced metabolism of Diazepam to less active compounds leads to higher plasma concentrations of active drug

There is a potential impact on pharmacokinetic properties. The impact of CYP2C19 variants on the safety of Diazepam has not been established

Donepezil	Phenotype	Genetic Test	Results	Source/Evidence
Aricept	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]

TreatGx ReviewGx

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Doxepin	Phenotype	Genetic Test	Results	Source/Evidence
Silenor Sinequan	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[16]; FDA 3[35]
	Poor metabolizer	CYP2C19	*2/*7	CPIC B[16]; FDA 3[35]

TreatGx ReviewGx

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Doxepin may affect response or adverse drug reactions

CYP2D6 intermediate metabolizer: reduced metabolism of Doxepin to less active compounds
Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

3 Avoid Doxepin use (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.

Dronabinol	Phenotype	Genetic Test	Results	Source/Evidence
Marinol Syndros	Normal metabolizer	CYP2C9	*1/*1	FDA 1[35]

ReviewGx

Implication: CYP2C9 alleles do not indicate changes from recommended dose

Efavirenz	Phenotype	Genetic Test	Results	Source/Evidence
Sustiva	Intermediate metabolizer	CYP2B6	*1/*6	CPIC A[8]; FDA 2[35]

TreatGx ReviewGx

Implication: CYP2B6 intermediate metabolizer: reduced metabolism of Efavirenz to less active compounds

2 Consider initiating Efavirenz with decreased dose of 400 mg/day

Elagolix	Phenotype	Genetic Test	Results	Source/Evidence
Orilissa	Normal function	SLCO1B1	*1/*37	FDA 3[35]

ReviewGx

Implication: SLCO1B1 alleles indicate a typical response to Elagolix

Eliglustat	Phenotype	Genetic Test	Results	Source/Evidence
Cerdelga	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]

ReviewGx

Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Eliglustat to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

3 Concurrent use of a strong or moderate CYP3A inhibitor, use of both a moderate or strong CYP2D6 inhibitor and a moderate or strong CYP3A inhibitor, or use of a strong CYP3A inducer: Avoid Eliglustat use

2 Concurrent use of a moderate or strong CYP2D6 inhibitor: Consider reducing eliglustat dose, refer to drug monograph or FDA labelling for dosing recommendations

No concurrent use of interacting drugs: CYP2D6 alleles do not indicate changes from recommended dose, refer to drug monograph or FDA labelling for dosing recommendations

Eltrombopag	Phenotype	Genetic Test	Results	Source/Evidence
Promacta Revolade	Typical risk of adverse drug reactions	Factor V rs6025	C/C	Product monograph (actionable)[28]
	Typical risk of adverse drug reactions	Factor II rs1799963	G/G	PharmGKB 3

ReviewGx

Implication: F2 and F5 alleles do not indicate changes from recommended dose

Erdafitinib	Phenotype	Genetic Test	Results	Source/Evidence
Balversa	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	FDA 1[35]

ReviewGx

Implication: CYP2C9 alleles do not indicate changes from recommended dose

Escitalopram	Phenotype	Genetic Test	Results	Source/Evidence
Cipralex Lexapro	Poor metabolizer	CYP2C19	*2/*7	CPIC A[4]; FDA 3[35]

TreatGx
ReviewGx

Implication: Reduced metabolism of citalopram and escitalopram to less active compounds when compared with CYP2C19 normal and intermediate metabolizers. Higher plasma concentrations may increase the probability of side effects.

2 Consider a clinically appropriate antidepressant not predominantly metabolized by CYP2C19. If citalopram or escitalopram are clinically appropriate, consider a lower starting dose, slower titration schedule, and 50% reduction of the standard maintenance dose as compared with normal metabolizers (per CPIC strong recommendation).

Fentanyl	Phenotype	Genetic Test	Results	Source/Evidence
Abstral Actiq Duragesic Fentora Lazanda Subsys	Typical response	OPRM1 rs1799971	A/A	PharmGKB 3
	Implication: OPRM1 alleles indicate a typical response to Fentanyl			

ReviewGx

Fesoterodine	Phenotype	Genetic Test	Results	Source/Evidence
Toviaz	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]
	Implication: CYP2D6 alleles do not indicate changes from recommended dose			

TreatGx
ReviewGx

Flecainide	Phenotype	Genetic Test	Results	Source/Evidence
Tambocor	Intermediate metabolizer	CYP2D6	*4/*41	DPWG[9]
	Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Flecainide to less active compounds			
	Higher plasma concentrations of active drug may increase the risk of adverse drug reactions			
	2 Reduce the standard dose by 25%, record electrocardiogram, and monitor plasma concentration			

TreatGx
ReviewGx

Flibanserin	Phenotype	Genetic Test	Results	Source/Evidence
Addyi	Poor metabolizer	CYP2C19	*2/*7	FDA 1[35]
	Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Flibanserin to less active compounds			
	Higher plasma concentrations of active drug may increase the risk of hypotension, syncope, and CNS depression			
	2 This drug has an FDA therapeutic recommendation, refer to drug monograph or FDA labelling for dosing recommendations			

ReviewGx

Fluorouracil	Phenotype	Genetic Test	Results	Source/Evidence
Carac Efudex Fluoroplex Tolak	Normal metabolizer	DPYD	*1/*1	CPIC A[1]; FDA 1[35]
	Implication: DPYD alleles indicate normal DPD activity and typical risk for Fluorouracil toxicity			
	DPYD alleles do not indicate changes from recommended dose			

ReviewGx

Flupentixol	Phenotype	Genetic Test	Results	Source/Evidence
Fluanxol	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia			
	HTR2C alleles indicate a typical risk of metabolic syndrome			

TreatGx
ReviewGx

Fluphenazine	Phenotype	Genetic Test	Results	Source/Evidence
Modecate	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
TreatGx ReviewGx	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome			

Flurazepam	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]
	Implication: CYP2C9 alleles indicate typical risk of Flurazepam-related falls			

Flurbiprofen	Phenotype	Genetic Test	Results	Source/Evidence
Ansaid	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[32]; FDA 1[35]
TreatGx ReviewGx	**Implication:** CYP2C9 alleles do not indicate changes from recommended dose			

Fluvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Lescol	Normal metabolizer	CYP2C9	*1/*1	CPIC A[6]
	Normal function	SLCO1B1	*1/*37	CPIC A[6]
TreatGx ReviewGx	**Implication:** SLCO1B1 alleles indicate typical exposure to Fluvastatin CYP2C9 alleles indicate typical exposure to Fluvastatin Consider prescribing desired starting dose and adjust based on disease-specific guidelines			

Fluvoxamine	Phenotype	Genetic Test	Results	Source/Evidence
Luvox	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[4]; FDA 3[35]
TreatGx ReviewGx	**Implication:** Reduced metabolism of fluvoxamine to less active compounds when compared with CYP2D6 normal metabolizers. Higher plasma concentrations may increase the probability of side effects. 2 Initiate therapy with recommended starting dose (per CPIC moderate recommendation).			

Formoterol	Phenotype	Genetic Test	Results	Source/Evidence
Foradil Oxeze Perforomist	Typical response	ADRB2 rs1042713	A/G	Clinical studies[36,38]
TreatGx ReviewGx	**Implication:** ADRB2 alleles indicate typical response to Formoterol			

Fosphenytoin	Phenotype	Genetic Test	Results	Source/Evidence
Cerebyx	Normal metabolizer	CYP2C9	*1/*1	CPIC A[18]; FDA 1[35]
ReviewGx	**Implication:** CYP2C9 normal metabolizer: normal metabolism of Fosphenytoin to less active compounds CYP2C9 alleles do not indicate changes from recommended dose			

Galantamine	Phenotype	Genetic Test	Results	Source/Evidence
Razadyne	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]
TreatGx ReviewGx	**Implication:** CYP2D6 alleles do not indicate changes from recommended dose			

Haloperidol	Phenotype	Genetic Test	Results	Source/Evidence
Haldol	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
TreatGx ReviewGx	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome			

Hydrocodone	Phenotype	Genetic Test	Results	Source/Evidence
Hysingla Zohydro	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[7]
TreatGx ReviewGx	**Implication:** CYP2D6 intermediate metabolizer: minimal evidence for pharmacokinetic or clinical effect for Hydrocodone CYP2D6 alleles do not indicate changes from recommended dose. If no response to Hydrocodone and opioid use is warranted, consider an opioid other than tramadol or codeine (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.			

Ibuprofen	Phenotype	Genetic Test	Results	Source/Evidence
Advil Caldolor Duexis Motrin IB NeoProfen	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[32]; FDA 3[35]
TreatGx ReviewGx	**Implication:** CYP2C9 alleles do not indicate changes from recommended dose			

Iloperidone	Phenotype	Genetic Test	Results	Source/Evidence
Fanapt	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia CYP2D6 alleles do not indicate changes from recommended dose HTR2C alleles indicate a typical risk of metabolic syndrome			

Imipramine	Phenotype	Genetic Test	Results	Source/Evidence
Tofranil	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[16]; FDA 3[35]
TreatGx ReviewGx	Poor metabolizer	CYP2C19	*2/*7	CPIC B[16]

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Imipramine may affect response or adverse drug reactions

CYP2D6 intermediate metabolizer: reduced metabolism of Imipramine to less active compounds
Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

3 Avoid Imipramine use (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.

Lansoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Prevacid	Poor metabolizer	CYP2C19	*2/*7	CPIC A[22]; FDA 3[35]
TreatGx ReviewGx				

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Lansoprazole to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

2 Moderate CPIC recommendation: Initiate standard starting dose. For chronic therapy (> 12 weeks) and efficacy achieved, consider a 50% reduction in daily dose.

Lofexidine	Phenotype	Genetic Test	Results	Source/Evidence
Lucemyra	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
ReviewGx				

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Lorazepam	Phenotype	Genetic Test	Results	Source/Evidence
Ativan	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]
ReviewGx				

Implication: CYP2C9 alleles indicate typical risk of Lorazepam-related falls

Lovastatin	Phenotype	Genetic Test	Results	Source/Evidence
Altoprev	Normal function	SLCO1B1	*1/*37	CPIC A[6]
TreatGx ReviewGx				

Implication: SLCO1B1 alleles indicate typical exposure to Lovastatin

Consider prescribing desired starting dose and adjust based on disease-specific guidelines

Loxapine	Phenotype	Genetic Test	Results	Source/Evidence
Adasuve Loxapac	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
TreatGx ReviewGx	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Lurasidone	Phenotype	Genetic Test	Results	Source/Evidence
Latuda	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
TreatGx ReviewGx	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Meclizine	Phenotype	Genetic Test	Results	Source/Evidence
Antivert	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
ReviewGx				

Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Meclizine to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

2 This drug has an FDA therapeutic recommendation, refer to drug monograph or FDA labelling for dosing recommendations

Meloxicam	Phenotype	Genetic Test	Results	Source/Evidence
Anjeso Mobic Qmiiz ODT Vivlodex	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[32]; FDA 1[35]
TreatGx ReviewGx				

Implication: CYP2C9 alleles do not indicate changes from recommended dose

Mercaptopurine	Phenotype	Genetic Test	Results	Source/Evidence
Purinethol Purixan	Normal metabolizer	TPMT	*1/*1	CPIC A[30]; FDA 1[35]
	Normal metabolizer	NUDT15	*1/*1	CPIC A[30]; FDA 1[35]
TreatGx ReviewGx				

Implication: For malignant and non-malignant conditions: Start with normal starting dose and adjust doses of Mercaptopurine without any special emphasis on Mercaptopurine compared with other agents. Allow 2 weeks to reach steady-state after each dose adjustment.

Methotrimeprazine	Phenotype	Genetic Test	Results	Source/Evidence
Nozinan	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
TreatGx ReviewGx	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Metoclopramide	Phenotype	Genetic Test	Results	Source/Evidence
Metonia Reglan	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
TreatGx ReviewGx				

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Metoprolol	Phenotype	Genetic Test	Results	Source/Evidence
Kapspargo Sprinkle Lopressor Toprol-XL TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	DPWG[9]; FDA 3[35]
	Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Metoprolol to less active compounds Higher plasma concentrations of active drug may increase the risk of adverse drug reactions 2 If a gradual reduction in heart rate is desired, or in the event of clinically significant bradycardia, increase the dose in small steps and/or prescribe no more than 50% of the standard dose.			

Mirabegron	Phenotype	Genetic Test	Results	Source/Evidence
Myrbetriq TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]
	Implication: CYP2D6 alleles do not indicate changes from recommended dose			

Molindone	Phenotype	Genetic Test	Results	Source/Evidence
Moban TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome			

Morphine	Phenotype	Genetic Test	Results	Source/Evidence
Kadian M-Eslon Morphabond ER MS Contin MS-IR Statex TreatGx ReviewGx	Typical response	OPRM1 rs1799971	A/A	PharmGKB 3[7]
	Implication: OPRM1 alleles indicate a typical response to Morphine			

Nebivolol	Phenotype	Genetic Test	Results	Source/Evidence
Bystolic TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]
	Implication: CYP2D6 alleles do not indicate changes from recommended dose			

Nitrazepam	Phenotype	Genetic Test	Results	Source/Evidence
Mogadon ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]
	Implication: CYP2C9 alleles indicate typical risk of Nitrazepam-related falls			

Nortriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Aventyl Pamelor TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC A[16]; FDA 3[35]
	Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Nortriptyline to less active compounds Higher plasma concentrations of active drug may increase the risk of adverse drug reactions			
	2 Consider a reduction of the recommended dose for Nortriptyline (per CPIC moderate recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.			

Olanzapine	Phenotype	Genetic Test	Results	Source/Evidence
Zyprexa TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome			

Omeprazole	Phenotype	Genetic Test	Results	Source/Evidence
Losec Olex Prilosec TreatGx ReviewGx	Poor metabolizer	CYP2C19	*2/*7	CPIC A[22]; FDA 3[35]
	Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Omeprazole to less active compounds Higher plasma concentrations of active drug may increase the risk of adverse drug reactions			
	2 Moderate CPIC recommendation: Initiate standard starting dose. For chronic therapy (> 12 weeks) and efficacy achieved, consider a 50% reduction in daily dose.			

Ondansetron	Phenotype	Genetic Test	Results	Source/Evidence
Zofran Zuplenz ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC A[2]
	Implication: CYP2D6 alleles do not indicate changes from recommended dose			

Oral contraceptives	Phenotype	Genetic Test	Results	Source/Evidence
ReviewGx	Typical risk of adverse drug reactions	Factor V rs6025	C/C	PharmGKB 1A
	Typical risk of adverse drug reactions	Factor II rs1799963	G/G	PharmGKB 3
	Implication: F2 and F5 alleles do not indicate changes from recommended dose			

Oxazepam	Phenotype	Genetic Test	Results	Source/Evidence
ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]
	Implication: CYP2C9 alleles indicate typical risk of Oxazepam-related falls			

Paliperidone	Phenotype	Genetic Test	Results	Source/Evidence
Invega TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication:	ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome		

Pantoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Pantoloc Protonix Tecta TreatGx ReviewGx	Poor metabolizer	CYP2C19	*2/*7	CPIC A[22]; FDA 1[35]
	Implication:	CYP2C19 poor metabolizer: greatly reduced metabolism of Pantoprazole to less active compounds Higher plasma concentrations of active drug may increase the risk of adverse drug reactions 2 Moderate CPIC recommendation: Initiate standard starting dose. For chronic therapy (> 12 weeks) and efficacy achieved, consider a 50% reduction in daily dose.		

Paroxetine	Phenotype	Genetic Test	Results	Source/Evidence
Brisdelle Paxil Pexeva TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC A[4]; FDA 3[35]
	Implication:	Reduced metabolism of paroxetine to less active compounds when compared with CYP2D6 normal metabolizers when starting treatment or at lower doses. Higher plasma concentrations may increase the probability of side effects. Paroxetine-associated phenoconversion of intermediate metabolizers to poor metabolizers due to CYP2D6 autoinhibition may occur and is dose-dependent and greater at steady-state concentrations. 2 Consider a lower starting dose and slower titration schedule as compared with normal metabolizers (per CPIC optional recommendation).		

Perphenazine	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 2[35]
	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication:	ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome CYP2D6 alleles do not indicate changes from recommended dose		

Phenytoin	Phenotype	Genetic Test	Results	Source/Evidence
Dilantin Tremytoine Phenytek ReviewGx	Normal metabolizer	CYP2C9	*1/*1	CPIC A[18]; FDA 1[35]
	Implication:	CYP2C9 normal metabolizer: normal metabolism of Phenytoin to less active compounds CYP2C9 alleles do not indicate changes from recommended dose		

Pimozide	Phenotype	Genetic Test	Results	Source/Evidence
Orap TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication:	ANKK1 alleles indicate an increased risk of tardive dyskinesia CYP2D6 alleles do not indicate changes from recommended dose HTR2C alleles indicate a typical risk of metabolic syndrome		

Piroxicam	Phenotype	Genetic Test	Results	Source/Evidence
Feldene TreatGx ReviewGx	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[32]; FDA 1[35]
	Implication:	CYP2C9 alleles do not indicate changes from recommended dose		

Pitavastatin	Phenotype	Genetic Test	Results	Source/Evidence
Livalo Zypitamag TreatGx ReviewGx	Normal function	SLCO1B1	*1/*37	CPIC A[6]
	Implication:	SLCO1B1 alleles indicate typical exposure to Pitavastatin Consider prescribing desired starting dose and adjust based on disease-specific guidelines		

Pravastatin	Phenotype	Genetic Test	Results	Source/Evidence
Pravachol TreatGx ReviewGx	Normal function	SLCO1B1	*1/*37	CPIC A[6]
	Implication:	SLCO1B1 alleles indicate typical exposure to Pravastatin Consider prescribing desired starting dose and adjust based on disease-specific guidelines		

Prochlorperazine	Phenotype	Genetic Test	Results	Source/Evidence
Compro TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication:	ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome		

Promethazine	Phenotype	Genetic Test	Results	Source/Evidence
Phenadoz Promethegan TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication:	ANKK1 alleles indicate an increased risk of tardive dyskinesia HTR2C alleles indicate a typical risk of metabolic syndrome		

Propafenone	Phenotype	Genetic Test	Results	Source/Evidence
Rythmol	Intermediate metabolizer	CYP2D6	*4/*41	DPWG[9]; FDA 1[35]

TreatG:x
ReviewG:x

Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Propafenone to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

2 Adjust dose in response to plasma concentration and record electrocardiogram or select an alternative drug

Propranolol	Phenotype	Genetic Test	Results	Source/Evidence
Inderal Innopran	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]

TreatG:x
ReviewG:x

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Protriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Vivactil	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]

ReviewG:x

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Quetiapine	Phenotype	Genetic Test	Results	Source/Evidence
Seroquel	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

TreatG:x
ReviewG:x

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Risperidone	Phenotype	Genetic Test	Results	Source/Evidence
Perseris Risperdal	Intermediate metabolizer	CYP2D6	*4/*41	DPWG[9]; FDA 3[35]
	Typical response	DRD2 rs1799978	T/T	PharmGKB 3

Implication: DRD2 alleles may indicate a typical response to Risperidone

CYP2D6 alleles do not indicate changes from recommended dose

TreatG:x
ReviewG:x

Rosuvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Crestor Ezallor	Normal function	SLCO1B1	*1/*37	CPIC A[6]; FDA 3[35]
	Normal function	ABCG2 rs2231142	G/G	CPIC A[6]

Implication: ABCG2 alleles indicate typical exposure to Rosuvastatin

SLCO1B1 alleles indicate typical exposure to Rosuvastatin

Consider prescribing desired starting dose and adjust based on disease-specific and population-specific guidelines

TreatG:x
ReviewG:x

Salmeterol	Phenotype	Genetic Test	Results	Source/Evidence
Serevent	Typical response	ADRB2 rs1042713	A/G	PharmGKB 2A[23]

TreatG:x
ReviewG:x

Implication: ADRB2 alleles indicate typical response to Salmeterol

Sertraline	Phenotype	Genetic Test	Results	Source/Evidence
Zoloft	Intermediate metabolizer	CYP2B6	*1/*6	CPIC B[4]
	Poor metabolizer	CYP2C19	*2/*7	CPIC A[4]

TreatGx
ReviewGx

Implication: Reduced metabolism of sertraline to less active compounds when compared with CYP2B6 normal metabolizers.

Greatly reduced metabolism of sertraline to less active compounds when compared with CYP2C19 normal metabolizers. Higher plasma concentrations may increase the probability of side effects.

2 Consider a lower starting dose, slower titration schedule, and 50% reduction of standard maintenance dose as compared with CYP2C19 normal metabolizers or select a clinically appropriate alternative antidepressant not predominantly metabolized by CYP2C19 (per CPIC moderate recommendation).

Simvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Zocor Flolipid	Normal function	SLCO1B1	*1/*37	CPIC A[6]; FDA 2[35]

Implication: SLCO1B1 alleles indicate typical exposure to Simvastatin

Consider prescribing desired starting dose and adjust based on disease-specific guidelines

TreatGx
ReviewGx

Siponimod	Phenotype	Genetic Test	Results	Source/Evidence
Mayzent	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	FDA 1[35]

Implication: CYP2C9 alleles do not indicate changes from recommended dose

ReviewGx

Tacrolimus	Phenotype	Genetic Test	Results	Source/Evidence
Advagraf Astagraf XL Envarsus XR Prograf Protopic	Poor metabolizer	CYP3A5	*3/*3	CPIC A[3]; FDA 1[35]
	Normal metabolizer	CYP3A4	*1A/*1A	PharmGKB 1B; PharmGKB 2A

Implication: CYP3A5 alleles do not indicate changes from recommended dose

CYP3A4 alleles do not indicate changes from recommended dose

Use therapeutic drug monitoring to guide dose adjustments

ReviewGx

Tamoxifen	Phenotype	Genetic Test	Results	Source/Evidence
Nolvadex Soltamox	Intermediate metabolizer (AS 0.25-0.75)	CYP2D6 (Activity Score)	*4/*41	CPIC A[12]; FDA 3[35]

ReviewGx

Implication: CYP2D6 intermediate metabolizer with an activity score of 0.25-0.75: reduced metabolism of Tamoxifen to endoxifen

2 Moderate CPIC recommendation for breast cancer therapy: Consider alternative hormonal therapy.

2 If aromatase inhibitor use is contraindicated, consideration should be given to use a higher but FDA approved tamoxifen dose (40 mg/day). Avoid CYP2D6 strong to weak inhibitors.

Recommendation for conditions other than breast cancer: There is a potential impact on pharmacokinetic properties. The impact of CYP2D6 variants on the safety of Tamoxifen has not been established (FDA PGx Table)

Tamsulosin	Phenotype	Genetic Test	Results	Source/Evidence
Flomax	Intermediate metabolizer	CYP2D6	*4/*41	FDA 3[35]
ReviewGx	**Implication:** CYP2D6 alleles do not indicate changes from recommended dose			

Temazepam	Phenotype	Genetic Test	Results	Source/Evidence
Restoril	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]
TreatGx ReviewGx	**Implication:** CYP2C9 alleles indicate typical risk of Temazepam-related falls			

Tenoxicam	Phenotype	Genetic Test	Results	Source/Evidence
Mobiflex	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[32]
ReviewGx	**Implication:** CYP2C9 alleles do not indicate changes from recommended dose			

Tetrabenazine	Phenotype	Genetic Test	Results	Source/Evidence
Austedo Nitoman Xenazine	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
ReviewGx	**Implication:** CYP2D6 alleles do not indicate changes from recommended dose			

Thioguanine	Phenotype	Genetic Test	Results	Source/Evidence
Lanvis	Normal metabolizer	TPMT	*1/*1	CPIC A[30]; FDA 1[35]
ReviewGx	Normal metabolizer	NUDT15	*1/*1	CPIC A[30]; FDA 1[35]
	Implication: For malignant and non-malignant conditions: Start with normal starting dose and adjust doses of Thioguanine and of other myelosuppressive therapy without any special emphasis on Thioguanine. Allow 2 weeks to reach steady-state after each dose adjustment.			

Thioridazine	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]
	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3
	Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia CYP2D6 alleles do not indicate changes from recommended dose HTR2C alleles indicate a typical risk of metabolic syndrome			

Tolterodine	Phenotype	Genetic Test	Results	Source/Evidence
Detrol	Intermediate metabolizer	CYP2D6	*4/*41	FDA 2[35]
TreatGx ReviewGx	**Implication:** CYP2D6 alleles do not indicate changes from recommended dose			

Tramadol	Phenotype	Genetic Test	Results	Source/Evidence
Conzip Durela Ralivia Ultram Zytram XL TreatGx ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC A[7]; FDA 1[35]; FDA 2[35]

Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Tramadol to active metabolite

CYP2D6 alleles do not indicate changes from recommended dose. If no response to Tramadol and opioid use is warranted, consider an opioid other than tramadol or codeine (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.

Triazolam	Phenotype	Genetic Test	Results	Source/Evidence
Halcion TreatGx ReviewGx	Normal metabolizer	CYP2C9	*1/*1	Case-control studies[14]

Implication: CYP2C9 alleles indicate typical risk of Triazolam-related falls

Trifluoperazine	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx ReviewGx	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Trimipramine	Phenotype	Genetic Test	Results	Source/Evidence
Surmontil ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[16]; FDA 3[35]
	Poor metabolizer	CYP2C19	*2/*7	CPIC B[16]

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Trimipramine may affect response or adverse drug reactions

CYP2D6 intermediate metabolizer: reduced metabolism of Trimipramine to less active compounds
Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

3 Avoid Trimipramine use (per CPIC optional recommendation). Refer to TreatGx for alternatives and specific dosing recommendations.

Valbenazine	Phenotype	Genetic Test	Results	Source/Evidence
Ingrezza ReviewGx	Intermediate metabolizer	CYP2D6	*4/*41	FDA 1[35]

Implication: CYP2D6 alleles do not indicate changes from recommended dose

Venlafaxine	Phenotype	Genetic Test	Results	Source/Evidence
Effexor XR	Intermediate metabolizer	CYP2D6	*4/*41	CPIC B[4]; FDA 1[35]

TreatGx
ReviewGx

Implication: Decreased metabolism of venlafaxine to active metabolite O-desmethylvenlafaxine (desvenlafaxine) and decreased O-desmethylvenlafaxine: venlafaxine ratio as compared with CYP2D6 normal metabolizers. There is insufficient evidence supporting the clinical impact of the decreased O-desmethylvenlafaxine: venlafaxine ratio in CYP2D6 intermediate metabolizers.

CPIC: No action recommended based on genotype for venlafaxine because of minimal evidence regarding the impact on efficacy or side effects.

Voriconazole	Phenotype	Genetic Test	Results	Source/Evidence
Vfend	Poor metabolizer	CYP2C19	*2/*7	CPIC A[26]; FDA 2[35]

ReviewGx

Implication: CYP2C19 poor metabolizer: greatly reduced metabolism of Voriconazole to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

2 Consider an alternative drug not predominantly metabolized by CYP2C19

Vortioxetine	Phenotype	Genetic Test	Results	Source/Evidence
Trintellix	Intermediate metabolizer	CYP2D6	*4/*41	CPIC A[4]; FDA 1[35]

TreatGx
ReviewGx

Implication: Reduced metabolism of vortioxetine to less active compounds when compared with CYP2D6 normal metabolizers. Higher plasma concentrations may increase the probability of side effects.

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

Warfarin	Phenotype	Genetic Test	Results	Source/Evidence
Coumadin Jantoven	Normal metabolizer	CYP2C9	*1/*1	CPIC A[17]; FDA 1[35]
	Reduced response	VKORC1	G/G	CPIC A[17]; FDA 1[35]
	Reduced response	CYP4F2 rs2108622	C/T	CPIC A[17]; FDA 1[35]
	Increased response	CYP2C rs12777823	G/A	CPIC A[17]

TreatGx
ReviewGx

Implication: 2 The algorithm in TreatGx includes pharmacogenetics and other clinical factors in calculating initial warfarin dose

Ziprasidone	Phenotype	Genetic Test	Results	Source/Evidence
Geodon Zeldox	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

TreatGx
ReviewGx

Implication: ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Zuclopenthixol	Phenotype	Genetic Test	Results	Source/Evidence
Clopixol	Intermediate metabolizer	CYP2D6	*4/*41	DPWG[9]
TreatG:x ReviewG:x	Increased risk of adverse drug reactions	ANKK1/DRD2 rs1800497	G/G	PharmGKB 3
	Typical risk of adverse drug reactions	HTR2C rs1414334	G/G	PharmGKB 3

Implication: CYP2D6 intermediate metabolizer: reduced metabolism of Zuclopenthixol to less active compounds

Higher plasma concentrations of active drug may increase the risk of adverse drug reactions

Avoid Zuclopenthixol use

ANKK1 alleles indicate an increased risk of tardive dyskinesia

HTR2C alleles indicate a typical risk of metabolic syndrome

Table of Available References

Drug	Genetic Test	Sources
Alfentanil	OPRM1 rs1799971	PharmGKB
Alprazolam	CYP2C9	Case-control studies[14]
Amitriptyline	CYP2D6	CPIC[16]; FDA[35]
Amitriptyline	CYP2C19	CPIC[16]
Amoxapine	CYP2D6	FDA[35]
Amphetamine	CYP2D6	FDA[35]
Aripiprazole	CYP2D6	DPWG[9]; FDA[35]
Aripiprazole	ANKK1/DRD2 rs1800497	PharmGKB
Aripiprazole	HTR2C rs1414334	PharmGKB
Aripiprazole lauroxil	CYP2D6	FDA[35]
Asenapine	ANKK1/DRD2 rs1800497	PharmGKB
Asenapine	HTR2C rs1414334	PharmGKB
Atomoxetine	CYP2D6 (Activity Score)	CPIC[5]; FDA[35]
Atorvastatin	SLCO1B1	CPIC[6]; FDA[35]
Avatrombopag	CYP2C9	FDA[35]
Azathioprine	TPMT	CPIC[30]; FDA[35]
Azathioprine	NUDT15	CPIC[30]; FDA[35]
Brexpiprazole	CYP2D6	DPWG[9]; FDA[35]
Brexpiprazole	ANKK1/DRD2 rs1800497	PharmGKB
Brexpiprazole	HTR2C rs1414334	PharmGKB
Brivaracetam	CYP2C19	FDA[35]
Bromazepam	CYP2C9	Case-control studies[14]
Capecitabine	DPYD	CPIC[1]; FDA[35]
Cariprazine	ANKK1/DRD2 rs1800497	PharmGKB
Cariprazine	HTR2C rs1414334	PharmGKB

Drug	Genetic Test	Sources
Carisoprodol	CYP2C19	FDA[35]
Carvedilol	CYP2D6	FDA[35]
Celecoxib	CYP2C9 (Star Alleles)	CPIC[32]; FDA[35]
Cevimeline	CYP2D6	FDA[35]
Chlordiazepoxide	CYP2C9	Case-control studies[14]
Chlorpromazine	ANKK1/DRD2 rs1800497	PharmGKB
Chlorpromazine	HTR2C rs1414334	PharmGKB
Citalopram	CYP2C19	CPIC[4]; FDA[35]
Citalopram	GRIK4 rs1954787	PharmGKB
Citalopram	HTR2A rs7997012	PharmGKB
Clobazam	CYP2C19	FDA[35]
Clomipramine	CYP2D6	CPIC[16]; FDA[35]
Clomipramine	CYP2C19	CPIC[16]
Clonazepam	CYP2C9	Case-control studies[14]
Clopidogrel	CYP2C19	CPIC[20]; FDA[35]
Clorazepate	CYP2C9	Case-control studies[14]
Clozapine	CYP2D6	FDA[35]
Clozapine	ANKK1/DRD2 rs1800497	PharmGKB
Clozapine	HTR2C rs1414334	PharmGKB
Codeine	CYP2D6	CPIC[7]; FDA[35]
Cyclosporine	CYP3A5	PharmGKB
Darifenacin	CYP2D6	FDA[35]
Desipramine	CYP2D6	CPIC[16]; FDA[35]
Deutetrabenazine	CYP2D6	FDA[35]
Dexlansoprazole	CYP2C19	CPIC[22]; FDA[35]

Drug	Genetic Test	Sources
Diazepam	CYP2C19	FDA[35]
Diazepam	CYP2C9	Case-control studies[14]
Donepezil	CYP2D6	FDA[35]
Doxepin	CYP2D6	CPIC[16]; FDA[35]
Doxepin	CYP2C19	CPIC[16]; FDA[35]
Dronabinol	CYP2C9	FDA[35]
Efavirenz	CYP2B6	CPIC[8]; DPWG[9]; FDA[35]
Elagolix	SLCO1B1	FDA[35]
Eliglustat	CYP2D6	DPWG[9]; FDA[35]
Eltrombopag	Factor V rs6025	FDA[28]
Eltrombopag	Factor II rs1799963	PharmGKB
Erdafitinib	CYP2C9 (Star Alleles)	FDA[35]
Escitalopram	CYP2C19	CPIC[4]; FDA[35]
Fentanyl	OPRM1 rs1799971	PharmGKB
Fesoterodine	CYP2D6	FDA[35]
Flecainide	CYP2D6	DPWG[9]
Flibanserin	CYP2C19	FDA[35]
Fluorouracil	DPYD	CPIC[1]; FDA[35]
Flupentixol	ANKK1/DRD2 rs1800497	PharmGKB
Flupentixol	HTR2C rs1414334	PharmGKB
Fluphenazine	ANKK1/DRD2 rs1800497	PharmGKB
Fluphenazine	HTR2C rs1414334	PharmGKB
Flurazepam	CYP2C9	Case-control studies[14]
Flurbiprofen	CYP2C9 (Star Alleles)	CPIC[32]; FDA[35]
Fluvastatin	CYP2C9	CPIC[6]

Drug	Genetic Test	Sources
Fluvastatin	SLCO1B1	CPIC[6]
Fluvoxamine	CYP2D6	CPIC[4]; FDA[35]
Formoterol	ADRB2 rs1042713	Clinical studies[36,38]
Fosphenytoin	CYP2C9	CPIC[18]; FDA[35]
Galantamine	CYP2D6	FDA[35]
Haloperidol	ANKK1/DRD2 rs1800497	PharmGKB
Haloperidol	HTR2C rs1414334	PharmGKB
Hydrocodone	CYP2D6	CPIC[7]
Ibuprofen	CYP2C9 (Star Alleles)	CPIC[32]; FDA[35]
Iloperidone	CYP2D6	FDA[35]
Iloperidone	ANKK1/DRD2 rs1800497	PharmGKB
Iloperidone	HTR2C rs1414334	PharmGKB
Imipramine	CYP2D6	CPIC[16]; FDA[35]
Imipramine	CYP2C19	CPIC[16]
Lansoprazole	CYP2C19	CPIC[22]; FDA[35]
Lofexidine	CYP2D6	FDA[35]
Lorazepam	CYP2C9	Case-control studies[14]
Lovastatin	SLCO1B1	CPIC[6]
Loxapine	ANKK1/DRD2 rs1800497	PharmGKB
Loxapine	HTR2C rs1414334	PharmGKB
Lurasidone	ANKK1/DRD2 rs1800497	PharmGKB
Lurasidone	HTR2C rs1414334	PharmGKB
Meclizine	CYP2D6	FDA[35]
Meloxicam	CYP2C9 (Star Alleles)	CPIC[32]; FDA[35]
Mercaptopurine	TPMT	CPIC[30]; FDA[35]

Drug	Genetic Test	Sources
Mercaptopurine	NUDT15	CPIC[30]; FDA[35]
Methotrimeprazine	ANKK1/DRD2 rs1800497	PharmGKB
Methotrimeprazine	HTR2C rs1414334	PharmGKB
Metoclopramide	CYP2D6	FDA[35]
Metoprolol	CYP2D6	DPWG[9]; FDA[35]
Mirabegron	CYP2D6	FDA[35]
Molindone	ANKK1/DRD2 rs1800497	PharmGKB
Molindone	HTR2C rs1414334	PharmGKB
Morphine	OPRM1 rs1799971	PharmGKB[7]
Nebivolol	CYP2D6	FDA[35]
Nitrazepam	CYP2C9	Case-control studies[14]
Nortriptyline	CYP2D6	CPIC[16]; FDA[35]
Olanzapine	ANKK1/DRD2 rs1800497	PharmGKB
Olanzapine	HTR2C rs1414334	PharmGKB
Omeprazole	CYP2C19	CPIC[22]; FDA[35]
Ondansetron	CYP2D6	CPIC[2]
Oral contraceptives	Factor V rs6025	PharmGKB
Oral contraceptives	Factor II rs1799963	PharmGKB
Oxazepam	CYP2C9	Case-control studies[14]
Paliperidone	ANKK1/DRD2 rs1800497	PharmGKB
Paliperidone	HTR2C rs1414334	PharmGKB
Pantoprazole	CYP2C19	CPIC[22]; FDA[35]
Paroxetine	CYP2D6	CPIC[4]; FDA[35]
Perphenazine	CYP2D6	FDA[35]
Perphenazine	ANKK1/DRD2 rs1800497	PharmGKB

Drug	Genetic Test	Sources
Perphenazine	HTR2C rs1414334	PharmGKB
Phenytoin	CYP2C9	CPIC[18]; FDA[35]
Pimozide	CYP2D6	DPWG[9]; FDA[35]
Pimozide	ANKK1/DRD2 rs1800497	PharmGKB
Pimozide	HTR2C rs1414334	PharmGKB
Piroxicam	CYP2C9 (Star Alleles)	CPIC[32]; FDA[35]
Pitavastatin	SLCO1B1	CPIC[6]
Pravastatin	SLCO1B1	CPIC[6]
Prochlorperazine	ANKK1/DRD2 rs1800497	PharmGKB
Prochlorperazine	HTR2C rs1414334	PharmGKB
Promethazine	ANKK1/DRD2 rs1800497	PharmGKB
Promethazine	HTR2C rs1414334	PharmGKB
Propafenone	CYP2D6	DPWG[9]; FDA[35]
Propranolol	CYP2D6	FDA[35]
Protriptyline	CYP2D6	FDA[35]
Quetiapine	ANKK1/DRD2 rs1800497	PharmGKB
Quetiapine	HTR2C rs1414334	PharmGKB
Risperidone	CYP2D6	DPWG[9]; FDA[35]
Risperidone	DRD2 rs1799978	PharmGKB
Rosuvastatin	SLCO1B1	CPIC[6]; FDA[35]
Rosuvastatin	ABCG2 rs2231142	CPIC[6]
Salmeterol	ADRB2 rs1042713	PharmGKB[23]
Sertraline	CYP2B6	CPIC[4]
Sertraline	CYP2C19	CPIC[4]
Simvastatin	SLCO1B1	CPIC[6]; FDA[35]

Drug	Genetic Test	Sources
Siponimod	CYP2C9 (Star Alleles)	FDA[35]
Tacrolimus	CYP3A5	CPIC[3]; FDA[35]
Tacrolimus	CYP3A4	PharmGKB
Tamoxifen	CYP2D6 (Activity Score)	Clinical trial[15]; CPIC[12]; FDA[35]
Tamsulosin	CYP2D6	FDA[35]
Temazepam	CYP2C9	Case-control studies[14]
Tenoxicam	CYP2C9 (Star Alleles)	CPIC[32]
Tetrabenazine	CYP2D6	FDA[35]
Thioguanine	TPMT	CPIC[30]; FDA[35]
Thioguanine	NUDT15	CPIC[30]; FDA[35]
Thioridazine	CYP2D6	FDA[35]
Thioridazine	ANKK1/DRD2 rs1800497	PharmGKB
Thioridazine	HTR2C rs1414334	PharmGKB
Tolterodine	CYP2D6	FDA[35]
Tramadol	CYP2D6	CPIC[7]; FDA[35]
Triazolam	CYP2C9	Case-control studies[14]
Trifluoperazine	ANKK1/DRD2 rs1800497	PharmGKB
Trifluoperazine	HTR2C rs1414334	PharmGKB
Trimipramine	CYP2D6	CPIC[16]; FDA[35]
Trimipramine	CYP2C19	CPIC[16]
Valbenazine	CYP2D6	FDA[35]
Venlafaxine	CYP2D6	CPIC[4]; FDA[35]
Voriconazole	CYP2C19	CPIC[26]; FDA[35]
Vortioxetine	CYP2D6	CPIC[4]; FDA[35]
Warfarin	CYP2C9	CPIC[17]; FDA[35]

Drug	Genetic Test	Sources
Warfarin	VKORC1	CPIC[17]; FDA[35]
Warfarin	CYP4F2 rs2108622	CPIC[17]; FDA[35]
Warfarin	CYP2C rs12777823	CPIC[17]
Ziprasidone	ANKK1/DRD2 rs1800497	PharmGKB
Ziprasidone	HTR2C rs1414334	PharmGKB
Zuclopenthixol	CYP2D6	DPWG[9]
Zuclopenthixol	ANKK1/DRD2 rs1800497	PharmGKB
Zuclopenthixol	HTR2C rs1414334	PharmGKB

References

1: Amstutz, U. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for Dihydropyrimidine Dehydrogenase Genotype and Fluoropyrimidine Dosing: 2017 Update. Clinical Pharmacology & Therapeutics 103, 210-216 (2017).

2: Bell, G. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) guideline for CYP2D6 genotype and use of ondansetron and tropisetron. Clinical Pharmacology & Therapeutics 102, 213-218 (2017).

3: Birdwell, K. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guidelines for CYP3A5 Genotype and Tacrolimus Dosing. Clinical Pharmacology & Therapeutics 98, 19-24 (2015).

4: Bousman, C. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for CYP2D6, CYP2C19, CYP2B6, SLC6A4, and HTR2A Genotypes and Serotonin Reuptake Inhibitor Antidepressants. Clinical Pharmacology & Therapeutics 114, 51-68 (2023).

5: Brown, J. et al. Clinical Pharmacogenetics Implementation Consortium Guideline for Cytochrome P450 (CYP)2D6 Genotype and Atomoxetine Therapy. Clinical Pharmacology & Therapeutics 106, 94-102 (2019).

6: CooperDeHoff, RM. et al. Clinical Pharmacogenetics Implementation Consortium Guideline for SLCO1B1, ABCG2, and CYP2C9 genotypes and StatinAssociated Musculoskeletal Symptoms. Clinical Pharmacology & Therapeutics 111, 10071021 (2022).

7: Crews, K. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for CYP2D6, OPRM1, and COMT genotype and select opioid therapy. Clinical Pharmacology & Therapeutics 110, 888-896 (2021).

8: Desta, Z. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for CYP2B6 and Efavirenz-Containing Antiretroviral Therapy. Clinical Pharmacology & Therapeutics 106, 726-733 (2019).

9: Dutch Pharmacogenetics Working Group. Dutch Pharmacogenetics Working Group Guidelines May 2020. (2020).

10: Gammal RS. et al. Clinical Pharmacogenetics Implementation Consortium Guideline for Medication Use in the Context of G6PD Genotype. Clinical Pharmacology & Therapeutics 113, 973-985 (2022).

11: Gammal, RS. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for UGT1A1 and Atazanavir Prescribing. Clinical Pharmacology & Therapeutics 99, 363-369 (2016).

12: Goetz M. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for CYP2D6 and Tamoxifen Therapy. Clinical Pharmacology & Therapeutics 103, 770-777 (2018).

13: Gonsalves, SG. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for the Use of Potent Volatile Anesthetic Agents and Succinylcholine in the Context of RYR1 or CACNA1S Genotypes. Clinical Pharmacology & Therapeutics 105, 1338-1344 (2019).

14: Ham, A. et al. CYP2C9 Genotypes Modify Benzodiazepine-Related Fall Risk: Original Results From Three Studies With Meta-Analysis. Journal of the American Medical Directors Association 18, 88.e1-88.e15 (2017).

15: He, W. et al. CYP2D6 genotype predicts tamoxifen discontinuation and drug response: a secondary analysis of the KARISMA trial. Annals of Oncology 32, 1286-1293 (2021).

16: Hicks, J. et al. Clinical pharmacogenetics implementation consortium guideline (CPIC) for CYP2D6 and CYP2C19 genotypes and dosing of tricyclic antidepressants: 2016 update. Clinical Pharmacology & Therapeutics 102, 37-44 (2017).

17: Johnson, J. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for Pharmacogenetics-Guided Warfarin Dosing: 2017 Update. Clinical Pharmacology & Therapeutics 102, 397-404 (2017).

18: Karnes, J. et al. Clinical pharmacogenetics implementation consortium (CPIC) guideline for CYP2C9 and HLA-B genotypes and phenytoin dosing: 2020 update. Clinical Pharmacology & Therapeutics 109, 302-309 (2021).

19: King, D. et al. Smoking cessation pharmacogenetics: analysis of varenicline and bupropion in placebo-controlled clinical trials. Neuropsychopharmacology 37, 641-650 (2012).

20: Lee, C. et al. Clinical Pharmacogenetics Implementation Consortium Guideline for CYP2C19 Genotype and Clopidogrel Therapy: 2022 Update. Clinical Pharmacology & Therapeutics 112, 959-967 (2022).

21: Lerman, C. et al. Use of the nicotine metabolite ratio as a genetically informed biomarker of response to nicotine patch or varenicline for smoking cessation: a randomised, double-blind placebo-controlled trial. The Lancet Respiratory Medicine 3, 131-138 (2015).

22: Lima, J. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for CYP2C19 and Proton Pump Inhibitor Dosing. Clinical Pharmacology & Therapeutics (2020)

23: Lipworth, J. et al. Tailored second-line therapy in asthmatic children with the Arg(16) genotype. Clinical science 124, 521-528 (2013).

24: Martin, MA. et al. Clinical pharmacogenetics implementation consortium guidelines for HLA-B genotype and abacavir dosing. Clinical Pharmacology & Therapeutics 91, 734-738 (2012).

25: McDermott, JH. et al. Clinical Pharmacogenetics Implementation Consortium Guideline for the Use of Aminoglycosides Based on MT-RNR1 Genotype. Clinical Pharmacology & Therapeutics 111, 366-372 (2022).

26: Moriyama, B. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guidelines for CYP2C19 and Voriconazole Therapy. Clinical Pharmacology & Therapeutics 102, 45-51 (2017).

27: Muir, A. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guidelines for IFNL3 (IL28B) Genotype and PEG Interferon-alpha-Based Regimens. Clinical Pharmacology & Therapeutics 95, 141-146 (2014).

28: Novartis Pharmaceuticals Corporation. Promacta Product Monograph. 10 (2018).

29: Phillips, E. et al. Clinical Pharmacogenetics Implementation Consortium Guideline for HLA Genotype and Use of Carbamazepine and Oxcarbazepine: 2017 Update. Clinical Pharmacology & Therapeutics 103, 574-581 (2018).

30: Relling, M. et al. Clinical Pharmacogenetics Implementation Consortium Guideline for Thiopurine Dosing Based on TPMT and NUDT15 Genotypes: 2018 Update. Clinical Pharmacology & Therapeutics 105, 1095-1105 (2019).

31: Saito, Y. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) guidelines for human leukocyte antigen B (HLA-B) genotype and allopurinol dosing: 2015 update. Clinical Pharmacology & Therapeutics 99, 36-37 (2015).

32: Theken, K. et al. Clinical Pharmacogenetics Implementation Consortium (CPIC) Guideline for CYP2C9 and Nonsteroidal Anti-inflammatory Drugs. Clinical Pharmacology & Therapeutics 108, 191-200 (2020)

33: Ueta, M. et al. Independent strong association of HLAA*02:06 and HLAB*44:03 with cold medicinerelated StevensJohnson syndrome with severe mucosal involvement. Scientific Reports 4, 4862 (2014).

34: Ueta, M. et al. Transethnic study confirmed independent associations of HLAA*02:06 and HLAB*44:03 with cold medicinerelated StevensJohnson syndrome with severe ocular surface complications. Scientific Reports 4, 5981 (2014).

35: US Food and Drug Administration. Table of Pharmacogenetic Associations: Section 1: Pharmacogenetic Associations for which the Data Support Therapeutic Management Recommendations, Section 2: Pharmacogenetic Associations for which the Data Indicate a Potential Impact on Safety or Response, Section 3: Pharmacogenetic Associations for which the Data Demonstrate a Potential Impact on Pharmacokinetic Properties Only. (2022).

36: Vijverberg, S. et al. Arg16 ADRB2 genotype increases the risk of exacerbations in children with a reported use of beta-2 agonists: Results of the PACMAN cohort study. Pharmaceutisch Weekblad 150, 233-238 (2015).

37: Wakamatsu, T. et al. Human Leukocyte Antigen Class I Genes Associated With Stevens-Johnson Syndrome and Severe Ocular Complications Following Use of Cold Medicine in a Brazilian Population. JAMA Ophthalmology 135, 355 (2017).

38: Wechsler, M. et al. Effect of beta2-adrenergic receptor polymorphism on response to longacting beta-agonist in asthma (LARGE trial): a genotype-stratified, randomised, placebo-controlled, crossover trial. The Lancet 374, 1754-1764 (2009).

PHD LABORATORY

PATIENT INFORMATION
NAME: PGX1-A 1 PGX1-A 1
DOB: 08/May/2024
SEX AT BIRTH: Unknown

SPECIMEN DETAILS
BARCODE: X241300004
SAMPLE ID: X241300004
TYPE: Saliva
COLLECTED: 08/May/2024

ORDERED BY
[redacted]
REPORT GENERATED: 09/May/2024

Methodology

Array based assays detect listed alleles, including all common and most rare variants with known clinical significance at analytical sensitivity and specificity >99%.

Limitation

This test will not detect all the known alleles that result in altered or inactive tested genes. This test does not account for all individual variations in the individual tested. Absence of a detectable gene mutation does not rule out the possibility that a patient has different phenotypes due to the presence of an undetected polymorphism or due to other factors such as drug-drug interactions, comorbidities, and lifestyle habits.

Lab Disclaimer

Nucleic acid was extracted via magnetic bead-based, solid-phase commercially available technology and reagents. Genotyping was performed by qPCR for the alleles and targets listed on the report, and that passed QC. Genotype and drug metabolism association is made using commercially available software and recommendations from CPIC and PharmGKB. This test does not assay all known alleles that result in altered or inactive function and is limited to the alleles and targets listed on the report. Alleles that re "no-call" or failed QC are not analyzed. Absence of a detectable gene mutation does not rule out the possibility that the patient has a phenotype due to the presence of an undetected polymorphism or due to other factors such as drug-drug interactions, comorbidities, and lifestyle habits. The performance characteristics of this test were determined by Ph.D. Laboratories (CLIA: 34D2214106, COLA: 30912). It has not been cleared or approved by the U.S. Food and Drug Administration (FDA). The FDA has determined that such clearance or approval is not necessary. This test is for clinical purposes only and not for investigational and/or research use. The laboratory is regulated under the Clinical Laboratory improvement Act of 1988 as qualified to perform high complexity testing.

Laboratory Director

09/May/2024

Cynthe L Sims PhD, HCLD(ABB), Laboratory Director, MD, FRCP(C), FRSC, ABIM, CLIA #34D2214106

Date of Signature

PHD LABORATORY

PATIENT INFORMATION
NAME: PGX1-A 1 PGX1-A 1
DOB: 08/May/2024
SEX AT BIRTH: Unknown

SPECIMEN DETAILS
BARCODE: X241300004
SAMPLE ID: X241300004
TYPE: Saliva
COLLECTED: 08/May/2024

ORDERED BY
[redacted]
REPORT GENERATED: 09/May/2024

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
ABCB1	rs1128503	c.1446G>A	NC_000007.14	A/G
ABCG2	rs2231142	c.421G>T	NC_000004.12	G/G
ADRA2A	rs11195419	c.*216C>A	NC_000010.11	C/C
ADRA2A	rs1800544	c.-1252G>C	NC_000010.11	C/C
ADRA2A	rs553668	c.*427G>A	NC_000010.11	G/G
ADRB2	rs1042713	c.46G>A	NC_000005.10	A/G
ANKK1	rs1800497	c.2137G>A	NC_000011.10	G/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/G
CYP1A2	rs12720461	c.-10+113C>T	NC_000015.10	C/C
CYP1A2	rs2069514	g.74745879G>A	NC_000015.10	G/G
CYP1A2	rs2069526	c.-10+103T>G	NC_000015.10	G/T
CYP1A2	rs35694136	c.-1635T>-	NC_000015.10	-/-
CYP1A2	rs762551	c.-9-154A>C	NC_000015.10	A/A
CYP2B6	rs28399499	c.983T>C	NC_000019.10	T/T
CYP2B6	rs3211371	c.1459C>T	NC_000019.10	C/C
CYP2B6	rs34223104	c.-82T>C	NC_000019.10	T/T
CYP2B6	rs2279343	c.785A>G	NC_000019.10	G/A
CYP2B6	rs3745274	c.516G>T	NC_000019.10	G/T
CYP2C	rs12777823	g.94645745G>A	NC_000010.11	A/G
CYP2C19	rs12248560	c.-806C>T	NC_000010.11	C/C
CYP2C19	rs12769205	c.332-23A>G	NC_000010.11	G/A
CYP2C19	rs28399504	c.1A>G	NC_000010.11	A/A
CYP2C19	rs41291556	c.358T>C	NC_000010.11	T/T
CYP2C19	rs4244285	c.681G>A	NC_000010.11	A/G
CYP2C19	rs4986893	c.636G>A	NC_000010.11	G/G
CYP2C19	rs72552267	c.395G>A	NC_000010.11	G/G
CYP2C19	rs17884712	c.431G>A	NC_000010.11	G/G
CYP2C19	rs56337013	c.1297C>T	NC_000010.11	C/C
CYP2C19	rs6413438	c.680C>T	NC_000010.11	C/C
CYP2C19	rs72558186	c.819+2T>A	NC_000010.11	A/T
CYP2C8	rs10509681	c.1196T>C	NC_000010.11	T/T
CYP2C8	rs1058930	c.792G>C	NC_000010.11	G/G

Gene	rsID	HGVS	HGVS Reference	Result
CYP2C8	rs11572103	c.805T>A	NC_000010.11	T/T
CYP2C8	rs17110453	c.-370A>C	NC_000010.11	A/C
CYP2C9	rs1057910	c.1075A>C	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>G	NC_000010.11	C/C
CYP2C9	rs72558187	c.269T>C	NC_000010.11	T/T
CYP2C9	rs9332131	c.818AA>-	NC_000010.11	A/A
CYP2C9	rs56165452	c.1076T>C	NC_000010.11	T/T
CYP2C9	rs7900194	c.449G>A/T	NC_000010.11	G/G
CYP2D6	rs1065852	c.100G>A	NC_000022.11	A/G
CYP2D6	rs1135840	c.1457G>C	NC_000022.11	G/G
CYP2D6	rs16947	c.886G>A	NC_000022.11	A/G
CYP2D6	rs28371706	c.320G>A	NC_000022.11	G/G
CYP2D6	rs28371725	c.985+39C>T	NC_000022.11	C/T
CYP2D6	rs35742686	c.775T>-	NC_000022.11	T/T
CYP2D6	rs3892097	c.506-1C>T	NC_000022.11	C/T
CYP2D6	rs5030655	c.454A>-	NC_000022.11	A/A
CYP2D6	rs5030656	c.841_843CTT>-	NC_000022.11	CTT/CTT
CYP2D6	rs5030867	c.971T>G	NC_000022.11	T/T
CYP2D6	rs59421388	c.1012C>T	NC_000022.11	C/C
CYP2D6	rs5030862	c.124C>T	NC_000022.11	C/C
CYP2D6	rs5030865	c.505C>T/A	NC_000022.11	C/C
CYP2D6	rs769258	c.31C>T	NC_000022.11	C/C
CYP2D6	rs201377835	c.181-1C>G	NC_000022.11	C/C
CYP2D6	rs774671100	c.137->A	NC_000022.11	A/A (-/-)[1]
CYP2D6	rs72549356	c.514_522GGGGCGAAA>	NC_000022.11	-/-
CYP2D6	rs267608319	c.1319C>T	NC_000022.11	C/C
CYP2D6	rs72549346	c.1088_1089AC>-	NC_000022.11	-/-
CYP2D6	rs1135822	c.358A>T	NC_000022.11	A/A
CYP2D6	rs79292917	c.975C>T	NC_000022.11	C/C
CYP3A4	rs12721629	c.1117G>A	NC_000007.14	G/G
CYP3A4	rs2740574	c.-392T>C	NC_000007.14	T/T
CYP3A4	rs35599367	c.522-191G>A	NC_000007.14	G/G
CYP3A4	rs4986910	c.1334A>G	NC_000007.14	A/A

Gene	rsID	HGVS	HGVS Reference	Result
CYP3A4	rs4987161	c.566A>G	NC_000007.14	A/A
CYP3A4	rs55785340	c.664A>G	NC_000007.14	A/A
CYP3A5	rs10264272	c.624C>T	NC_000007.14	C/C
CYP3A5	rs41303343	c.1035_1036->A	NC_000007.14	A/A (-/-)[1]
CYP3A5	rs776746	c.219-237C>T	NC_000007.14	C/C
CYP3A5	rs28365083	c.1193G>T	NC_000007.14	G/G
CYP3A5	rs28383468	c.88G>A	NC_000007.14	G/G
CYP3A5	rs28383479	c.1009C>T	NC_000007.14	C/C
CYP3A5	rs55817950	c.82G>A	NC_000007.14	G/G
CYP4F2	rs2108622	c.1297C>T	NC_000019.10	C/T
C11orf65	rs11212617	c.175-5285C>A	NC_000011.10	A/C
DPYD	rs3918290	c.1905+1C>T	NC_000001.11	C/C
DPYD	rs67376798	c.2846T>A	NC_000001.11	T/T
DPYD	rs56038477	c.1236C>T	NC_000001.11	C/C
DPYD	rs55886062	c.1679A>C	NC_000001.11	A/A
DPYD	rs115232898	c.557T>C	NC_000001.11	T/T
DRD2	rs1079598	c.-31-870A>G	NC_000011.10	A/A
DRD2	rs1799732	c.-486_-485G>-	NC_000011.10	G/G
DRD2	rs1799978	c.-32+29T>C	NC_000011.10	T/T
DRD2	rs2734841	c.1139-134C>A	NC_000011.10	C/C
EPHX1	rs1051740	c.337T>C	NC_000001.11	C/T
Factor II	rs1799963	c.*97G>A	NC_000011.10	G/G
Factor V	rs6025	c.1601C>T	NC_000001.11	C/C
GRIK4	rs1954787	c.83-10039C>T	NC_000011.10	C/T
HTR1A	rs6295	c.-1019G>C	NC_000005.10	C/G
HTR2A	rs6311	c.-510C>T	NC_000013.11	C/C
HTR2A	rs7997012	c.614-2211G>A	NC_000013.11	G/G
HTR2C	rs1414334	c.551-3008G>C	NC_000023.11	G/G
HTR2C	rs3813929	c.-759C>T	NC_000023.11	C/C
ITGB3	rs5918	c.176T>C	NC_000017.11	C/T
MTHFR	rs1801131	c.1409T>G	NC_000001.11	T/T
MTHFR	rs1801133	c.788G>A	NC_000001.11	G/A
NUDT15	rs116855232	c.415C>T	NC_000013.11	C/C
NUDT15	rs147390019	c.416G>A	NC_000013.11	G/G
NUDT15	rs186364861	c.52G>A	NC_000013.11	G/G

Gene	rsID	HGVS	HGVS Reference	Result
OPRM1	rs1799971	c.118A>G	NC_000006.12	A/A
SLCO1B1	rs4149056	c.521T>C	NC_000012.12	T/T
SLCO1B1	rs2306283	c.388G>A	NC_000012.12	A/G
SLC6A2	rs12708954	c.1261-210C>A	NC_000016.10	C/C
SLC6A2	rs3785143	c.274+4226C>T	NC_000016.10	C/C
TPMT	rs1142345	c.719T>C	NC_000006.12	T/T
TPMT	rs1800460	c.460C>T	NC_000006.12	C/C
TPMT	rs1800462	c.238C>G	NC_000006.12	C/C
TPMT	rs1800584	c.626-1C>T	NC_000006.12	C/C
UGT2B15	rs1902023	c.253C>A	NC_000004.12	A/C
VKORC1	rs9923231	c.-1639C>T	NC_000016.10	G/G (C/C)[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 exon 9	2

Phenotype Table

Gene	Allele Result	Phenotype Result
CYP3A4	*1A/*1A	Normal Metabolizer
CYP2D6	*4/*41	Intermediate Metabolizer
CYP2C9	*1/*1	Normal Metabolizer
CYP2C19	*2/*7	Poor Metabolizer
SLCO1B1	*1/*37	Normal Function
CYP2B6	*1/*6	Intermediate Metabolizer
CYP3A5	*3/*3	Poor Metabolizer
DPYD	*1/*1	Normal Metabolizer
NUDT15	*1/*1	Normal Metabolizer
TPMT	*1/*1	Normal Metabolizer