FORENSIC GENOMICS INNOVATION HUB

PATIENT INFORMATION
NAME: Demo FGIH
DOB: 12/May/1982
SEX AT BIRTH: Female

SPECIMEN DETAILS
BARCODE: Demo1_FGIH
SAMPLE ID: Demo1_FGIH
TYPE: Swab
COLLECTED: 18/Dec/2024

ORDERED BY
Clinical Lead
REPORT GENERATED: 24/Jan/2025 (GMT)

Your Pharmacogenomics Report

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.

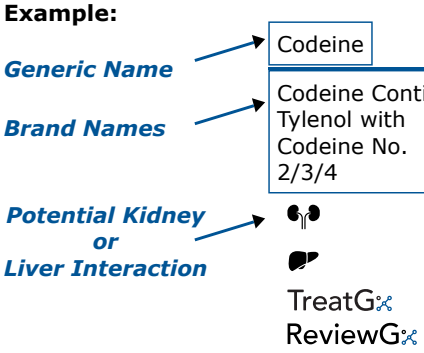
ReviewGx

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:



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

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.

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

2
Alfentanil
Amitriptyline
Fentanyl
Imipramine
Morphine

Autoimmune

1
Azathioprine
Mercaptopurine
Methotrexate
Siponimod

...Autoimmune

1
Thioguanine

2
Cyclosporine
Tacrolimus

Cancer

1
Capecitabine
Erdafitinib
Fluorouracil
Gefitinib
Mercaptopurine
Methotrexate
Tamoxifen
Thioguanine

Cardiovascular

1
Carvedilol
Clopidogrel
Flecainide
Mavacamten
Metoprolol
Nebivolol
Propafenone
Propranolol

2
Atorvastatin
Fluvastatin
Pitavastatin

...Cardiovascular

2
Pravastatin
Rosuvastatin
Warfarin

3
Lovastatin
Simvastatin

Endocrinology

1
Nateglinide

Gastroenterology

1
Dronabinol
Esomeprazole
Meclizine
Methotrexate
Metoclopramide
Ondansetron
Rabeprazole

2
Dexlansoprazole
Lansoprazole
Omeprazole
Pantoprazole

Infection

2
Efavirenz
Voriconazole

Mental Health

1
Amoxapine
Amphetamine
Aripiprazole
Aripiprazole lauroxil
Atomoxetine
Brexpiprazole
Desipramine
Diazepam
Fluoxetine
Fluvoxamine
Haloperidol
Iloperidone
Lofexidine
Nicotine replacement therapy
Nortriptyline
Paroxetine
Perphenazine
Pimozide
Protriptyline
Quetiapine
Sertraline
Thioridazine
Venlafaxine
Viloxazine
Vortioxetine
Zuclopenthixol

2
Amitriptyline

...Mental Health

2

Bupropion
Citalopram
Clomipramine
Clozapine
Doxepin
Escitalopram
Imipramine
Methylphenidate
Olanzapine
Risperidone
Trimipramine

Neurology

1

Brivaracetam
Clobazam
Deutetrabenazine
Diazepam
Donepezil
Fosphenytoin
Galantamine
Metoprolol
Phenytoin
Pitolisant
Propranolol
Tetrabenazine
Valbenazine
Venlafaxine

2

Amitriptyline

Respiratory

1

Salmeterol

Rheumatology

1

Azathioprine
Celecoxib
Flurbiprofen
Ibuprofen
Meloxicam
Methotrexate
Piroxicam
Tenoxicam

Urology

1

Darifenacin
Fesoterodine
Mirabegron
Tamsulosin
Tolterodine

Other

1

Abrocitinib
Avatrombopag
Cevimeline
Elagolix
Eliglustat
Eltrombopag
Flibanserin
Lusutrombopag
Oral contraceptives

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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	Carisoprodol Celecoxib Codeine Desipramine Flurbiprofen Hydrocodone Ibuprofen Meloxicam Nortriptyline Oliceridine Piroxicam Tenoxicam Tramadol Venlafaxine	Amitriptyline Imipramine		Alfentanil Fentanyl Morphine	Amitriptyline Fentanyl Imipramine	Amitriptyline Imipramine	
Autoimmune	Azathioprine Mercaptopurine Methotrexate Siponimod Thioguanine		Cyclosporine Tacrolimus		Tacrolimus		
Cancer	Capecitabine Erdafitinib Fluorouracil Gefitinib Mercaptopurine Methotrexate Tamoxifen Thioguanine						
Cardiovascular	Carvedilol Clopidogrel Flecainide Mavacamten Metoprolol Nebivolol	Atorvastatin Fluvastatin Pitavastatin Pravastatin	Warfarin	Atorvastatin Fluvastatin Pitavastatin Pravastatin Rosuvastatin Warfarin	Warfarin	Atorvastatin Fluvastatin Pitavastatin Pravastatin Rosuvastatin Warfarin	Lovastatin Simvastatin

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	Propafenone Propranolol						
Endocrinology	Nateglinide						
Gastroenterology	Dronabinol Esomeprazole Meclizine Methotrexate Metoclopramide Ondansetron Rabeprazole		Dexlansoprazole Lansoprazole Omeprazole Pantoprazole		Dexlansoprazole Lansoprazole Omeprazole Pantoprazole		
Infection		Voriconazole		Efavirenz	Voriconazole	Efavirenz	
Mental Health	Amoxapine Amphetamine Aripiprazole Aripiprazole lauroxil Atomoxetine Brexpiprazole Desipramine Diazepam Fluoxetine Fluvoxamine Haloperidol Iloperidone Lofexidine Nicotine replacement therapy Nortriptyline Paroxetine Perphenazine Pimozide Protriptyline Quetiapine Sertraline Thioridazine Venlafaxine Viloxazine Vortioxetine Zuclopenthixol	Amitriptyline Citalopram Clomipramine Doxepin Escitalopram Imipramine Trimipramine	Citalopram Escitalopram		Amitriptyline Bupropion Citalopram Clomipramine Doxepin Escitalopram Imipramine Methylphenidate Olanzapine Risperidone Trimipramine	Amitriptyline Clomipramine Clozapine Doxepin Imipramine Risperidone Trimipramine	

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	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
Neurology	Brivaracetam Clobazam Deutetrabenazine Diazepam Donepezil Fosphenytoin Galantamine Metoprolol Phenytoin Pitolisant Propranolol Tetrabenazine Valbenazine Venlafaxine	Amitriptyline			Amitriptyline	Amitriptyline	
Respiratory	Salmeterol						
Rheumatology	Azathioprine Celecoxib Flurbiprofen Ibuprofen Meloxicam Methotrexate Piroxicam Tenoxicam						
Urology	Darifenacin Fesoterodine Mirabegron Tamsulosin Tolterodine						
Other	Abrocitinib Avatrombopag Cevimeline Elagolix Eliglustat Eltrombopag Flibanserin Lusutrombopag Oral contraceptives						

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 ReviewGx	Rapid metabolizer	CYP2C19	*1/*17	FDA 1[39]; Product monograph (actionable)[31]
	FDA PGx Table: no information for this phenotype.			

Alfentanil	Phenotype	Genetic Test	Results	Source/Evidence
Alfenta ReviewGx	Increased analgesic response	OPRM1 rs1799971	A/A	PharmGKB 3[40,41]

2 PharmGKB – Clinical Annotation (Level 3 Efficacy): Patients with the OPRM1 rs1799971 A/A genotype may have an increased analgesic response to alfentanil as compared to patients with the A/G or G/G genotypes. Note that one study reported a non-significant association. This drug-variant pair has been assigned a "no recommendation" by CPIC, as it was determined to be not clinically actionable. Other genetic or clinical factors may also affect a patient's response to alfentanil.
PharmGKB – Clinical Annotation (Level 3 Dosage): Patients with the OPRM1 rs1799971 A/A genotype may have reduced alfentanil dose requirements as compared to patients with the A/G or G/G genotypes. This drug-variant pair has been assigned a "no recommendation" by CPIC, as it was determined to be not clinically actionable. Other genetic or clinical factors may also affect a alfentanil dose requirements.

Amitriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Elavil Levate TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*10	CPIC A[20]; FDA 3[39]
	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[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.

Amoxapine	Phenotype	Genetic Test	Results	Source/Evidence
ReviewGx	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]
	FDA PGx Table: no information for this phenotype.			

Amphetamine	Phenotype	Genetic Test	Results	Source/Evidence
Adzenys TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]
	CYP2D6 alleles do not indicate changes from recommended dose			

Aripiprazole	Phenotype	Genetic Test	Results	Source/Evidence
Abilify TreatG ReviewG	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]; Product monograph (actionable)[35]

FDA PGx Table: no information for this CYP2D6 phenotype.

Aripiprazole lauroxil	Phenotype	Genetic Test	Results	Source/Evidence
Aristada TreatG ReviewG	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]; Product monograph (actionable)[2]

FDA PGx Table: no information for this CYP2D6 phenotype.

Atomoxetine	Phenotype	Genetic Test	Results	Source/Evidence
Strattera TreatG ReviewG	Normal metabolizer	CYP2D6 (Activity Score)	*1/*10	CPIC A[8]; FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

Atorvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Lipitor TreatG ReviewG	Poor function	SLCO1B1	*5/*15	CPIC A[10]; FDA 3[39]

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

2 CPIC – Moderate Recommendation: Prescribe ≤20 mg as a starting dose and adjust doses of atorvastatin based on disease-specific guidelines. If dose >20 mg is needed for desired efficacy, consider rosuvastatin or 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.

Avatrombopag	Phenotype	Genetic Test	Results	Source/Evidence
Doptelet ReviewG	Normal metabolizer	CYP2C9	*1/*1	FDA 3[39]
	Normal Factor II	Factor II rs1799963	G/G	Product monograph (actionable)[1]
	Normal Factor V Leiden	Factor V rs6025	C/C	Product monograph (actionable)[1]

FDA PGx Table: no information for this CYP2C9 phenotype.

Product Monograph: no change in risk stated for normal Factor II (i.e. Prothrombin 20210A mutation absent).

Product Monograph: no change in risk stated for normal Factor V.

Azathioprine	Phenotype	Genetic Test	Results	Source/Evidence
Azasan Imuran	Normal metabolizer	TPMT	*1/*1	CPIC A[33,37]; FDA 1[39]
	Normal metabolizer	NUDT15	*1/*1	CPIC A[33,37]; FDA 1[39]

TreatG
ReviewG

CPIC – TPMT Implication: Lower concentrations of thioguanine nucleotides metabolites, higher metabolites of thiopurine methyltransferase, this is the 'normal' pattern. Normal risk of thiopurine-related leukopenia, neutropenia, myelosuppression.

CPIC – NUDT15 Implication: Normal risk of thiopurine-related leukopenia, neutropenia, myelosuppression.

CPIC – Strong Recommendation: Start with normal starting dose (e.g., 2-3 mg/kg/day) and adjust doses of azathioprine based on disease-specific guidelines. Allow 2 weeks to reach steady-state after each dose adjustment.
Normal starting doses vary by race/ethnicity and treatment regimens.

Brexpiprazole	Phenotype	Genetic Test	Results	Source/Evidence
Rexulti	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]; Product monograph (actionable)[3]

TreatG
ReviewG

FDA PGx Table: no information for this CYP2D6 phenotype.

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

CYP2C19 alleles do not indicate changes from recommended dose

ReviewG

Bupropion	Phenotype	Genetic Test	Results	Source/Evidence
Wellbutrin Zyban	Less likely to quit smoking compared to G/G	ANKK1/DRD2 rs1800497	A/G	PharmGKB 3[40,41]

TreatG
ReviewG

2 PharmGKB – Clinical Annotation (Level 3 Efficacy): Patients with the ANKK1 rs1800497 A/G genotype who are treated with bupropion may be less likely to quit smoking as compared to patients with the G/G genotype, however contradictory findings about abstinence exist. Other genetic and clinical factors may also influence a patient's chance for quitting smoking.

Capecitabine	Phenotype	Genetic Test	Results	Source/Evidence
Xeloda	Normal metabolizer	DPYD	*1/*1	CPIC A[4]; FDA 1[39]

ReviewG

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

DPYD alleles do not indicate changes from recommended dose

Carisoprodol	Phenotype	Genetic Test	Results	Source/Evidence
ReviewG	Rapid metabolizer	CYP2C19	*1/*17	FDA 3[39]

CYP2C19 alleles do not indicate changes from recommended dose

Carvedilol	Phenotype	Genetic Test	Results	Source/Evidence
Coreg	Normal metabolizer	CYP2D6	*1/*10	FDA 2[39]

TreatG
ReviewG

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]

TreatG: ReviewG:

CYP2C9 alleles do not indicate changes from recommended dose

Cevimeline	Phenotype	Genetic Test	Results	Source/Evidence
Evoxac	Normal metabolizer	CYP2D6	*1/*10	FDA 2[39]

ReviewG:

CYP2D6 alleles do not indicate changes from recommended dose

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

TreatG: ReviewG:

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

2 Initiate therapy with recommended starting dose. If patient does not adequately respond to recommended maintenance dosing, consider titrating to a higher maintenance dose or switching to a clinically appropriate alternative antidepressant not predominantly metabolized by CYP2C19 (per CPIC optional recommendation).

Clobazam	Phenotype	Genetic Test	Results	Source/Evidence
Onfi Sympazan	Rapid metabolizer	CYP2C19	*1/*17	FDA 1[39]; Product monograph (actionable)[25]

ReviewG:

FDA PGx Table: no information for this CYP2C19 phenotype.

Clomipramine	Phenotype	Genetic Test	Results	Source/Evidence
Anafranil	Normal metabolizer	CYP2D6	*1/*10	CPIC B[20]; FDA 3[39]
	Rapid metabolizer	CYP2C19	*1/*17	CPIC B[20]

ReviewG:

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	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[23]; FDA 1[39]

TreatG: ReviewG:

CYP2C19 alleles do not indicate changes from recommended dose

Clozapine	Phenotype	Genetic Test	Results	Source/Evidence
Clozaril Fazaclo ODT Versacloz TreatG ReviewG	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]
	Increased risk of developing metabolic syndrome	HTR2C rs1414334	C/G	PharmGKB 3[40,41]

FDA PGx Table: no information for this CYP2D6 phenotype.

2 PharmGKB – Clinical Annotation (Level 3 Toxicity): Patients with two X-chromosomes and the HTR2C rs1414334 C/C or C/G genotype, or one X-chromosome and the C genotype who are treated with Clozapine may have an increased risk of developing metabolic syndrome as compared to patients with the G/G or G genotype. Other genetic and clinical factors may also influence a patient's risk for developing metabolic syndrome.

Codeine	Phenotype	Genetic Test	Results	Source/Evidence
Codeine Contin Tylenol with Codeine No. 2/3/4 TreatG ReviewG	Normal metabolizer	CYP2D6	*1/*10	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.

Cyclosporine	Phenotype	Genetic Test	Results	Source/Evidence
Neoral Sandimmune ReviewG	Intermediate metabolizer	CYP3A5	*1/*3	PharmGKB 3[40,41]

2 PharmGKB – Clinical Annotation (Level 3 Dosage): Patients who are recipients of a kidney transplant and who carry the *1 allele in combination with a normal or no function allele may have increased cyclosporine dose requirements as compared to patients carrying two no function alleles. However, conflicting evidence has been reported. Other genetic and clinical factors may also affect cyclosporine dose requirements.

Darifenacin	Phenotype	Genetic Test	Results	Source/Evidence
Enablex TreatG ReviewG	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]

CYP2D6 alleles do not indicate changes from recommended dose

Desipramine	Phenotype	Genetic Test	Results	Source/Evidence
Norpramin TreatG ReviewG	Normal metabolizer	CYP2D6	*1/*10	CPIC B[20]; FDA 3[39]

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 ReviewG	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

Dexlansoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Dexilant	Rapid metabolizer	CYP2C19	*1/*17	CPIC B[24]; FDA 3[39]

TreatG: ReviewG:

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

2 CPIC – Moderate Recommendation: Initiate standard starting daily dose. Consider increasing dose by 50–100% for the treatment of Helicobacter pylori infection and erosive esophagitis. Daily dose may be given in divided doses. Monitor for efficacy.

Diazepam	Phenotype	Genetic Test	Results	Source/Evidence
Diastat Valium	Rapid metabolizer	CYP2C19	*1/*17	FDA 3[39]

FDA PGx Table: no information for this CYP2C19 phenotype.

TreatG: ReviewG:

Donepezil	Phenotype	Genetic Test	Results	Source/Evidence
Aricept	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]

TreatG: ReviewG:

CYP2D6 alleles do not indicate changes from recommended dose

Doxepin	Phenotype	Genetic Test	Results	Source/Evidence
Silenor Sinequan	Normal metabolizer	CYP2D6	*1/*10	CPIC B[20]; FDA 3[39]
	Rapid metabolizer	CYP2C19	*1/*17	CPIC B[20]; FDA 3[39]

TreatG: ReviewG:

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]

ReviewG:

CYP2C9 alleles do not indicate changes from recommended dose

Efavirenz	Phenotype	Genetic Test	Results	Source/Evidence
Sustiva	Intermediate metabolizer	CYP2B6	*5/*6	CPIC A[12]; FDA 2[39]

ReviewG:

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	Poor function	SLCO1B1	*5/*15	FDA 3[39]

ReviewG:

There is a potential impact on pharmacokinetic properties. The impact of SLCO1B1 variants on the safety or response of Elagolix has not been established

Eliglustat	Phenotype	Genetic Test	Results	Source/Evidence
Cerdelga	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

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

ReviewGx

Eltrombopag	Phenotype	Genetic Test	Results	Source/Evidence
Promacta Revolade	Normal Factor V Leiden	Factor V rs6025	C/C	Product monograph (actionable)[30]

Product Monograph: no change in risk stated for normal Factor V.

ReviewGx

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	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[7]; FDA 3[39]

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

TreatGx
ReviewGx

2 Initiate therapy with recommended starting dose. If patient does not adequately respond to recommended maintenance dosing, consider titrating to a higher maintenance dose or switching to a clinically appropriate alternative antidepressant not predominantly metabolized by CYP2C19 (per CPIC optional recommendation).

Esomeprazole	Phenotype	Genetic Test	Results	Source/Evidence
Nexium	Rapid metabolizer	CYP2C19	*1/*17	FDA 3[39]

FDA PGx Table: no information for this phenotype.

TreatGx
ReviewGx

Fentanyl	Phenotype	Genetic Test	Results	Source/Evidence
Actiq Duragesic Fentora Sublimaze	Decreased analgesic response	OPRM1 rs1799971	A/A	PharmGKB 3[40,41]

2 PharmGKB – Clinical Annotation (Level 3 Efficacy): Patients with the OPRM1 rs1799971 A/A genotype may have a decreased analgesic response to fentanyl as compared to patients with the A/G or G/G genotypes. However, conflicting evidence has been reported. This drug-variant pair has been assigned a "no recommendation" by CPIC, as it was determined to be not clinically actionable. Other genetic or clinical factors may also affect response to fentanyl.
PharmGKB – Clinical Annotation (Level 3 Dosage): Patients with the OPRM1 rs1799971 A/A genotype may have decreased fentanyl dose requirements as compared to patients with the G/G genotype. However, conflicting evidence has been reported. This drug-variant pair has been assigned a "no recommendation" by CPIC, as it was determined to be not clinically actionable. Other genetic or clinical factors may also affect fentanyl dose requirements.

ReviewGx

Fesoterodine	Phenotype	Genetic Test	Results	Source/Evidence
Toviaz	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]

CYP2D6 alleles do not indicate changes from recommended dose

TreatGx
ReviewGx

Flecainide	Phenotype	Genetic Test	Results	Source/Evidence
Tambocor	Normal metabolizer	CYP2D6	*1/*10	DPWG[14]
TreatG ReviewG	CYP2D6 alleles do not indicate changes from recommended dose			

Flibanserin	Phenotype	Genetic Test	Results	Source/Evidence
Addyi	Rapid metabolizer	CYP2C19	*1/*17	FDA 1[39]
ReviewG	CYP2C19 alleles do not indicate changes from recommended dose			

Fluorouracil	Phenotype	Genetic Test	Results	Source/Evidence
Carac Efudex Fluoroplex Tolak	Normal metabolizer	DPYD	*1/*1	CPIC A[4]; FDA 1[39]
	DPYD alleles indicate normal DPD activity and typical risk for Fluorouracil toxicity			
ReviewG	DPYD alleles do not indicate changes from recommended dose			

Fluoxetine	Phenotype	Genetic Test	Results	Source/Evidence
Prozac	Normal metabolizer	CYP2D6	*1/*10	Product monograph (actionable)[9]
TreatG ReviewG	Product Monograph: no information for this phenotype.			

Flurbiprofen	Phenotype	Genetic Test	Results	Source/Evidence
Ansaid	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]; FDA 1[39]
TreatG ReviewG	CYP2C9 alleles do not indicate changes from recommended dose			

Fluvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Lescol	Normal metabolizer	CYP2C9	*1/*1	CPIC A[10]
	Poor function	SLCO1B1	*5/*15	CPIC A[10]
TreatG ReviewG	CPIC – CYP2C9 Implication: Normal exposure.			
	CPIC – SLCO1B1 Implication: Increased fluvastatin exposure as compared with normal and decreased function; typical myopathy risk with doses ≤40 mg.			
	2 CPIC – Moderate Recommendation: Prescribe ≤40 mg per day as a starting dose and adjust doses of fluvastatin based on disease-specific guidelines. If patient is tolerating 40 mg per day but higher potency is needed, a higher dose (>40 mg) or an alternative statin or combination therapy (i.e., fluvastatin plus non-statin guideline-directed medical therapy) could be considered. Prescriber should be aware of possible increased risk for myopathy with fluvastatin 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.			

Fluvoxamine	Phenotype	Genetic Test	Results	Source/Evidence
Luvox	Normal metabolizer	CYP2D6	*1/*10	CPIC B[7]; FDA 3[39]

Normal CYP2D6 metabolism

TreatG
ReviewG

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

ReviewG

CYP2C9 alleles do not indicate changes from recommended dose

Galantamine	Phenotype	Genetic Test	Results	Source/Evidence
Razadyne	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]

CYP2D6 alleles do not indicate changes from recommended dose

TreatG
ReviewG

Gefitinib	Phenotype	Genetic Test	Results	Source/Evidence
Iressa	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]

ReviewG

FDA PGx Table: no information for this phenotype.

Haloperidol	Phenotype	Genetic Test	Results	Source/Evidence
Haldol	Normal metabolizer	CYP2D6	*1/*10	DPWG[14]

TreatG
ReviewG

DPWG: no recommendation for this CYP2D6 phenotype.

Hydrocodone	Phenotype	Genetic Test	Results	Source/Evidence
Hysingla Zohydro	Normal metabolizer	CYP2D6	*1/*10	CPIC B[11]

CPIC – Implication: Normal hydromorphone formation.

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

TreatG
ReviewG

Ibuprofen	Phenotype	Genetic Test	Results	Source/Evidence
Advil Caldolor Duexis Motrin IB NeoProfen	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]; FDA 3[39]

CYP2C9 alleles do not indicate changes from recommended dose

TreatG
ReviewG

Iloperidone	Phenotype	Genetic Test	Results	Source/Evidence
Fanapt	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]

TreatGx
ReviewGx

FDA PGx Table: no information for this CYP2D6 phenotype.

Imipramine	Phenotype	Genetic Test	Results	Source/Evidence
Tofranil	Normal metabolizer	CYP2D6	*1/*10	CPIC B[20]; FDA 3[39]
	Rapid metabolizer	CYP2C19	*1/*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	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[24]; FDA 3[39]

TreatGx
ReviewGx

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

2 CPIC – Moderate Recommendation: Initiate standard starting daily dose. Consider increasing dose by 50–100% for the treatment of Helicobacter pylori infection and erosive esophagitis. Daily dose may be given in divided doses. Monitor for efficacy.

Lofexidine	Phenotype	Genetic Test	Results	Source/Evidence
Lucemyra	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]

ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

Lovastatin	Phenotype	Genetic Test	Results	Source/Evidence
Altoprev	Poor function	SLCO1B1	*5/*15	CPIC A[10]

TreatGx
ReviewGx

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

3 CPIC – Moderate Recommendation: Prescribe an alternative statin depending on the desired potency. 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.

Lusutrombopag	Phenotype	Genetic Test	Results	Source/Evidence
Mupleta ReviewGx	Normal Factor II	Factor II rs1799963	G/G	Product monograph (actionable)[36]
	Normal Factor V Leiden	Factor V rs6025	C/C	Product monograph (actionable)[36]

Product Monograph: no change in risk stated for normal Factor II (i.e. Prothrombin 20210A mutation absent).

Product Monograph: no change in risk stated for normal Factor V.

Mavacamten	Phenotype	Genetic Test	Results	Source/Evidence
Camzyos ReviewGx	Rapid metabolizer	CYP2C19	*1/*17	FDA 2[39]

FDA PGx Table: no information for this phenotype.

Meclizine	Phenotype	Genetic Test	Results	Source/Evidence
Antivert ReviewGx	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]

CYP2D6 alleles do not indicate changes from recommended dose

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

CYP2C9 alleles do not indicate changes from recommended dose

Mercaptopurine	Phenotype	Genetic Test	Results	Source/Evidence
Purinethol Purixan TreatGx ReviewGx	Normal metabolizer	TPMT	*1/*1	CPIC A[33,37]; FDA 1[39]
	Normal metabolizer	NUDT15	*1/*1	CPIC A[33,37]; FDA 1[39]

CPIC – TPMT Implication: Lower concentrations of thioguanine nucleotides metabolites, higher metabolites of thiopurine methyltransferase, this is the 'normal' pattern. Normal risk of thiopurine-related leukopenia, neutropenia, myelosuppression.

CPIC – NUDT15 Implication: Normal risk of thiopurine-related leukopenia, neutropenia, myelosuppression.

CPIC – Strong Recommendation: Start with normal starting dose (e.g., 75 mg/m2/day or 1.5 mg/kg/day) and adjust doses of mercaptopurine (and of any other myelosuppressive therapy) without any special emphasis on mercaptopurine compared to other agents. Allow at least 2 weeks to reach steady-state after each dose adjustment.
Normal starting doses vary by race/ethnicity and treatment regimens.

Methotrexate	Phenotype	Genetic Test	Results	Source/Evidence
Metoject Otrexup Rasuvo Trexall Xatmep TreatGx ReviewGx	Decreased risk of toxicity	MTHFR rs1801133	G/G	PharmGKB 2A[40,41]

PharmGKB – Clinical Annotation (Level 2A Toxicity): Patients with the MTHFR rs1801133 G/G genotype and cancer or arthritis who are treated with methotrexate may have a decreased risk of toxicity as compared to patients with the A/G or A/A genotype. However, conflicting evidence has been reported. Other genetic and clinical factors may also influence methotrexate toxicity. This drug-variant pair has been assigned a "no recommendation" by DPWG, as it was determined to be not clinically actionable.

Methylphenidate	Phenotype	Genetic Test	Results	Source/Evidence
Aptensio Concerta Cotempla Daytrana Jornay Metadate Methylin Quillichew Quillivant Relexxiii Ritalin	Poorer response	ADRA2A rs1800544	C/C	PharmGKB 4[40,41]
	No significant association to response	COMT rs4680	G/G	PharmGKB 4[40,41]
	PharmGKB – Clinical Annotation (Level 4 Efficacy): The current evidence base suggests that there is no significant association between the COMT rs4680 G/G genotype and response to methylphenidate. However, conflicting evidence has been reported. This drug-variant pair has been assigned a "no recommendation" by DPWG, as it was determined to be not clinically actionable. Other genetic and clinical factors may also influence response to methylphenidate.			
	2 PharmGKB – Clinical Annotation (Level 4 Efficacy): Patients (mainly pediatric patients) with the ADRA2A rs1800544 C/C genotype and attention deficit hyperactivity disorder (ADHD) may have a poorer response to methylphenidate treatment as compared to patients with the C/G or G/G genotype. However, contradictory evidence exists for this association. Studies used different scales to analyze improvement, e.g. CGI-I, ARS-IV, and other. Other genetic and clinical factors may also influence response to methylphenidate.			

TreatG
ReviewG

Metoclopramide	Phenotype	Genetic Test	Results	Source/Evidence
Metonia Reglan	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]
	CYP2D6 alleles do not indicate changes from recommended dose			

TreatG
ReviewG

Metoprolol	Phenotype	Genetic Test	Results	Source/Evidence
Kapspargo Sprinkle Lopressor Toprol-XL	Normal metabolizer	CYP2D6	*1/*10	CPIC B[13]
	CPIC – Implication: Normal metabolism of metoprolol.			
	CPIC – Strong Recommendation: Initiate standard dosing.			

TreatG
ReviewG

Mirabegron	Phenotype	Genetic Test	Results	Source/Evidence
Myrbetriq	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]
	CYP2D6 alleles do not indicate changes from recommended dose			

TreatG
ReviewG

Morphine	Phenotype	Genetic Test	Results	Source/Evidence
Kadian M-Eslon Morphabond ER MS Contin MS-IR Statex	Increased analgesic response	OPRM1 rs1799971	A/A	PharmGKB 3[40,41]
	2 PharmGKB – Clinical Annotation (Level 3 Efficacy): Patients with the OPRM1 rs1799971 A/A genotype may have an increased analgesic response to morphine as compared to patients with the A/G or G/G genotypes. However, conflicting evidence has been reported. This drug-variant pair has been assigned a "no recommendation" by CPIC, as it was determined to be not clinically actionable. Other genetic or clinical factors may also affect response to morphine. PharmGKB – Clinical Annotation (Level 3 Dosage): Patients with the OPRM1 rs1799971 A/A genotype may have decreased morphine dose requirements as compared to patients with the A/G or G/G genotypes. However, conflicting evidence has been reported. This drug-variant pair has been assigned a "no recommendation" by CPIC, as it was determined to be not clinically actionable. Other genetic or clinical factors may also affect morphine dose requirements.			

TreatG
ReviewG

Nateglinide	Phenotype	Genetic Test	Results	Source/Evidence
ReviewGx	Normal metabolizer	CYP2C9	*1/*1	FDA 1[39]
	FDA PGx Table: no information for this phenotype.			

Nebivolol	Phenotype	Genetic Test	Results	Source/Evidence
Bystolic	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]
TreatGx ReviewGx	CYP2D6 alleles do not indicate changes from recommended dose			

Nicotine replacement therapy	Phenotype	Genetic Test	Results	Source/Evidence
Nicorette Nicotrol Habitrol Nicoderm Thrive	Increased likelihood of smoking cessation compared to G/G	ANKK1/DRD2 rs1800497	A/G	PharmGKB 3[40,41]
TreatGx ReviewGx	PharmGKB – Clinical Annotation (Level 3 Efficacy): Patients with the ANKK1 rs1800497 A/G genotype may have an increased likelihood of smoking cessation when treated with nicotine replacement therapy as compared to patients with the G/G genotype. However, contradictory findings have been reported. Other genetic and clinical factors may influence a patient's likelihood of smoking cessation.			

Nortriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Aventyl Pamelor	Normal metabolizer	CYP2D6	*1/*10	CPIC A[20]; FDA 3[39]
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.			

Olanzapine	Phenotype	Genetic Test	Results	Source/Evidence
Zyprexa	May have increased time until response	DRD2 rs1799978	T/T	PharmGKB 3[40,41]
TreatGx ReviewGx	2 PharmGKB – Clinical Annotation (Level 3 Response): Patients with the DRD2 rs1799978 T/T genotype and schizophrenia who are treated with olanzapine or risperidone may have increased time until response as compared to patients with the C/C or C/T genotype. Other genetic and clinical factors may also influence a patient's response to olanzapine or risperidone.			

Oliceridine	Phenotype	Genetic Test	Results	Source/Evidence
Olinvyk	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]
ReviewGx	FDA PGx Table: no information for this phenotype.			

Omeprazole	Phenotype	Genetic Test	Results	Source/Evidence
Losec Olex Prilosec	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[24]; FDA 3[39]
TreatGx ReviewGx	CPIC – Implication: Decreased plasma concentrations of PPIs compared with CYP2C19 NMs; increased risk of therapeutic failure.			
	2 CPIC – Moderate Recommendation: Initiate standard starting daily dose. Consider increasing dose by 50–100% for the treatment of Helicobacter pylori infection and erosive esophagitis. Daily dose may be given in divided doses. Monitor for efficacy.			

Ondansetron	Phenotype	Genetic Test	Results	Source/Evidence
Zofran Zuplenz	Normal metabolizer	CYP2D6	*1/*10	CPIC A[5]

CYP2D6 alleles do not indicate changes from recommended dose

ReviewGx

Oral contraceptives	Phenotype	Genetic Test	Results	Source/Evidence
	Decreased risk for DVT	Factor II rs1799963	G/G	PharmGKB 2B[40,41]
ReviewGx	Decreased risk of thrombosis (normal Factor V)	Factor V rs6025	C/C	PharmGKB 2B[40,41]

PharmGKB – Clinical Annotation (Level 2B Toxicity): Patients with the Factor II rs1799963 G/G genotype who are taking oral contraceptives may have a decreased risk for deep vein thrombosis (DVT), as compared to patients with the A/A or A/G genotypes or those who are not taking oral contraceptives. However, conflicting evidence has been reported. Other genetic and clinical factors may also influence risk for DVT in patients taking oral contraceptives.

PharmGKB – Clinical Annotation (Level 2B Toxicity): Patients with the rs6025 C/C genotype (normal Factor V) may have a decreased risk of experiencing thrombosis when receiving oral contraceptives as compared to patients with the C/T or T/T genotype (carriers of Factor V Leiden). However, conflicting evidence has been reported. Both Factor V Leiden and oral contraceptives have been found to independently increase the risk for thrombosis, but together they may have a cumulative effect on thrombosis risk. Other genetic and clinical factors may also influence risk of thrombosis.

Pantoprazole	Phenotype	Genetic Test	Results	Source/Evidence
Pantoloc Protonix Tecta	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[24]; FDA 1[39]

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

TreatGx
ReviewGx

2 CPIC – Moderate Recommendation: Initiate standard starting daily dose. Consider increasing dose by 50–100% for the treatment of Helicobacter pylori infection and erosive esophagitis. Daily dose may be given in divided doses. Monitor for efficacy.

Paroxetine	Phenotype	Genetic Test	Results	Source/Evidence
Brisdelle Paxil Pexeva	Normal metabolizer	CYP2D6	*1/*10	CPIC A[7]; FDA 3[39]

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).

TreatGx
ReviewGx

Perphenazine	Phenotype	Genetic Test	Results	Source/Evidence
	Normal metabolizer	CYP2D6	*1/*10	FDA 2[39]

FDA PGx Table: no information for this CYP2D6 phenotype.

TreatGx
ReviewGx

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 TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]
	FDA PGx Table: no information for this CYP2D6 phenotype.			

Piroxicam	Phenotype	Genetic Test	Results	Source/Evidence
Feldene TreatGx ReviewGx	Normal metabolizer	CYP2C9 (Star Alleles)	*1/*1	CPIC A[38]; FDA 1[39]
	CYP2C9 alleles do not indicate changes from recommended dose			

Pitavastatin	Phenotype	Genetic Test	Results	Source/Evidence
Livalo Zypitamag TreatGx ReviewGx	Poor function	SLCO1B1	*5/*15	CPIC A[10]
	CPIC – Implication: Increased Pitavastatin exposure as compared with normal and decreased function, which may translate to increased myopathy risk.			
	2 CPIC – Moderate Recommendation: Prescribe ≤1 mg as a starting dose and adjust doses of pitavastatin based on disease-specific guidelines. If dose >1 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 ReviewGx	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]; Product monograph (actionable)[19]
	FDA PGx Table: no information for this phenotype.			

Pravastatin	Phenotype	Genetic Test	Results	Source/Evidence
Pravachol TreatGx ReviewGx	Poor function	SLCO1B1	*5/*15	CPIC A[10]
	CPIC – Implication: Increased pravastatin statin exposure as compared with normal and decreased function; typical myopathy risk with doses ≤40 mg.			
	2 CPIC – Moderate Recommendation: Prescribe ≤40 mg as a starting dose and adjust doses of pravastatin based on disease-specific guidelines. If patient is tolerating 40 mg dose but higher potency is needed, a higher dose (>40 mg) or an alternative statin or combination therapy (i.e., pravastatin plus non-statin guideline-directed medical therapy) could be considered. Prescriber should be aware of possible increased risk for myopathy especially with pravastatin doses >40 mg. 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 TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*10	DPWG[14]; FDA 1[39]
	CYP2D6 alleles do not indicate changes from recommended dose			

Propranolol	Phenotype	Genetic Test	Results	Source/Evidence
Inderal Innopran TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]
	CYP2D6 alleles do not indicate changes from recommended dose			

Protriptyline	Phenotype	Genetic Test	Results	Source/Evidence
Vivactil ReviewGx	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]
	CYP2D6 alleles do not indicate changes from recommended dose			

Quetiapine	Phenotype	Genetic Test	Results	Source/Evidence
Seroquel TreatGx ReviewGx	Normal metabolizer	CYP3A4	*1A/*1B	DPWG[14]
	DPWG: no recommendation for this CYP3A4 phenotype.			

Rabeprazole	Phenotype	Genetic Test	Results	Source/Evidence
Aciphex Pariet TreatGx ReviewGx	Rapid metabolizer	CYP2C19	*1/*17	FDA 3[39]
	FDA PGx Table: no information for this phenotype.			

Risperidone	Phenotype	Genetic Test	Results	Source/Evidence
Perseris Risperdal TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*10	DPWG[14]; FDA 3[39]
	Increased prolactin compared to G/G	ANKK1/DRD2 rs1800497	A/G	PharmGKB 3[40,41]
	May have increased time until response	DRD2 rs1799978	T/T	PharmGKB 3[40,41]
	Increased risk of developing metabolic syndrome	HTR2C rs1414334	C/G	PharmGKB 3[40,41]

FDA PGx Table: no information for this CYP2D6 phenotype.

DPWG: no recommendation for this CYP2D6 phenotype.

2 PharmGKB – Clinical Annotation (Level 3 Toxicity): Patients with the ANKK1/DRD2 rs1800497 A/G genotype and schizophrenia may have increased prolactin when treated with risperidone as compared to patients with the G/G genotype. Other genetic and clinical factors may also influence risperidone related hyperprolactinemia.

2 PharmGKB – Clinical Annotation (Level 3 Response): Patients with the DRD2 rs1799978 T/T genotype and schizophrenia who are treated with olanzapine or risperidone may have increased time until response as compared to patients with the C/C or C/T genotype. Other genetic and clinical factors may also influence a patient's response to olanzapine or risperidone.

2 PharmGKB – Clinical Annotation (Level 3 Toxicity): Patients with two X-chromosomes and the HTR2C rs1414334 C/C or C/G genotype, or one X-chromosome and the C genotype who are treated with Risperidone may have an increased risk of developing metabolic syndrome as compared to patients with the G/G or G genotype. Other genetic and clinical factors may also influence a patient's risk for developing metabolic syndrome.

Rosuvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Crestor	Poor function	SLCO1B1	*5/*15	CPIC A[10]; FDA 3[39]
	Normal function	ABCG2 rs2231142	G/G	CPIC A[10]

TreatG: ReviewG:

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

CPIC – ABCG2 Implication: Typical myopathy risk and rosuvastatin exposure.

2 CPIC – Moderate Recommendation: Prescribe ≤20 mg as a starting dose and adjust doses of rosuvastatin based on disease-specific and population-specific guidelines. If dose >20 mg needed for desired efficacy, consider combination therapy (i.e., rosuvastatin plus non-statin guideline-directed medical therapy).
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.

Salmeterol	Phenotype	Genetic Test	Results	Source/Evidence
Serevent	Increased response compared to A/A	ADRB2 rs1042713	A/G	PharmGKB 2A[40,41]

TreatG: ReviewG:

PharmGKB – Clinical Annotation (Level 2A Efficacy): Patients with the ADRB2 rs1042713 A/G genotype and asthma may have an increased response to salmeterol as compared to patients with the A/A genotype. However, conflicting evidence has been reported. Other genetic and clinical factors may also influence a response to salmeterol.

Sertraline	Phenotype	Genetic Test	Results	Source/Evidence
Zoloft	Intermediate metabolizer	CYP2B6	*5/*6	CPIC B[7]
	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[7]

TreatG: ReviewG:

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

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

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

Simvastatin	Phenotype	Genetic Test	Results	Source/Evidence
Zocor Flolipid	Poor function	SLCO1B1	*5/*15	CPIC A[10]; FDA 2[39]

CPIC – Implication: Increased simvastatin acid exposure compared with normal and decreased function; highly increased myopathy risk.

TreatG: ReviewG:

3 CPIC – Strong Recommendation: Prescribe an alternative statin depending on the desired potency. 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]

ReviewG:

CYP2C9 alleles do not indicate changes from recommended dose

Tacrolimus	Phenotype	Genetic Test	Results	Source/Evidence
Advagraf Astagraf XL Envarsus XR Prograf Protopic	Intermediate metabolizer	CYP3A5	*1/*3	CPIC A[6]; FDA 1[39]
	Normal metabolizer	CYP3A4	*1A/*1B	PharmGKB 2A[40,41]

ReviewGx

2 CPIC – CYP3A5 Implication: Lower dose-adjusted trough concentrations of tacrolimus and decreased chance of achieving target tacrolimus concentrations.
CPIC – CYP3A5 Strong Recommendation: Increase starting dose 1.5–2 times recommended starting dose. Total starting dose should not exceed 0.3 mg/kg/day. Use therapeutic drug monitoring to guide dose adjustments. Further dose adjustments or selection of alternative therapy may be necessary because of other clinical factors (e.g., medication interactions, or hepatic function). 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.

PharmGKB – CYP3A4 Clinical Annotation (Level 2A Dosage): Patients who are recipients of an organ transplant and carry two copies of the CYP3A4*1 allele may require an increased dose of tacrolimus as compared to patients with two copies of the *3 or *22 alleles or one copy of the 1* allele in combination with one copy of the *3 or *22 alleles. Other genetic and clinical factors may also influence tacrolimus dose.

Tamoxifen	Phenotype	Genetic Test	Results	Source/Evidence
Nolvadex Soltamox	Normal metabolizer	CYP2D6 (Activity Score)	*1/*10	CPIC A[17]; FDA 3[39]

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.

Tamsulosin	Phenotype	Genetic Test	Results	Source/Evidence
Flomax	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]

ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

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

ReviewGx

CYP2C9 alleles do not indicate changes from recommended dose

Tetrabenazine	Phenotype	Genetic Test	Results	Source/Evidence
Austedo Nitoman Xenazine	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]

ReviewGx

CYP2D6 alleles do not indicate changes from recommended dose

Thioguanine	Phenotype	Genetic Test	Results	Source/Evidence
Lanvis	Normal metabolizer	TPMT	*1/*1	CPIC A[33,37]; FDA 1[39]
ReviewGx	Normal metabolizer	NUDT15	*1/*1	CPIC A[33,37]; FDA 1[39]

CPIC – TPMT Implication: Lower concentrations of thioguanine nucleotides (TGN) metabolites, but note that TGN after thioguanine are 5-10X higher than TGN after mercaptopurine or azathioprine. Normal risk of thiopurine-related leukopenia, neutropenia, myelosuppression.

CPIC – NUDT15 Implication: Normal risk of thiopurine-related leukopenia, neutropenia, myelosuppression.

CPIC – Strong Recommendation: Start with normal starting dose (e.g., 40-60 mg/m2/day) 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.
Normal starting doses vary by race/ethnicity and treatment regimens.

Thioridazine	Phenotype	Genetic Test	Results	Source/Evidence
TreatGx	Normal metabolizer	CYP2D6	*1/*10	FDA 1[39]
ReviewGx	FDA PGx Table: no information for this CYP2D6 phenotype.			

Tolterodine	Phenotype	Genetic Test	Results	Source/Evidence
Detrol	Normal metabolizer	CYP2D6	*1/*10	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/*10	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/*10	CPIC B[20]; FDA 3[39]
ReviewGx	Rapid metabolizer	CYP2C19	*1/*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/*10	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/*10	CPIC B[7]; FDA 1[39]
	Normal CYP2D6 metabolism			
TreatGx	Initiate therapy with recommended starting dose (per CPIC strong recommendation).			
ReviewGx				

Viloxazine	Phenotype	Genetic Test	Results	Source/Evidence
Qelbree	Normal metabolizer	CYP2D6	*1/*10	FDA 3[39]
ReviewGx	FDA PGx Table: no information for this phenotype.			

Voriconazole	Phenotype	Genetic Test	Results	Source/Evidence
Vfend	Rapid metabolizer	CYP2C19	*1/*17	CPIC A[28]; FDA 2[39]
	CYP2C19 rapid metabolizer: increased metabolism of Voriconazole to less active compounds			
	Lower plasma concentrations of active drug may reduce response			
ReviewGx	2 Consider an alternative drug not predominantly metabolized by CYP2C19			

Vortioxetine	Phenotype	Genetic Test	Results	Source/Evidence
Trintellix	Normal metabolizer	CYP2D6	*1/*10	CPIC A[7]; FDA 1[39]
TreatGx	Normal CYP2D6 metabolism			
ReviewGx	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]
	Typical response	CYP4F2 rs2108622	C/C	CPIC A[21]; FDA 1[39]
	Typical response	CYP2C rs12777823	G/G	CPIC A[21]

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

Zuclopenthixol	Phenotype	Genetic Test	Results	Source/Evidence
Clopixol TreatGx ReviewGx	Normal metabolizer	CYP2D6	*1/*10	DPWG[14]

DPWG: no recommendation for this CYP2D6 phenotype.

Laboratory Report

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

Gene	rsID	Genomic Location	HGVS	HGVS Reference	Result
ABCB1	rs1045642		c.3645G>A	NC_000007.14	A/G
ABCB1	rs1128503		c.1446G>A	NC_000007.14	A/G
ABCB1	rs2032582		c.2887C>A/T	NC_000007.14	C/A
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	A/G
APOE	rs429358		c.388T>C	NC_000019.10	C/T
APOE	rs7412		c.526C>T	NC_000019.10	C/C
COMT	rs4680		c.472G>A	NC_000022.11	G/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	T/T
CYP1A2	rs35694136		c.-1635T>-	NC_000015.10	T/T
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/T
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	G/G
CYP2C19	rs12248560		c.-806C>T	NC_000010.11	C/T
CYP2C19	rs12769205		c.332-23A>G	NC_000010.11	A/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	G/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	T/T
CYP2C8	rs10509681		c.1196T>C	NC_000010.11	T/T
CYP2C8	rs1058930		c.792G>C	NC_000010.11	G/G
CYP2C8	rs11572103		c.805T>A	NC_000010.11	T/T
CYP2C8	rs17110453		c.-370A>C	NC_000010.11	A/A
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	C/G

PATIENT INFORMATION
NAME: Demo FGIH
DOB: 12/May/1982
SEX AT BIRTH: Female

SPECIMEN DETAILS
BARCODE: Demo1_FGIH
SAMPLE ID: Demo1_FGIH
TYPE: Swab
COLLECTED: 18/Dec/2024

ORDERED BY
Clinical Lead
REPORT GENERATED: 24/Jan/2025 (GMT)

Gene	rsID	Genomic Location	HGVS	HGVS Reference	Result
CYP2D6	rs16947		c.886G>A	NC_000022.11	G/G
CYP2D6	rs28371706		c.320G>A	NC_000022.11	G/G
CYP2D6	rs28371725		c.985+39C>T	NC_000022.11	C/C
CYP2D6	rs35742686		c.775T>-	NC_000022.11	T/T
CYP2D6	rs3892097		c.506-1C>T	NC_000022.11	C/C
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	C/T
CYP3A4	rs35599367		c.522-191G>A	NC_000007.14	G/G
CYP3A4	rs4986910		c.1334A>G	NC_000007.14	A/A
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	T/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/C
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/T
HTR2A	rs7997012		c.614-2211G>A	NC_000013.11	A/G
HTR2C	rs1414334		c.551-3008G>C	NC_000023.11	C/G
HTR2C	rs3813929		c.-759C>T	NC_000023.11	C/C
ITGB3	rs5918		c.176T>C	NC_000017.11	C/T
MTHFR	rs1801131		c.665C>T	NM_005957.5	G/G

Gene	rsID	Genomic Location	HGVS	HGVS Reference	Result
MTHFR	rs1801133		c.1286A>C	NM_005957.5	G/G
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
OPRM1	rs1799971		c.118A>G	NC_000006.12	A/A
SLCO1B1	rs4149056		c.521T>C	NC_000012.12	C/C
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	C/C
VKORC1	rs9923231		c.-1639C>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_exon9	NG_008376.3 exon 9	Unreported

Phenotype Table

Gene	Allele Result	Phenotype Result
CYP3A4	*1A/*1B	Normal Metabolizer
CYP2D6	*1/*10	Normal Metabolizer
CYP2C9	*1/*1	Normal Metabolizer
CYP2C19	*1/*17	Rapid Metabolizer
SLCO1B1	*5/*15	Poor Function
CYP2B6	*5/*6	Intermediate Metabolizer
CYP3A5	*1/*3	Intermediate Metabolizer
DPYD	*1/*1	Normal Metabolizer
NUDT15	*1/*1	Normal Metabolizer
TPMT	*1/*1	Normal Metabolizer

Table of Available References

Drug	Genetic Test	Sources
Abrocitinib	CYP2C19	FDA[31,39]
Alfentanil	OPRM1 rs1799971	PharmGKB[40,41]
Amitriptyline	CYP2D6	CPIC[20]; FDA[39]
Amitriptyline	CYP2C19	CPIC[20]
Amoxapine	CYP2D6	FDA[39]
Amphetamine	CYP2D6	FDA[39]
Aripiprazole	CYP2D6	FDA[39]; Product monograph (actionable)[35]
Aripiprazole lauroxil	CYP2D6	FDA[39]; Product monograph (actionable)[2]
Atomoxetine	CYP2D6 (Activity Score)	CPIC[8]; FDA[39]
Atorvastatin	SLCO1B1	CPIC[10]; FDA[39]
Avatrombopag	CYP2C9	FDA[39]
Avatrombopag	Factor II rs1799963	Product monograph (actionable)[1]
Avatrombopag	Factor V rs6025	Product monograph (actionable)[1]
Azathioprine	TPMT	CPIC[33,37]; FDA[39]
Azathioprine	NUDT15	CPIC[33,37]; FDA[39]
Brexpiprazole	CYP2D6	FDA[39]; Product monograph (actionable)[3]
Brivaracetam	CYP2C19	FDA[39]
Bupropion	ANKK1/DRD2 rs1800497	PharmGKB[40,41]
Capecitabine	DPYD	CPIC[4]; 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]; Product monograph (actionable)[25]
Clomipramine	CYP2D6	CPIC[20]; FDA[39]
Clomipramine	CYP2C19	CPIC[20]
Clopidogrel	CYP2C19	CPIC[23]; FDA[39]
Clozapine	CYP2D6	FDA[39]
Clozapine	HTR2C rs1414334	PharmGKB[40,41]
Codeine	CYP2D6	CPIC[11]; FDA[39]
Cyclosporine	CYP3A5	PharmGKB[40,41]
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]

Drug	Genetic Test	Sources
Dronabinol	CYP2C9	FDA[39]
Efavirenz	CYP2B6	CPIC[12]; FDA[39]
Elagolix	SLCO1B1	FDA[39]
Eliglustat	CYP2D6	DPWG[14]; FDA[39]
Eltrombopag	Factor V rs6025	Product monograph (actionable)[30]
Erdafitinib	CYP2C9 (Star Alleles)	FDA[39]
Escitalopram	CYP2C19	CPIC[7]; FDA[39]
Esomeprazole	CYP2C19	FDA[39]
Fentanyl	OPRM1 rs1799971	PharmGKB[40,41]
Fesoterodine	CYP2D6	FDA[39]
Flecainide	CYP2D6	DPWG[14]
Flibanserin	CYP2C19	FDA[39]
Fluorouracil	DPYD	CPIC[4]; FDA[39]
Fluoxetine	CYP2D6	Product monograph (actionable)[9]
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]
Galantamine	CYP2D6	FDA[39]
Gefitinib	CYP2D6	FDA[39]
Haloperidol	CYP2D6	DPWG[14]
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]
Lusutrombopag	Factor II rs1799963	Product monograph (actionable)[36]
Lusutrombopag	Factor V rs6025	Product monograph (actionable)[36]
Mavacamten	CYP2C19	FDA[39]
Meclizine	CYP2D6	FDA[39]
Meloxicam	CYP2C9 (Star Alleles)	CPIC[38]; FDA[39]
Mercaptopurine	TPMT	CPIC[33,37]; FDA[39]
Mercaptopurine	NUDT15	CPIC[33,37]; FDA[39]
Methotrexate	MTHFR rs1801133	PharmGKB[40,41]
Methylphenidate	ADRA2A rs1800544	PharmGKB[40,41]
Methylphenidate	COMT rs4680	PharmGKB[40,41]
Metoclopramide	CYP2D6	FDA[39]
Metoprolol	CYP2D6	CPIC[13]
Mirabegron	CYP2D6	FDA[39]
Morphine	OPRM1 rs1799971	PharmGKB[40,41]
Nateglinide	CYP2C9	FDA[39]

Drug	Genetic Test	Sources
Nebivolol	CYP2D6	FDA[39]
Nicotine replacement therapy	ANKK1/DRD2 rs1800497	PharmGKB[40,41]
Nortriptyline	CYP2D6	CPIC[20]; FDA[39]
Olanzapine	DRD2 rs1799978	PharmGKB[40,41]
Oliceridine	CYP2D6	FDA[39]
Omeprazole	CYP2C19	CPIC[24]; FDA[39]
Ondansetron	CYP2D6	CPIC[5]
Oral contraceptives	Factor II rs1799963	PharmGKB[40,41]
Oral contraceptives	Factor V rs6025	PharmGKB[40,41]
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]; Product monograph (actionable)[19]
Pravastatin	SLCO1B1	CPIC[10]
Propafenone	CYP2D6	DPWG[14]; FDA[39]
Propranolol	CYP2D6	FDA[39]
Protriptyline	CYP2D6	FDA[39]
Quetiapine	CYP3A4	DPWG[14]
Rabeprazole	CYP2C19	FDA[39]
Risperidone	CYP2D6	DPWG[14]; FDA[39]
Risperidone	ANKK1/DRD2 rs1800497	PharmGKB[40,41]
Risperidone	DRD2 rs1799978	PharmGKB[40,41]
Risperidone	HTR2C rs1414334	PharmGKB[40,41]
Rosuvastatin	SLCO1B1	CPIC[10]; FDA[39]
Rosuvastatin	ABCG2 rs2231142	CPIC[10]
Salmeterol	ADRB2 rs1042713	PharmGKB[40,41]
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]
Tacrolimus	CYP3A4	PharmGKB[40,41]
Tamoxifen	CYP2D6 (Activity Score)	CPIC[17]; FDA[39]
Tamsulosin	CYP2D6	FDA[39]
Tenoxicam	CYP2C9 (Star Alleles)	CPIC[38]
Tetrabenazine	CYP2D6	FDA[39]
Thioguanine	TPMT	CPIC[33,37]; FDA[39]
Thioguanine	NUDT15	CPIC[33,37]; FDA[39]
Thioridazine	CYP2D6	FDA[39]
Tolterodine	CYP2D6	FDA[39]
Tramadol	CYP2D6	CPIC[11]; FDA[39]
Trimipramine	CYP2D6	CPIC[20]; FDA[39]
Trimipramine	CYP2C19	CPIC[20]

Drug	Genetic Test	Sources
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]
Warfarin	CYP4F2 rs2108622	CPIC[21]; FDA[39]
Warfarin	CYP2C rs12777823	CPIC[21]
Zuclopenthixol	CYP2D6	DPWG[14]

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Methods

The results meet stringent quality control metrics for DNA isolation and genotyping. SNPs are processed in an OpenArray platform. Each call has an estimated quality value >95%, based on the autocaller algorithm in the TaqMan® Genotyper software (ThermoFisher Scientific). Copy number calls are accepted when confidence values are >95%.

Limitations

The annotations and interpretations provided in this report are based on scientific literature and do not take into account drug-drug interactions, medical conditions or other clinical factors that may affect medication response. Gene-drug interactions are ranked according to guidelines, level of evidence and clinical utility. The AttoDiagnostics pharmacogenetics platform, GenXys reports and TreatGx Clinical Decision Support are regularly updated. Current predicted phenotype and allele functionality may change in the future depending on new evidence. Phenotype annotations for CYP2C9 are based on total activity scores as defined by CPIC[79]. Genetic test results and interpretation may be inaccurate for individuals who have undergone or are receiving non-autologous blood transfusion, tissue, or organ transplant therapies.

The report includes alleles of proteins involved in the metabolism of many medications. In rare cases, a variant that is not covered may be typed as *1 or other variants. In the case of pseudogenes and mutations in the untranslated regions of genes, incorrect allele typing may occur despite proper SNP detection. Preferential amplification of one allele over another present in the sample may also lead to incorrect genotyping.

Liability Disclaimer

This test was developed by ThermoFisher Scientific and its performance characteristics has been validated by AttoDiagnostics Ltd and verified on GenXys Health Care Systems. It has not been cleared or approved by the US Food and Drug Administration. 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.

DO NOT MAKE ANY CHANGES TO YOUR CURRENT MEDICATION(S) WITHOUT TALKING TO YOUR DOCTOR FIRST. While genetics is important, other factors also contribute to how you react to medications. The final choice of medication used will be based on your health care provider's professional judgement and may be different from what is recommended in this report. This test does not determine your risk of any health problem. It only evaluates select portions of your DNA that help predict how you may react to the medications covered.

Laboratory Director

P Agyirey-Kwakye, Laboratory Director, BS54287

24/Jan/2025 (GMT)

Date of Signature

Note: AttoDiagnostics is a leading precision healthcare genetic testing company. We provide research and diagnostic testing for brands, medical institutions and healthcare service providers including pharmacies to deliver life-changing personalised healthcare solutions.