Patient	**XXX**	Requesting physician	
Date of birth	01/06/1956 | Sex F		

Sample type	DNA	Report generated	29/08/2022
Collection date	10/06/2022	Laboratory director	Dr C. Lapucci
Received date	28/06/2022	Contact email	cristina.lapucci@synlab.it
Sample number	xxx		

MyPGx ® - Pharmacogenetic large screening panel (method: PCR, MassArray and MLPA)

Provided clinical information:

Clinical information	
Known problematic medication	NKDA
Relevant medical history	None

Summary of key pharmacogenetic results (predicted Poor or Ultrarapid activity):

Gene	Prediction
CYP2C19	Rapid metabolizer
VKORC1	Warfarin resistance
SLC22A1	Low function
SLCO1B3	Low function
SULT1A1	Poor metabolizer
NAT2	Poor acetylator

The detailed pharmacogenetic results are presented on the following pages.

Technical comments and limitations:

Coverage 100%. Haplotypes not determined (failed SNPs): None

PGx is a rapidly-evolving field primarily providing evidence-based predictions of how the tested individual's genetic profile may affect reaction to certain drugs. Factors such as drug-drug interaction and also age, diet, ethnicity, family and personal health history, can also impact the likelihood of exhibiting certain drug reactions, independently of genotype-based predictions.

This report is intended for use by a healthcare professional. Based on PGx results, **patients should make no changes to medical care without the prior advice of and consultation with a healthcare professional** [including, but not limited to, changes in dosage or frequency of medication, diet and/or exercise regimens, or pregnancy planning].

ELECTRONIC SIGNATURE	**Dott.ssa Cristina Lapucci** SPECIALISTA IN GENETICA MEDICA SYNLAB ITALIA

GENOTYPE/HAPLOTYPE/PHENOTYPE DETAIL

Gene	Genotype-Haplotype	Allele Tested	Predicted Phenotype
CYP1A1	*1/*1	*1, *2, *3, *4, *5, *6, *7, *8	Normal metabolizer
CYP1A2	*1A/*1F	*1A, *1F, *1K, *7	Normal metabolizer
CYP2A6	*1A/*9	*1A, *1B, *2, *4, *5, *6, *7, *8, *9, *11, *17, *20	Intermediate metabolizer
CYP2B6	*6/*6	*1, *6, *8, *10, *18, *28	Intermediate metabolizer
CYP2C8	*1/*1	*1, *2, *3, *4, *5, *7, *8	Normal metabolizer
CYP2C9	*1/*3	*1, *2, *3, *4, *5, *6, *8, *9, *10, *11, *12, *13, *15, *25, *27	Intermediate metabolizer
CYP2C19	***1A/*17**	***1A, *1B, *2A, *3, *4, *5A, *5B, *6, *7, *8, *12, *17**	**Rapid metabolizer**
CYP2D6	*2A/*41	*1, *2A, *3, *4A, *4M, *5, *6A, *7, *8, *9, *10, *11, *12, *14A, *14B, *17, *18, *19, *20, *21, *36, *38, *40, *41, *42, *44, *56A, *56B, and CNVs	Normal metabolizer
CYP2E1	*1/*7	*1, *2, *7	Normal metabolizer
CYP3A4	*1/*1	*1, *2, *6, *20, *22	Normal metabolizer
CYP3A5	*1A/*1A	*1A, *3A, *3K, *5, *6, *7	Normal metabolizer
VKORC1	**H7/H7**	**H1, H3, H7, H9**	**Warfarin resistance**
SLC15A2	*1/*1	*1, *509K, *284A, *350F, *409S	Normal function
SLC22A1	***420Del/*420Del**	***1, *2, *3, *4, *5, *6, *220V, *283L, *287G, *341L, *408V, *420Del**	**Low function**
SLC22A2	*1/*270A	*1, *54S, *165V, *270A, *400C, *432N	Normal function
SLC22A6	*1/*1	*1, *50H	Normal function
SLCO1B1	*1A/*1A	*1A, *1B, *2, *3, *5, *6, *9, *10, *11, *12, *13, *15	Normal function
SLCO1B3	***233I/*233I**	***1, *112A, *233I**	**Low function**
SLCO2B1	*1/*1	*1, *3	Normal function
ABCB1	*1/*2	*1, *2	Intermediate function
ABCC2	*1/*1324I	*1, *417I, *789F, *768W, *1324I, *1450S	Intermediate function
ABCG2	*1/*1	*1, *141K, *126Ter	Normal function
SULT1A1	***3/*3**	***1, *2, *3, *4**	**Poor metabolizer**
NAT1	*4/*11	*1, *5, *11, *14, *15, *17, *19, *22	Normal acetylator
NAT2	***5B/*6A or *5A/*6C or *6B/*5G or *12C/*5J**	***4, *5A, *5B, *5C, *5D, *5E, *5G, *5J, *6A, *6B, *6C, *6E, *7A, *7B, *11A, *12A, *12B, *12C, *13, *14A, *14B, *14C, *14D, *14E, *14F, *14G, *19**	**Poor acetylator**
TPMT	*1/*1	*1, *2, *3A, *3B, *3C, *4, *8	Normal metabolizer
GSTM1	*1/*1	*1, *173Asn	Normal metabolizer
GSTP1	*1A/*1A	*1A, *1B, *1D, *1C	Normal metabolizer
UGT1A1	*28(*60)/*28(*60)	*1, *6, *7, *27, *29, *60	Intermediate metabolizer
UGT2B7	*1a/*1a	*1a, 2b	Normal metabolizer
UGT2B15	*2/*2	*1, *2	Intermediate metabolizer
DPYD	*1/*2A	*1, *2A, *7, *8, *9A, *9B, *10	Intermediate metabolizer

Disclaimer: Laboratory-developed screening test and interpretation protocols, employing research-use only (RUO) materials. The result of the "Phenotype" shown in the table is to be considered as a generic parameter and not specific to a single drug. For a reference to a specific drug check the tables below in the report. Additional Disclaimer: MyPGx® is a registered trade mark of SYNLAB International GmbH. **Patients should not initiate or modify any treatment or otherwise use the information in this report without the prior advice, consultation and supervision of a licensed healthcare professional such as a pharmacist or medical doctor.**

Methodology: PCR-based RUO assays detect listed alleles, including all common and most rare variants with known clinical significance at analytical sensitivity and specificity >99%. Phenotypic predictions based on the current state of the scientific literature and PharmGKB. MLPA assay to identify CYP2D6 CNVs (deletions, duplications).

Limitations: Testing cannot detect all genetic variants, inactive or altered genes. The absence of a finding of a detectable gene or variant does not necessarily indicate patient possesses intermediate- or high-sensitivity phenotypes or that patient has an undetected variant. Drug-drug interactions may significantly modify phenotypes, especially in polymedicated patients. The lack of data in the literature and the absence of clinical reports do not allow any ambiguous variants and related phenotypic consequences to be adequately characterised. For these reasons, in the absence of this information, the result is given on the basis of haplotype frequencies.

PHARMACOGENOMICS

Genetic Markers Tested for Pharmacogenomics:

Results are arranged by drug response. Each individual report contains six sections, including: Patient's current medication (if any), Medication history, genotype/haplotype/phenotype detail, PGx report, Genomic Test Results, and Patient Information Card. Inclusion of the PGx Report indicates that the tested individual: displays decreased efficacy to the drug (yellow dots), should use the drug as directed (green dots), or exhibits increased toxicity to the drug (orange dots). Inclusion of Genomic Test Results indicates genotype, haplotype, phenotype, or presence of mutation.

Organization of Table:

1. Gene/Locus refers to gene or intergenic region of genetic marker location.

2. Marker refers to the tested marker's unique identifier.

3. Genotype/Haplotype refers to the particular marker's combination of nucleotides. The letter(s) on either side of the slash refer(s) to the two (2) copies of the patient DNA. Del and dashes denotes nucleotide indels in patient DNA. Empty cells indicate an absence of genotyping results.

4. Phenotype refers to the CYP specific drug metabolizing capabilities of an individual.

See RISKS AND LIMITATIONS on the last pages of this Report.

PGx Report - Pain Management

Type: Anti-inflammatory Agent, Analgesic, Antipyretic

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
The Nonsteroidal Antiinflammatory Drugs (NSAIDs)						
Acetic acid derivatives	Diclofenac	UGT2B7	CYP2C9, CYP2E1, CYP3A4		●	
	Nabumetone	CYP1A2	CYP2C19, CYP3A4		●	
	Indomethacin	CYP2C9	CYP2C19			●
Enolic acid (Oxicam) derivatives	Meloxicam	CYP2C9	CYP1A2, CYP3A4, CYP3A5			●
	Piroxicam	CYP2C9	CYP3A4, CYP3A5			●
	Tenoxicam	CYP2C9				●
	Lornoxicam	CYP2C9				●
Selective COX-2 inhibitors (Coxibs)	Etoricoxib	CYP3A4	CYP3A5, CYP2C9, CYP2D6, CYP1A2		●	
	Parecoxib	CYP2C9	CYP3A4, CYP3A5			●
	Celecoxib	CYP2C9	CYP2C19			●
Propionic acid derivatives	Ibuprofen	CYP2C9	CYP2C19, CYP2C8, UGT2B7		●	
	Flurbiprofen	CYP2C9				●
	Ketoprofen	CYP3A4	CYP2C9, CYP3A5, UGT2B7		●	
	Fenoprofen	CYP2C9	UGT2B7			●
	Vicoprofen	CYP2D6	CYP3A4		●	
	Naproxen	CYP2C9	CYP1A2, CYP2C8, UGT2B7, SULT1A1			●
Anthranilic acid derivatives (Fenamates)	Mefenamic acid	CYP2C9				●
The Non-NSAIDs Analgesic	Acetaminophen	UGT1A1, SULT1A1, GSHs	CYP2E1, CYP3A4, CYP3A5, CYP2D6, CYP1A2, ABCG2		●	

PGx Report - Pain Management

Type: Opioid

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Opioid Analgesics						
Opium alkaloids	Morphine	UGT2B7	ABCB1, UGT1A1, COMT		●	
	Codeine	CYP2D6	CYP3A4, UGT2B7, CYP3A5		●	
Ethers of morphine	Dihydrocodeine	CYP3A4	CYP2D6, CYP3A5		●	
	Ethylmorphine	CYP2D6	CYP3A4, CYP3A5		●	
Semi-synthetic alkaloid derivatives	Hydrocodone	CYP2D6	CYP3A4, CYP3A5		●	
	Hydromorphone	UGT2B7			●	
	Oxycodone	CYP3A4	CYP3A5, CYP2D6, ABCB1, UGT2B7, COMT		●	
	Oxymorphone	UGT2B7			●	
Synthetic opioids						
Anilidopiperidine derivatives	Alfentanyl	CYP3A4	CYP3A5, ABCB1		●	
	Fentanyl	CYP3A4	CYP3A5, ABCB1		●	
	Sufentanil	CYP3A4	CYP3A5		●	
Phenylpiperidine derivatives	Meperidine	CYP2B6	CYP3A4, CYP2C19, CYP3A5			●
	Ketobemidone	CYP2C9	CYP3A4, CYP3A5			●
Diphenylpropylamine derivatives	Dextropropoxyphene	CYP3A4	CYP3A5, Renal Excretion		●	
	Levacetylmethadol	CYP3A4	CYP3A5		●	
	Methadone	CYP3A4	CYP2B6, CYP2D6, CYP3A5, ABCB1, UGT2B7, COMT		●	
Oripavine derivatives	Buprenorphine	CYP3A4	CYP3A5, CYP2C8, UGT1A1, UGT2B7		●	
Morphinan derivatives	Dextromethorphan	CYP2D6	CYP3A4, CYP3A5		●	
Others	Tramadol	CYP2D6	CYP3A4, CYP2B6, CYP3A5, SLC22A1, COMT	●		
	Tapentadol	CYP2C9	CYP2C19, CYP2D6		●	
	Tilidine	CYP3A4	CYP2C19, CYP3A5		●	
Anti-opioid	Methylnaltrexone	CYP2D6	CYP3A4, CYP3A5		●	
	Naltrexone	UGT2B7	UGT1A1		●	

PGx Report - Pain Management

Type: Drugs Prescribed for the Treatment of Gout, Antirheumatic

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drugs Prescribed for Gout						
Uricosurics	Sulfinpyrazone	CYP2C9	CYP3A4, CYP3A5		✓	
Mitotic inhibitors	Colchicine	CYP3A4	CYP3A5		✓	
Xanthine oxidase inhibitors	Febuxostat	CYP1A2, CYP2C8	CYP2C9, UGT1A1, UGT2B7		✓	
	Allopurinol	AOX1	Renal Excretion, HLA-B*5801		✓	
	Oxypurinol	Renal Excretion			✓	
Recombinant urate oxidase	Rasburicase		G6PD, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
Antimetabolites	Azathioprine	XO	TPMT, AOX1		✓	
	Methotrexate	Renal Excretion	AOX1, SLCO1B1, SLC19A1, ABCC1, ABCC2, ABCC3, ABCG2		✓	
DMARDs	Leflunomide	CYP1A2			✓	
Anti-inflammatory	Tofacitinib	CYP3A4	CYP2C19, CYP3A5		✓	

Abbreviations: DMARDs, Disease-modifying antirheumatic drugs; RE, renal excretion (unchanged drug).

Additional SNPs of Importance for Pain Management

Gene	Marker	Genotype	Drug	Level of Evidence	Results
COMT	rs4680	G/G	Paroxetine	3	Patients may require a higher dose

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Modulation of Respiratory Function

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Respiratory						
Anticholinergic	Umeclidinium	CYP2D6				⊘
	Aclidinium	CYP2D6	CYP3A4, CYP3A5		✓	
Beta2-adrenergic agonist	Arformoterol	CYP2D6, UGT1A1	CYP2C19			⊘
	Indacaterol	UGT1A1, CYP3A4	CYP3A5, CYP1A2, CYP2D6		✓	
	Formoterol	CYP2D6	CYP2C19, CYP2C9, CYP2A6		✓	
	Salmeterol	CYP3A4	CYP3A5		✓	
	Vilanterol	CYP3A4	CYP3A5		✓	
Corticosteroid	Budesonide	CYP3A4	CYP3A5		✓	
	Fluticasone	CYP3A4	CYP3A5		✓	
	Mometasone	CYP3A4	CYP3A5		✓	
Phosphodiesterase inhibitor	Roflumilast	CYP3A4	CYP1A2, CYP3A5		✓	
	Theophylline	CYP1A2	CYP2E1		✓	
5-lipoxygenase inhibitor	Zileuton	CYP1A2	CYP2C9, CYP3A4, CYP3A5		✓	
Leukotriene receptor-1 antagonist	Montelukast	CYP3A4	CYP2C9, CYP3A5, SLCO2B1, ABCC1		✓	
	Pranlukast	CYP3A4	CYP3A5		✓	
	Zafirlukast	CYP2C9	CYP3A4, CYP3A5			⊘
Treatment of cystic fibrosis (specifics mutations in the CFTR gene)	Ivacaftor	CYP3A4	CYP3A5, CFTR		✓	

Abbreviations: CFTR, Cystic fibrosis transmembrane conductance regulator.

PGx Report - Internal Medicine

Type: Antiemetic

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antiemetic						
Antiemetic, 5-HT3 receptor antagonist Indole derivative	Dolasetron	CYP3A4	CYP2D6, CYP3A5		✓	
	Tropisetron	CYP3A4	CYP2D6, CYP3A5		✓	
Antiemetic, 5-HT3 receptor antagonist Isoquinoline derivative	Palonosetron	CYP1A2	CYP2D6, CYP3A4, CYP3A5		✓	
Antiemetic, 5-HT3 receptor antagonist Indazole derivative	Granisetron	CYP3A4	CYP3A5		✓	
Antiemetic, 5-HT3 receptor antagonist	Ondansetron	CYP2B6	CYP1A2, CYP2D6, CYP3A4, ABCB1			✓
Antiemetic, dopamine-receptor antagonist	Domperidone	CYP3A4	CYP3A5		✓	
	Prochlorperazine	CYP2D6	CYP3A4, CYP3A5		✓	
	Metoclopramide	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
Antiemetic, NK1 receptor antagonist	Aprepitant	CYP3A4	CYP3A5, CYP1A2, CYP2C19		✓	
Antiemetic, H1 histamine receptor antagonist	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
	Hydroxyzine	ADHs	CYP3A4, CYP3A5		✓	
	Promethazine	CYP2D6	SULTs		✓	
Cannabinoids	Dronabinol	CYP2C9	CYP2C19, CYP3A4, CYP3A5		✓	
Benzodiazepines	Lorazepam	UGT2B15	UGT2B7		✓	
	Midazolam	CYP3A4	CYP3A5		✓	
Anticholinergics	Scopolamine	CYP3A4	CYP3A5		✓	
Steroids	Dexamethasone	CYP3A4	CYP17A1, CYP3A5		✓	

Abbreviations: 5-HT, Serotonin; NK1, neurokinin 1.

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Treatment of Peptic Ulcers and/or Gastro-Esophageal Reflux Disease

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Histamine H2-receptor antagonists	Ranitidine	Renal Excretion	CYP1A2, CYP2C19, CYP3A4, CYP3A5		✓	
Proton-pump inhibitor	**Omeprazole**	**CYP2C19**	CYP3A4, CYP2C9, CYP3A5		✓	
	Dexlansoprazole	**CYP2C19**	CYP3A4, CYP3A5		✓	
	Esomeprazole	**CYP2C19**	CYP3A4, CYP3A5		✓	
	Lansoprazole	CYP3A4	CYP2C19, CYP3A5		✓	
	Rabeprazole	Non Enz	CYP2C19, CYP3A4, CYP3A5		✓	
	Ilaprazole	CYP3A4	CYP3A5		✓	
	Pantoprazole	**CYP2C19**	CYP3A4, CYP2D6, CYP2C9, CYP3A5		✓	

Abbreviations: Non Enz, non-enzymatic metabolism.

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Treatment of Functional Gastrointestinal Disorders, Obesity

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drugs for functional gastrointestinal disorders						
Acting on serotonin receptors 5-HT3 antagonists	Alosetron	CYP2C9	CYP3A4, CYP1A2			⊘
	Cilansetron	CYP3A4	CYP2D6, CYP1A2, CYP2C19, CYP3A5		✓	
Acting on serotonin receptors 5-HT4 agonists	Mosapride	CYP3A4	CYP3A5		✓	
	Prucalopride	Renal Excretion	CYP3A4, CYP3A5		✓	
Gastroprokinetic						
Serotonin 5-HT$_4$ receptor agonist	Cisapride	CYP3A4	CYP3A5		✓	
	Cinitapride	CYP3A4	CYP2C8, CYP3A5		✓	
Parasympatho mimetic	Itropride	FMO3			✓	
Dopamine antagonists	Metoclopramide	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
	Clebopride	CYP3A4	CYP3A5		✓	
	Domperidone	CYP3A4	CYP3A5		✓	
Antipropulsives						
Opioids	Loperamide	CYP3A4	CYP2C8, CYP3A5		✓	
	Morphine	UGT2B7	ABCB1, UGT1A1, COMT		✓	
Centrally acting anti-obesity drugs						
Stimulant/ Amphetamine/ Appetite suppressant agent	Sibutramine	CYP3A4	CYP3A5		✓	
	Phentermine	Renal Excretion	CYP3A4, CYP3A5		✓	
Anorectic	Lorcaserin	CYP2D6	CYP3A4, CYP3A5		✓	

PGx Report - Internal Medicine

Type: Diabetes

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antidiabetic Secretagogues						
Meglitinides	Repaglinide	CYP2C8	SLCO1B1, CYP3A4, CYP3A5, ABCC8		✓	
	Nateglinide	CYP2C9	CYP3A4, CYP3A5			⊘
Sulfonylurea 1st generation	Chlorpropamide	Renal Excretion	CYP2D6, G6PD		✓	
	Tolazamide	CYP2C9				⊘
	Tolbutamide	CYP2C9	CYP2C19, CYP2C8		✓	
Sulfonylurea 2nd generation	Glipizide	CYP2C9	G6PD			⊘
	Glyburide	CYP3A4	CYP2C9, CYP2C19, CYP3A5, G6PD		✓	
	Gliquidone	CYP2C9				⊘
	Gliclazide	CYP2C9	CYP2C19		✓	
	Glimepiride	CYP2C9	G6PD			⊘
DPP-IV inhibitor	Saxagliptin	CYP3A4	CYP3A5		✓	
	Alogliptin	Renal Excretion	CYP2D6, CYP3A4, CYP3A5		✓	
	Linagliptin	Renal Excretion	CYP3A4, CYP3A5		✓	
	Sitagliptin	CYP3A4	CYP2C8, CYP3A5		✓	
Antidiabetic Sensitizers						
Biguanides	Metformin	Renal Excretion			✓	
Thiazolidinediones	Pioglitazone	CYP2C8	CYP3A4, CYP3A5		✓	
	Rosiglitazone	CYP2C8	CYP2C9		✓	

Abbreviations: DPP-IV, Dipeptidyl peptidase-4; SGLT2, sodium/glucose cotransporter 2 or gliflozins.

PGx Report - Internal Medicine

Type: Migraine, Antihistamine, Abortifacient, Drugs Prescribed for the Treatment of Hyperparathyroidism, Dermatology

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anti-migraine						
Selective serotonin (5-HT1) agonists	Almotriptan	CYP3A4	CYP2D6, CYP3A5		✓	
	Eletriptan	CYP3A4	CYP3A5		✓	
	Frovatriptan	CYP1A2			✓	
	Naratriptan	CYP1A2	CYP2C8, CYP2C9, CYP2D6		✓	
	Sumatriptan	MAO	UGTs, HTR2A		✓	
	Zolmitriptan	CYP1A2			✓	
Ergot alkaloids	Dihydroergotamine	CYP3A4	CYP3A5		✓	
	Ergotamine	CYP3A4	CYP3A5		✓	
Antihistamines						
Aminoalkyl ethers	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
Substituted alkylamines	Chlorpheniramine	CYP3A4	CYP3A5		✓	
Phenothiazine derivatives	Promethazine	CYP2D6	SULTs		✓	
Piperazine derivatives	Hydroxyzine	ADHs	CYP3A4, CYP3A5		✓	
	Cyclizine	CYP2D6			✓	
	Cetirizine	Renal Excretion			✓	
Other antihistamines	Terfenadine	CYP3A4	CYP3A5		✓	
	Loratadine	CYP3A4, CYP2D6	CYP3A5, CYP2C8, CYP2C9		✓	
	Fexofenadine	Biliary Excretion	Renal Excretion, CYP3A4, CYP3A5, SLCO2B1		✓	
	Desloratadine	CYP2C8			✓	
	Astemizole	CYP3A4	CYP3A5		✓	
Treatment of secondary hyperparathyroidism						
Calcimimetic	Cinacalcet	CYP3A4	CYP2D6, CYP3A5, CYP1A2		✓	
Abortifacient						
Progestin Antagonist	Mifepristone	CYP3A4	CYP3A5		✓	
Dermatology Antipsoriatics						
Retinoids	Etretinate	CYP26A1			✓	
	Acitretin	CYP26A1			✓	
Dermatology Anti-acne						
Retinoid	Isotretinoin	CYP2C8	CYP2C9, CYP3A4, CYP2B6, CYP3A5		✓	
Abbreviations: BE, biliary excretion.						

PGx Report - Modulation of Cardiovascular Function

Type: Antiarrhythmic

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antiarrhythmic class Ia	Quinidine	CYP3A4, CYP2D6	CYP2E1, CYP3A5, CYP2C9, CYP2C8		✓	
	Procainamide	CYP2D6	NAT2			⊘
	Sparteine	CYP2D6				⊘
	Disopyramide	CYP3A4	CYP3A5, CYP1A2, CYP2C19		✓	
Antiarrhythmic class Ib	**Phenytoin**	**CYP2C19**	CYP2C9, CYP3A4, CYP3A5, CYP2D6, ABCB1, EPHX1, HLA-B*1502		✓	
	Tocainide	UGTs			✓	
	Lidocaine	CYP1A2	CYP3A4, CYP3A5		✓	
	Mexiletine	CYP2D6	CYP1A2		✓	
Antiarrhythmic class Ic	Propafenone	CYP2D6	CYP3A4, CYP1A2, CYP3A5		✓	
	Flecainide	CYP2D6				⊘
	Encainide	CYP2D6				⊘
Antiarrhythmic class II	Carvedilol	CYP2D6	UGT1A1, CYP2C9			⊘
	Bisoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Metoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Propranolol	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5		✓	
Antiarrhythmic class III	Amiodarone	CYP3A4	CYP2C8, CYP3A5		✓	
	Dronedarone	CYP3A4	CYP3A5		✓	
	Dofetilide	Renal Excretion	CYP3A4, CYP3A5		✓	
Antiarrhythmic class IV	Diltiazem	CYP3A4	CYP2C19, CYP3A5		✓	
	Verapamil	CYP3A4	CYP2C8, CYP3A5, ABCB1		✓	

PGx Report - Modulation of Cardiovascular Function

Type: Antihypertensive I

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antihypertensives						
Angiotensin II receptor antagonist	Losartan	CYP2C9	CYP3A4, CYP3A5, UGT1A1	⊘		
	Azilsartan	CYP2C9				⊘
	Irbesartan	CYP2C9				⊘
	Telmisartan	Biliary Excretion	UGT1A1		✓	
	Olmesartan	Hydrolysis	Renal Excretion, SLCO1B1		✓	
	Valsartan	CYP2C9				⊘
Angiotensin-Converting Enzyme Inhibitors	Captopril	Renal Excretion	CYP2D6		✓	
	Enalapril	CES1, Renal Excretion	CYP3A4, CYP3A5		✓	
	Trandolapril	CES1	CYP2D6, CYP2C9, Renal Excretion		✓	
Renin inhibitors	Aliskiren	CYP3A4	CYP3A5, ABCB1		✓	
Aldosterone Antagonists	Eplerenone	CYP3A4	CYP3A5		✓	
Loop diuretic	Torasemide	CYP2C9	CYP2C8, Renal Excretion			⊘
Thiazide-like diuretic	Indapamide	CYP3A4	CYP3A5		✓	
Potassium-sparing diuretic	Triamterene	CYP1A2			✓	
Vasopressin receptor antagonists	Tolvaptan	CYP3A4	CYP3A5		✓	
Adrenergic release inhibitors	Debrisoquine	CYP2D6				⊘
Peripheral Adrenergic Inhibitors	Reserpine	CYP2D6				⊘
Beta-1 cardioselective beta-blockers	Metoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Bisoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Nebivolol	CYP2D6				⊘

PGx Report - Modulation of Cardiovascular Function

Type: Antihypertensive II

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antihypertensives						
Nonselective beta-blockers	Timolol	CYP2D6				⊘
	Propranolol	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5		✓	
Beta-blockers with alpha activity	Carvedilol	CYP2D6	UGT1A1, UGT2B4, CYP2C9			⊘
	Labetalol	CYP2D6	CYP2C19, ABCB1, UGT1A1, UGT2B7		✓	
Alpha blockers	Terazosin	CYP3A4	CYP3A5		✓	
	Doxazosin	CYP2D6	CYP2C19, CYP3A4, CYP3A5		✓	
α-2 adrenergic agonist	Clonidine	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
	Tizanidine	CYP1A2			✓	
Antihypertensives Calcium channel blockers						
Dihydropyridine	Amlodipine	CYP3A4	CYP3A5		✓	
	Nifedipine	CYP3A4	CYP1A2, CYP2A6, CYP3A5		✓	
	Nimodipine	CYP3A4	CYP3A5		✓	
	Nicardipine	CYP2C8	CYP2D6, CYP3A4, CYP3A5		✓	
Benzothiazepine	Diltiazem	CYP3A4	CYP2C19, CYP3A5		✓	
Phenylalkylamine	Verapamil	CYP3A4	CYP2C8, CYP3A5, ABCB1		✓	
Nonselective	Bepridil	CYP3A4	CYP3A5		✓	
Anti-pulmonary arterial hypertension						
ERA-Dual antagonists	Bosentan	CYP2C9	CYP3A4, CYP3A5, SLCO1B3			⊘
	Macitentan	CYP3A4	CYP2C19, CYP3A5		✓	
Phosphodiesterase inhibitors	Sildenafil	CYP3A4	CYP2C9, CYP3A5		✓	
	Tadalafil	CYP3A4	CYP3A5		✓	
Abbreviations: ERA, endothelin receptor antagonist.						

PGx Report - Modulation of Cardiovascular Function

Type: Cardiac stimulant, Vasodilator, Drugs Prescribed for the Treatment of Angina

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Cardiac stimulants						
Digitalis glycosides	Digoxin	Renal Excretion	ABCB1, SLCO1B3, ABCB4		✓	
Adrenergic and dopaminergic agents	Epinephrine	MAO	COMT		✓	
	Phenylephrine	MAO	SULTs, UGTs		✓	
	Dopamine	ALDH1A1, ALDH2	DBH, MAOA, MAOB, SULT1A3, SULT1A4, COMT		✓	
	Synephrine	MAO			✓	
Vasodilators used in cardiac diseases						
Organic nitrates	**Isosorbide dinitrate**	**NAT2**	NAT1			✗
Other Vasodilators	**Hydralazine**	**NAT2**	NAT1, CYP1A2, CYP3A4, CYP3A5			✗
Other Drugs Used in Angina						
Other cardiac preparations	Ranolazine	CYP3A4	CYP2D6, CYP3A5		✓	
	Ivabradine	CYP3A4	CYP3A5		✓	

PGx Report - Modulation of Cardiovascular Function

Type: Dyslipidemia

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Liver)						
HMG CoA reductase inhibitors Statins	Atorvastatin	CYP3A4, SLCO1B1	ABCG2, CYP3A5, ABCB1, ABCG8, UGT1A1, UGT2B7, KIF6		✓	
	Fluvastatin	CYP2C9, SLCO1B1	ABCG2, CYP3A4, CYP2C8, UGT1A1, UGT2B7			✗
	Lovastatin	CYP3A4, SLCO1B1	CYP3A5, UGT1A1		✓	
	Cerivastatin	CYP3A4, SLCO1B1	CYP2C8, CYP3A5		✓	
	Pitavastatin	UGT2B7	CYP2C9, CYP2C8, ABCB1		✓	
	Simvastatin	CYP3A4, SLCO1B1	ABCG2, CYP3A5, ABCB1, SLCO2B1, UGT1A1, UGT2B7, KIF6		✓	
	Rosuvastatin	UGT1A1	ABCG2		✓	
MTTP inhibitors	Lomitapide	CYP3A4	CYP3A5, LDLR		✓	
Drug Therapy for Hypercholesterolemia and Dyslipidemia (GI)						
Cholesterol absorption inhibitors	Ezetimibe	UGT1A1	UGT2B15			✗
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Blood vessels)						
Fibrates	Gemfibrozil	CYP3A4	CYP3A5, UGT2B7, UGT1A1, UGT2B15		✓	
	Clofibrate	UGT2B7			✓	
Drug Therapy for familial hypercholesterolemia						
Cholesterol-reducing drug (antisense oligonucleotide)	Mipomersen	Nuclease, Renal Excretion	LDLR		✓	
rosuvastatin						

PGx Report - Modulation of Cardiovascular Function

Type: Anticoagulant, Antiplatelet

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Blood Coagulation and Anticoagulant, and Antiplatelet Drugs						
Vitamin K antagonist	Warfarin	CYP2C9, VKORC1	CYP2C19, CYP1A2, CYP3A4, EPHX1, PROC, PROS1		✓	
	Acenocoumarol	CYP2C9, VKORC1	CYP2C19, CYP1A2		✓	
	Phenprocoumon	CYP2C9, VKORC1	CYP3A4, CYP2C8		✓	
Direct factor Xa inhibitors	Rivaroxaban	CYP3A4	CYP3A5		✓	
	Apixaban	CYP3A4	CYP3A5		✓	
Antiplatelet Drugs						
ADP receptor (P2Y12) inhibitors Nucleotide/nucleoside analogs	Ticagrelor	CYP3A4	CYP3A5		✓	
ADP receptor (P2Y12) inhibitors Thienopyridines	**Clopidogrel**	**CYP2C19**	ABCB1, ABCC3			✗
	Prasugrel	BCHE, CYP3A4	CYP2B6, CYP2C9, CYP2C19, CYP3A5, CYP2D6		✓	
Irreversible cyclooxygenase inhibitors	Aspirin	GLYAT, UGTs, Renal Excretion	CYP2C9, CYP3A4, CYP3A5		✓	
Phosphodiesterase inhibitors	Cilostazol	CYP3A4	CYP2C19, CYP3A5		✓	
Protease-activated receptor-1 (PAR-1) antagonists	Vorapaxar	CYP3A4	CYP3A5		✓	
Abbreviations: P2Y12, purinergic receptor P2Y12.						

PGx Report - Psychiatry

Type: Antidepressant I

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antidepressants						
SSRIs	Citalopram	CYP2C19, CYP2D6	CYP3A4, CYP3A5, SLC6A4, HTR2A		✓	
	Escitalopram	CYP3A4, CYP2C19	CYP2D6, CYP3A5, SLC6A4, HTR2C		✓	
	Dapoxetine	CYP2D6	CYP3A4, CYP3A5		✓	
	Fluoxetine	CYP2D6	CYP3A4, CYP2C9, CYP3A5, CYP2C19, SLC6A4, HTR2A		✓	
	Paroxetine	CYP2D6	CYP3A4, CYP1A2, CYP3A5, CYP2C9, SLC6A4, HTR2A, DRD3		✓	
	Sertraline	CYP2B6	CYP2C19, CYP2C9, CYP3A4, CYP2D6, SLC6A4			⊘
	Fluvoxamine	CYP2D6	CYP1A2, SLC6A4, HTR2A		✓	
SMSs	Vilazodone	CYP3A4	CYP3A5, CYP2C19, CYP2D6		✓	
SNRIs	Levomilnacipran	CYP3A4	CYP2C8, CYP3A5, CYP2C19, CYP2D6		✓	
	Milnacipran	UGTs	Renal Excretion		✓	
	Venlafaxine	CYP2D6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, SLC6A3, SLC6A4, HTR2A		✓	
	Duloxetine	CYP2D6	CYP1A2, HTR2A		✓	
NRIs	Atomoxetine	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2		✓	
	Reboxetine	CYP3A4	CYP3A5		✓	
	Maprotiline	CYP2D6	CYP1A2		✓	
TCAs that preferentially inhibit the reuptake of serotonin	Clomipramine	CYP2D6	CYP3A4, CYP2C19, CYP1A2, CYP2C9, SLC6A4, HTR2A		✓	
	Imipramine	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5		✓	
TCAs that preferentially inhibit the reuptake of norepinephrine	Desipramine	CYP2D6	CYP1A2, CYP2C19		✓	
	Nortriptyline	CYP2D6	CYP1A2, CYP2C19, ABCB1, SLC6A4		✓	
	Protriptyline	CYP2D6				⊘

PGx Report - Psychiatry

Type: Antidepressant II

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antidepressants						
TCAs that fairly balanced serotonin-norepinephrine reuptake inhibitors	Amitriptyline	CYP2D6	CYP3A4, CYP2C19, CYP2C9, CYP1A2, CYP2B6		✓	
	Doxepin	CYP2D6, CYP2C19	CYP1A2, CYP3A4, CYP3A5		✓	
	Dosulepin	CYP2D6, CYP2C9	CYP3A4, CYP1A2, CYP3A5, CYP2C19		✓	
TeCAs	Mianserin	CYP2D6	CYP3A4, CYP1A2, CYP2B6, CYP3A5		✓	
	Amoxapine	CYP2D6	CYP3A4, CYP3A5		✓	
TCA with antipsychotic and sedative properties	Trimipramine	CYP2D6	CYP2C19, CYP2C9		✓	
MAOI	Tranylcypromine	MAO	CYP3A4, CYP2A6, CYP3A5, CYP2C19, CYP2D6		✓	
	Moclobemide	**CYP2C19**	CYP2D6, CYP1A2, HTR2A		✓	
Atypical antidepressants						
SMSs	Vortioxetine	CYP2D6	CYP2C9, CYP3A4, CYP3A5, UGTs, CYP2A6, CYP2C8, CYP2C19, CYP2B6			⊘
NaSSAs	Mirtazapine	CYP1A2	CYP2D6, CYP3A4, CYP3A5, SLC6A4, HTR2A		✓	
SARIs	Trazodone	CYP3A4	CYP2D6, CYP3A5		✓	
	Nefazodone	CYP2D6, CYP3A4	CYP3A5		✓	
Antidepressant and smoking cessation aid	Bupropion	CYP2B6	CYP2E1, CYP3A4, CYP2D6, CYP1A2, CYP3A5			⊘
Antidepressant and anti-anxiety	Buspirone	CYP3A4	CYP3A5		✓	

Abbreviations: SSRI, serotonin selective reuptake inhibitor; SMS, Serotonin modulator and stimulator; SNRI, serotonin-norepinephrine reuptake inhibitor; NRI, norepinephrine reuptake inhibitor; TCA, tricyclic antidepressant; TeCA, tetracyclic antidepressant; MAOI, monoamine oxidase inhibitor; NaSSA, noradrenergic and specific serotonergic antidepressant; SARI, serotonin antagonist and reuptake inhibitor.

Additional SNPs of Importance for the Treatment of Depression and Psychosis, and the Treatment of Alcohol and Tobacco Use Disorders

Gene	Marker	Genotype	Drug	Level of Evidence	Results
COMT	rs4680	G/G	Fluvoxamine	3	Schizophrenia patients may have a decreased risk for developing extrapyramidal symptoms
COMT	rs4680	G/G	Venlafaxine	3	Patients with Depressive Disorder may have increased response but patients with Anxiety Disorders may have a decreased response
COMT	rs4680	G/G	Paroxetine	3	Depressive patients may have a decreased response or decreased improvement

PGx Report - Psychiatry

Type: Typical Antipsychotic

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Typical antipsychotic						
Butyrophenones	Bromperidol	CYP3A4	CYP3A5		✓	
	Droperidol	CYP3A4	CYP3A5		✓	
	Haloperidol	UGTs, CYP3A4	CYP1A2, CYP2D6, CYP3A5, SLC6A4, HTR2C		✓	
Phenothiazines with aliphatic side-chain	Chlorpromazine	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
	Levomepromazine	CYP3A4	CYP1A2, CYP3A5		✓	
	Promazine	CYP1A2	CYP3A4, CYP2C19, CYP2C9, CYP3A5		✓	
	Cyamemazine	CYP1A2	CYP3A4, CYP2C9, CYP2C8, CYP3A5		✓	
Phenothiazines with piperazine structure	Fluphenazine	CYP2D6				✓
	Perphenazine	CYP2D6				✓
	Prochlorperazine	CYP2D6	CYP3A4, CYP3A5		✓	
	Trifluoperazine	CYP1A2			✓	
Phenothiazines with piperidine structure	Thioridazine	CYP2D6	CYP1A2, CYP3A4, CYP2C19, CYP3A5		✓	
Phenothiazines used as an anti-histamine, sedative, and antiemetic	Promethazine	CYP2D6	SULTs		✓	
Diphenyl-butylpiperidine	Pimozide	CYP3A4, CYP2D6	CYP1A2, CYP3A5		✓	
Thioxanthene derivative	Thiothixene	CYP1A2	CYP3A4, CYP3A5		✓	
	Zuclopenthixol	CYP2D6	CYP3A4, CYP3A5		✓	
Tricyclics	Loxapine	CYP1A2	CYP3A4, CYP2D6, CYP3A5		✓	

PGx Report - Psychiatry

Type: Atypical antipsychotic

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Atypical antipsychotic						
Diazepines, Oxazepines, Thiazepines and Oxepines	Quetiapine	CYP3A4, CYP2D6	CYP3A5, CYP1A2, CYP2C9, CYP2C19, SLC6A4		✓	
	Olanzapine	CYP1A2	CYP2D6		✓	
	Asenapine	CYP1A2	CYP2D6, CYP3A4, CYP3A5		✓	
	Clozapine	CYP1A2, CYP2D6	CYP3A4, CYP2C9, CYP2C19, CYP3A5, CYP2A6, SLC6A3, SLC6A4, SLC1A1, HTR2C, DRD3		✓	
Indole derivatives	Sertindole	CYP2D6	CYP3A4, CYP3A5		✓	
	Ziprasidone	CYP3A4	AOX1, CYP3A5		✓	
	Lurasidone	CYP3A4	CYP3A5		✓	
Benzamides	Sulpiride	Renal Excretion			✓	
	Amisulpride	Renal Excretion			✓	
Other antipsychotics	Aripiprazole	CYP2D6	CYP3A4, CYP3A5, DRD3		✓	
	Risperidone	CYP2D6	CYP3A4, CYP3A5, ABCB1, SLC6A4, SLC1A1, HTR2A, HTR2C, DRD3		✓	
	Iloperidone	CYP2D6	CYP3A4, CYP3A5		✓	
	Paliperidone	CYP2D6	CYP3A4, CYP3A5		✓	
	Zotepine	CYP3A4	CYP1A2, CYP3A5, CYP2D6		✓	

Additional SNPs of Importance in Treatment that Includes the Use of Antipsychotics and for the Treatment of Autism

Gene	Marker	Genotype	Drug	Level of Evidence	Results
COMT	rs4680	G/G	Haloperidol	3	Schizophrenia patients may have a decreased risk for developing extrapyramidal symptoms

Other genetic and clinical factors may also influence a patient's response to medications

PGx Report - Neurology

Type: Drugs Prescribed for the Treatment of ADHD, Related Drugs

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anti ADHD Stimulants						
Amphetamine	Dextroamphetamine	Renal Excretion, CYP2D6	DBH, FMO3, GLYAT		✓	
	Levoamphetamine	Renal Excretion, CYP2D6	FMO3		✓	
NDRI	Dexmethylphenidate	CYP2D6	Renal Excretion		✓	
Psychostimulant	Lisdexamfetamine	Hydrolysis	CYP2D6, Renal Excretion		✓	
	Methylphenidate	CYP2D6	Renal Excretion, SLC6A2, SLC6A3, SLC6A4, DRD3			⊘
Anti ADHD Non-stimulants						
NERI	Atomoxetine	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2		✓	
Central alpha-2 Adrenergic Agonist	Clonidine	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
Antidepressants	Bupropion	CYP2B6	CYP2E1, CYP3A4, CYP2D6, CYP1A2, CYP3A5			⊘
	Imipramine	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
	Desipramine	CYP2D6	CYP1A2, CYP2C19		✓	
	Milnacipran	UGTs	Renal Excretion		✓	
	Reboxetine	CYP3A4	CYP3A5		✓	
Wakefulness-promoting agent	Modafinil	Hydrolysis, CYP2D6	CYP1A2, CYP3A4, CYP2B6, CYP3A5		✓	
	Armodafinil	CYP3A4	CYP3A5		✓	
Anti-insomnia						
Melatonin Receptor Agonist	Ramelteon	CYP1A2	CYP2C19, CYP3A4, CYP3A5		✓	

Abbreviations: ADHD, Attention deficit hyperactivity disorder; NERI; norepinephrine reuptake inhibitor, NDRI, norepinephrine-dopamine reuptake inhibitor.

PGx Report - Neurology

Type: Drugs Prescribed for the Treatment of Epilepsy

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antiepileptic						
Barbiturates	**Phenobarbital**	**CYP2C19**	ABCB1	⊘		
Carbamates	Felbamate	CYP3A4	CYP2E1, CYP3A5		✓	
Carboxamides	Carbamazepine	CYP3A4	CYP2C8, CYP2B6, UGT2B7, CYP1A2, CYP3A5, ABCB1, HLA-B*1502, HLA-A*3101, ABCC2		✓	
Fatty acids	Tiagabine	CYP3A4	CYP3A5, CYP1A2, CYP2D6, CYP2C19		✓	
Fructose derivatives	Topiramate	Renal Excretion	CYPs, UGTs		✓	
GABA analogs	Gabapentin	Renal Excretion			✓	
	Pregabalin	Renal Excretion			✓	
Hydantoin	**Phenytoin**	**CYP2C19**	CYP2C9, CYP3A4, CYP3A5, CYP2D6, ABCB1, EPHX1, HLA-B*1502		✓	
	Mephenytoin	**CYP2C19**	CYP2C8, CYP2C9, CYP2B6, CYP1A2, CYP2D6		✓	
Oxazolidinediones	Trimethadione	CYP2C9	CYP2E1, CYP3A4, CYP3A5		✓	
	Paramethadione	CYP2C9				⊘
Pyrimidinedione	Primidone	CYP2C9	CYP2C19		✓	
Pyrrolidines	Brivaracetam	CYP2C19, CYP2C9	CYP3A4, CYP3A5, CYP2C8, CYP2B6		✓	
	Levetiracetam	Renal Excretion			✓	
	Seletracetam	Renal Excretion			✓	
Succinimides	Ethosuximide	CYP3A4	CYP3A5, CYP2E1		✓	
Sulfonamides	Zonisamide	CYP3A4	CYP2C19, CYP3A5		✓	
Other	Lacosamide	CYP2C9	CY2C19, CYP3A4		✓	
	Perampanel	CYP3A4	CYP3A5		✓	

Abbreviations: GABA, gamma-aminobutyric acid.

PGx Report - Neurology

Type: Anxiolytic, Hypnotic, Sedative, Anticonvulsant, Muscle Relaxants

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anxiolytic, Hypnotic, Sedative, Anticonvulsant, and Muscle Relaxant						
Benzodiazepine Short-acting	Midazolam	CYP3A4	CYP3A5		✓	
	Triazolam	CYP3A4	CYP3A5		✓	
	Brotizolam	CYP3A4	CYP3A5		✓	
Benzodiazepine Intermediate-acting	Alprazolam	CYP3A4	CYP3A5		✓	
	Bromazepam	CYP1A2	CYP2D6		✓	
	Clobazam	**CYP2C19**	CYP3A4, CYP3A5, CYP2B6		✓	
	Flunitrazepam	CYP2C19	CYP2C9, CYP3A4, CYP3A5, NAT2		✓	
	Estazolam	CYP3A4	CYP3A5		✓	
	Clonazepam	CYP3A4	CYP2C19, CYP3A5, NAT2		✓	
	Oxazepam-r	UGT2B7	UGT1A9		✓	
	Oxazepam-s	UGT2B15				⊘
	Quazepam	CYP3A4	CYP2C19, CYP3A5		✓	
	Lormetazepam	CYP3A4	CYP3A5		✓	
	Lorazepam-r	UGT2B7			✓	
	Lorazepam-s	UGT2B15				⊘
	Nitrazepam	CYP3A4	CYP3A5, NAT2		✓	
	Temazepam	CYP2C19	CYP3A4, CYP3A5, UGT2B7		✓	
Benzodiazepine Long-acting	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
	Clorazepate	CYP3A4	CYP3A5		✓	
	Chlordiazepoxide	CYP3A4	CYP3A5		✓	
	Flurazepam	CYP3A4	CYP3A5		✓	
	Nordazepam	CYP3A4	CYP3A5		✓	
Nonbenzodiazepine hypnotic	Zolpidem	CYP3A4	CYP3A5, CYP1A2, CYP2D6		✓	
	Zaleplon	AOX1, CYP3A4	CYP3A5		✓	
	Zopiclone	CYP3A4	CYP2C8, CYP2C9, CYP3A5		✓	
	Eszopiclone	CYP3A4	CYP2E1, CYP3A5		✓	

PGx Report - Neurology

Type: Drugs Prescribed for the Treatment of Alzheimer's and Parkinson's, Related Drugs

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anti-Alzheimer disease						
Acetylcholinesterase inhibitor	Tacrine	CYP1A2	CYP2D6		✓	
	Donepezil	CYP2D6	CYP3A4, CYP3A5		✓	
	Galantamine	CYP2D6	CYP3A4, CYP3A5		✓	
NMDA receptor antagonist	Memantine	Renal Excretion	UGTs		✓	
Anti-Parkinson disease & Anti-multiple sclerosis						
Precursor of dopamine	Levodopa	AAAD	COMT, SLC22A1		✓	
Inhibitor of MAO-B	Selegiline	CYP2B6	CYP2C9, CYP3A4, CYP3A5, CYP2A6, FMO3			⊘
	Rasagiline	CYP1A2			✓	
Dopamine receptor agonists	Bromocriptine	CYP3A4	CYP3A5		✓	
	Pramipexole	Renal Excretion	DRD3		✓	
	Ropinirole	CYP1A2	UGTs, Renal Excretion		✓	
Anticholinergics - Antimuscarinics	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
Anti-hyperkinetic movement	Tetrabenazine	CYP2D6	CYP1A2		✓	
Anti-amyotrophic lateral sclerosis drug	Riluzole	CYP1A2			✓	
Anthracenedione	Mitoxantrone	CYP2E1			✓	
Sphingosine 1-phosphate Receptor Modulator	Siponimod	CYP2C9	CYP3A4, CYP3A5			⊘
Selective blocker of members of voltage-activated K+ channels	Dalfampridine	Renal Excretion	CYP2E1		✓	
Abbreviations: NMDA, N-methyl-D-aspartate; COMT, Catechol-O-methyltransferase.						

Additional SNP of Importance for different Medical Condition and personality

Gene	Marker	Genotype	Results
ABCG2	rs2231142	G/G	Increased risk for Gout

PGx Report - Infectology

Type: Antibiotics

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antibacterials: protein synthesis inhibitors 50S						
Amphenicols	Chloramphenicol	CYP2C9	UGT2B7			⊘
Lincosamides	Clindamycin	CYP3A4	CYP3A5		✓	
Antibiotic						
Macrolides	Clarithromycin	CYP3A4	CYP3A5		✓	
	Erythromycin	CYP3A4			✓	
	Telithromycin	CYP3A4	CYP3A5		✓	
Antibacterials: nucleic acid inhibitors						
DHPS inhibitor Short-acting sulfonamides	**Sulfadimidine**	**NAT2**	Renal Excretion			⊘
	Sulfapyridine	**NAT2**	Renal Excretion			⊘
DHPS inhibitor Intermediate-acting sulfonamides	Sulfamethoxazole	Renal Excretion	NAT2, CYP2C9			⊘
Anaerobic DNA inhibitors/ Nitroimidazole	Tinidazole	CYP3A4	CYP3A5		✓	
	Ornidazole	CYP3A4	CYP3A5		✓	
DNA-dependent RNA polymerase inhibitors	Rifampicin	CYP3A4	CYP2C8, CYP3A5, CYP2C19, CYP2A6, RE		✓	
	Rifabutin	CYP3A4	CYP1A2, CYP3A5		✓	
Other drugs against mycobacteria	Dapsone	CYP2E1	NAT2, CYP3A4, CYP2C9, CYP3A5, CYP2D6, G6PD		✓	
	Bedaquiline	CYP3A4	CYP2C8, CYP2C19, CYP3A5		✓	
	Isoniazid	**NAT2**	CYP2E1, Renal Excretion			⊘
	Pyrazinamide	AOX1, XDH	CYP1A2, CYP3A4, CYP3A5, RE		✓	
Abbreviations: DHPS, Dihydropteroate synthase.						

PGx Report - Infectology

Type: Antimalarial, Anthelmintic, Antifungal

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antimalarial						
Aminoquinolines	Chloroquine	CYP2C8	CYP3A4, CYP3A5, G6PD		✓	
	Hydroxychloroquine	CYP2D6	CYP2C8, CYP3A4, CYP3A5		✓	
	Amodiaquine	CYP2C8			✓	
	Primaquine	CYP2D6	G6PD			⊘
Methanolquinolines	Quinine	CYP3A4, CYP2D6	CYP2C19, CYP3A5, G6PD		✓	
	Mefloquine	CYP3A4	CYP3A5		✓	
Artemisinin and derivatives	Artemisinin	CYP3A4	CYP2B6, CYP3A5		✓	
	Artemether	CYP3A4	CYP3A5		✓	
	Artesunate	CYP2A6				⊘
	Arteether	CYP3A4	CYP2B6, CYP3A5		✓	
Biguanides	**Proguanil**	**CYP2C19**			✓	
Other antimalarials	Halofantrine	CYP3A4	CYP3A5		✓	
	Pentamidine	**CYP2C19**	CYP1A2, CYP2D6		✓	
Anthelmintic						
Benzimidazoles	Albendazole	CYP3A4	CYP1A2, CYP3A5		✓	
Antifungals						
Imidazoles	Ketoconazole	CYP3A4	UGT1A1, CYP26A1		✓	
Triazoles	Itraconazole	CYP3A4			✓	
	Voriconazole	**CYP2C19**	CYP2C9, CYP3A4, CYP3A5		✓	
	Fluconazole	Renal Excretion			✓	
Allylamines	Terbinafine	CYP2C9	CYP1A2, CYP3A4, CYP2C8, CYP2C19		✓	

PGx Report - Infectology

Type: Antiretroviral, Antiviral

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Protease inhibitor 1st generation	Lopinavir	CYP3A4	SLCO1B1, CYP3A5, ABCC1, ABCC2		✓	
	Ritonavir	CYP3A4	CYP2D6, CYP3A5, ABCC1		✓	
	Saquinavir	CYP3A4	CYP3A5		✓	
	Indinavir	CYP3A4	CYP2D6, CYP3A5, ABCC4		✓	
	Nelfinavir	**CYP2C19**	CYP3A4, CYP3A5		✓	
	Fosamprenavir	CYP3A4	CYP3A5		✓	
Protease inhibitor 2nd generation	Atazanavir	CYP3A4	CYP3A5, ABCB1		✓	
	Darunavir	CYP3A4	CYP3A5, SLCO3A1		✓	
	Tipranavir	CYP3A4	CYP3A5		✓	
NNRTI 1st generation	Delavirdine	CYP3A4	CYP2D6, CYP3A5		✓	
	Efavirenz	CYP2B6	CYP2A6, ABCB1, SLCO3A1, ABCG2			⊘
NNRTI 2nd generation	Nevirapine	CYP3A4	CYP2B6, CYP3A5, ABCB1, SLCO3A1		✓	
	Etravirine	CYP3A4	CYP2C9, CYP2C19, CYP3A5		✓	
	Rilpivirine	CYP3A4	CYP3A5		✓	
Nucleoside reverse transcriptase inhibitor (NRTI)	Zidovudine	UGT2B7	Renal Excretion, SLCO3A1, ABCC1, ABCC4		✓	
	Abacavir	ADH6	UGT1A1, ADK, HLA-B*5701		✓	
Neuraminidase inhibitors/release phase	Zanamivir	Renal Excretion			✓	
	Peramivir	Renal Excretion			✓	
CCR5 Co-receptor Antagonist	Maraviroc	CYP3A4	CYP3A5		✓	
Hepatitis C Virus NS3/4A Protease Inhibitor	Boceprevir	CYP3A4	IFNL3, CYP3A5		✓	
	Telaprevir	CYP3A4	CYP3A5, IFNL3		✓	
	Paritaprevir	CYP3A4	CYP3A5		✓	
	Simeprevir	CYP3A4	CYP2C8, CYP2C19, CYP3A5, IFNL3		✓	
Other antivirals	**Enfuvirtide**	**CYP2C19**	CYP2E1, CYP1A2		✓	
	Raltegravir	UGT1A1	SLCO1A2			⊘
	Elvitegravir	CYP3A4	CYP3A5		✓	
	Dolutegravir	UGT1A1, CYP3A4	CYP3A5		✓	

Abbreviations: NNRTI, Non-Nucleoside Reverse Transcriptase Inhibitors; CCR5, C-C chemokine receptor type 5.

PGx Report - Oncology, Hematology

Type: Antineoplastic I

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Alkylating agents						
Nitrogen mustard analogues	Cyclophosphamide	CYP2B6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, ALDH1A1, ABCC3	⊘		
	Iphosphamide	CYP2B6	CYP3A4, CYP3A5	⊘		
Nitrosoureas	Carmustine	CYP1A2	Renal Excretion		✓	
Antimetabolites						
Folic acid analogues	Methotrexate	Renal Excretion	AOX1, SLCO1B1, SLC19A1, ABCC1, ABCC2, ABCC3, ABCG2		✓	
	Pemetrexed	Renal Excretion	SLC19A1		✓	
Purine analogues	Mercaptopurine	XO	TPMT, AOX1, SLC19A1		✓	
	Tioguanine	HPRT1	TPMT		✓	
	Cladribine	DCK	Renal Excretion		✓	
	Clofarabine	DCK	Renal Excretion		✓	
	Nelarabine	ADA	DCK, Renal Excretion, XO		✓	
Pyrimidine analogues	Tegafur	CYP2A6	DPYD, TYMS			⊘

PGx Report - Oncology, Hematology

Type: Antineoplastic II

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Plant alkaloids and other natural products						
Vinca alkaloids and analogues	Vincristine	CYP3A4	CYP3A5, ABCC3		✓	
	Vinblastine	CYP3A4	CYP3A5		✓	
Podophyllotoxin derivatives	Etoposide	CYP3A4	CYP3A5, CYP1A2, CYP2E1, ABCB1, UGT1A1		✓	
	Teniposide	**CYP2C19**	CYP3A4, CYP3A5, ABCB1		✓	
Taxanes	Paclitaxel	CYP2C8	CYP3A4, CYP3A5, ABCB1, SLC29A1		✓	
	Docetaxel	CYP3A4	CYP3A5, EPHX1, SLCO1B3, ABCC6		✓	
Cytotoxic antibiotics and related substances						
Anthracyclines and related substances	Doxorubicin	ALDH1A1, ABCB1, GSTP1, NQO1	CYP3A4, CYP2B6, CYP3A5, CYP2C8, CYP2D6, ABCC2, ABCC3		✓	
	Mitoxantrone	CYP2E1			✓	
Other antineoplastic agents						
Platinum compounds	Cisplatin	Renal Excretion, NQO1, GSTP1	EPHX1, GSTM1, ABCB1, XPC, LRP2, SLC19A1, ABCC2, ABCC3		✓	
Derivative of camptothecin	Irinotecan	UGT1A1, CYP3A4	CYP3A5, CYP2B6, SLCO1B3, SLCO1B3, ABCG2			⊘

PGx Report - Oncology, Hematology

Type: Antineoplastic Targeted Therapy I

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Protein kinase inhibitor (receptor)						
Epidermal growth factor receptor (EGFR)	Erlotinib	CYP3A4	CYP1A2, CYP3A5		✓	
	Gefitinib	CYP3A4	CYP2D6, CYP3A5, ABCG2		✓	
	Vandetanib	CYP3A4	CYP3A5		✓	
EGFR and epidermal growth factor receptor (HER2)	Lapatinib	CYP3A4, CYP2C19	CYP2C8, CYP3A5, HLA-DQA1*0201, HLA-DRB1*0701		✓	
	Neratinib	CYP3A4	CYP3A5		✓	
C-KIT and PDGFR	Masitinib	CYP3A4	CYP3A5		✓	
FLT3	Lestaurtinib	CYP3A4	CYP3A5		✓	
RET, VEGFR and EGFR	Vandetanib	CYP3A4	CYP3A5		✓	
c-MET and VEGFR2	Cabozantinib	CYP3A4	CYP2C8, CYP3A5		✓	
Multiple targets (c-KIT, FGFR, PDGFR and VEGFR)	Axitinib	CYP3A4	CYP1A2, CYP2C19, CYP3A5, UGT1A1		✓	
	Nintedanib	CYP1A2	CYP2C9, CYP2C19, CYP2D6, CYP2E1		✓	
	Pazopanib	CYP3A4, UGT1A1	CYP1A2, CYP2C8, CYP3A5		✓	
	Ponatinib	CYP3A4	CYP2C8, CYP2D6, CYP3A5		✓	
	Regorafenib	CYP3A4	CYP3A5		✓	
	Sorafenib	CYP3A4	CYP3A5		✓	
	Sunitinib	CYP3A4	CYP3A5, ABCG2		✓	
	Toceranib	CYP3A4	CYP3A5		✓	
Protein kinase inhibitor (non-receptor)						
BCR-ABL	Imatinib	CYP3A4	CYP3A5, ABCB1, ABCG2		✓	
	Nilotinib	CYP3A4, UGT1A1	CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A5, ABCG2		✓	
	Dasatinib	CYP3A4	CYP3A5, ABCG2		✓	
	Ponatinib	CYP3A4	CYP2C8, CYP2D6, CYP3A5		✓	
Src	Bosutinib	CYP3A4	CYP3A5		✓	
Janus kinase	Lestaurtinib	CYP3A4	CYP3A5		✓	
	Ruxolitinib	CYP3A4	CYP3A5		✓	
	Pacritinib	CYP3A4	CYP3A5		✓	
	Tofacitinib	CYP3A4	CYP2C19, CYP3A5		✓	

PGx Report - Oncology, Hematology

Type: Antineoplastic Targeted Therapy II

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Protein kinase inhibitor (non-receptor)						
EML4-ALK	Ceritinib	CYP3A4	CYP2C9, CYP3A5		✓	
	Crizotinib	CYP3A4	CYP3A5		✓	
Bruton tyrosine kinase	Ibrutinib	CYP3A4	CYP2D6, CYP3A5		✓	
BRAF inhibitor (V600E mutation-positive)	Dabrafenib	CYP2C8	CYP3A4, CYP3A5, G6PD		✓	
Other Targeted therapy						
mTOR Inhibitors	Sirolimus	CYP3A4	CYP3A5		✓	
	Everolimus	CYP3A4	CYP2C8, CYP3A5	✓		
Hedgehog pathway inhibitor	Vismodegib	CYP2C9	CYP3A4, CYP3A5		✓	
Hormone antagonists and related agents						
Selective estrogen receptor modulators (SERM)	Toremifene	CYP3A4	CYP2D6, CYP3A5		✓	
	Tamoxifen	CYP2D6, CYP3A4, CYP2C9	CYP3A5, CYP2B6, CYP2C19, CYP1A2, SULT1A1, F2, F5, ABCC2		✓	
SERD	Fulvestrant	CYP3A4	CYP3A5		✓	
Anti-androgens	Flutamide	CYP1A2	CYP3A4, CYP3A5		✓	
	Nilutamide	**CYP2C19**			✓	
	Bicalutamide	CYP3A4	CYP3A5		✓	
	Enzalutamide	CYP2C8	CYP3A4, CYP3A5		✓	
Aromatase inhibitors	Anastrozole	CYP3A4	CYP3A5, UGT1A4		✓	
	Letrozole	CYP3A4	CYP2A6, CYP3A5		✓	
	Exemestane	CYP3A4	CYP3A5		✓	
Other hormone antagonists and related agents	Abiraterone	CYP3A4	CYP3A5, SULT2A1		✓	
Hematologic						
Thrombopoiesis Stimulating Agent	Eltrombopag	CYP1A2	CYP2C8, F5, SERPINC1		✓	

Abbreviations: C-KIT, tyrosine-protein kinase Kit; PDGFR, Platelet-derived growth factor receptor; FLT3, FMS-like tyrosine kinase-3; RET, RET proto-oncogene; VEGFR, Vascular endothelial growth factor receptor; Src, Proto-oncogene tyrosine-protein kinase Src; EML4-ALK, echinoderm microtubule associated protein like 4 – anaplastic lymphoma kinase; BRAF, proto-oncogene B-Raf; mTOR mammalian target of rapamycin; SERD, selective estrogen receptor down-regulator.

PGx Report - Organ Transplantation

Type: Immunosuppressive, Immunomodulation

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Immunosuppressive						
Antimetabolite	Mycophenolate mofetil	CYP3A4	CYP3A5, CYP2C8, UGT2B7, SLCO1B1, SLCO1B3, ABCC2, HPRT1		✓	
	Azathioprine	XO	TPMT, AOX1		✓	
Calcineurin Inhibitors	Pimecrolimus	CYP3A4	CYP3A5	✓		
	Tacrolimus	CYP3A5	CYP3A4, ABCB1, UGT2B7	✓		
	Cyclosporine	CYP3A4	CYP3A5, ABCB1, UGT2B7, ABCC2	✓		
mTOR Inhibitors	Temsirolimus	CYP3A4	CYP3A5	✓		
	Everolimus	CYP3A4	CYP2C8, CYP3A5	✓		
Immunomodulation						
Immunomodulator and anti-angiogenic	Pomalidomide	CYP1A2	CYP3A4, CYP2C19, CYP2D6, CYP3A5		✓	

PGx Report - Anesthesiology

Type: Anesthetic, Muscle Relaxant

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Inhaled Anesthetics						
Inhaled Agents	Enflurane	CYP2E1			✓	
	Halothane	CYP2E1	CYP3A4, CYP2A6, CYP3A5		✓	
	Isoflurane	CYP2E1	CYP2B6		✓	
	Methoxyflurane	CYP2E1	CYP1A2, CYP2C9, CYP2D6		✓	
	Sevoflurane	CYP2E1			✓	
Intravenous agents (non-opioid)						
Barbiturates	**Hexobarbital**	**CYP2C19**	CYP2C9, CYP2E1, CYP1A2		✓	
	Thiamylal	CYP2C9				✓
Benzodiazepines	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
	Lorazepam	UGT2B15	UGT2B7		✓	
	Midazolam	CYP3A4	CYP3A5		✓	
Other Anesthetics	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5		✓	
Skeletal muscle relaxants						
Muscle Relaxants	**Carisoprodol**	**CYP2C19**		✓		
	Cyclobenzaprine	CYP1A2	CYP2D6, CYP3A4, CYP3A5		✓	
	Tizanidine	CYP1A2			✓	

PGx Report - Urology

Type: Drugs Prescribed for the Treatment of Incontinence, Erectile Dysfunction, Benign Prostatic Hypertrophy

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drugs for urinary frequency and incontinence						
Anticholinergic	Oxybutynin	CYP3A4	CYP3A5		✓	
	Tolterodine	CYP2D6, CYP3A4	CYP2C9, CYP3A5, CYP2C19		✓	
	Solifenacin	CYP3A4	CYP3A5		✓	
	Darifenacin	CYP2D6	CYP3A4, CYP3A5		✓	
Drugs used in erectile dysfunction						
Phosphodiesterase inhibitors	Sildenafil	CYP3A4	CYP2C9, CYP3A5		✓	
	Tadalafil	CYP3A4	CYP3A5		✓	
	Vardenafil	CYP3A4	CYP2C9, CYP3A5		✓	
	Avanafil	CYP3A4	CYP3A5		✓	
	Udenafil	CYP3A4	CYP3A5		✓	
Drugs used in benign prostatic hypertrophy						
Alpha-adrenoreceptor antagonists	Alfuzosin	CYP3A4	CYP3A5, Renal Excretion		✓	
	Tamsulosin	CYP3A4	CYP2D6, CYP3A5, Renal Excretion		✓	
	Silodosin	CYP3A4	UGT2B7, CYP3A5		✓	
Testosterone-5-alpha reductase inhibitors	Finasteride	CYP3A4	CYP3A5		✓	
	Dutasteride	CYP3A4	CYP3A5		✓	

PGx Report - Endocrinology

Type: Contraceptives, Androgens, Antiandrogens, Glucocorticoid, Thyroid

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Hormonal contraceptives						
Estrogens	Ethinylestradiol	CYP3A4, CYP2C9	CYP3A5, CYP2C19, CYP1A2, UGT1A1		✓	
	Estradiol	CYP1A2	CYP3A4, CYP3A5, CYP2C8, UGT1A1		✓	
Progestogens	Desogestrel	CYP3A4, HSD3B1	CYP3A5, CYP2C9, CYP2C19, UGT1A1		✓	
	Dienogest	CYP3A4	CYP3A5		✓	
	Mestranol	CYP2C9				⊘
Emergency contraceptives	Levonorgestrel	CYP3A4	CYP3A5		✓	
	Ulipristal	CYP3A4	CYP1A2, CYP2D6, CYP3A5		✓	
Androgens						
3-oxoandrosten-(4) derivatives	Testosterone	CYP3A4, CYP19A1	HSD3B2, CYP3A5, UGT2B15, SULTs		✓	
Antiandrogens						
Antiandrogens	Cyproterone	CYP3A4	CYP3A5		✓	
Other sex hormones and modulators of the genital system						
Selective estrogen receptor modulators (SERMs)	Raloxifene	UGT1A1				⊘
	Bazedoxifene	UGT1A1				⊘
	Ospemifene	CYP3A4	CYP2C9, CYP3A5, CYP2C19, CYP2B6		✓	
Steroid hormone						
Glucocorticoids	Dexamethasone	CYP3A4	CYP17A1, CYP3A5		✓	
	Cortisol (hydrocortisone)	CYP3A4	CYP3A5		✓	
	Prednisone	HSD11B2	CYP3A4, CYP3A5, SLC19A1, SULTs, UGTs		✓	
Thyroid hormone						
Thyroid hormones	Levothyroxine	DIO2	UGT1A1, SULTs		✓	
	Liothyronine	DIO2	UGT1A1, SULTs		✓	
There are additional SERMs (Tamoxifen and Toremifene) described under antineoplastics)						

PGx Report - Recreational Drugs

Type: Barbiturates, Benzodiazepines, Cannabinoids, Synthetic Cannabis, Dissociative Drugs, Tobacco

Drug Class	Substance	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Amphetamines	3,4-methylenedioxy-methamphetamine (MDMA)	Renal Excretion, CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
	Methamphetamine	CYP2D6, Renal Excretion	DBH, FMO3, ACSM1, GLYAT, DRD3		✓	
Barbiturates	Amobarbital	CYP3A4	CYP3A5, CYP2B6, CYP2C9, CYP2A6		✓	
	Phenobarbital	**CYP2C19**	ABCB1	⊘		
Benzodiazepines	Alprazolam	CYP3A4	CYP3A5		✓	
	Clonazepam	CYP3A4	CYP2C19, CYP3A5, NAT2		✓	
	Lorazepam	UGT2B15	UGT2B7		✓	
	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
Cannabinoids & Related Drugs	Cannabidiol (CBD)	CYP3A4	CYP2C19, CYP3A5		✓	
	Delta 9-tetra hydrocannabinol (∆9_THC)	CYP2C9	CYP2C19, CYP3A4, CYP3A5		✓	
	Cannabinol (CBN)	CYP2C9	CYP2C19, CYP3A4, CYP3A5		✓	
Synthetic Cannabis	JWH-018	CYP1A2	CYP2C9		✓	
	AM2201	CYP1A2	CYP2C9		✓	
Dissociative Drugs	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5		✓	
	Phencyclidine (PCP)	CYP3A4	CYP3A5, CYP2A6, CYP1A2		✓	
Ergoline derivatives	Lysergic acid diethylamide (LSD)	CYP3A4	CYP3A5		✓	
Tobacco	Nicotine	CYP2A6	UGT2B7, CYP2B6			⊘

Summary of pharmacogenetic results including SNP genotypes (rs), for compatibility with the CPIC Guidelines (see below) and the medical literature

Gene	Haplotype (if known)	Predicted phenotype	Marker	Genotype
CYP1A1	*1/*1	Normal metabolizer	rs1048943	A/A
			rs1800031	T/T
			rs1799814	C/C
			rs41279188	C/C
			rs56313657	G/G
			rs72547510	-/-
			rs72547509	T/T
CYP1A2	*1A/*1F	Normal metabolizer	rs12720461	C/C
			rs762551	C/A
			rs56107638	G/G
CYP2A6	*1A/*9	Intermediate metabolizer	CYP2A6_A7conversion	
			rs1801272	T/T
			rs5031017	G/G
			rs4986891	G/G
			rs5031016	T/T
			rs28399468	G/G
			rs28399433	G/T
			rs28399447	T/T
			rs28399454	G/G
			rs28399444	AA/AA
CYP2B6	*6/*6	Intermediate metabolizer	rs3745274	T/T
			rs12721655	A/A
			rs8192709	C/C
			rs28399499	T/T
			rs34097093	C/C
CYP2C8	*1/*1	Normal metabolizer	rs11572103	A/A
			rs11572080	G/G
			rs10509681	T/T
			rs1058930	C/C
			rs72558196	A/A
			rs72558195	C/C
CYP2C9	*1/*3	Intermediate metabolizer	rs1799853	C/C
			rs1057910	C/A
			rs56165452	T/T
			rs28371686	C/C
			rs9332131	A/A
			rs7900194	G/G
			rs2256871	A/A
			rs9332130	A/A
			rs28371685	C/C
			rs9332239	C/C
			rs72558187	T/T
			rs72558190	C/C
			rs72558188	AGAAATGGAA/AGAAATGGA
			rs9332094	T/T

Gene	Haplotype (if known)	Predicted phenotype	Marker	Genotype
CYP2C19	*1A/*17	Rapid metabolizer	rs3758581	G/A
			rs4244285	G/G
			rs4986893	G/G
			rs28399504	A/A
			rs56337013	C/C
			rs72552267	G/G
			rs72558186	T/T
			rs41291556	T/T
			rs55640102	A/A
			rs12248560	C/T
CYP2D6	*2A/*41	Normal metabolizer	rs1080985	G/C
			rs35742686	A/A
			rs3892097	G/G
			CYP2D6_CNVs	2
			rs5030655	T/T
			rs5030867	A/A
			rs5030865	G/G
			rs5030656	AAG/AAG
			rs1065852	C/C
			rs201377835	G/G
			rs5030862	G/G
			rs28371706	C/C
			rs765776661	-/-
			rs72549353	AACT/AACT
			rs72549354	-/-
			rs72549352	-/-
			CYP2D7/2D6 hybrid *36	T/T
			rs72549351	GACT/GACT
			rs72549356	-/-
			rs28371725	A/G
			rs72549346	-/-
			rs72549349	G/G
			rs147960066	C/C
CYP2E1	*1/*7	Normal metabolizer	rs72559710	G/G
			rs2070673	T/A
CYP3A4	*1/*1	Normal metabolizer	rs55785340	T/T
			rs4646438	-/-
			rs67666821	-/-
			rs35599367	C/C
CYP3A5	*1A/*1A	Normal metabolizer	rs776746	T/T
			rs55965422	T/T
			rs10264272	G/G
			rs41303343	-/-
			rs41279854	T/T
VKORC1	H7/H7	Warfarin resistance	rs9934438	C/C

Summary of pharmacogenetic results including SNP genotypes (rs), for compatibility with the CPIC Guidelines (see below) and the medical literature

Gene	Haplotype (if known)	Predicted phenotype	Marker	Genotype
VKORC1	H7/H7	Warfarin resistance	rs9934438	C/C
			rs9923231	C/C
			rs7294	T/T
			rs17708472	C/C
SLC15A2	*1/*1	Normal function	rs1143672	G/G
			rs2293616	G/G
			rs2257212	C/C
			rs1143671	C/C
SLC22A1	*420Del/*420Del	Low function	rs12208357	C/C
			rs55918055	T/T
			rs36103319	G/G
			rs4646277	C/C
			rs4646278	C/C
			rs2282143	C/C
			rs34130495	G/G
			rs628031	G/G
			rs72552763	GAT/-
			rs4646281	AAGTTGGT/AAGTTGGT
			rs34305973	T/T
			rs35167514	A/A
			rs34059508	G/G
SLC22A2	*1/*270A	Normal function	rs8177504	C/C
			rs8177508	A/A
			rs316019	G/T
			rs8177516	C/C
			rs8177517	A/A
SLC22A6	*1/*1	Normal function	rs11568626	G/G
SLCO1B1	*1A/*1A	Normal function	rs2306283	A/A
			rs56101265	T/T
			rs56061388	T/T
			rs72559745	A/A
			rs4149056	T/T
			rs55901008	T/T
			rs59502379	G/G
			rs56199088	A/A
			rs55737008	A/A
SLCO1B3	*233I/*233I	Low function	rs4149117	G/G
			rs7311358	A/A
SLCO2B1	*1/*1	Normal function	rs2306168	C/C
ABCB1	*1/*2	Intermediate function	rs1045642	G/A
			rs2032582	
			rs1128503	G/A
			rs3213619	T/T
ABCC2	*1/*1324I	Intermediate function	rs717620	C/C
			rs2273697	G/G
			rs56220353	C/C
			rs56199535	C/C
			rs3740066	C/T

Gene	Haplotype (if known)	Predicted phenotype	Marker	Genotype
ABCG2	*1/*1	Normal function	rs2231142	G/G
			rs72552713	C/C
SULT1A1	*3/*3	Poor metabolizer	rs9282861	G/G
			rs1801030	A/A
			rs72547527	G/G
NAT1	*4/*11	Normal acetylator	rs55793712	A/A
			rs4986989	A/T
			rs4986782	G/G
			rs5030839	C/C
			rs56379106	C/C
			rs56318881	C/C
			rs56172717	A/A
NAT2	*5B/*6A or *5A/*6C or *6B/*5G or *12C/*5J	Poor acetylator	rs1801280	T/C
			rs1799930	G/A
			rs1799931	G/G
			rs1799929	C/T
			rs1208	A/G
			rs1041983	C/T
			rs1801279	G/G
			rs1805158	C/C
TPMT	*1/*1	Normal metabolizer	rs1800462	G/G
			rs1800460	G/G
			rs1142345	A/A
			rs1800584	G/G
			rs56161402	G/G
COMT			rs4680	G/G
			rs165599	G/G
			rs737865	A/G
GSTP1	*1A/*1A	Normal metabolizer	rs1695	A/A
			rs1138272	C/C
UGT1A1	*28(*60)/*28(*60)	Intermediate metabolizer	rs4148323	G/G
			rs34993780	T/T
			rs35350960	C/C
			rs55750087	C/C
			rs4124874	G/G
UGT2B7	*1a/*1a	Normal metabolizer	rs7662029	G/G
			rs7668258	C/C
UGT2B15	*2/*2	Intermediate metabolizer	rs1902023	A/A
DPYD	*1/*2A	Intermediate metabolizer	rs3918290	C/T
			rs72549309	TCAT/TCAT
			rs1801266	C/C
			rs1801265	T/T
			rs1801267	C/C
			rs1801268	G/G

Medications Affected by Patient Genetic Results

Clinical Annotation for rs2231142 (ABCG2)

Allopurinol and Gout — **Genotype: *G/G*** — Evidence Level 2B Efficacy

Patients with gout may have improved response when treated with allopurinol as compared to patients with the GT or TT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1447982582

Clinical Annotation for CYP2C19*1, *2, *3, *4, *5, *6, *8

Clopidogrel — **Haplotype: *1A/*17** — Evidence Level 1A Efficacy, Toxicity/ADR

-- https://www.pharmgkb.org/clinicalAnnotation/1043858794

Clinical Annotation for rs4149056 (SLCO1B1)

Simvastatin, Muscular Diseases and Central Core Myopathy — **Genotype: *T/T*** — Evidence Level 1A Toxicity/ADR

Patients may have a lower risk of simvastatin-related myopathy as compared to patients with the CC or CT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655384011

Clinical Annotation for CYP2C9*1, *2, *3

Warfarin, Cardiovascular Diseases and Heart Diseases — **Haplotype: *1/*3** — Evidence Level 1A Dosage

Patients may require a lower dose of warfarin as compared to patients with the *1/*1 diplotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981238341

Clinical Annotation for rs9923231 (VKORC1)

Warfarin — **Genotype: *C/C*** — Evidence Level 1A Dosage

Patients may require an increased dose of warfarin as compared to patients with the CT or TT genotype.
-- https://www.pharmgkb.org/variant/rs9923231?previousQuery=rs9923231

Clinical Annotation for rs7294 (VKORC1)

Warfarin — **Genotype: *T/T*** — Evidence Level 1B Dosage

Patients treated with warfarin may require a higher dose as compared to patients with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655384733

Clinical Annotation for rs1045642 (ABCB1)

Digoxin — **Genotype: *G/A*** — Evidence Level 2A

Patients may have decreased metabolism and increased serum concentration of digoxin as compared to patients with the GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981204372

Clinical Annotation for rs2032582 (ABCB1)

Simvastatin and Hypercholesterolemia — Evidence Level 2A Efficacy

-- https://www.pharmgkb.org/clinicalAnnotation/1150414901

Clinical Annotation for rs4149056 (SLCO1B1)

Cerivastatin and Rhabdomyolysis — **Genotype: *T/T*** — Evidence Level 2A Toxicity/ADR

Patients may have a lower risk of cerivastatin-related rhabdomyolysis as compared to patients with the CC or CT genotype. Cerivastatin was withdrawn from the market because of 52 deaths attributed to drug-related rhabdomyolysis that lead to kidney failure.
-- https://www.pharmgkb.org/clinicalAnnotation/981344897

Clinical Annotation for rs4149056 (SLCO1B1)

Pravastatin **Genotype: *T/T*** Evidence Level 2A Metabolism/PK

Patients may have decreased plasma concentrations of pravastatin as compared to patients with the CC or CT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981345293

Clinical Annotation for rs4149056 (SLCO1B1)

Rosuvastatin and Hypercholesterolemia **Genotype: *T/T*** Evidence Level 2A

Patients may have lower plasma concentrations of rosuvastatin as compared to patients with the CC genotype. No association is seen between genotypes of this variant and change in LDL-cholesterol levels in response to rosuvastatin treatment.
-- https://www.pharmgkb.org/clinicalAnnotation/981345350

Clinical Annotation for rs7294 (VKORC1)

Acenocoumarol and phenprocoumon **Genotype: *T/T*** Evidence Level 2A Dosage

Patients may require an increased dose of phenprocoumon or acenocoumarol as compared to patients with the CT or CC genotype, although this has been contradicted in some studies.
-- https://www.pharmgkb.org/clinicalAnnotation/1445585748

Clinical Annotation for rs2231142 (ABCG2)

Rosuvastatin, Hypercholesterolemia and Myocardial Infarction **Genotype: *G/G*** Evidence Level 2B Efficacy

Patients treated with rosuvastatin 1) may have lower plasma concentrations of rosuvastatin 2) may have a reduced response to treatment as determined by a lower reduction in LDL-C as compared to patients with the TT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1154221922

Clinical Annotation for rs1045642 (ABCB1)

Ondansetron **Genotype: *G/A*** Evidence Level 2A Efficacy

Patients may have increased likelihood of nausea and vomiting shortly after being treated with treated with ondansetron as compared to patients with AA genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183632195

Clinical Annotation for rs2032582 (ABCB1)

Ondansetron Evidence Level 2A Efficacy

-- https://www.pharmgkb.org/clinicalAnnotation/1183632200

Clinical Annotation for rs10509681 (CYP2C8)

Rosiglitazone **Genotype: *T/T*** Evidence Level 2A Dosage

Patients may have decreased metabolism of rosiglitazone, a larger change in HbA1c, and an increased risk of edema as compared to patients with the CC (CYP2C8*3/*3) or CT (CYP2C8*3/*1) genotype. One study found no association with blood glucose levels.
-- https://www.pharmgkb.org/clinicalAnnotation/655384653

Clinical Annotation for CYP2C19*1, *2, *3

Sertraline and Major Depressive Disorder **Haplotype: *1A/*17** Evidence Level 1A Metabolism/PK

-- https://www.pharmgkb.org/clinicalAnnotation/1183619004

Clinical Annotation for CYP2C19*1, *17, *2, *3, *4

Citalopram, escitalopram and Major Depressive Disorder **Haplotype: *1A/*17** Evidence Level 1A Efficacy, Toxicity/ADR

Patients treated with citalopram or escitalopram may have an increased drug clearance/metabolism as compared to patients with CYP2C19*1/*1 genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183620386

Clinical Annotation for rs1902023 (UGT2B15)

Lorazepam and oxazepam **Genotype: *A/A*** Evidence Level 2B

Subjects may have decreased clearance of oxazepam or lorazepam as compared to subjects with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655387798

Clinical Annotation for CYP2C19*1, *17, *2, *3

Voriconazole and Mycoses — **Haplotype:** ***1A/*17*** — Evidence Level 1B — Metabolism/PK

Patients may have increased metabolism of voriconazole as compared to patients with the CYP2C19*1/*1 diplotype (extensive metabolizers), the CYP2C19*1/*2 or *1/*3 diplotypes (intermediate/heterozygous extensive metabolizers), or the CYP2C19*2/*2, *2/*3 or *3/*3 diplotypes (poor metabolizers, or may have decreased metabolism as compared to patients with the CYP2C19*17/*17 diplotype (ultrarapid metabolizers). Though several studies have found no association, the majority report an association.
-- https://www.pharmgkb.org/clinicalAnnotation/1183689217

Clinical Annotation for rs1045642 (ABCB1)

Nevirapine and HIV Infections — **Haplotype:** ***1/*2*** — Evidence Level 2A — Toxicity/ADR

Patients with HIV-1 infection who are treated with nevirapine may have a decreased, but not absent, risk for nevirapine hepatotoxicity as compared to patients with the GG genotype, it is not clear what the influence of one A allele with the G allele is.
-- https://www.pharmgkb.org/clinicalAnnotation/655386244

Clinical Annotation for rs3745274 (CYP2B6)

Nevirapine and HIV Infections — **Genotype:** ***T/T*** — Evidence Level 2A

Patients with HIV infection may have decreased clearance of and increased exposure to nevirapine as compared to patients with the GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981202294

Clinical Annotation for rs28399499 (CYP2B6)

Nevirapine and HIV — **Genotype:** ***T/T*** — Evidence Level 2A

Patients may have decreased plasma drug exposure when treated with nevirapine as compared to patients with the CC or CT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981201854

Clinical Annotation for rs28399499 (CYP2B6)

Efavirenz and HIV — **Genotype:** ***T/T*** — Evidence Level 2A — Metabolism/PK

Patients may have decreased plasma drug exposure when treated with efavirenz as compared to patients with the CC or CT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981201844

Clinical Annotation for NAT2*12, NAT2*13, NAT2*14, NAT2*4, NAT2*5, NAT2*6, NAT2*7

Isoniazid and Tuberculosis — **Haplotype:** ***5B/*6A or *5A/*6C or *6B/*5G or *12C/*5J*** — Evidence Level 2A

-- https://www.pharmgkb.org/clinicalAnnotation/982030222

Clinical Annotation for rs3918290 (DPYD)

Capecitabine, fluorouracil, Pyrimidine analogues, tegafur and Neoplasms — **Genotype:** ***C/T*** — Evidence Level 1A — Toxicity/ADR, Metabolism/PK

Cancer patients treated with fluoropyrimidine-based chemotherapy may have 1) DPYD deficiency and decreased clearance of fluoropyrimidine drugs and 2) be at risk for severe or even fatal drug toxicity as compared to patients with the CC genotype (DPYD *1/*1). Fluoropyrimidines are often used in combination chemotherapy such as FOLFOX (fluorouracil, leucovorin and oxaliplatin), FOLFIRI (fluorouracil, leucovorin and irinotecan) or FEC (fluorouracil, epirubicin and cyclophosphamide) or with other drugs such as bevacizumab, cetuximab, raltitrexed. The combination and delivery of the drug may influence risk for toxicity.
-- https://www.pharmgkb.org/clinicalAnnotation/827843617

Clinical Annotation for TPMT*1, *2, *3A, *3B, *3C, *4

Azathioprine, mercaptopurine, purine analogues and thioguanine — **Haplotype:** ***1/*1*** — Evidence Level 1A — Toxicity/ADR

Patients treated with thiopurine drugs and purine analogues: 1) may have increased inactivation of thiopurines due to normal TPMT activity and 2) may have a decreased risk for toxicity when receiving thiopurine drugs and purine analogues as compared to patients with a non-functional allele (e.g. *2, *3A, *3B, *3C, *4). Patients with the *1/*1 genotype may still be at risk for toxicity when taking thiopurine drugs and purine analogues based upon their genotypes.
-- https://www.pharmgkb.org/clinicalAnnotation/1184648909

Clinical Annotation for rs1695 (GSTP1)

Platinum compounds and Neoplasms — **Genotype: *A/A*** — Evidence Level 2A Toxicity/ADR

Cancer patients treated with platinum-based drugs may have the highest risk of toxicity as compared to patients with the AG or GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/637880221

Clinical Annotation for rs1045642 (ABCB1)

Methotrexate, Burkitt Lymphoma, Drug Toxicity, T-Cel Lymphomal, Precursor Cell Lymphoblastic Leukemia-Lymphoma and Toxic liver disease — **Haplotype: *1/*2** — Evidence Level 2A Toxicity/ADR

Patients with lymphoma or leukemia who are treated with methotrexate may have an increased risk of toxicity as compared to patients with the GG genotype, or a decreased risk of toxicity as compared to patients with the AA genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1296599132

Clinical Annotation for rs1695 (GSTP1)

Fluorouracil, oxaliplatin and Colorectal Neoplasms — **Genotype: *A/A*** — Evidence Level 2A Efficacy

Patients with colorectal cancer who are treated with fluorouracil and oxaliplatin may have poorer treatment outcome (reduced responsiveness, lower overall survival time, increased risk of death) as compared to patients with the GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/827847788

Clinical Annotation for rs1695 (GSTP1)

Cyclophosphamide, epirubicin and Breast Neoplasms — **Genotype: *A/A*** — Evidence Level 2A Toxicity/ADR

Patients with Breast Neoplasms who are treated with cyclophosphamide and epirubicin may have 1) increased drug response 2) decreased severity of toxicity as compared to patients with GG genotype. Some patients were additionally treated with fluorouracil.
-- https://www.pharmgkb.org/clinicalAnnotation/981238323

Clinical Annotation for rs4148323 (UGT1A1)

SN-38 and Neoplasms — **Genotype: *G/G*** — Evidence Level 2A

Cancer patients may have increased metabolism of SN-38 when treated with irinotecan as compared to patients with the AA genotype. SN-38 is the active metabolite of irinotecan, and is glucuronidated by UGT1A1. One in vitro study found increased enzyme activity for the G allele compared to the A allele.
-- https://www.pharmgkb.org/clinicalAnnotation/982047955

Clinical Annotation for rs4148323 (UGT1A1)

Irinotecan and Neoplasms — **Genotype: *G/G*** — Evidence Level 2A

Cancer patients treated with irinotecan-based regimens may have a decreased risk of neutropenia as compared to patients with the AA genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981201713

Clinical Annotation for rs776746 (CYP3A5)

Tacrolimus, heart transplantation, hemopoietic stem cell transplant, Kidney Transplantation and lung transplantation — **Genotype: *T/T*** — Evidence Level 1A Dosage, Metabolism/PK

Patients who are recipients of a kidney, heart, lung or hematopoeitic stem cell transplant, or have other diseases, who are treated with tacrolimus may have increased metabolism of tacrolimus resulting in decreased exposure, and may require a higher dose as compared to patients with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981203719

Clinical Annotation for rs776746 (CYP3A5)

Tacrolimus and liver transplantation — **Genotype: *T/T*** — Evidence Level 2A Dosage, Metabolism/PK

Patients who are recipients of a liver transplantation from a donor with the TT genotype may have increased metabolism of tacrolimus resulting in decreased exposure, and may require a higher dose as compared to patients who receive a liver transplantation from a donor with the CC (*3/*3) genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/982046323

Clinical Annotation for rs776746 (CYP3A5)

Tacrolimus and transplant rejection **Genotype: *T/T*** Evidence Level 2A Efficacy

Patients who are recipients of kidney or hematopoietic stem cell transplant who are treated with tacrolimus may have an increased risk of transplant rejection as compared to patients with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981203808

Clinical Annotation for rs776746 (CYP3A5)

Sirolimus and Transplantation **Genotype: *T/T*** Evidence Level 2A Dosage

Patients who are recipients of transplants may have increased metabolism of sirolimus and require a higher dose as compared to patients with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981203936

Clinical Annotation for rs4680 (COMT)

Nicotine and Tobacco Use Disorder **Genotype: *G/G*** Evidence Level 2A Efficacy

Patients treated with nicotine replacement therapy may have a decreased likelihood of smoking cessation and increased risk of relapse as compared to patients with the AA genotype. However, some contradictory evidence exists.
-- https://www.pharmgkb.org/clinicalAnnotation/981202618

Risk of Laboratory Technical Problems or Laboratory Error

Standard and effective procedures are in place at testing laboratory to protect against and prevent both technical and operational problems although problems may still occur. Errors can occur due to improper sample collection by patients and physicians. Damage to sample can occur during shipment due to such issues as improper paperwork, mislabeled/misaddressed packaging, loss/delay in receipt of sample at certified testing lab, etc. Issues which may prevent the lab from obtaining results include, but are not limited to: contamination of DNA sample; human &/or testing system error; results which cannot be interpreted; and, mislabeling of DNA sample.

When such issues are encountered, the lab may request a new sample. Re-testing does not guarantee that results will be obtained.

There is a statistically small percentage of inaccurate reporting that may include, but is not limited to such issues as: a false report that a genotype is present. Such errors may cause, but is not limited to: incorrect decisions/recommendations on medical treatment; incorrect decisions/recommendations on diet and/or fitness plans. In cases where laboratory error is suspected or is proven to have occurred, the patient's healthcare professional may recommend/request additional evaluation/testing. Additional testing may be recommended/requested to verify results for any reason presented by patient's healthcare professional.

Limitations

PGx testing primarily provides evidence-based predictions of how the tested individual's genetic profile may affect reaction to certain drugs. It may also reveal possibly-altered response to selected diet, exercise, and/or nutritional factors, and/or the risks for certain common health conditions, and/or information concerning the tested individual's near or ancient ancestry. **Based on PGx test results, patients should make no changes to medical care [including, but not limited to, changes in dosage or frequency of medication, diet and/or exercise regimens, or pregnancy planning] without the prior advice of and consultation with a healthcare professional.**

Genetic testing is an evolving science. Current testing protocols and results are based on the current/existing developments, information and testing techniques known at this time.

In the future, new variants may be identified and/or more research may be developed on the significance of currently identified variants that will drive changes in the interpretation of previously obtained genetic testing results. Current testing may not include identification of certain variants associated with: diet, exercise or nutrition; disease; and/or, drug response due to these issues.

Factors such as age, diet, ethnicity, family health history, and/or personal health, not related to genetics can also impact the likelihood of developing certain conditions or exhibiting certain drug reactions. Therefore, patients may not always exhibit and/or require the specific diet, nutrition and/or exercise, disease, or drug response expected or consistent with his/her genetic test results.

The genetic associations of certain conditions, particularly those related to diet and exercise, have only been observed/studied in Caucasian populations only. This limitation means that interpretations and recommendations are made in the context of Caucasian-only studies and results may or may not be relevant to those tested who are non-Caucasian or mixed ethnicity individuals.

Healthcare professionals may recommend additional testing to be performed by an independent laboratory or consult with an outside, independent genetic counselor or healthcare professional.

Examples of different levels of evidence for PGx SNPs

Level of Evidence	Marker	Gene	Drugs
1A	rs1142345	TPMT	Azathioprine, Mercaptopurine, Thioguanine
1A	rs3918290	DPYD	Fluorouracil, Capecitabine, Tegafur, Pyrimidine analogues
1A	rs16947	CYP2D6	Amitriptyline, Codeine, Nortriptyline, Paroxetine
1A	rs9923231	VKORC1	Warfarin
1A	rs4149056	SLCO1B1	Simvastatin
1B	rs16947	CYP2D6	Tramadol
1B	rs9923231	VKORC1	Acenocoumarol
2A	rs1801280	NAT2	Isoniazid
2A	rs16947	CYP2D6	Flecainide, Doxepin, Desipramine, Atomoxetine, Risperidone, Clomipramine, Imipramine, Venlafaxine
2A	rs4149056	SLCO1B1	Cerivastatin, Pravastatin, Rosuvastatin
2A	rs1045642	ABCB1	Digoxin, Nevirapine, Methotrexate
3	rs9282861	SULT1A1	Conjugated estrogens
3	rs16947	CYP2D6	Timolol, Carvedilol, Haloperidol, Aripiprazole, Metoprolol, Citalopram, Escitalopram, Tamoxifen
3	rs9923231	VKORC1	Phenprocoumon
3	rs4149056	SLCO1B1	Repaglinide, Irinotecan, Mycophenolate mofetil, Atorvastatin, Methotrexate, Olmesartan
3	rs1045642	ABCB1	Paclitaxel, Phenytoin, Fluorouracil, Dicloxacillin, Capecitabine, Nortriptyline, Oxaliplatin, Verapamil, Fexofenadine, Atorvastatin, Simvastatin, Sirolimus, Talinolol, Tamoxifen, Morphine, Efavirenz, Vincristine, Imatinib, Olanzapine, Risperidone, Cyclosporine, Tacrolimus, Atazanavir, Phenobarbital, Codeine, Clopidogrel, Etoposide, Oxaliplatin
4	rs16947	CYP2D6	Methylphenidate, Bufuralol
4	rs4149056	SLCO1B1	Lopinavir, Atrasentan
4	rs1045642	ABCB1	Carbamazepine

Level 1A Annotation for a variant-drug combination in a CPIC or medical society-endorsed PGx guideline, or implemented at a PGRN site or in another major health system.

Level 1B Annotation for a variant-drug combination where the preponderance of evidence shows an association. The association must be replicated in more than one cohort with significant p-values, and preferably will have a strong effect size.

Level 2A Annotation for a variant-drug combination that qualifies for level 2A where the variant is within a VIP (Very Important Pharmacogene) as defined by PharmGKB. The variants in level 2A are in known pharmacogenes, so functional significance is more likely.

Level 2B Annotation for a variant-drug combination with moderate evidence of an association. The association must be replicated but there may be some studies that do not show statistical significance, and/or the effect size may be small.

Level 3 Annotation for a variant-drug combination based on a single significant (not yet replicated) or annotation for a variant-drug combination evaluated in multiple studies but lacking clear evidence of an association.

Level 4 Annotation based on a case report, non-significant study or in vitro, molecular or functional assay evidence only.

Patient Information Card

An easily portable summary of the report patients can share with their medical professionals. (Please cut along dotted line.)

Pharmacogenomic Test Summary

CYP1A1	*1/*1	Normal metabolizer
CYP1A2	*1A/*1F	Normal metabolizer
CYP2A6	*1A/*9	Intermediate metabolizer
CYP2B6	*6/*6	Intermediate metabolizer
CYP2C8	*1/*1	Normal metabolizer
CYP2C9	*1/*3	Intermediate metabolizer
CYP2C19	***1A/*17**	**Rapid metabolizer**
CYP2D6	*2A/*41	Normal metabolizer
CYP2E1	*1/*7	Normal metabolizer
CYP3A4	*1/*1	Normal metabolizer
CYP3A5	*1A/*1A	Normal metabolizer
VKORC1	**H7/H7**	**Warfarin resistance**
SLC15A2	*1/*1	Normal function
SLC22A1	***420Del/*420Del**	**Low function**
SLC22A2	*1/*270A	Normal function
SLC22A6	*1/*1	Normal function
SLCO1B1	*1A/*1A	Normal function
SLCO1B3	***233I/*233I**	**Low function**
SLCO2B1	*1/*1	Normal function
ABCB1	*1/*2	Intermediate function
ABCC2	*1/*1324I	Intermediate function
ABCG2	*1/*1	Normal function
SULT1A1	***3/*3**	**Poor metabolizer**
NAT1	*4/*11	Normal acetylator
NAT2	***5B/*6A or *5A/*6C or *6B/*5G or *12C/*5J**	**Poor acetylator**
TPMT	*1/*1	Normal metabolizer
GSTM1	*1/*1	Normal metabolizer
GSTP1	*1A/*1A	Normal metabolizer
UGT1A1	*28(*60)/*28(*60)	Intermediate metabolizer
UGT2B7	*1a/*1a	Normal metabolizer
UGT2B15	*2/*2	Intermediate metabolizer
DPYD	*1/*2A	Intermediate metabolizer

For a complete report contact Synlab.com