MyTheragene

NAME:	EMQN1	**REPORT NUMBER:**	7011pgx_IonCode_0341
DATE OF BIRTH:		**DATE COLLECTED:**	
GENDER:		**DATE RECEIVED:**	
SPECIMEN TYPE:		**DATE OF REPORT:**	
ORDERING PHYSICIAN:			

COMPREHENSIVE PGX REPORT

Current Patient Medication

This patient is either not receiving any medication or may be receiving medications that are outside the scope of this report.

SNPs of Importance for Venous Thromboembolism Risk

Gene	Protein change	Nucleotide change	Marker	Genotype	Results
F5	Arg534Gln	1601G>A	rs6025	C/C	Normal risk
F2		*97G>A	rs1799963	G/G	Normal risk
VKORC1		1173C>T	rs9923231	C/C	Low warfarin sensitivity; high warfarin dosage
VKORC1		-1639G>A	rs9934438	G/G	Low warfarin sensitivity; high warfarin dosage
MTHFR	Ala222Val	665C>T	rs1801133	G/G	Normal MTHFR enzyme function.
MTHFR	Glu429Ala	1286A>C	rs1801131	T/T	Normal MTHFR enzyme function.

GENOTYPE/HAPLOTYPE/PHENOTYPE DETAIL

Gene	Genotype-Haplotype	Phenotype
CYP1A2	*1B/*1L	Extensive metaboliser
CYP2B6	*9/*9	Extensive metaboliser
CYP2C8	*1/*1	Extensive metaboliser
CYP2C9	*1/*9	Extensive metaboliser
CYP2C19	*1/*2	Intermediate metaboliser
CYP2D6	*1/*1	Extensive metaboliser
CYP3A4	*1A/*1B	Extensive metaboliser
CYP3A5	***3A/*6**	**Poor metaboliser**
VKORC1	**H3/H4**	**Sensitive to Warfarin**
SLCO1B1	*1B/*1B	Extensive function
ABCB1	*1/*1	Extensive function
ABCG2	*1/*1	Extensive function
TPMT	*1/*3C	Intermediate metaboliser
UGT1A1	*1/*1	Extensive metaboliser
UGT2B7	*1a/*1a	Extensive metaboliser
UGT2B15	*1/*2	Extensive metaboliser
DPYD	*9A/*9A	Extensive metaboliser
OPRM1	*1/*1	Sensitive to Opioids

Disclaimer: No patient should evaluate or use the information contained herein without the advice, consultation and supervision of a licensed healthcare professional such as a pharmacist or physician.

Methodology: Genomic DNA was extracted from the sample under analysis. A pharmacogenomics Ion Ampliseq panel was used to detect 136 SNV/Indel targets in 40 genes as well as CYP2D6 copy number variation. This panel covers the commonly known targets in genes encoding drug metabolism enzymes and associated transport proteins. The following genes are included: ABCB1, ABCG2, ADRA2A, ANK1, APOE, COMT, CYP1A2, CYP2B6, CYP2C19, CYP2C8, CYP2C9, CYP2D6, CYP3A4, CYP3A5, DBH, DPYD, DRD1, DRD4, F2, F5, FLOT1, GABRA6, GABRP, GRIK4, HCP5, HLA-A, HTR2A, HTR2C, ITGB3, KIF6, MTHFR, OPRD1, OPRK1, OPRM1, SLCO1B1, TPMT, UGT1A1, UGT2B15, UGT2B7, VKORC1. Sequencing was carried out using the Next Generation Sequencing platform Ion Gene Studio S5 Prime System (Thermo Fisher Scientific).

Limitations: This test detects specific mutations with pharmacogenomics evidence in the genes described without analysing the full coding sequence of these genes. Every molecular test has an internal 0,5-1% chance of error. This is attributable to rare molecular events and factors relating to the preparation and analysis of the samples.

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 (light green dots), should use the drug as directed (green dots), or exhibits increased toxicity to the drug (red dots). Inclusion of Genomic Test Results indicates genotype, haplotype, phenotype, or presence of mutation.

Organisation 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 metabolising 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	Generic	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, UGT1A3, UGT1A9, 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, UGT1A3, UGT1A9, UGT2B7		✓	
	Flurbiprofen	CYP2C9			✓	
	Ketoprofen	CYP3A4	CYP2C9, CYP3A5, UGT1A6, UGT1A9, UGT2B7		✓	
	Fenoprofen	CYP2C9	UGT2B7		✓	
	Vicoprofen	CYP2D6	CYP3A4		✓	
	Naproxen	CYP2C9	CYP1A2, CYP2C8, UGT2B7, SULT1A1, UGT1A3, UGT1A6, UGT1A9		✓	
Anthranilic acid derivatives (Fenamates)	Mefenamic acid	CYP2C9			✓	
The Non-NSAIDs Analgesic	Paracetamol	UGT1A1, UGT1A6, UGT1A9, SULT1A1, GSHs	CYP2E1, CYP3A4, CYP3A5, CYP2D6, CYP1A2, ABCG2			✓

PGx Report - Pain Management

Type: Opioid

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Opioid Analgesics						
Opium alkaloids	Morphine	UGT2B7	ABCB1, ABCC3, UGT1A1, UGT1A8, OPRM1, COMT		✓	
	Codeine	CYP2D6	CYP3A4, UGT2B7, UGT2B4, FMO3, CYP3A5, OPRM1		✓	
Esters of morphine	Diacetylmorphine (Heroin)	CES1	CES2, BCHE, OPRM1		✓	
Ethers of morphine	Dihydrocodeine	CYP3A4	CYP2D6, CYP3A5		✓	
	Ethylmorphine	CYP2D6	CYP3A4, CYP3A5		✓	
Semi-synthetic alkaloid derivatives	Hydrocodone	CYP2D6	CYP3A4, CYP3A5, OPRM1		✓	
	Hydromorphone	UGT2B7			✓	
	Oxycodone	CYP3A4	CYP3A5, CYP2D6, ABCB1, UGT2B7, COMT			✗
	Oxymorphone	UGT2B7			✓	
Synthetic opioids						
Anilidopiperidine derivatives	Alfentanyl	CYP3A4	CYP3A5, ABCB1, OPRM1		✓	
	Fentanyl	CYP3A4	CYP3A5, ABCB1, OPRM1		✓	
	Sufentanil	CYP3A4	CYP3A5, OPRM1		✓	
Phenylpiperidine derivatives	Meperidine	CYP2B6	CYP3A4, CYP2C19, CYP3A5, UGT1A4		✓	
	Ketobemidone	CYP2C9	CYP3A4, CYP3A5		✓	
Diphenylpropylamine derivatives	Dextropropoxyphene	CYP3A4	CYP3A5, Renal Excretion			✗
	Levacetylmethadol	CYP3A4	CYP3A5		✓	
	Loperamide	CYP3A4	CYP2C8, CYP3A5		✓	
	Methadone	CYP3A4	CYP2B6, CYP2D6, CYP3A5, ABCB1, UGT2B7, COMT		✓	
Oripavine derivatives	Buprenorphine	CYP3A4	CYP3A5, CYP2C8, UGT1A1, UGT1A3, UGT2B7		✓	
Morphinan derivatives	Dextromethorphan	CYP2D6	CYP3A4, CYP3A5		✓	
Others	Tramadol	CYP2D6	CYP3A4, CYP2B6, CYP3A5, OPRM1, SLC22A1, COMT		✓	
	Tapentadol	CYP2C9	CYP2C19, CYP2D6		✓	
	Tilidine	CYP3A4	CYP2C19, CYP3A5			✗
Anti-opioid	Methylnaltrexone	CYP2D6	CYP3A4, CYP3A5		✓	
	Naloxone	UGT2B7	UGT1A3		✓	
	Naltrexone	UGT2B7	UGT1A1, UGT1A3, OPRM1		✓	

Additional SNPs of Importance for Pain Management

Gene	Marker	Genotype	Drug	Level of Evidence	Results
OPRM1	rs1799971	A/A	Naloxone	2B	Patients may have lower cortisol response
OPRM1	rs1799971	A/A	Morphine	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	A/A	Alfentanil	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	A/A	Fentanyl	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	A/A	Tramadol	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	A/A	Hydrocodone	3	Patients may have a decreased risk for experiencing side effects, including constipation, dry mouth or respiratory depression
COMT	rs4680	G/G	Paroxetine	3	Patients may require a higher dose

PGx Report - Pain Management

Type: Drugs Prescribed for the Treatment of Gout, Antirheumatic

Drug Class	Generic	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, UGT1A3, UGT1A9, UGT2B7		✓	
	Allopurinol	AOX1	Renal Excretion, HLA-B*5801		✓	
	Oxypurinol	Renal Excretion				✓
Recombinant urate oxidase	Rasburicase		G6PD, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
DMARDs	Leflunomide	CYP1A2			✓	
Anti-inflammatory	Tofacitinib	CYP3A4	CYP2C19, CYP3A5			✓
Abbreviations: DMARDs, Disease-modifying antirheumatic drugs; RE, renal excretion (unchanged drug).						

PGx Report - Modulation of Cardiovascular Function

Type: Antiarrhythmic

Drug Class	Generic	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, UGT2B4, CYP2C9		✓	
	Bisoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Metoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Propranolol	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5, UGT1A9		✓	
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	Generic	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, UGT1A3		✓	
	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		✓	
	Furosemide	Renal Excretion	UGT1A9, UGT1A10			✓
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	Generic	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, UGT1A9		✓	
Beta-blockers with alpha activity	Carvedilol	CYP2D6	UGT1A1, UGT2B4, CYP2C9		✓	
	Labetalol	CYP2D6	CYP2C19, ABCB1, UGT1A1, UGT1A9, 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	Generic	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						
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	Generic	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, HMGCR	HMGCR, ABCG2, CYP3A5, ABCB1, ABCG8, UGT1A1, UGT1A3, UGT2B7, KIF6			
	Fluvastatin	CYP2C9, SLCO1B1	HMGCR, ABCG2, CYP3A4, CYP2C8, UGT1A1, UGT1A3, UGT2B7			
	Lovastatin	CYP3A4, SLCO1B1	CYP3A5, HMGCR, UGT1A1, UGT1A3			
	Cerivastatin	CYP3A4, SLCO1B1	HMGCR, CYP2C8, CYP3A5			
	Pitavastatin	UGT1A3, UGT2B7	CYP2C9, CYP2C8, ABCB1, HMGCR			
	Pravastatin	SLCO1B1, HMGCR	KIF6, APOE, ABCA1			
	Simvastatin	CYP3A4, SLCO1B1	ABCG2, HMGCR, CYP3A5, ABCB1, SLCO2B1, UGT1A1, UGT1A3, UGT2B7, KIF6			
	Rosuvastatin	UGT1A1	UGT1A3, ABCG2, HMGCR			
MTTP inhibitors	Lomitapide	CYP3A4	CYP3A5, LDLR			
Drug Therapy for Hypercholesterolemia and Dyslipidemia (GI)						
Cholesterol absorption inhibitors	Ezetimibe	UGT1A1	UGT1A3, UGT2B15			
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Blood vessels)						
Fibrates	Gemfibrozil	CYP3A4	CYP3A5, UGT2B7, UGT1A1, UGT1A3, UGT1A9, UGT2B15			
	Clofibrate	UGT2B7				
Drug Therapy for familial hypercholesterolemia						
Cholesterol-reducing drug (antisense oligonucleotide)	Mipomersen	Nuclease, Renal Excretion	LDLR			

Abbreviations: MTTP, microsomal triglyceride transfer protein; GI, gastrointestinal tract. Rosuvastatin and Pravastatin are considered alternative Statins since are not extensively metabolised by the CYPs.

Additional SNPs of Importance for Treatment Using Statins

Gene	Marker	Genotype	Drug	Level of Evidence	Results
KIF6	rs20455	A/G	Atorvastatin	3	Intermediate risk for adverse cardiovascular events
KIF6	rs20455	A/G	Pravastatin	3	Intermediate risk for adverse cardiovascular events
APOE	rs7412	C/C	Atorvastatin	2A	Less responsive to Statin treatment
APOE	rs7412	C/C	Pravastatin	3	Less responsive to Statin treatment
APOE	rs7412	C/C	Simvastatin	3	Less responsive to Statin treatment
ITGB3	rs5918	T/T	Clopidogrel	3	Patients may have an increased antiplatelet effect to a 300 or 600 mg loading dose of Clopiodgrel

PGx Report - Modulation of Cardiovascular Function

Type: Anticoagulant, Antiplatelet

Drug Class	Generic	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	CYP4F2, CYP2C19, CYP1A2, CYP3A4, EPHX1, PROC, PROS1		●	
	Acenocoumarol	CYP2C9, VKORC1	CYP4F2, CYP2C19, CYP1A2		●	
	Phenprocoumon	CYP2C9, VKORC1	CYP4F2, CYP3A4, CYP2C8, EPHX1	◑		
Direct factor Xa inhibitors	Rivaroxaban	CYP3A4	CYP2J2, CYP3A5		●	
	Apixaban	CYP3A4	CYP3A5		●	
Antiplatelet Drugs						
ADP receptor (P2Y12) inhibitors Nucleotide/nucleoside analogues	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	CYP2J2, CYP3A5		●	
Abbreviations: P2Y12, purinergic receptor P2Y12.						

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Modulation of Respiratory Function

Drug Class	Generic	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	Generic	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	UGT1A3, UGT1A4, 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-Oesophageal Reflux Disease

Drug Class	Generic	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, FMO3, 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	Generic	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, ABCC3, UGT1A1, UGT1A8, OPRM1, 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	Generic	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 Sensitisers						
Thiazolidinediones	Pioglitazone	CYP2C8	CYP3A4, CYP3A5		✓	
	Rosiglitazone	CYP2C8	CYP2C9		✓	
Antidiabetic Other						
SGLT2 inhibitors	Canagliflozin	UGT1A9, UGT2B4	CYP3A4, CYP3A5		✓	

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	Generic	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	UGT1A3, UGT1A4, 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	UGT2B10		✓	
	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 - Psychiatry

Type: Antidepressant I

Drug Class	Generic	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, FMO1		●	
	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, UGT1A3, UGT1A4		●	
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	Generic	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, UGT1A3, UGT1A4		✓	
	Doxepin	CYP2D6, CYP2C19	CYP1A2, CYP3A4, CYP3A5, UGT1A3, UGT1A4			✓
	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, UGT1A6		✓	
Antidepressant and smoking cessation aid	Bupropion	CYP2B6	CYP2E1, CYP3A4, CYP2C9, 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 Treatment Using Antidepressants

Gene	Marker	Genotype	Drug	Level of Evidence	Results
GRIK4	rs1954787	T/T	Citalopram	1B	Patients may have a decreased chance of response to Citalopram treatment
GRIK4	rs1954787	T/T	Antidepressants	2B	Patients with Depressive Disorder or Depression may be less likely to respond to antidepressant treatment
ADRA2A	rs1800544	G/C	SSRIs	3	Patients with major depressive disorder may have an increased response to selective serotonin reuptake inhibitors
GABRP	rs10036156	C/C	SSRIs	3	Patients with Depressive Disorder or Depression may be more likely to respond to antidepressant treatment
GABRP	rs10036156	C/C	Venlafaxine	3	Patients with Depressive Disorder or Depression may be more likely to respond to antidepressant treatment
HTR2A	rs6313	G/G	Paroxetine	3	Patients with depression may have an increased risk of adverse medication reactions

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
HTR2A	rs6311	C/C	Escitalopram	3	Patients with anxiety disorder may have a decreased risk of adverse cognitive effects
HTR2A	rs6311	C/C	Fluvoxamine	3	Depressive patients may have an increased risk of gastrointestinal side effects and increased response
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
ANKK1/DRD2	rs1800497	G/A	Bupropion	1B	Patients may be less likely to quit smoking
ANKK1/DRD2	rs1800497	G/A	Antipsychotics	2A	Schizophrenia patients may have an increased risk for tardive dyskinesia
ANKK1/DRD2	rs1800497	G/A	Ethanol	2B	Patients may have an increased risk for Alcoholism
ANKK1/DRD2	rs1800497	G/A	Clozapine Olanzapine Risperidone	2B	Patients may have increased risk of side effects including hyperprolactinemia and weight gain
ANKK1/DRD2	rs1800497	G/A	Nicotine	3	Patients may have an increased likelihood of smoking cessation when treated with nicotine replacement therapy
ANKK1/DRD2	rs1800497	G/A	Risperidone	3	Schizophrenia patients may have more improvement in symptoms

PGx Report - Psychiatry

Type: Typical Antipsychotic

Drug Class	Generic	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, UGT1A3, UGT1A4, 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	UGT1A4		✓	
Phenothiazines with piperidine structure	Thioridazine	CYP2D6	CYP1A2, CYP3A4, CYP2C19, CYP3A5		✓	
Phenothiazines used as an anti-histamine, sedative, and antiemetic	Promethazine	CYP2D6	UGT1A3, UGT1A4, SULTs		✓	
Diphenyl-butylpiperidine	Pimozide	CYP3A4, CYP2D6	CYP1A2, CYP3A5		✓	
Thioxanthene derivative	Thiothixene	CYP1A2	CYP3A4, CYP3A5		✓	
	Zuclopenthixol	CYP2D6	CYP3A4, CYP3A5		✓	
Tricyclics	Loxapine	CYP1A2	CYP3A4, CYP2D6, UGT1A3, UGT1A4, CYP3A5		✓	

PGx Report - Psychiatry

Type: Atypical antipsychotic

Drug Class	Generic	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		✓	
	Asenapine	CYP1A2, UGT1A4	CYP2D6, CYP3A4, CYP3A5		✓	
	Clozapine	CYP1A2, CYP2D6	CYP3A4, FMO3, CYP2C9, CYP2C19, CYP3A5, CYP2A6, UGT1A3, UGT1A4, 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
HTR2A	rs6311	C/C	Risperidone	3	Children with Autism may have poorer response to treatment
HTR2C	rs3813929	C/C	Olanzapine	3	Patients with psychiatric disorders or schizophrenia may have an increased risk of weight gain
COMT	rs4680	G/G	Haloperidol	3	Schizophrenia patients may have a decreased risk for developing extrapyramidal symptoms
DRD1	rs4532	C/T	Methylphenidate or Dextroamphetamine	3	Patients with attention deficit hyperactivity disorder (ADHD) may have a decreased severity of social withdrawal or nausea

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	Generic	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, CYP2C9, 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	Generic	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, EPHX1	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 analogues	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	Generic	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	Generic	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		✓	
	Rivastigmine	ACHE	BCHE, CHAT		✓	
	Galantamine	CYP2D6	CYP3A4, CYP3A5		✓	
NMDA receptor antagonist	Memantine	Renal Excretion	UGTs		✓	
Anti-Parkinson disease						
Inhibitor of MAO-B	Selegiline	CYP2B6	CYP2C9, CYP3A4, CYP3A5, CYP2A6, FMO3		✓	
	Rasagiline	CYP1A2			✓	
COMT inhibitors	Entacapone	UGT1A9, CYP3A4	CYP2A6, CYP3A5, UGT1A6, UGT2B7, UGT2B15		✓	
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			✓	
Anti-multiple sclerosis						
Dihydroorotate dehydrogenase inhibitor	Teriflunomide	Hydrolysis	NATs , SULTs		✓	
Improvement of walking in patients with multiple sclerosis						
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
APOE	rs429358	T/T	Normal risk for Alzheimer's disease
GABRA6	rs3219151	T/T	Decreased risk for schizophrenia
DRD4	rs1800955	T/C	Increased susceptibility to novelty seeking personality
ABCG2	rs2231142	G/G	Increased risk for Gout

Additional SNP of Importance for hypersensitivity

Gene	Marker	Genotype	HLA	Drug	Results
HLA-A	rs1061235	A/T	HLA-A*3101	Carbamazepine	3.2-fold increased risk for Carbamazepine hypersensitivity syndrome
FLOT1	rs3909184	G/C	HLA-B*1502	Carbamazepine Lamotrigine Phenytoin	Increased risk for medication-induced hypersensitivity
HCP5	rs2395029	T/T	HLA-B*5701	Abacavir	Normal risk for medication-induced hypersensitivity

The variant allele for rs1061235(T) serves as a proxy for the HLA-A*3101 allele, the variant allele for rs3909184(C) serves as a proxy for the HLA-B*1502 allele, the variant allele for rs2395029(G) serves as a proxy for the HLA-B*5701 allele.

PGx Report -Infectious Disease

Type: Antibiotics

Drug Class	Generic	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 Intermediate-acting sulfonamides	Sulphamethoxazole	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	Bedaquiline	CYP3A4	CYP2C8, CYP2C19, CYP3A5		●	
	Pyrazinamide	AOX1, XDH	CYP1A2, CYP3A4, CYP3A5, RE		●	
Abbreviations: DHPS, Dihydropteroate synthase.						

PGx Report -Infectious Disease

Type: Antimalarial, Anthelmintic, Antifungal

Drug Class	Generic	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		●	
	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, FMO3, CYP26A1		●	
Triazoles	Itraconazole	CYP3A4			●	
	Voriconazole	CYP2C19	CYP2C9, CYP3A4, CYP3A5			●
	Fluconazole	Renal Excretion				●
Allylamines	Terbinafine	CYP2C9	CYP1A2, CYP3A4, CYP2C8, CYP2C19		●	

PGx Report -Infectious Disease

Type: Antiretroviral, Antiviral

Drug Class	Generic	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, UGT1A9, SLCO3A1, ABCC1, ABCC4		●	
	Abacavir	ADH6	UGT1A1, ADK, HLA-B*5701		●	
Neuraminidase inhibitors/release phase	Zanamivir	Renal Excretion				●
	Peramivir	Renal Excretion				●
	Oseltamivir	BCHE, ACHE	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	Generic	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, EPHX1, 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, NUDT15, AOX1, SLC19A1			●
	Tioguanine	HPRT1	TPMT, NUDT15			●
	Cladribine	DCK	Renal Excretion		●	
	Clofarabine	DCK	Renal Excretion		●	
	Nelarabine	ADA	DCK, Renal Excretion, XO		●	
Pyrimidine analogues	Fluorouracil	DPYD, TYMS, MTHFR	NQO1, GSTP1, UMPS, TYMP, SLC19A1, ABCG2			●
	Cytarabine	CES1, CES2, CDA	TYMP, DPYD, TYMS, SLCO1B1, SLC29A1		●	

PGx Report - Oncology, Hematology

Type: Antineoplastic II

Drug Class	Generic	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		✓	
Other antineoplastic agents						
Platinum compounds	Cisplatin	Renal Excretion, NQO1, GSTP1	EPHX1, GSTM1, ABCB1, XPC, LRP2, SLC19A1, ABCC2, ABCC3		✓	
Derivative of camptothecin	Irinotecan	UGT1A1, CYP3A4, CES1, CES2	CYP3A5, CYP2B6, UGT1A4, SLCO1B1, BCHE, UGT1A9, UGT1A10, SLC19A1, SLCO1B3, ABCG2		✓	

PGx Report - Oncology, Hematology

Type: Antineoplastic Targeted Therapy I

Drug Class	Generic	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	FMO3, FMO1, 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	FMO3, FMO1, 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	UGT1A9, CYP3A5		✓	
	Sorafenib	CYP3A4	UGT1A9, CYP3A5		✓	
	Sunitinib	CYP3A4	CYP3A5, ABCG2		✓	
	Toceranib	CYP3A4	CYP3A5		✓	
Protein kinase inhibitor (non-receptor)						
BCR-ABL	Imatinib	CYP3A4	CYP3A5, ABCB1, SLCO1A2, SLC22A4, 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	Generic	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 oestrogen receptor modulators (SERM)	Toremifene	CYP3A4	CYP2D6, CYP3A5		✓	
	Tamoxifen	CYP3A4, CYP2D6, CYP2C9	CYP3A5, CYP2B6, FMO1, FMO3, CYP2C19, CYP1A2, UGT1A3, UGT1A4, SULT1A1, F2, F5, ABCC2		✓	
SERD	Fulvestrant	CYP3A4	CYP3A5		✓	
Anti-androgens	Flutamide	CYP1A2	CYP3A4, CYP3A5		✓	
	Nilutamide	CYP2C19	FMO3			✓
	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 oestrogen receptor down-regulator.

PGx Report - Organ Transplantation

Type: Immunosuppressive, Immunomodulation

Drug Class	Generic	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, UGT1A8, UGT1A9, SLCO1B1, SLCO1B3, ABCC2, HPRT1		✓	
	Azathioprine	XO	TPMT, NUDT15, AOX1			✓
Calcineurin Inhibitors	Pimecrolimus	CYP3A4	CYP3A5		✓	
	Tacrolimus	CYP3A4	CYP3A5, 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 - Anaesthesiology

Type: Anaesthetic, Muscle Relaxant

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Inhaled Anaesthetics						
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 Anaesthetics	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5		●	
Skeletal muscle relaxants						
Muscle Relaxants	Carisoprodol	CYP2C19				●
	Cyclobenzaprine	CYP1A2	CYP2D6, CYP3A4, CYP3A5, UGT1A4		●	
	Tizanidine	CYP1A2			●	

PGx Report - Urology

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

Drug Class	Generic	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	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Hormonal contraceptives						
Oestrogens	Ethinylestradiol	CYP3A4, CYP2C9	CYP3A5, CYP2C19, CYP1A2, UGT1A1		✓	
	Estradiol	CYP1A2	CYP3A4, CYP3A5, CYP2C8, UGT1A1, UGT1A9		✓	
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 oestrogen receptor modulators (SERMs)	Raloxifene	UGT1A1	UGT1A8, UGT1A10		✓	
	Bazedoxifene	UGT1A1	UGT1A8, UGT1A10		✓	
	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, UGT1A9, SULTs		✓	
There are additional SERMs (Tamoxifen and Toremifene) described under antineoplastics)						

PGx Report - Recreational Drugs

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

Drug Class	Generic	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, FMO3			◔
	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			◔
Ecgonine derivative	Cocaine	BCHE, CES2	CYP3A4, CYP3A5, SLC6A3			◔
Ergoline derivatives	Lysergic acid diethylamide (LSD)	CYP3A4	CYP3A5		✓	

Additional SNPs of Importance for Recreational Drugs

Gene	Marker	Genotype	Drug	Level of Evidence	Results
OPRD1	rs2236857	T/T	Heroin		Patients may have a lower tendency for heroin addiction
OPRK1	rs702764	T/T	Opioids		Neonates may display reduced abstinence syndrome due to in-utero opioid exposure
OPRK1	rs1051660	C/C	Opioids		Patients may have a lower tendency for Opioids addiction
DBH	rs1611115	C/C	Analgesics	3	Patients with substance withdrawal syndrome may have an increased likelihood of headache when discontinuing the use of analgesics (such as opioids, NSAIDs, triptans, ergot)

Medications Affected by Patient Genetic Results

Clinical Annotation for CYP2D6*1, *1XN, *2, *2XN, *3, *4, *5, *6, *10, *17, *40, *41

Codeine and Pain — **Haplotype:** ***1/*1*** — Evidence Level 1A Efficacy, Toxicity/ADR

Patients treated with codeine may have 1) increased metabolism/clearance of codeine 2) increased likelihood of response to codeine and 3) decreased but not absent risk for side effects as compared to patients with non-functional or reduced function alleles.

-- https://www.pharmgkb.org/clinicalAnnotation/1183616718

Clinical Annotation for CYP2D6*1, *1XN, *2, *2XN, *3, *4, *5, *6, *10

Tramadol and Pain — **Haplotype:** ***1/*1*** — Evidence Level 1B Dosage, Efficacy, Toxicity/ADR

Patients treated with tramadol may have 1) increased metabolism of tramadol 2) increased likelihood of response to tramadol and 3) decreased but not absent risk for side effects as compared to patients with non-functional or reduced function alleles.

-- https://www.pharmgkb.org/clinicalAnnotation/1183618159

Clinical Annotation for rs1045642 (ABCB1)

Fentanyl, methadone, morphine, opioids, oxycodone, tramadol and Pain — **Haplotype:** ***1/*1*** — Evidence Level 2B Dosage

Patients may experience decreased efficacy of fentanyl methadone morphine tramadol oxycodone or other opioids and thus may require an increased dose those drugs as compared to patients with the the AA or AG genotype athough this is contradicted in some studies.

-- https://www.pharmgkb.org/clinicalAnnotation/1444704833

Clinical Annotation for rs3745274 (CYP2B6)

Methadone and Heroin Dependence — **Genotype:** ***T/T*** — Evidence Level 2A Dosage

Patients treated with methadone for heroin addiction may require a decreased dose of the drug as compared to patients with the GG or GT genotype.

-- https://www.pharmgkb.org/clinicalAnnotation/1183702975

Clinical Annotation for rs1045642 (ABCB1)

Fentanyl, methadone, morphine, opioids, oxycodone, tramadol and Pain — **Genotype:** ***G/G*** — Evidence Level 2B Dosage

Patients may experience decreased efficacy of fentanyl, methadone, morphine, tramadol, oxycodone or other opioids and thus may require an increased dose those drugs as compared to patients with the AA or AG genotype, although this is contradicted in some studies.

-- https://www.pharmgkb.org/clinicalAnnotation/1444704833

Clinical Annotation for rs1799971 (OPRM1)

Alfentanil, Drugs used in opioid dependence, fentanyl, heroin, morphine, naltrexone, opioids, tramadol, Heroin Dependence, Opioid-Related Disorders, Pain and Postoperative Pain — **Genotype:** ***A/A*** — Evidence Level 2B Metabolism/PK

Individuals may experience increased efficacy of opioids for pain and opioid related drugs to treat addiction and may require a decreased dose of opioids as compared to individuals with the AG and GG genotypes. However this has been contradicted in some studies. In some studies the AA and AG genotypes were found to have a increased efficacy and to require a decreased dose as compared to the GG genotype.

-- https://www.pharmgkb.org/clinicalAnnotation/982034197

Clinical Annotation for rs1799971 (OPRM1)

Naloxone **Genotype: *A/A*** Evidence Level 2B Efficacy

Patients treated with naloxone may have lower cortisol response as compared to patients with the AG or GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655385241

Clinical Annotation for rs1799971 (OPRM1)

Ethanol **Genotype: *A/A*** Evidence Level 2B Toxicity/ADR

Patients may have a decreased but not absent severity of intoxication and a decreased response when exposed to ethanol as compared to patients with the AG and GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981204641

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 rs762551 (CYP1A2)

Leflunomide and Rheumatoid Arthritis **Genotype: *C/A*** Evidence Level 3 Toxicity/ADR

Patients with rheumatoid arthritis who are treated with leflunomide may have a decreased but not absent risk of toxicity as compared to patients with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655384902

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

Clopidogrel **Haplotype: **1/*2*** Evidence Level 1A Efficacy, Toxicity/ADR

Patients with one functional allele may have 1) poor metabolism of clopidogrel and decreased formation of active drug metabolite resulting in decreased response 2) may have an increased risk for secondary cardiovascular events when treated with clopidogrel as compared to patients with two functional alleles (*1/*1).
-- 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 CT or CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655384011

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

Warfarin, Cardiovascular Diseases and Heart Diseases **Haplotype: **1/*9*** Evidence Level 1A Dosage

-- 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: *C/C*** Evidence Level 1B Dosage

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

Clinical Annotation for rs1045642 (ABCB1)

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

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

Clinical Annotation for rs7412 (APOE)

Atorvastatin, Coronary Disease and Hyperlipidemias **Genotype: *C/C*** Evidence Level 2A Efficacy

Patients treated with atorvastatin may have a reduced response (less reduction in LDL-cholesterol) as compared to patients with the CT or TT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183492249

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: *C/C*** Evidence Level 2A Dosage

Patients may require a decreased dose of phenprocoumon or acenocoumarol as compared to patients with the CT or TT genotypes 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 rs762551 (CYP1A2)

Clopidogrel **Genotype: *C/A*** Evidence Level 3 Efficacy

Patients may have decreased on-treatment platelet reactivity when treated with clopidogrel as compared to patients with the CC genotype. However another study found no association with risk of major adverse cardiac events.
-- https://www.pharmgkb.org/clinicalAnnotation/982030732

Clinical Annotation for rs1045642 (ABCB1)

Ondansetron **Genotype: *G/G*** 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 genotype AA.
-- https://www.pharmgkb.org/clinicalAnnotation/1183632195

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 rs762551 (CYP1A2)

Deferasirox and beta-Thalassemia **Genotype: *C/A*** Evidence Level 3 Metabolism/PK

Patients with beta-thalassemia may have increased concentrations of deferasirox as compared to patients with the AA genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1444666564

Clinical Annotation for rs2470890 (CYP1A2)

Deferasirox and beta-Thalassemia **Genotype: *C/C*** Evidence Level 3 Metabolism/PK

Patients with beta-thalassemia may have increased concentrations of deferasirox as compared to patients with the TT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1444666571

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

Sertraline and Major Depressive Disorder **Haplotype: **1/*2*** Evidence Level 1A Metabolism/PK

Patients treated with sertraline may have increased clearance as compared to patients with the *2/*2 or *2/*3 diplotype and a decreased clearance as compared to patients with the *1/*1 diplotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183619004

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

Citalopram, escitalopram and Major Depressive Disorder **Haplotype: **1/*2*** Evidence Level 1A Efficacy, Toxicity/ADR

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

Clinical Annotation for CYP2D6*1, *1XN, *2, *2XN, *3, *4, *5, *6, *10

Paroxetine, Major Depressive Disorder, Mental Disorders and Obsessive-Compulsive Disorder **Haplotype: **1/*1*** Evidence Level 1A Efficacy, Toxicity/ADR, Metabolism/PK

Patients treated with paroxetine may have 1) a decreased clearance of paroxetine as compared to patients with more than 2 functional CYP2D6 alleles (*1XN *2XN) and 2) an increased clearance of paroxetine as compared to patients with two non-functional CYP2D6 alleles (*3 *4 *5 *6) or *10/*10 genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183621261

Clinical Annotation for CYP2D6*1, *1XN, *2, *2XN, *3, *4, *5, *6, *10

Nortriptyline and Major Depressive Disorder | **Haplotype: *1/*1** | Evidence Level 1A Efficacy, Toxicity/ADR, Metabolism/PK

Patients treated with nortriptyline may have decreased metabolism of nortriptyline as compared to patients with a duplication of a functional CYP2D6 gene and 1) increased metabolism of nortriptyline (decreased nortriptyline plasma levels) 2) a decreased but not absent risk for side effects as compared to patients with CYP2D6 non-functional alleles (*3 *4 *5 *6) or reduced function alleles (*10).

-- https://www.pharmgkb.org/clinicalAnnotation/1183618725

Clinical Annotation for CYP2D6*1, *3, *4, *5, *6, *10

Fluvoxamine, Depressive Disorder, Major Depressive Disorder, Mental Disorders and Obsessive-Compulsive Disorder | **Haplotype: *1/*1** | Evidence Level 1A Efficacy, Toxicity/ADR, Metabolism/PK

Patients treated with fluvoxamine may have 1) decreased steady-state plasma concentration-to-dose (C/D) ratio as compared to patients with the *1/*5 *1/*10 *5/*10 *10/*10 genotype 2) decreased plasma concentrations 3) decreased risk of developing gastrointestinal side effects as compared to patients with the *5/*10 *10/*10 genotype and 4) decreased AUC Cmax and half-life time of fluvoxamine as compared to patients with two non-functional CYP2D6 alleles (poor metaboliser phenotypes). However contradictory findings are reported.

-- https://www.pharmgkb.org/clinicalAnnotation/1183700410

Clinical Annotation for CYP2D6*1, *1XN, *2, *2XN, *3, *4, *5, *6, *10, *41

Amitriptyline, Major Depressive Disorder, Mental Disorders and Mood Disorders | **Haplotype: *1/*1** | Evidence Level 1A Efficacy, Toxicity/ADR

Patients treated with amitriptyline may have 1) decreased nortriptyline plasma levels and increased clearance of amitryptyline and 2) a decreased but not absent risk for side effects as compared to patients with CYP2D6 non-functional alleles (*3 *4 *5 *6) or reduced function alleles and a decreased metabolism of amitriptyline as compared to patients with duplication of a functional CYP2D6 gene.

-- https://www.pharmgkb.org/clinicalAnnotation/1183617651

Clinical Annotation for rs1800497 (ANKK1)

Bupropion and Tobacco Use Disorder | **Genotype: *G/A** | Evidence Level 1B Efficacy

Patients treated with bupropion may be less likely to quit smoking as compared to patients with the GG genotype although this has been contradicted in one study.

-- https://www.pharmgkb.org/clinicalAnnotation/655385422

Clinical Annotation for rs1800497 (ANKK1, DRD2)

Antipsychotics, clozapine, olanzapine, risperidone, Hyperprolactinemia, tardive dyskinesia and Weight gain | **Genotype: *G/A** | Evidence Level 2B Toxicity/ADR

Patients may have increased risk of side effects including hyperprolactinaemia and weight gain but decreased risk of tardive dyskinesia during treatment with antipsychotic drugs as compared to patients with the GG genotype.

-- https://www.pharmgkb.org/clinicalAnnotation/655385495

Clinical Annotation for rs3813929 (HTR2C)

Antipsychotics and Mental Disorders | **Genotype: *C/C** | Evidence Level 2B Toxicity/ADR

Patients with psychiatric disorders who are treated with antipsychotics may have an increased risk of weight gain as compared to patients with the TT genotype. However some studies find no association with weight gain.

-- https://www.pharmgkb.org/clinicalAnnotation/655384971

Clinical Annotation for rs1954787 (GRIK4)

Antidepressants, Depression, Depressive Disorder and Major Depressive Disorder | **Genotype: *T/T*** | Evidence Level 2B Efficacy

Patients with Depressive Disorder or Depression may be less likely to respond to antidepressant treatment as compared to patients with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/982030381

Clinical Annotation for rs762551 (CYP1A2)

Olanzapine | **Genotype: *C/A*** | Evidence Level 3 Efficacy

Patients with psychiatric disorders who are treated with olanzapine may have an increased response to olanzapine based on not decreased mean dose-/body weight-normalised olanzapine serum concentrations as compared to patients with the AA genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655385604

Clinical Annotation for rs762551 (CYP1A2)

Antipsychotics, chlorpromazine, fluphenazine, thioridazine, trifluoperazine and Schizophrenia | **Genotype: *C/A*** | Evidence Level 3 Toxicity/ADR

Patients may have increased QT interval when treated with antipsychotics chlorpromazine fluphenazine thioridazine and trifluoperazine in people with Schizophrenia as compared to patients with genotype AA.
-- https://www.pharmgkb.org/clinicalAnnotation/1183679775

Clinical Annotation for CYP1A2*1A, *1F

Clozapine and Schizophrenia | **Haplotype: **1B/*1L*** | Evidence Level 3 Toxicity/ADR

-- https://www.pharmgkb.org/clinicalAnnotation/1444608250

Clinical Annotation for rs2069514 (CYP1A2)

Antipsychotics and Schizophrenia | **Genotype: *G/A*** | Evidence Level 3 Toxicity/ADR

Schizophrenia patients may have increased severity of tardive dyskinesia when treated with antipsychotics in people who were smokers as compared to patients with the GG genotype. Genotype AG is not associated with increased QT interval in Schizophrenia patients treated with antipsychotics as compared to genotype GG.
-- https://www.pharmgkb.org/clinicalAnnotation/981201888

Clinical Annotation for rs762551 (CYP1A2)

Paroxetine and Major Depressive Disorder | **Genotype: *C/A*** | Evidence Level 3 Dosage, Toxicity/ADR

Patients may require an increased dose of paroxetine and may have an increased risk of fatigue when treated with paroxetine as compared to patients with the CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/982031767

Clinical Annotation for rs2470890 (CYP1A2)

Paroxetine and Major Depressive Disorder | **Genotype: *C/C*** | Evidence Level 3 Efficacy

Patients with major depressive disorder who are treated with paroxetine may be less likely to experience remission as compared to patients with the TT genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183617623

Clinical Annotation for rs2069526 (CYP1A2)

Escitalopram and Major Depressive Disorder | **Genotype: *T/T*** | Evidence Level 3 Toxicity/ADR

Patients with major depressive disorder may have reduced metabolism of escitalopram as compared to patients with the GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183622557

Clinical Annotation for rs1902023 (UGT2B15)

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

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

Clinical Annotation for rs762551 (CYP1A2)

Carbamazepine and Epilepsy **Genotype: *C/A*** Evidence Level 3 Metabolism/PK

Paediatric patients with epilepsy may have decreased clearance of carbamazepine as compared to paediatric patients with epilepsy and the AA genotypes.
-- https://www.pharmgkb.org/clinicalAnnotation/1447983940

Clinical Annotation for rs28365063 (UGT2B7)

Carbamazepine and Epilepsy **Genotype: *A/A*** Evidence Level 3 Metabolism/PK

Patients with epilepsy may have decreased clearance of carbamazepine as compared to patients with the AG or GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1447987066

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

Voriconazole and Mycoses **Haplotype: **1/*9*** Evidence Level 1B Metabolism/PK

-- https://www.pharmgkb.org/clinicalAnnotation/1183689217

Clinical Annotation for rs1045642 (ABCB1)

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

Patients with HIV-1 infection who are treated with nevirapine may have an increased risk for nevirapine hepatotoxicity as compared to patients with the AA genotype.
-- 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 CT or CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981201854

Clinical Annotation for rs2279343 (CYP2B6)

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

Patients with HIV may have increased clearance and decreased plasma concentration of efavirenz as compared to patients with the GG genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1183631455

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 CT or CC genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981201844

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

Azathioprine, mercaptopurine, purine analogues and thioguanine **Haplotype: **1/*3C*** Evidence Level 1A Dosage, Toxicity/ADR

Patients treated with thiopurine drugs and purine analogues: 1) may have decreased inactivation of thiopurines due to deficient TPMT activity and 2) may have an increased risk for toxicity when receiving thiopurine drugs and purine analogues as compared to patients with the *1/*1 genotype. These effects may be more pronounced in those who are homozygous for two non-functional variants (e.g. *2/*3A) than in those who are heterozygous for the non-functional variant (*1/*2).
-- https://www.pharmgkb.org/clinicalAnnotation/1184648909

Clinical Annotation for rs1801133 (MTHFR)

Carboplatin and Non-Small-Cell Lung Carcinoma **Genotype: *G/G*** Evidence Level 2A Efficacy

Patients may have 1) decreased likelihood of response 2) decreased progression free survival to carboplatin in people with Non-Small-Cell Lung Carcinoma as compared to patients with genotype AA.
-- https://www.pharmgkb.org/clinicalAnnotation/981220481

Clinical Annotation for rs1045642 (ABCB1)

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

Patients with lymphoma or leukemia who are treated with methotrexate may have lower concentrations of the drug and may have a reduced but not absent risk of toxicity as compared to patients with the AA genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/1296599132

Clinical Annotation for rs1801133 (MTHFR)

Methotrexate and Neoplasms **Genotype: *G/G*** Evidence Level 2A Dosage, Efficacy, Toxicity/ADR

Patients with leukemia or lymphoma who are treated with methotrexate: 1) may have better response to treatment 2) may be at decreased risk of toxicity 3) may require a higher dose of methotrexate and 4) may be at lower risk of folate deficiency as compared to patients with the AA or AG genotype. This association has been contradicted or not found in multiple studies.
-- https://www.pharmgkb.org/clinicalAnnotation/827848365

Clinical Annotation for rs1801133 (MTHFR)

Cyclophosphamide **Genotype: *G/G*** Evidence Level 2A Toxicity/ADR

Patients may have decreased likelihood of Drug Toxicity when treated with cyclophosphamide as compared to patients with the AA genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/981204929

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: *C/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 rs2740574 (CYP3A4)

Tacrolimus and Organ Transplantation **Genotype: *C/T*** Evidence Level 2A Dosage

Transplant recipients may require an increased dose of tacrolimus as compared to patients with the TT (*1/*1) genotype.
-- https://www.pharmgkb.org/clinicalAnnotation/655387058

Clinical Annotation for rs776746 (CYP3A5)

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

Patients who are recipients of a liver transplantation from a donor with the CT (CYP3A5 *1/*3) 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: *C/T*** Evidence Level 2A Efficacy

Patients with the CT genotype (*1/*3) and 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 (*3/*3) or a decreased risk of transplant rejection as compared to patients with the TT genotype (*1/*1).
-- https://www.pharmgkb.org/clinicalAnnotation/981203808

Clinical Annotation for rs776746 (CYP3A5)

Sirolimus and Transplantation **Genotype: *C/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 (*3/*3).
-- https://www.pharmgkb.org/clinicalAnnotation/981203936

Clinical Annotation for rs6025 (F5)

Hormonal contraceptives for systemic use and Thrombosis **Genotype: *C/C*** Evidence Level 2A Toxicity/ADR

Patients may have a decreased risk of experiencing thrombosis when receiving oral contraceptives as compared to patients with the CT or TT genotype (carriers of Factor V Leiden). 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.
-- https://www.pharmgkb.org/clinicalAnnotation/1183689558

Clinical Annotation for rs1799963 (F2)

Hormonal contraceptives for systemic use, Stroke and Venous Thrombosis **Genotype: *G/G*** Evidence Level 3 Toxicity/ADR

Patients not taking oral contraceptives (OCs) may have a decreased risk for deep vein thrombosis (DVT) as compared to patients with the AG genotype who are taking oral contraceptives. Current evidence suggests that patients with the AG mutation who are taking oral contraceptives experience an increase risk for DVT due to the cumulative effect of both the contraceptives and the AG genotype. At the time of writing there are no studies that show a significant increase in risk for DVT when considering only the AG genotype. Additionally some contradictory evidence exists for this association.

-- https://www.pharmgkb.org/clinicalAnnotation/1444672766

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

Clinical Annotation for rs1800497 (ANKK1)

Ethanol and Alcoholism **Genotype: *G/A*** Evidence Level 2B Toxicity/ADR

Patients may have an increased risk for Alcoholism when exposed to ethanol as compared to patients with the GG genotype.

-- https://www.pharmgkb.org/clinicalAnnotation/981204890

Clinical Annotation for rs762551 (CYP1A2)

Caffeine and Myocardial Infarction **Genotype: *C/A*** Evidence Level 3 Toxicity/ADR

Patients may have an increased risk of nonfatal myocardial infarction with increased coffee consumption as compared to patients with the AA genotype.

-- https://www.pharmgkb.org/clinicalAnnotation/655385388

Genomic Test Results

Genotype/Haplotype Details

CYP1A2

Allele Tested: *1A, *1B, *1C, *1D, *1E, *1F, *1G, *1J, *1K, *1L, *3, *4, *5, *6, *7, *8, *11, *15, *16.

Genetic results: CYP1A2 *1B/*1L

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP1A2	Asn516Asn	1548T>C	*1B	rs2470890	C/C
CYP1A2		-3860G>A	*1C	rs2069514	G/A
CYP1A2		-2467delT	*1D	rs35694136	T/-
CYP1A2		-739T>G	*1E	rs2069526	T/T
CYP1A2		-729C>T	*1K	rs12720461	C/C
CYP1A2		-163C>A	*1F	rs762551	C/A
CYP1A2	Asp348Asn	1042G>A	*3	rs56276455	G/G
CYP1A2	Ile386Phe	1156A>T	*4	rs72547516	A/A
CYP1A2	Cys406Tyr	1217G>A	*5	rs55889066	G/G
CYP1A2	Arg431Trp	1291C>T	*6	rs28399424	C/C
CYP1A2	Splicing defect	1253+1G>A	*7	rs56107638	G/G
CYP1A2	Arg456His	1367G>A	*8	rs72547517	G/G
CYP1A2	Phe186Leu	558C>A	*11	rs72547513	C/C
CYP1A2	Pro42Arg	125C>G	*15	rs72547511	C/C
CYP1A2	Arg377Gln	1130G>A	*16	rs72547515	G/G

CYP1A2 is the most important gene in the metabolism of: Asenapine, Bromazepam, Carmustine, Clozapine, Cyamemazine, Cyclobenzaprine, Eltrombopag, Estradiol, Febuxostat, Flutamide, Frovatriptan, Imipramine, Leflunomide, Lidocaine, Loxapine, Mirtazapine, Nabumetone, Naratriptan, Nintedanib, Palonosetron, Pomalidomide, Promazine, Pyrazinamide, Ramelteon, Rasagiline, Riluzole, Ropinirole, Tacrine, Theophylline, Thiothixene, Tizanidine, Triamterene, Trifluoperazine, Zileuton, Zolmitriptan.

Drugs and substances known to induce CYP1A2 activity include: beta-naphthoflavone, char-grilled meat, Marijuana, Modafinil, Omeprazole, Tobacco.

Drugs and substances known to inhibit CYP1A2 activity include: Amiodarone, Efavirenz, Fluoroquinolones, Fluvoxamine, Ticlopidine, Verapamil.

CYP1A2 activity is dependent upon hepatic and renal function status as well as age.

Genotype/Haplotype Details

CYP2B6

Allele Tested: *1, *4, *5, *6, *7, *9, *10, *11, *18, *16, *22, *28.

Genetic results: CYP2B6 *9/*9

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2B6	Lys262Arg	785A>G	*4	rs2279343	A/A
CYP2B6	Arg487Cys	1459C>T	*5/*7	rs3211371	C/C
CYP2B6	Gln172His	516G>T	*6/*9	rs3745274	T/T
CYP2B6	Arg22Cys	64C>T	*10	rs8192709	C/C
CYP2B6	Met46Leu	136A>G	*11	rs35303484	A/A
CYP2B6	Ile328Thr	983T>C	*16	rs28399499	T/T
CYP2B6		-82T>C	*22	rs34223104	T/T
CYP2B6	Arg378Ter	1132C>T	*28	rs34097093	C/C

CYP2B6 is the most important gene in the metabolism of: Bupropion, Cyclophosphamide, Efavirenz, Iphosphamide, Meperidine, Ondansetron, Selegiline, Sertraline.

Drugs and substances known to induce CYP2B6 activity include: Artemisinin, Carbamazepine, Efavirenz, Nevirapine, Phenobarbital, Phenytoin, Rifampicin.

Drugs and substances known to inhibit CYP2B6 activity include: Clopidogrel, Orphenadrine, Thiotepa, Ticlopidine, Voriconazole.

Genotype/Haplotype Details

CYP2C8

Allele Tested: *1, *2, *3, .

Genetic results: CYP2C8 *1/*1

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C8	Ile269Phe	805A>T	*2	rs11572103	A/A
CYP2C8	Lys399Arg	1196A>G	*3	rs10509681	T/T

CYP2C8 is the most important gene in the metabolism of: Amodiaquine, Chloroquine, Dabrafenib, Desloratadine, Enzalutamide, Isotretinoin, Nicardipine, Paclitaxel, Pioglitazone, Repaglinide, Rosiglitazone.

Drugs and substances known to induce CYP2C8 activity include: Rifampicin.

Drugs and substances known to inhibit CYP2C8 activity include: Gemfibrozil, Montelukast, Trimethoprim.

Genotype/Haplotype Details

CYP2C9

Allele Tested: *1, *2, *3, *4, *5, *6, *7, *8, *9, *10, *11, *13, *15, *16, *27.

Genetic results: CYP2C9 *1/*9

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C9	Arg144Cys	430C>T	*2	rs1799853	C/C
CYP2C9	Ile359Leu	1075A>C	*3	rs1057910	A/A
CYP2C9	Ile359Asn	1076T>C	*4	rs56165452	T/T
CYP2C9	Asp360Glu	1080C>G	*5	rs28371686	C/C
CYP2C9	Lys273Argfs	817delA	*6	rs9332131	A/A
CYP2C9	Leu19Ile	55C>A	*7	rs67807361	C/C
CYP2C9	Arg150His/Leu	449G>A/T	*8/*27	rs7900194	G/G
CYP2C9	His251Arg	752A>G	*9	rs2256871	A/G
CYP2C9	Glu272Gly	815A>G	*10	rs9332130	A/A
CYP2C9	Arg335Trp	1003C>T	*11	rs28371685	C/C
CYP2C9	Leu90Pro	269T>C	*13	rs72558187	T/T
CYP2C9	Ser162Ter	485C>A	*15	rs72558190	C/C
CYP2C9	Thr299Ala	895A>G	*16	rs72558192	A/A

CYP2C9 is the most important gene in the metabolism of: Acenocoumarol, Alosetron , Azilsartan, Bosentan, Cannabinol (CBN), Celecoxib, Chloramphenicol, Delta 9-tetra hydrocannabinol (▵9_THC), Dronabinol, Fenoprofen, Flurbiprofen, Fluvastatin, Gliclazide, Glimepiride, Glipizide, Gliquidone, Ibuprofen, Indomethacin, Irbesartan, Ketobemidone, Lacosamide, Lornoxicam, Losartan, Mefenamic acid, Meloxicam, Mestranol, Naproxen, Nateglinide, Paramethadione, Parecoxib, Phenprocoumon, Piroxicam, Primidone, Sulfinpyrazone, Tapentadol, Tenoxicam, Terbinafine, Thiamylal, Tolazamide, Tolbutamide, Torasemide, Trimethadione, Valsartan, Vismodegib, Warfarin, Zafirlukast.

Drugs and substances known to induce CYP2C9 activity include: Carbamazepine, Nevirapine, Phenobarbital, Rifampicin, Secobarbital.

Drugs and substances known to inhibit CYP2C9 activity include: Amentoflavone, Amiodarone, Apigenin, Isoniazid, Fluconazole, Miconazole, Sulfaphenazole, Valproic acid.

Genotype/Haplotype Details

CYP2C19

Allele Tested: *1, *2, *2B, *4, *5, *6, *7, *8, *9, *10, *17.

Genetic results: CYP2C19 *1/*2

Phenotype: Intermediate metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C19	Splicing defect	681G>A	*2	rs4244285	G/A
CYP2C19	Glu92Asp	276G>C	*2B	rs17878459	G/G
CYP2C19	Met1Val	1A>G	*4	rs28399504	A/A
CYP2C19	Arg433Trp	1297C>T	*5	rs56337013	C/C
CYP2C19	Arg132Gln	395G>A	*6	rs72552267	G/G
CYP2C19	Splicing defect	819+2T>A	*7	rs72558186	T/T
CYP2C19	Trp120Arg	358T>C	*8	rs41291556	T/T
CYP2C19	Arg144His	431G>A	*9	rs17884712	G/G
CYP2C19	Pro227Leu	680C>T	*10	rs6413438	C/C
CYP2C19		-806C>T	*17	rs12248560	C/C

CYP2C19 is the most important gene in the metabolism of: Brivaracetam, Carisoprodol, Citalopram, Clobazam, Clopidogrel, Dexlansoprazole, Diazepam, Enfuvirtide, Esomeprazole, Flunitrazepam, Hexobarbital, Mephenytoin, Moclobemide, Nelfinavir, Nilutamide, Omeprazole, Pantoprazole, Pentamidine, Phenobarbital, Phenytoin, Proguanil, Rabeprazole, Temazepam, Teniposide, Voriconazole.

Drugs and substances known to induce CYP2C19 activity include: Artemisinin, Carbamazepine, Efavirenz, Norethisterone, Rifampicin, Ritonavir, St. John's Wort.

Drugs and substances known to inhibit CYP2C19 activity include: Chloramphenicol, Esomeprazole, Felbamate, Fluvoxamine, Isoniazid, Lansoprazole, Moclobemide, Omeprazole.

Genotype/Haplotype Details

CYP2D6

Allele Tested: *1, *2A, *2D, *3, *4A, *4B, *4K, *4M, *4N, *5, *6A, *6C, *7, *8, *9, *10, *11, *12, *14A, *14B, *15, *17, *20, *29, *34, *35, *36, *39, *41, *69, and CNVs.

Genetic results: CYP2D6 *1/*1

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2D6	Arg296Cys	886C>T	*2	rs16947	G/G
CYP2D6	Ser486Thr	1457G>C	*2	rs1135840	G/G
CYP2D6	Val136Val	408G>C	*2A	rs1058164	G/G
CYP2D6	Arg259Glyfs	775delA	*3	rs35742686	T/T
CYP2D6	Splicing defect	506-1G>A	*4	rs3892097	C/C
CYP2D6	CNV assay		*5/XN	CYP2D6_CNVs	**
CYP2D6	Trp152Glyfs	454delT	*6	rs5030655	A/A
CYP2D6	His324Pro	971A>C	*7	rs5030867	T/T
CYP2D6	Gly169Ter/Arg	505G>T/A	*8/*14	rs5030865	G/G
CYP2D6	Lys281del	841_843delAAG	*9	rs5030656	T/T
CYP2D6	Pro34Ser	100C>T	*10	rs1065852	G/G
CYP2D6	Splicing defect	181-1G>C	*11	rs201377835	G/G
CYP2D6	Gly42Arg	124G>A	*12	rs5030862	C/C
CYP2D6	46fs	137-138insT	*15	rs774671100	-/-
CYP2D6	Thr107Ile	320C>T	*17	rs28371706	G/G
CYP2D6	211fs	1973_1974insG	*20	rs72549354	-/-
CYP2D6	Val136Met	406G>A	*29/*70	rs61736512	C/C
CYP2D6	Val11Met	31G>A	*35	rs769258	C/C
CYP2D6	(sing-dup)		*36	CYP2D7/2D6 hybrid *36	WT/WT
CYP2D6	Splicing defect	985+39G>A	*41	rs28371725	C/C

CYP2D6 is the most important gene in the metabolism of: Aclidinium, Amitriptyline, Amoxapine, Arformoterol, Aripiprazole, Atomoxetine, Bisoprolol, Carvedilol, Chlorpromazine, Clomipramine, Clonidine, Codeine, Cyclizine, Dapoxetine, Darifenacin, Debrisoquine, Desipramine, Dexmethylphenidate, Dextromethorphan, Diphenhydramine, Donepezil, Dosulepin, Doxazosin, Doxepin, Duloxetine, Encainide, Ethylmorphine, Flecainide, Fluoxetine, Fluphenazine, Fluvoxamine, Formoterol , Galantamine, Hydrocodone, Hydroxychloroquine, Iloperidone, Labetalol, Lisdexamfetamine, Lorcaserin, Maprotiline, Methamphetamine, Methylnaltrexone, Methylphenidate, Metoclopramide, Metoprolol, Mexiletine, Mianserin, Modafinil, Nebivolol, Nefazodone, Nortriptyline, Paliperidone, Paroxetine, Perphenazine, Primaquine, Procainamide, Prochlorperazine, Promethazine, Propafenone, Propranolol, Protriptyline, Reserpine, Risperidone, Sertindole, Sparteine, Tetrabenazine, Thioridazine, Timolol, Tolterodine, Tramadol, Trimipramine, Umeclidinium, Venlafaxine, Vicoprofen, Vortioxetine, Zuclopenthixol.

In Caucasians, approximately 6 -10% are CYP2D6 poor metabolisers and up to 7% are ultrarapid drug metabolisers.

Drugs and substances known to induce CYP2D6 activity include: Dexamethasone, Glutethimide, Rifampicin.

Drugs and substances known to inhibit CYP2D6 activity include: Bupropion, Fluoxetine, Paroxetine, Quinidine, Ritonavir.

Genotype/Haplotype Details

CYP3A4

Allele Tested: *1A, *1B, *2, *3, *6, *12, *13, *15, *17, *20, *22.

Genetic results: CYP3A4 *1A/*1B

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A4		-392A>G	*1B	rs2740574	C/T
CYP3A4	Ser222Pro	664T>C	*2	rs55785340	A/A
CYP3A4	Met445Thr	1334T>C	*3	rs4986910	A/A
CYP3A4	Asp277Glufs	830_831insA	*6	rs4646438	-/-
CYP3A4	Leu373Phe	1117C>T	*12	rs12721629	G/G
CYP3A4	Pro416Leu	1247C>T	*13	rs4986909	G/G
CYP3A4	Arg162Gln	485G>A	*15	rs4986907	C/C
CYP3A4	Phe189Ser	566T>C	*17	rs4987161	A/A
CYP3A4	Lys487_Pro488delinsLysThrArgfs	1461_1462insA	*20	rs67666821	-/-
CYP3A4		522-191C>T	*22	rs35599367	G/G

Genotype/Haplotype Details

CYP3A5

Allele Tested: *1A, *1D, *2, *3A, *3B, *3K, *3L, *6, *7, *8, *9.

Genetic results: CYP3A5 *3A/*6

Phenotype: Poor metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A5	Thr398Asn	1193C>A	*2	rs28365083	G/G
CYP3A5	Splicing defect	689-1A>G	*3	rs776746	C/T
CYP3A5	His30Tyr	58C>T	*3B	rs28383468	G/G
CYP3A5	Leu32Thrfs	92_93insG	*3B	rs200579169	-/-
CYP3A5		*14C>T	*1D/*3	rs15524	A/G
CYP3A5	Splicing defect	624G>A	*6	rs10264272	C/T
CYP3A5	Thr346Tyrfs	1035_1036insT	*7	rs41303343	-/-
CYP3A5	Arg28Cys	82C>T	*8	rs55817950	G/G
CYP3A5	Ala337Thr	1009G>A	*9	rs28383479	C/C
CYP3A5	Phe446Ser	1337T>C	*3K	rs41279854	A/A

CYP3A4/5 are the most important genes in the metabolism of: Abiraterone, Albendazole, Alfentanyl, Alfuzosin, Aliskiren, Almotriptan, Alprazolam, Amiodarone, Amlodipine, Amobarbital, Anastrozole, Apixaban, Aprepitant, Armodafinil, Arteether, Artemether, Artemisinin, Astemizole, Atazanavir, Atorvastatin, Avanafil, Axitinib, Bedaquiline, Bepridil, Bicalutamide, Boceprevir, Bosutinib, Bromocriptine, Bromperidol, Brotizolam, Budesonide, Buprenorphine, Buspirone, Cabozantinib, Cannabidiol (CBD), Carbamazepine, Ceritinib, Cerivastatin, Chlordiazepoxide, Chlorpheniramine, Cilansetron, Cilostazol, Cinacalcet, Cinitapride, Cisapride, Clarithromycin, Clebopride , Clindamycin, Clonazepam, Clorazepate, Colchicine, Cortisol (hydrocortisone), Crizotinib, Cyclosporine, Cyproterone, Darunavir, Dasatinib, Delavirdine, Desogestrel, Dexamethasone, Dextropropoxyphene, Dienogest, Dihydrocodeine, Dihydroergotamine, Diltiazem, Disopyramide, Docetaxel, Dolasetron, Domperidone, Dronedarone, Droperidol, Dutasteride, Eletriptan, Elvitegravir, Eplerenone, Ergotamine, Erlotinib, Erythromycin, Escitalopram, Estazolam, Eszopiclone, Ethinylestradiol, Ethosuximide, Etoposide, Etoricoxib, Etravirine, Everolimus, Exemestane, Felbamate, Fentanyl, Finasteride, Flurazepam, Fluticasone, Fosamprenavir, Fulvestrant, Gefitinib, Gemfibrozil, Glyburide, Granisetron, Halofantrine, Haloperidol, Hydroxyzine, Ibrutinib, Ilaprazole, Imatinib, Indinavir, Itraconazole, Ivabradine, Ivacaftor, Ketamine, Ketoconazole, Ketoprofen, Lansoprazole, Lapatinib, Lestaurtinib, Letrozole, Levacetylmethadol, Levomepromazine, Levomilnacipran, Levonorgestrel, Loperamide, Lopinavir, Loratadine, Lormetazepam, Lovastatin, Lurasidone, Lysergic acid diethylamide (LSD), Macitentan, Maraviroc, Masitinib, Mefloquine, Methadone, Midazolam, Mifepristone, Mometasone, Montelukast, Mosapride, Mycophenolate mofetil, Neratinib, Nevirapine, Nifedipine, Nilotinib, Nimodipine, Nitrazepam, Nordazepam, Ornidazole, Ospemifene, Oxybutynin, Oxycodone, Pacritinib, Paritaprevir, Pazopanib, Perampanel , Phencyclidine (PCP), Pimecrolimus, Pimozide, Ponatinib, Pranlukast, Prednisone, Quazepam, Quetiapine, Quinidine, Quinine, Ranolazine, Reboxetine, Regorafenib, Rifabutin, Rifampicin, Rilpivirine, Ritonavir, Rivaroxaban, Roflumilast, Ruxolitinib, Salmeterol, Saquinavir, Saxagliptin, Scopolamine, Sibutramine, Sildenafil, Silodosin, Simeprevir, Simvastatin, Sirolimus, Sitagliptin, Solifenacin, Sorafenib, Sufentanil, Sunitinib, Tacrolimus, Tadalafil, Tamoxifen, Tamsulosin, Telaprevir, Telithromycin, Temsirolimus, Terazosin, Terfenadine, Testosterone, Tiagabine, Ticagrelor, Tilidine, Tinidazole, Tipranavir, Toceranib, Tofacitinib, Tolvaptan, Toremifene, Trazodone, Triazolam, Tropisetron, Udenafil, Ulipristal, Vandetanib, Vardenafil, Verapamil, Vilanterol, Vilazodone, Vinblastine, Vincristine, Vorapaxar, Zaleplon, Ziprasidone, Zolpidem, Zonisamide, Zopiclone, Zotepine.

Drugs and substances known to induce CYP3A4/5 activity include: Carbamazepine, Efavirenz, Nevirapine, Phenobarbital, Phenytoin, Pioglitazone, Rifabutin, Rifampicin, St. John's Wort, Troglitazone.

Drugs and substances known to inhibit CYP3A4/5 activity include: Chloramphenicol, Clarithromycin, Grapefruit juice flavonoids, Indinavir, Itraconazole, Ketoconazole, Nefazodone, Nelfinavir, Ritonavir.

Genotype/Haplotype Details

VKORC1

Allele Tested: H1, H2, H3, H4, H6, H7.

Genetic results: VKORC1 H3/H4

Phenotype: Sensitive to Warfarin

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
VKORC1		497T>G	H2	rs2884737	A/A
VKORC1		2255T>C	H3	rs2359612	A/G
VKORC1		1542C>G	H3	rs8050894	C/G
VKORC1		1173T>C	H4	rs9934438	G/G
VKORC1		-1639A>G	H4	rs9923231	C/C
VKORC1		3730G>A	H7	rs7294	C/C

The VKORC1 gene encodes the vitamin K epoxide reductase enzyme, the drug target of Warfarin.

Genotype/Haplotype Details

ABCB1

Allele Tested: *1, *2.

Genetic results: ABCB1 *1/*1

Phenotype: Extensive function

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
ABCB1	Ile1145Ile	3435C>T	*2	rs1045642	G/G

ABCB1 is an important pharmacokinetic gene modifying drug disposition. Pharmaceutical agents affected include: Alfentanyl, Aliskiren, Atazanavir, Atorvastatin, Carbamazepine, Cisplatin, Clopidogrel, Cyclosporine, Digoxin, Doxorubicin, Efavirenz, Etoposide, Fentanyl, Imatinib, Labetalol, Methadone, Morphine, Nevirapine, Nortriptyline, Ondansetron, Oxycodone, Paclitaxel, Phenobarbital, Phenytoin, Pitavastatin, Pravastatin, Risperidone, Simvastatin, Tacrolimus, Verapamil.

Genotype/Haplotype Details

ABCG2

Allele Tested: *1, *141K.

Genetic results: ABCG2 *1/*1

Phenotype: Extensive function

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
ABCG2	Gln141Lys	421C>A	*141K	rs2231142	G/G

ABCG2 is an important pharmacokinetic gene affecting drug disposition. Pharmaceutical agents affected include: Paracetamol, Atorvastatin, Docetaxel, Doxorubicin, Erlotinib, Fluoropyrimidines, Gefitinib, Imatinib, Irinotecan, Lovastatin, Lamivudine, Methotrexate, Pazopanib, Paclitaxel, Pravastatin, Simvastatin, Uricosurics, Zidovudine.

Genotype/Haplotype Details

TPMT

Allele Tested: *1, *2, *3A, *3B, *3C, *4.

Genetic results: TPMT *1/*3C

Phenotype:Intermediate metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
TPMT	Ala80Pro	238G>C	*2	rs1800462	G/G
TPMT	Ala154Thr	460G>A	*3A or *3B	rs1800460	C/C
TPMT	Tyr240Cys	719A>G	*3A or *3C	rs1142345	T/C
TPMT	Splicing defect	626-1G>A	*4	rs1800584	C/C

TPMT contribute in the metabolism of several drugs including: Azathioprine, Mercaptopurine, Thioguanine.

Genotype/Haplotype Details

UGT1A1

Allele Tested: *1, *6, *28, *36, *37.

Genetic results: UGT1A1 *1/*1

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT1A1	Gly71Arg	211G>A	*6	rs4148323	G/G
UGT1A1		A(TA)(7,5,8)TAA	*28, *36, *37	rs8175347	6/6

UGT1A1 is the most important gene in the metabolism of: Bazedoxifene, Ezetimibe, Irinotecan, Raloxifene, Raltegravir, Rosuvastatin.

UGT1A1 contribute in the metabolism of several drugs including: Abacavir, Paracetamol, Arformoterol, Atorvastatin, Axitinib, Buprenorphine, Carvedilol, Desogestrel, Dolutegravir, Ethinylestradiol, Estradiol, Etoposide, Febuxostat, Fluvastatin, Gemfibrozil, Indacaterol, Ketoconazole, Labetalol, Levothyroxine, Liothyronine, Losartan, Lovastatin, Morphine, Naltrexone, Nilotinib, Pazopanib, Simvastatin, Telmisartan.

Genotype/Haplotype Details

UGT2B7

Allele Tested: *1a, *1d.

Genetic results: UGT2B7 *1a/*1a

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT2B7	Arg124Arg	372A>G	*1d	rs28365063	A/A

UGT2B7 is the most important gene in the metabolism of: Clofibrate, Diclofenac, Hydromorphone, Morphine, Lorazepam-r, Naloxone, Naltrexone, Oxazepam-r, Oxymorphone, Zidovudine.

Genotype/Haplotype Details

UGT2B15

Allele Tested: *1, *2.

Genetic results: UGT2B15 *1/*2

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT2B15	Tyr85Asp	253G>T	*2	rs1902023	A/C

UGT2B15 is the most important gene in the metabolism of: Lorazepam-s, Oxazepam-s.

Genotype/Haplotype Details

DPYD

Allele Tested: *1, *2A, *9A, *9B, *10.

Genetic results: DPYD *9A/*9A

Phenotype: Extensive metaboliser

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
DPYD		1905+1G>A	*2A	rs3918290	G/G
DPYD	Cys29Arg	85T>C	*9A/*9B	rs1801265	G/G
DPYD	Arg886His	2612C>T	*9B	rs1801267	C/C
DPYD	Val995Phe	2983G>T	*10	rs1801268	C/C

DPYD is the most important gene in the metabolism of: Cytarabine, Fluorouracil, Tegafur.

Genotype/Haplotype Details

OPRM1

Allele Tested: *1, *2.

Genetic results: OPRM1 *1/*1

Phenotype: Sensitive to Opioids

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
OPRM1	Asn40Asp	118A>G	*2	rs1799971	A/A

Genotype/Haplotype Details

APOE

Allele Tested: *3, *2, *4, *1.

Genetic results: APOE

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
APOE	Arg176Cys	526C>T	*2	rs7412	C/C
APOE	Cys130Arg	388T>C	*4	rs429358	T/T

Testing purpose(s): 1) To provide information on how tested individual's genetic profile may affect carrier status for: a) certain inherited disease, b) reaction to certain drugs, c) risk of certain common health conditions, and/or d) response to selected diet, exercise, and/or nutrition recommendations. 2) To obtain information on tested individual's ancient ancestry. Testing purposes are dependent upon specific genetic testing ordered by patient's healthcare professional. Based on testing 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 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

Gene	Marker	Level of Evidence	Drugs
TPMT	rs1142345	1A	Azathioprine, Mercaptopurine, Thioguanine
CYP2D6	rs16947	1A	Amitriptyline, Codeine, Nortriptyline, Paroxetine
VKORC1	rs9923231	1A	Warfarin
SLCO1B1	rs4149056	1A	Simvastatin
CYP2D6	rs16947	1B	Tramadol
VKORC1	rs9923231	1B	Acenocoumarol
CYP2D6	rs16947	2A	Flecainide, Doxepin, Desipramine, Atomoxetine, Risperidone, Clomipramine, Imipramine, Venlafaxine
SLCO1B1	rs4149056	2A	Cerivastatin, Pravastatin, Rosuvastatin
ABCB1	rs1045642	2A	Digoxin, Nevirapine, Methotrexate
CYP2D6	rs16947	3	Timolol, Carvedilol, Haloperidol, Aripiprazole, Metoprolol, Citalopram, Escitalopram, Tamoxifen
VKORC1	rs9923231	3	Phenprocoumon
SLCO1B1	rs4149056	3	Repaglinide, Irinotecan, Mycophenolate mofetil, Atorvastatin, Methotrexate, Olmesartan
ABCB1	rs1045642	3	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
CYP2D6	rs16947	4	Methylphenidate, Bufuralol
SLCO1B1	rs4149056	4	Lopinavir, Atrasentan
ABCB1	rs1045642	4	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

CYP1A2	*1B/*1L	Extensive metaboliser
CYP2B6	*9/*9	Extensive metaboliser
CYP2C8	*1/*1	Extensive metaboliser
CYP2C9	*1/*9	Extensive metaboliser
CYP2C19	*1/*2	Intermediate metaboliser
CYP2D6	*1/*1	Extensive metaboliser
CYP3A4	*1A/*1B	Extensive metaboliser
CYP3A5	***3A/*6**	**Poor metaboliser**
VKORC1	**H3/H4**	**Sensitive to Warfarin**
SLCO1B1	*1B/*1B	Extensive function
ABCB1	*1/*1	Extensive function
ABCG2	*1/*1	Extensive function
TPMT	*1/*3C	Intermediate metaboliser
UGT1A1	*1/*1	Extensive metaboliser
UGT2B7	*1a/*1a	Extensive metaboliser
UGT2B15	*1/*2	Extensive metaboliser
DPYD	*9A/*9A	Extensive metaboliser
OPRM1	*1/*1	Sensitive to Opioids
APOE		

For a complete report contact Genekor.com

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