

Pharmacogenetic Test

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Interpretation Guide

The report contains 4 major sections:

1. Patient Medications
2. Drug Guide
3. Summary of Genes Tested
4. Detailed Explanation of Findings

In all 4 sections, color coding easily shows whether there is a genetic predisposition that may affect the patient's response to drugs or indicate the potential for adverse effects.

- Green Color indicates **+ NORMAL**
- Yellow Color indicates **- INCREASED RISK**
- Red Color indicates **x EXTREME RISK**
- Black color indicates **No current drug-gene interaction**

1. Patient Medications

Outlines all patient prescribed medications, if any & legend underneath explains the following:

- Medications with **(i)** in parenthesis are considered informative based on CPIC guidelines (<https://cpicpgx.org/>).
- Medications with **(+ +)** in parenthesis are considered a Pro-Drug; may not be effective in poor Metabolizers due to inability to metabolize and produce active metabolite.
- Medications with **(*)** indicate the enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance).

2. Drug Guide

- Details the most commonly prescribed medications along with individual patient medications in each therapeutic category.

Example 1 :

Neuropsychiatric - ADHD Drug x Dextroamphetamine (Dexadrine), - Clonidine (Kapvay), - amphetamine (Adderall, Evekeo), + atomoxetine (Strattera), + Lisdexamfetamine (Vyvanse), x Methylphenidate (Ritalin, Aptensio XR, Concerta, Metadate, Quillivant ER), + Guanfacine (Intuniv)

3. Summary of Genes Tested

- Shows the patient's genotype and phenotype for each of the genes tested.
- The **genotype** will specify the alleles or variants the patient carries in a particular gene or genetic location.
- The **phenotype** describes the metabolic expression of the gene as 1 of 4 categories:
 - Normal Metabolizer
 - Intermediate Metabolizer
 - Poor Metabolizer
 - Ultra Rapid Metabolizer

Example 2 :

Gene (Genotype)	Phenotype (Gene expression)
CYP2D6 *2/*5	Intermediate Metabolizer

4. Detailed Explanation of Findings

- Explains how the genotype and phenotype may impact drug response.

Example:

In example 2, the patient is an **Intermediate Metabolizer** for the gene **CYP2D6**. This gene is responsible for the metabolism of the prescribed medication **Amphetamine (Adderall)**. Therefore, this may affect the patient's response to the drug or indicate the potential for adverse effects.

COMMON MEDICINES METABOLIZED BY CYP2D6

Neuropsychiatric

amitriptyline (Elavil)
amphetamine (Adderall)
aripiprazole (Abilify)
asenapine (Saphris)
atomoxetine (Strattera)
bupropion (Wellbutrin)
chlorpromazine (Thorazine)
citalopram (Celexa) *
clomipramine (Anafranil)
desipramine (Norpramin)
desvenlafaxine (Pristiq)*
doxepin (Sinequan,
Silenor, Prudoxin, Zonalon)



Patient Medications:



How to interpret the patient medications table:

- The first column "Drug Name" lists all medications, prescribed and contemplated, that are indicated on the order.
- Each medication will show in the color corresponding to its drug to gene interactions.
- Any drug to drug interaction(s) will show in the corresponding column, Major or Moderate, relating to each of the patient's medications.

Drug Name	Major Drug Interaction	Moderate Drug Interaction
+ Alprazolam (4)		x tapentadol (Nucynta)
		x Tramadol
x Amphetamine (4) (i)		x Tramadol
x tapentadol (Nucynta) (4)		+ Alprazolam
		x Tramadol
x Tramadol (4) (++)		+ Alprazolam
		x Amphetamine
		x tapentadol (Nucynta)

Legends:

= Contemplated Medication

- 1.Consider changing drug due to one or more Major drug to drug interaction(s).
- 2.Consider changing drug due to one or more Major drug to drug interaction(s) and potential genetic interaction(s).
- 3.Consider changing drug due to one or more Moderate drug to drug interaction(s).
- 4.Consider changing drug due to one or more Moderate drug to drug interaction(s) and potential genetic interaction(s).
- 5.Consider changing drug due to one or more potential genetic interaction(s).
- 6.Medications with (i) in parenthesis are considered informative based on CPIC guidelines.
- 7.Medications with (++) in parenthesis are considered a Pro-Drug; may not be effective in poor Metabolizer due to inability to metabolize and produce active metabolite.
- 8.Medications with (*) indicate to enzyme encoded by this gene is minor metabolic pathway for this drug (of minor clinical importance).



Drug Guide

These lists of drugs are color-coded to reflect whether a genetic predisposition indicates that there may be issues with regard to drug response or adverse effects.

+ Normal

A drug in green font indicates that no genetic issues of clinical relevance were found for this drug among the genes tested.

⊖ Increased Risk

A drug in yellow font indicates that genetic issues of clinical relevance were found for this drug. Extra caution should be observed when considering this drug for this patient.

⊗ Extreme Risk

A drug in red font indicates that serious genetic issues of clinical relevance were found for this drug and extreme caution or avoidance of this drug should be observed when considering this drug for this patient.

Drug Category/Class	Drugs
Antidiabetic	+ Chlorpropamide (Diabinese), + glipizide (Glucotrol), + tolbutamide (Orinase), + glyburide (Diabeta, Micronase), + Nateglinide (Starlix), + glimepiride (Amaryl), + Repaglinide (Prandin, Prandimet)
Anti-Infectives	x nelfinavir (Viracept), x efavirenz (Sustiva), + indinavir (Crixivan), + ritonavir (Norvir), + telithromycin (Ketek), + erythromycin (E-Mycin), + clarithromycin (Biaxin), + saquinavir (Invirase)
Cardiovascular - Antianginal	+ ranolazine (Ranexa)
Cardiovascular - Antiarrhythmics	- flecainide (Tambacor), - propafenone (Rythmol), - Mexiletine (Mexitol), - quinidine (Quinidine), + Amiodarone (Nexterone, Pacerone), + dofetilide (Tikosyn), + Disopyramide (Norpace), Sotalol (Betapace, Sorine, Sotylize)
Cardiovascular - Anticoagulants	x clopidogrel ++ (Plavix), + ticagrelor (Brilinta), + Vorapaxar (Zontivity), + warfarin (Coumadin, Jantoven), + rivaroxaban (Xarelto), + Apixaban (Eliquis), Betrixaban (Bevyxxa), Prasugrel (Effient)
Cardiovascular - Antihypertensive	x Azilsartan medoxomil (Edarbi, Edarbyclor), x timolol (Blocadren), x Propranolol (Inderal), - nebivolol (Bystolic), - metoprolol (Lopressor, Toprol), - carvedilol (Coreg), + Irbesartan (Avapro), + nifedipine (Adalat, Procardia), + felodipine (Plendil), + losartan (Cozaar, Hyzaar), + Labetalol (Normodyne, Trandate), + Bisoprolol (Zebeta), + nisoldipine (Sular), + amlodipine (Norvasc), + lercanidipine (Zanidip), + nitrendipine (Baypress), + Candesartan cilexetil (Atacand), + diltiazem (Cardizem), Telmisartan (Micardis), Valsartan (Diovan, Entresto), Olmesartan (Benicar), Atenolol (Tenormin)
Cardiovascular - Cholesterol Lowering	+ pravastatin (Pravachol), + lovastatin (Mevacor, Altoprev, Advior), + fluvastatin (Lescol), + simvastatin (FloLip, Zocor), + atorvastatin (Lipitor, Caduet), + rosuvastatin (Crestor)
Cholinesterase Inhibitors	x Donepezil (Aricept), - Rivastigmine (Exelon), - Galantamine (Razadyne, Reminyl), Memantine (Namenda)
Gastrointestinal	x lansoprazole (Prevacid), x omeprazole (Prilosec), x pantoprazole (Protonix), x Dexlansoprazole (Dexilant, Kapidex), x rabeprazole (Aciphex), x esomeprazole (Nexium)
Gastrointestinal - Antiemetics	- Dolasetron (Anzemet), - Metoclopramide (Reglan), + Aprepitant (Emend-oral), + Dronabinol (Marinol), + Ondansetron (Zofran, Zuplenz), + Rolapitant (Varubi), + Granisetron (Sancuso, Sustol)
Immunological	+ cyclosporine (Gengraf), + zafirlukast (Accolate), + hydrocortisone, + tacrolimus (Prograf, Protopic)
Immunological - Cholinergic Agonists	- Cevimeline (Evoxac)

Drug Category/Class	Drugs
Immunological - Selective Immunosuppressants	+ Siponimod (Mayzent)
Infections - Antifungals	x Voriconazole (Vfend), + Itraconazole (Sporanox), Fluconazole (Diflucan)
Miscellaneous Metabolic Agents	- Eliglustat (Cerdelga)
Neuropsychiatric - ADHD Drug	x amphetamine (Adderall, Evekeo), x Clonidine (Kapvay), - atomoxetine (Strattera), - Dextroamphetamine (Dexadrine), + Lisdexamfetamine (Vyvanse), + Methylphenidate (Ritalin, Aptensio XR, Concerta, Metadate, Quillivant ER), + Guanfacine (Intuniv)
Neuropsychiatric - Antiaddictives	- Lofexidine (Lucemyra)
Neuropsychiatric - Anticonvulsants	+ Felbamate (Felbatol), + Primidone (Mysoline), + tiagabine (Gabitril), + carbamazepine (Tegretol, Carbatrol, Epitol), + zonisamide (Zonegran), + phenytoin (Dilantin), Divalproex, Pregabalin (Lyrica), Oxcarbazepine (Trileptal, Oxtellar XR), Lamotrigine (Lamictal), Levetiracetam (Keppra), Topiramate (Topamax)
Neuropsychiatric - Antidepressant	x citalopram (Celexa), x imipramine (Tofranil), x Trimipramine (Surmontil), x venlafaxine (Effexor), x amitriptyline (Elavil), x bupropion (Wellbutrin, Zyban), x clomipramine (Anafranil), x doxepin (Sinequan, Silenor, Prudoxin, Zonalon), x escitalopram (Lexapro), x sertraline (Zoloft), - paroxetine (Paxil, Brisdelle), - Vortioxetine (Trintellix), - Maprotiline (Ludiomil), - fluoxetine (Prozac, Sarafem), - Fluvoxamine (Luvox), - nortriptyline (Aventyl, Pamelor), - desipramine (Norpramin), - Protriptyline (Vivactil), + vilazodone (Viibryd), + desvenlafaxine (Pristiq), + mirtazapine (Remeron), + nefazodone (Serzone), + trazodone (Oleptro)
Neuropsychiatric - Antiemetics	- Meclizine (Antivert)
Neuropsychiatric - Antipsychotic	x Pimozide (Orap), x asenapine (Saphris), x promazine (Sparine), x clozapine (Clozaril), x olanzapine (Zyprexa), - perphenazine (Trilafon), - aripiprazole (Abilify, Aristada), - thioridazine (Mellaril), - loperidone (Fanapt), - Fluphenazine (Prolixin), - risperidone (Risperdal), - Brexpiprazole (Rexulti), - haloperidol (Haldol), - chlorpromazine (Thorazine), + lurasidone (Latuda), + Cariprazine (Vraylar), + quetiapine (Seroquel), + ziprasidone (Geodon)
Neuropsychiatric - Anxiolytic	x Clobazam (Onfi), - diazepam (Valium), - phenobarbital, + alprazolam (Xanax), + triazolam (Halcion), + zolpidem (Ambien), + midazolam (Versed), + Clonazepam (Klonopin), + buspirone (BuSpar)
Neuropsychiatric - Other	- Tetrabenazine (Xenazine), - Dextromethorphan (Nuedexta), + Valbenazine (Ingrezza)
Neuropsychiatric - Pain Management	x duloxetine (Cymbalta)
Neuropsychiatric - Precognitive Drug	x tacrine (Cognex)
Oncology	- ifosfamide (Ifex), + vincristine (Vincasar, Oncovin), + docetaxel (Taxotere)
Other	x caffeine, x theophylline (Theo-24, Elixophylline, Theochron)
Pain Management	Acetylsalicylic acid (Aspirin)
Pain Management - Muscle Relaxant	x tizanidine (Zanaflex), x cyclobenzaprine (Flexaril, Amrix), - Milnacipran (Savella), Methocarbamol (Robaxin)
Pain Management - NSAID	x ropivacaine (Naropin), - ibuprofen (Advil, Motrin), - naproxen (Aleve), + Diclofenac (Voltaren), + Meloxicam (Mobic), + celecoxib (Celebrex), + Flurbiprofen (Ansaid, Ocufen), + Ketorolac (Toradol), + Indomethacin (Indocin, Tivorbex), + Piroxicam (Feldene), Nabumetone (Relafen), Acetaminophen (Tylenol)

Drug Category/Class	Drugs
Pain Management - Opioids	x carisoprodol++ (Soma), x meperidine (Demerol), x tramadol++ (Ultram), x methadone (Dolophine), x tapentadol (Nucynta), - Benzhydrocodone (Apadaz), - hydrocodone++ (Vicodin), - oxycodone++ (Oxycontin, Percocet), - codeine++ (Codeine, Fioricet with codeine), + Buprenorphine (Butrans, Buprenex), + alfentanil (Alfenta), + fentanyl (Actiq, Duragesic, Sublimaze), Oxymorphone (Opana, Numorphan), Hydromorphone (Dilaudid, Exalgo), Morphine (MS Contin)
Pain Management - Other	x lidocaine (xylocaine, Lidoderm), x zolmitriptan (Zomig)
Rheumatology - Anti Hyperuricemics/Anti-Gout	+ Colchicine (Mitigare), Febuxostat (Uloric)
Rheumatology - Immunomodulators	x Leflunomide (Arava), + Apremilast (Otezla), + Tofacitinib (Xeljanz)
Steroids	x estradiol, + testosterone, + progesterone
Urologicals - 5-Alpha Reductase Inhibitors	+ Finasteride (Proscar)
Urologicals - Alpha-Blockers	- Tamsulosin (Flomax), + Silodosin (Rapaflo), + Doxazosin (Cardura), Terazosin (Hytrin)
Urologicals - Antispasmodics for OAB	- Tolterodine (Tolterodine), - Mirabegron (Myrbetriq), + Solifenacin (Vesicare), + Darifenacin (Enablex), + Oxybutynin (Ditropan)
Urologicals - Erectile Dysfunction	+ sildenafil (Viagra), + Vardenafil (Levitra), + Avanafil (Stendra), + Tadalafil (Cialis)

++ Pro-drug; may not be effective in Poor Metabolizers due to inability to metabolize and produce active metabolite

* The enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance)



Summary of Genes Tested

The following is a summary of findings

Genes affecting drug metabolism

Gene (Genotype)	Phenotype (Gene expression)	What it means
CYP1A2 *1F/*1F	Ultra Rapid Metabolizer	Extremely rapid metabolism expected for the enzyme controlled by this gene, especially in smokers. It may be difficult to achieve effective drug concentrations.
CYP2B6 *6/*6	Poor Metabolizer	The patient is a poor metabolizer (PM). Reduced or no metabolic enzyme activity is anticipated. There is a high potential risk for adverse drug reaction. Please consult drug labeling for further dosing guidance.
CYP2C19 *17/*17	Ultra Rapid Metabolizer	Extremely rapid metabolic enzyme activity expected for the enzyme controlled by this gene. It may be difficult to achieve effective drug concentrations. ++ Caution should be observed with pro-drugs, e.g., clopidogrel. Excessive active metabolite formation may occur and a high risk for adverse drug reactions exists (e.g., for clopidogrel this can lead to increased risk for serious bleeding).
CYP2C9 *1/*1	Normal Metabolizer	This genotype predicts normal metabolic activity for the enzyme controlled by this gene.
CYP2D6 *2/*5	Intermediate Metabolizer	This genotype predicts less than normal metabolic enzyme activity. Increased potential for drug accumulation and adverse drug reactions. ++ Caution should be observed with pro-drugs, e.g., codeine. Less than normal active metabolite formation is expected.
CYP3A4 *1/*1A	Normal Metabolizer	The expected metabolic activities for the enzymes controlled by these genes are shown at left. CYP3A4 and CYP3A5 are so similar that they generally affect the same drugs. If you are normal for one of these genes, then you can expect to metabolize these drugs normally. If you are impaired for both of these genes, then there is increased potential for drug accumulation and adverse drug reactions.
CYP3A5 *1/*1	Normal Metabolizer	The expected metabolic activities for the enzymes controlled by these genes are shown at left. CYP3A4 and CYP3A5 are so similar that they generally affect the same drugs. If you are normal for one of these genes, then you can expect to metabolize these drugs normally. If you are impaired for both of these genes, then there is increased potential for drug accumulation and adverse drug reactions.



Summary of Genes Tested

The following is a summary of your drug sensitivity report. More detail on each gene can be found on the pages referenced.

Genes affecting response or function

APOE E2/E2	Significant Risk	This diplotype is associated with decreased risk of Alzheimer's Disease and an increased risk of hyperlipidemia and cardiovascular disease.
COMT G/G	Normal Activity	This genotype is associated with normal COMT activity.
Factor II G/G	Normal Risk	The patient is wildtype for Factor II Prothrombin. Patients with this genotype (G/G) are associated with a normal risk of developing an abnormal blood clot.
Factor V Leiden C/C	Normal Risk	The patient is wildtype for Factor V Leiden. Patients with this genotype (C/C) are associated with a normal risk of developing an abnormal blood clot.
GLP1R (rs10305420) C/T	Decreased Response	Individuals carrying this allele may be less likely to respond well to GLP-1 and GIP drugs for weight loss and HBA1C reduction. Other clinical and genetic factors may also influence response to treatment in individuals with obesity.
GLP1R (rs6923761) A/G	Normal / Increased Response	Individuals carrying this allele may be more likely to respond to GLP-1 and GIP drugs for weight loss. Other clinical and genetic factors may also influence response to treatment in individuals with obesity.
MTHFR CC-677/AA-1298	Normal Function	This genotype predicts normal function of the enzyme methylenetetrahydrofolate reductase (MTHFR). This enzyme plays a crucial role in converting dietary folate into methylfolate, the active form of this critical B vitamin. Normal ability to convert dietary folate into active methylfolate. This genotype is associated with normal plasma homocysteine levels and no homocysteine-related increased risk of premature cardiovascular disease.
SLCO1B1 *1A/*1A	Normal Function	No increased risk of statin-induced myopathy expected at low to moderate doses.
UGT2B15 (rs1902023) *1/*1	Normal Metabolizer	Subjects with this genotype may have normal clearance or glucuronidation of drugs (e.g., oxazepam, lorazepam). Other genetic and clinical factors may also influence metabolism.
VKORC1 C/T	Normal Sensitivity	Usual warfarin doses are predicted to produce the desired anticoagulant effect. Excessive anticoagulant activity is associated with an increased risk of serious bleeding.



Detailed Explanation of Findings

Gene	Phenotype (Gene expression)	What it means
CYP2D6	Intermediate Metabolizer	This genotype predicts less than normal metabolic enzyme activity. Increased potential for drug accumulation and adverse drug reactions. ++ Caution should be observed with pro-drugs, e.g., codeine. Less than normal active metabolite formation is expected.

COMMON MEDICINES METABOLIZED BY CYP2D6

Neuropsychiatric

amitriptyline (Elavil)	haloperidol (Haldol)
amphetamine (Adderall)	iloperidone (Fanapt)
aripiprazole (Abilify)	imipramine (Tofranil)
asenapine (Saphris)	mirtazapine (Remeron) *
atomoxetine (Strattera)	nortriptyline (Aventyl, Pamelor)
bupropion (Wellbutrin)	olanzapine (Zyprexa) *
chlorpromazine (Thorazine)	paroxetine (Paxil)
citalopram (Celexa) *	perphenazine (Trilafon)
clomipramine (Anafranil)	quetiapine (Seroquel) *
desipramine (Norpramin)	risperidone (Risperdal)
desvenlafaxine (Pristiq) *	sertraline (Zoloft) *
doxepin (Sinequan,	tacrine (Cognex)
Silenor, Prudoxin, Zonalon)	thioridazine (Mellaril)
duloxetine (Cymbalta)	trazadone (Oleptro) *
escitalopram (Lexapro)	venlafaxine (Effexor)
fluoxetine (Prozac)	

Cardiovascular

carvedilol (Coreg)	propafenone (Rythmol)
flecainide (Tambocor)	propranolol (Inderal)
lercandipine (Zandip)	quinidine (various brands)
metoprolol (Lopressor, Toprol)	timolol (Blocadren)
nebivolol (Bystolic)	

Pain

celecoxib (Celebrex) *
codeine++
cyclobenzaprine (Flexeril) *
hydrocodone++ ibuprofen *
methadone *
oxycodone++ (Oxycontin)
tiagabine (Gabitril) *
tramadol++ (Ultram)

Anti-Infectives

indinavir (Crixivan) *
ritonavir (Norvir) *

Oncologic

tamoxifen ++

++ Pro-drug; may not be effective in Poor Metabolizers due to inability to metabolize and produce active metabolite

* The enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance)



Detailed Explanation of Findings

Gene	Phenotype (Gene expression)	What it means
CYP2C19	Ultra Rapid Metabolizer	Extremely rapid metabolic enzyme activity expected for the enzyme controlled by this gene. It may be difficult to achieve effective drug concentrations. ++ Caution should be observed with pro-drugs, e.g., clopidogrel. Excessive active metabolite formation may occur and a high risk for adverse drug reactions exists (e.g., for clopidogrel this can lead to increased risk for serious bleeding).

COMMON MEDICINES METABOLIZED BY CYP2C19

Neuropsychiatric

citalopram (Celexa)	paroxetine (Paxil) *
clomipramine (Anafranil) *	perphenazine (Trilafon) *
diazepam (Valium)	phenobarbital
doxepin (Sinequan, Silenor, Prudoxin, Zonalon)	phenytoin (Dilantin)
escitalopram (Lexapro)	sertraline (Zoloft)
imipramine (Tofranil)	venlafaxine (Effexor) *
	vilazodone (Viibryd) *

Pain

carisoprodol ++ (Soma)
 ibuprofen *
 meperidine (Demerol)
 methadone
 tapentadol (Nucynta)

GERD

esomeprazole (Nexium)
 lansoprazole (Prevacid)
 omeprazole (Prilosec)
 pantoprazole (Protonix)
 rabeprazole (Aciphex)

Antivirals, Hormones, and Anti-Diabetics

efavirenz (Sustiva) *	progesterone *
nelfinavir (Viracept)	tolbutamide (Orinase) *

Oncologic

tamoxifen ++

++ Pro-drug; may not be effective in Poor Metabolizers due to inability to metabolize and produce active metabolite

* The enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance)



Detailed Explanation of Findings

Gene	Phenotype (Gene expression)	What it means
CYP3A4	Normal Metabolizer	The expected metabolic activities for the enzymes controlled by these genes are shown at left. CYP3A4 and CYP3A5 are so similar that they generally affect the same drugs. If you are normal for one of these genes, then you can expect to metabolize these drugs normally. If you are impaired for both of these genes, then there is increased potential for drug accumulation and adverse drug reactions.
CYP3A5	Normal Metabolizer	The expected metabolic activities for the enzymes controlled by these genes are shown at left. CYP3A4 and CYP3A5 are so similar that they generally affect the same drugs. If you are normal for one of these genes, then you can expect to metabolize these drugs normally. If you are impaired for both of these genes, then there is increased potential for drug accumulation and adverse drug reactions.

COMMON MEDICINES METABOLIZED BY CYP3A4 and CYP3A5

Pain

alfentanil (Alfenta)	lidocaine (xylocaine, various) *
codeine *	meperidine (Demerol)
cyclobenzaprine (Flexeril)	methadone
fentanyl (Actiq, Duragesic, Sublimaze)	oxycodone (Oxycontin)
hydrocodone *	ropivacaine (Naropin) *
ibuprofen *	tizanidine (Zanaflex) *
	tramadol (Ultram) *

Cardiovascular

amiodarone (Cordarone)
 amlodipine (Norvasc)
 atorvastatin (Lipitor, Caduet)
 carvedilol (Coreg) *
 clopidogrel (Plavix) *
 diltiazem (Cardizem)
 dofetilide (Tikosyn)
 felodipine (Plendil)
 fluvastatin (Lescol) *
 lercanidipine (Zanidip)
 losartan (Cozaar)
 lovastatin (Mevacor)
 nifedipine (Adalat, Procardia)
 nisoldipine (Sular)
 nitrendipine
 propafenone (Rythmol)
 quinidine (Various brands)
 ranolazine (Ranexa)
 rivaroxaban (Xarelto)
 simvastatin (Zocor)
 ticagrelor (Brilinta)

Neuropsychiatric

alprazolam (Xanax)	midazolam (Versed)
amphetamine (Adderall) *	mirtazapine (Remeron)
aripiprazole (Abilify)	nefazodone (Serzone)
atomoxetine (Strattera) *	paroxetine (Paxil) *
buspirone (Buspar)	perphenazine (Trilafon)
carbamazepine (Tegretol, Various brands)	phenytoin (Dilantin) *
chlorpromazine (Thorazine) *	promazine (Sparine)
citalopram (Celexa) *	quetiapine (Seroquel)
clomipramine (Anafranil) *	sertraline (Zoloft) *
clozapine (Clozaril) *	thioridazine (Mellaril)
desvenlafaxine (Pristiq)	tiagabine (Gabitril)
diazepam (Valium)	trazodone (Oleptro)
escitalopram (Lexapro) *	triazolam (Halcion)
fluoxetine (Prozac) *	venlafaxine (Effexor) *
haloperidol (Haldol)	vilazodone (Viibryd)
iloperidone (Fanapt)	ziprasidone (Geodon)
lurasidone (Latuda)	zolpidem (Ambien)
	zonisamide (Zonegran)

Oncological

docetaxel (Taxotere)
 tamoxifen (Nolvades) *
 vincristine (Vincasar, Oncovin)

Anti-Infective

clarithromycin (Biaxin)	nelnavir (Viracept)
efavirenz (Sustiva)	ritonavir (Norvir)
erythromycin (E-Mycin)	saquinavir (Invirase)
indinavir (Crixivan)	telithromycin (Ketek)

Hormonal / Endocrine

estradiol
hydrocortisone
progesterone
testosterone

Gastrointestinal

esomeprazole (Nexium)	pantoprazole (Protonix) *
lansoprazole (Prevacid)	rabeprazole (Aciphex)
omeprazole (Prilosec) *	

Antidiabetic

glipizide (Glucotrol) *
glyburide (Diabeta)

Immunosuppressant

cyclosporine (Gengraf)	tacrolimus (Prograf)
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Impotence

sildenafil (Viagra)

Immunomodulation

cyclophosphamide (Cytosan) *
ifosfamide
zafirlukast (Accolate) *

++ Pro-drug; may not be effective in Poor Metabolizers due to inability to metabolize and produce active metabolite

* The enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance)



Detailed Explanation of Findings

Gene	Phenotype (Gene expression)	What it means
CYP2C9	Normal Metabolizer	This genotype predicts normal metabolic activity for the enzyme controlled by this gene.

COMMON MEDICINES METABOLIZED BY CYP2C9

Cardiovascular

carvedilol (Coreg) *	glyburide (Diabeta)
clopidogrel (Plavix) *	losartan (Cozaar)
fluvastatin (Lescol)	rosuvastatin (Crestor)
glimepiride (Amaryl)	tolbutamide (Orinase)
glipizide (Glucotrol)	warfarin (Coumadin)

Steroids

progesterone

Anti-Infectives

efavirenz (Sustiva) *

Pain

carisoprodol celecoxib (Celebrex) ibuprofen (Advil, Motrin)	methadone * naproxen (Aleve) tapentadol (Nucynta)
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Oncology

tamoxifen (Nolvadex) *

Neuropsychiatric

fluoxetine (Prozac) *	phenobarbital
phenytoin (Dilantin)	

Other

sildenafil (Viagra) *

Immunomodulation

zarlukast (Accolate)

++ Pro-drug; may not be effective in Poor Metabolizers due to inability to metabolize and produce active metabolite

* The enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance)



Detailed Explanation of Findings

Gene	Phenotype (Gene expression)	What it means
CYP1A2	Ultra Rapid Metabolizer	Extremely rapid metabolism expected for the enzyme controlled by this gene, especially in smokers. It may be difficult to achieve effective drug concentrations.

COMMON MEDICINES METABOLIZED BY CYP1A2

Neuropsychiatric

amphetamine (Adderall) *	paroxetine (Paxil) *
asenapine (Saphris)	perphenazine (Trilafon) *
clomipramine (Anafranil) *	promazine (Sparine)
clozapine (Clozaril)	tacrine (Cognex)
duloxetine (Cymbalta)	tiagabine (Gabitril) *
mirtazapine (Remeron)	thioridazine (Mellaril)
olanzapine (Zyprexa)	ziprasidone (Geodon) *

Miscellaneous

caffeine
carvedilol (Coreg) *
clopidogrel (Plavix) *
estradiol
propranolol (Inderal)
ritonavir (Norvir) *
theophylline

Pain and Local Anesthetics

cyclobenzaprine (Flexeril)	lidocaine (xylocaine, various brands)
naproxen (Aleve)	ropivacaine (Naropin)
tizanidine (Zanaflex)	
zolmitriptan (Zomig)	

++ Pro-drug; may not be effective in Poor Metabolizers due to inability to metabolize and produce active metabolite

* The enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance)



Detailed Explanation of Findings

Gene	Phenotype (Gene expression)	What it means
CYP2B6	Poor Metabolizer	The patient is a poor metabolizer (PM). Reduced or no metabolic enzyme activity is anticipated. There is a high potential risk for adverse drug reaction. Please consult drug labeling for further dosing guidance.

COMMON MEDICINES METABOLIZED BY CYP2B6

Miscellaneous

bupropion	ibuprofen (Advil, Motrin) *	sertraline (Zoloft)
clopidogrel (Plavix) *	ifosfamide meperidine	tramadol (Ultram) *
cyclophosphamide (Cytoxan)++	methadone (Demerol)	
efavirenz (Sustiva)		

++ Pro-drug; may not be effective in Poor Metabolizers due to inability to metabolize and produce active metabolite

* The enzyme encoded by this gene is a minor metabolic pathway for this drug (of minor clinical importance)

Method Summary:**Loci / Mutations Tested:**

APOE:	E1,E2,E3,E4
COMT:	A,G
CYP1A2:	*1A,*1C,*1D,*1E,*1F,*1J,*1K,*1L,*1V,*1W
CYP2B6:	*1,*16,*18,*22,*4,*5,*6,*7
CYP2C19:	*1,*10,*17,*2,*3,*4,*5,*6,*7,*8,*9
CYP2C9:	*1,*11,*2,*27,*3,*4,*5,*6
CYP2D6:	*1,*10,*10xN,*12,*14,*17,*17xN,*1xN,*2,*29,*29xN,*2xN,*3,*32,*3xN,*4,*41,*41xN,*49,*4xN,*5,*6,*7,*8,*9,*9xN
CYP3A4:	*1,*12,*17,*1A,*2,*22,*3
CYP3A5:	*1,*3A,*6,*7,*8,*9
Factor II:	A,G
Factor V Leiden:	A,C,G,T
GLP1R (rs10305420):	C,T
GLP1R (rs6923761):	A,G
MTHFR:	AA-1298,AC-1298,CC-1298,CC-677,CT-677,TT-677
SLCO1B1:	*1,*1A,*5
UGT2B15 (rs1902023):	*1,*2,A,C
VKORC1:	A,C,G,T

Patient Information Card

This is summary genetic report for your patient to share with orther healthcare providers. Card can be cut out along dashed line, and carried with the patient.



Personalized Genomics

Patient: testorder,TMIT241219001
DOB: 01/01/2023
Requisition ID: P243540001

Pharmacogenetic Test Summary

COMT	G/G	Normal Activity
CYP2C9	*1/*1	Normal Metabolizer
CYP3A4	*1/*1A	Normal Metabolizer
Factor II	G/G	Normal Risk
Factor V Leiden	C/C	Normal Risk
GLP1R (rs10305420)	C/T	Decreased Response
MTHFR	CC-677/AA-1298	Normal Function
SLCO1B1	*1A/*1A	Normal Function
UGT2B15 (rs1902023)	*1/*1	Normal Metabolizer

APOE	E2/E2	Significant Risk
CYP1A2	*1F/*1F	Ultra Rapid Metabolizer
CYP2B6	*6/*6	Poor Metabolizer
CYP2C19	*17/*17	Ultra Rapid Metabolizer
CYP2D6	*2/*5	Intermediate Metabolizer
CYP3A5	*1/*1	Normal Metabolizer
GLP1R (rs6923761)	A/G	Normal / Increased Response
VKORC1	C/T	Normal Sensitivity

↑ Fold

Final Report Reviewed and Released By:

Principle Diagnostics, LLC
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Bethlehem 18020 PA
Phone: 4843536661
CLIA #: 39D2087560
Note:

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

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

Disclaimer: The information presented on this report is provided as general educational health information. The content is not intended to be a substitute for professional medical advice, diagnosis, or treatment. Only a physician, pharmacist or other healthcare professional should advise a patient on the use of the medications prescribed. The pharmacogenetic assay involves use of reporting software and genotype-phenotype associations performed by SmartPGX (www.smartpgx.com). The software has not been evaluated by the Food and Drug Administration. The software, and the report generated by the software, is not intended to diagnose, treat, cure, or prevent any disease. A qualified designee within the lab uses Translational Software to generate and subsequently review the report. The pharmacogenetic report is one of multiple pieces of information that clinicians should consider in guiding their therapeutic choice for each patient. It remains the responsibility of the health-care provider to determine the best course of treatment for a patient. Adherence to dose guidelines does not necessarily assure a successful medical outcome.

The information presented in this report is based on The Pharmacogenetics Implementation Consortium (CPIC) and includes a standard system for grading levels of evidence linking genotypes to phenotypes. These guidelines are designed to help clinicians understand how available genetic test results should be used to optimize drug therapy. CPIC assigns level A and B to gene-drug pairs which have sufficient evidence for at least one prescribing action to be recommended (actionable). CPIC level C and D gene-drug pairs are not considered to have adequate evidence or actionability to have prescribing recommendations (informative).