SelfDecode™

PGx

Pharmacogenomics Report

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Personal information

NAME

Joseph Cohen

SEX AT BIRTH

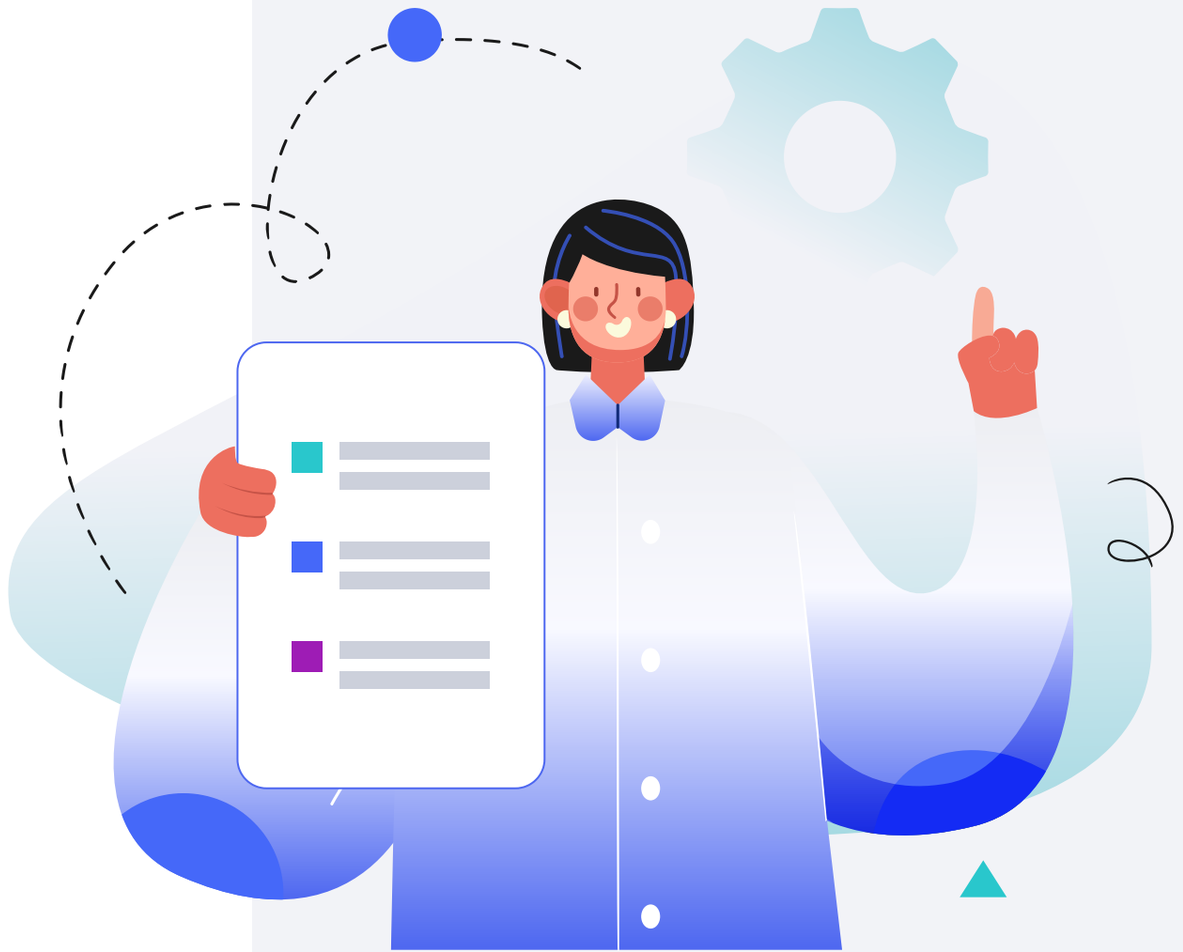
Male

HEIGHT

5ft 8" 172.7cm

WEIGHT

148lb 67kg



How this works

What is a PGx report

Our **Pharmacogenomic (PGx) Report** provides information about how your genetic makeup affects your body's response to medication. Genetic variants can speed or slow down the processing of certain drugs in the body, making them more or less effective. They can also make you more or less prone to side effects associated with the use of certain drugs.

This report provides information about 50+ drugs, based on the guidelines developed by specialized organizations such as the **Clinical Pharmacogenetics Implementation Consortium (CPIC)**, US Food and Drug Administration (FDA), Pharmacogenomics Knowledge Base (PharmGKB), and the Dutch Pharmacogenetics Working Group (DPWG).

The information in this report is provided for:
- **a specific variant** you carry
- **your metabolizer type**, which is based on a set of multiple variants that are found in a certain gene. You carry a combination of two alleles, denoted by a star (e.g. *1*2) which are mapped to a specific metabolizer type as defined by CPIC and PharmGKB

Evidence levels

Information provided in this report carries the following evidence levels:

⭐⭐⭐ This is a variant-drug combination that is listed in a current clinical guideline or FDA-approved drug label annotation with at least one additional independent publication. Alternatively, there is a high level of evidence supporting this association with at least two independent publications.

⭐⭐ This is a variant-drug combination with a moderate level of evidence and at least two independent publications. For example, this association may be found in multiple studies, but a minority of the studies don't support the major conclusion.

⭐ This is a variant-drug combination with a low level of evidence. This association may be based on a single study or there may be several studies that didn't replicate the association. Or it may be based on preliminary evidence (e.g., a case report, non-significant study, or in vitro, molecular, or functional assay evidence). Alternatively, this is an association involving a rare combination of alleles that is difficult to study, that has been extrapolated based on information available for more common and well studied allele combinations.

Prescribing guidance

Based on the available information and recommendations, drugs are classified into two categories:

Standard precautions: You may respond well to this drug, with a low risk of side effects. The standard recommended dosage is advised for this drug.

Use with caution: You may be at an increased risk of adverse events and may need monitoring for efficacy or side effects. Standard dosage may not be adequate for certain drugs, and, in some cases, an alternative drug may be recommended.

All recommendations are obtained from CPIC, FDA, or DPWG guidelines.

Warnings and limitations

Both genetics and non-genetic factors affect drug metabolism. Other factors that influence your response to drugs include:
- age
- body weight
- existing medical conditions (e.g. liver or kidney disease)
- other drugs or supplements you may be taking
- other genetic variants we are not able to account for in this report

Do not use this report to start, stop, or change any medical treatment!

Medications should always be taken as directed by your healthcare provider. Making changes of your own accord can harm your body and/or interfere with the benefits of the medication.

This report intends to provide information you can use to discuss how your genetics impact your response to medication with your doctor. If you have any concerns, discuss them with your healthcare provider. While unlikely, this report may provide false positive or false negative results. **Confirm any results with an independent specialized genetic test prescribed by a healthcare professional before making any medical decisions.**

Pharmacogenetic tests from other companies may include different genetic variants and may therefore provide slightly different results.

Disclaimer

This PGx report does not provide medical advice and does not replace discussions with your doctor about your treatment and your medications. This report does not account for lifestyle or other health factors that may affect how your body processes medications, and does not look at all possible genetic variants that may affect the metabolism of a certain drug. This report does not diagnose any health condition or disease and does not inform about your risk of developing any health conditions or diseases.

Pharmacogenomic guidance overview

Category	Drug Class	Standard Precautions	Use With Caution
Anesthesiology	Anesthetic	Volatile Anesthetics (Desflurane, Enflurane, Halothane, Isoflurane, Methoxyflurane, Sevoflurane)	
	Skeletal Muscle Relaxant	Succinylcholine	
Cardiovascular	Antiplatelets & Anticoagulants	Acenocoumarol Clopidogrel	Phenprocoumon Warfarin
	Statins		Atorvastatin Fluvastatin Lovastatin Pitavastatin Pravastatin Rosuvastatin Simvastatin
Gastrointestinal	Proton Pump Inhibitors	Rabeprazole	Dexlansoprazole Lansoprazole Omeprazole Pantoprazole
Immunology, Rheumatology & Oncology	Antihyperuricemic & Antigout Agents	Allopurinol	
	Antimetabolites	Capecitabine Fluorouracil Mercaptopurine Tegafur	
	Immunosuppressants	Azathioprine Siponimod Tacrolimus	Methotrexate
Infections	Antifungals	Voriconazole	
	Antivirals	Nevirapine	Efavirenz Triple therapy (peginterferon alfa-2a/b & ribavirin)

Category	Drug Class	Standard Precautions	Use With Caution
Pain	NSAIDs	Celecoxib Flurbiprofen Ibuprofen Lornoxicam Meloxicam Piroxicam Tenoxicam	
	Opioids	Methadone	
Psychotropic	Antidepressants	Amitriptyline Bupropion Citalopram Clomipramine Doxepin Escitalopram Imipramine Trimipramine	Sertraline
	Antiepileptic	Phenytoin	
	Antipsychotics	Quetiapine	

Detailed prescribing guidance

Atorvastatin

Cardiovascular / Statins

GENE	GENOTYPE	PHENOTYPE
SLCO1B1	***1*15**	Intermediate Metabolizer

The SLCO1B1*1 allele is assigned as a normal function allele by CPIC. The SLCO1B1*15 allele is assigned as a no function allele by CPIC. Patients with the *1*15 genotype (intermediate metabolizers) **may have increased atorvastatin concentrations** as compared to patients with two normal function alleles. ★★★

Patients with the *1*15 genotype **may have a higher risk of atorvastatin-related myopathy when treated with atorvastatin** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ★★★

CPIC recommends prescribing ≤40 mg as a starting dose and adjusting doses of atorvastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy especially for 40mg dose. If dose >40 mg needed for desired efficacy, consider combination therapy (i.e., atorvastatin plus non-statin guideline directed medical therapy).

Other genetic and clinical factors may also affect atorvastatin pharmacokinetics and toxicity.

Dexlansoprazole

Gastrointestinal / Proton Pump Inhibitors

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of dexlansoprazole** compared to patients with a decreased or no function allele. ★★★

CPIC recommends initiating therapy with the standard starting daily dose and considering increasing dose by 50-100% for the treatment of H. pylori infection and erosive esophagitis. The daily dose may be given in divided doses. Monitor for efficacy.

Other genetic and clinical factors may also influence dexlansoprazole metabolism.

Efavirenz

Infections / Antivirals

GENE	GENOTYPE	PHENOTYPE
CYP2B6	***1*6**	Likely Intermediate Metabolizer

The CYP2B6*1 allele is assigned as a normal function allele by CPIC. The CYP2B6*6 allele is assigned as a decreased function allele by CPIC. Patients with the *1*6 genotype (likely intermediate metabolizers) **may have decreased metabolism of efavirenz** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the *1*6 genotype **may require a decreased dose of efavirenz** compared to patients with two normal function alleles. ⭐⭐⭐

Patients with the *1*6 genotype **may have an increased risk of adverse events (eg. liver toxicity or CNS side effects) when treated with efavirenz** compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating efavirenz therapy with a decreased dose of 400 mg/day.

Other genetic and clinical factors may also influence efavirenz metabolism, dose requirements and toxicity.

Fluvastatin

Cardiovascular / Statins

GENE	GENOTYPE	PHENOTYPE
CYP2C9	***1*1**	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of fluvastatin** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

Patients carrying the CYP2C9*1*1 genotype **may have a decreased likelihood of adverse events when treated with fluvastatin** as compared to patients carrying at least one copy of a decreased function or no function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends prescribing the desired starting dose and adjusting doses of fluvastatin based on disease-specific guidelines.

Other genetic and clinical factors may also influence fluvastatin metabolism and toxicity.

GENE	GENOTYPE	PHENOTYPE
SLCO1B1	***1*15**	Intermediate Metabolizer

The SLCO1B1*1 allele is assigned as a normal function allele by CPIC. The SLCO1B1*15 allele is assigned as a no function allele by CPIC. Patients with the *1*15 genotype (intermediate metabolizers) **may have increased fluvastatin concentrations when treated with fluvastatin** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the *1*15 genotype **may have a higher risk of fluvastatin-related myopathy when treated with fluvastatin** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends prescribing the desired starting dose and adjusting doses of fluvastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy especially for doses > 40mg per day.

Other genetic and clinical factors may also influence the metabolism and the toxicity of fluvastatin.

Lansoprazole

Gastrointestinal / Proton Pump Inhibitors

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of lansoprazole** compared to patients with at least one decreased or no function allele but **decreased metabolism of lansoprazole** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the *1*1 genotype **may have a reduced response to lansoprazole (greater % of time with intragastric pH < 4.0, a lower intragastric pH during a 24-hour time period, poorer healing or cure rate of gastroesophageal reflux disease, decreased likelihood of *H. pylori* eradication, among other parameters)** compared to patients with at least one decreased or no function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with the standard starting daily dose. Consider increasing the dose by 50-100% for the treatment of H. pylori infection and erosive esophagitis. The daily dose may be given in divided doses. Monitor for efficacy.

Other genetic and clinical factors may also influence lansoprazole metabolism and clinical response.

Lovastatin

Cardiovascular / Statins

GENE	GENOTYPE	PHENOTYPE
SLCO1B1	***1*15**	Intermediate Metabolizer

The SLCO1B1*1 allele is assigned as a normal function allele by CPIC. The SLCO1B1*15 allele is assigned as a no function allele by CPIC. Patients with the *1*15 genotype (intermediate metabolizers) **may have increased lovastatin concentrations** as compared to patients with two normal function alleles. ⭐⭐⭐

Patients with the *1*15 genotype **may have a higher risk of lovastatin-related myopathy when treated with lovastatin** as compared to patients with two normal function alleles. ⭐⭐⭐

CPIC recommends prescribing an alternative statin depending on the desired potency. If lovastatin therapy is warranted, CPIC recommends limiting the dose to ≤20 mg/day.

Other genetic and clinical factors may also influence a patient's lovastatin pharmacokinetics and toxicity.

Methotrexate

Immunology, Rheumatology & Oncology / Immunosuppressants

GENE	GENOTYPE	PHENOTYPE
MTHFR	rs1801133 **AA**	

Patients with the rs1801133 AA genotype and arthritis or cancer who are treated with methotrexate **may be at increased risk of toxicity** as compared to patients with the AG or GG genotype. However, conflicting evidence has been reported. ⭐⭐

Other genetic and clinical factors may also influence methotrexate toxicity.

Omeprazole

Gastrointestinal / Proton Pump Inhibitors

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of omeprazole** compared to patients with a decreased or no function allele but **decreased metabolism of omeprazole** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the *1*1 genotype **may have a reduced response to omeprazole (greater % of time with intragastric pH < 4.0, a lower intragastric pH during a 24-hour time period, decreased likelihood of *H. pylori* eradication, among other parameters)** compared to patients with at least one no or decreased function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with the standard starting daily dose. Considering increasing the dose by 50-100% for the treatment of H. pylori infection and erosive esophagitis. The daily dose may be given in divided doses. Monitor for efficacy.

Other genetic and clinical factors may also influence omeprazole metabolism and response.

Pantoprazole

Gastrointestinal / Proton Pump Inhibitors

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of pantoprazole** compared to patients with at least one decreased or no function allele but **decreased metabolism of pantoprazole** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. ⭐⭐⭐

Patients with the *1*1 genotype **may have a reduced response to pantoprazole (greater % of time with intragastric pH < 4.0, a lower intragastric pH during a 24-hour time period, decreased likelihood of *H. pylori* eradication, among other parameters)** compared to patients with at least one no or decreased function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with the standard starting daily dose. Consider increasing dose by 50-100% for the treatment of H. pylori infection and erosive esophagitis. The daily dose may be given in divided doses. Monitor for efficacy.

Other genetic and clinical factors may also influence pantoprazole metabolism and response.

Phenprocoumon

Cardiovascular / Antiplatelets & Anticoagulants

GENE	GENOTYPE	PHENOTYPE
VKORC1	rs9923231 **TC** rs9934438 **AG**	

Patients with the rs9923231 CT genotype **may require a lower dose of phenprocoumon** as compared to patients with the CC genotype. ⭐⭐⭐

Patients with the rs9923231 CT genotype **may have an increased risk of adverse events (bleeding, over-anticoagulation or increased time above therapeutic range) when treated with phenprocoumon** as compared to patients with the CC genotype. ⭐⭐

Patients with the rs9934438 AG genotype **may require a decreased dose of phenprocoumon as compared to patients with the GG genotype, but an increased dose as compared to patients with the AA genotype**. ⭐⭐

Other clinical and genetic factors may also influence dose requirements and the risk of adverse events due to phenprocoumon.

Pitavastatin

Cardiovascular / Statins

GENE	GENOTYPE	PHENOTYPE
SLCO1B1	***1*15**	Intermediate Metabolizer

The SLCO1B1*1 allele is assigned as a normal function allele by CPIC. The SLCO1B1*15 allele is assigned as a no function allele by CPIC. Patients with the *1*15 genotype (intermediate metabolizers) **may have increased exposure to pitavastatin** as compared to patients with two normal function alleles. ⭐⭐⭐

CPIC recommends prescribing ≤2 mg as a starting dose and adjusting doses of pitavastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy especially for doses >1 mg. If dose >2 mg is needed for desired efficacy, consider an alternative statin or combination therapy (i.e. pitavastatin plus non-statin guideline directed medical therapy).

Other genetic or clinical factors may also affect a patient's exposure to pitavastatin.

Pravastatin

Cardiovascular / Statins

GENE	GENOTYPE	PHENOTYPE
SLCO1B1	***1*15**	Intermediate Metabolizer

The SLCO1B1*1 allele is assigned as a normal function allele by CPIC. The SLCO1B1*15 allele is assigned as a no function allele by CPIC. Patients with the *1*15 genotype (intermediate metabolizers) **may have increased bioavailability of pravastatin** as compared to patients with two normal function alleles. ⭐⭐⭐

Patients with the *1*15 genotype **may have a higher risk of pravastatin-related myopathy when treated with pravastatin** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends prescribing the desired starting dose and adjusting doses of pravastatin based on disease-specific guidelines. Prescriber should be aware of possible increased risk for myopathy with pravastatin especially with doses >40 mg per day.

Other genetic and clinical factors may also influence the pharmacokinetics and the toxicity of pravastatin.

Rosuvastatin

Cardiovascular / Statins

GENE	GENOTYPE	PHENOTYPE
SLCO1B1	***1*15**	Intermediate Metabolizer

The SLCO1B1*1 allele is assigned as a normal function allele by CPIC. The SLCO1B1*15 allele is assigned as a no function allele by CPIC. Patients with the *1*15 genotype (intermediate metabolizers) **may have increased exposure to rosuvastatin** as compared to patients with two normal function alleles. ⭐⭐⭐

Patients with the *1*15 genotype **may have a higher risk of rosuvastatin-related myopathy or myalgia when treated with rosuvastatin** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends prescribing the desired starting dose and adjusting doses of rosuvastatin based on disease-specific and specific population guidelines. Prescriber should be aware of possible increased risk for myopathy especially for doses >20 mg.

Other genetic and clinical factors may also influence rosuvastatin pharmacokinetics.

GENE	GENOTYPE	PHENOTYPE
ABCG2	rs2231142 **GG**	

Patients with the rs2231142 GG genotype **may have decreased plasma concentrations of rosuvastatin when treated with rosuvastatin** as compared to patients with the TT or GT genotype. ⭐⭐⭐

Patients with the rs2231142 GG genotype and who are treated with **rosuvastatin may have a reduced response to treatment** as determined by a lower reduction in LDL-C as compared to patients with the GT or TT genotypes. ⭐⭐

Patients with the rs2231142 GG genotype **may have a lower risk of statin-related myopathy when treated with rosuvastatin** as compared to patients with the TT or GT genotype. However, conflicting evidence has been reported. ⭐⭐⭐

Other genetic and clinical factors may also influence the metabolism, efficacy, and toxicity of rosuvastatin.

Sertraline

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2B6	***1*6**	Likely Intermediate Metabolizer

The CYP2B6*1 allele is assigned as a normal function allele by CPIC. The CYP2B6*6 allele is assigned as a decreased function allele by CPIC. Patients with the *1*6 genotype (likely intermediate metabolizers) **may have increased concentrations of sertraline** as compared to patients with two normal function alleles. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose. CPIC also recommends considering a slower titration schedule and lower maintenance dose than CYP2B6 normal metabolizers.

Other genetic and clinical factors may also influence metabolism of sertraline.

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of sertraline** compared to patients with at least one decreased or no function allele but **decreased metabolism of sertraline** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence sertraline metabolism.

Simvastatin

Cardiovascular / Statins

GENE	GENOTYPE	PHENOTYPE
SLCO1B1	***1*15**	Intermediate Metabolizer

The SLCO1B1*1 allele is assigned as a normal function allele by CPIC. The SLCO1B1*15 allele is assigned as a no function allele by CPIC. Patients with the *1*15 genotype (intermediate metabolizers) **may have increased simvastatin acid concentration when treated with simvastatin** as compared to patients with two normal function alleles. ⭐⭐⭐

Patients with the *1*15 genotype **may have a higher risk of simvastatin-related myopathy when treated with simvastatin** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends prescribing an alternative statin depending on the desired potency. If simvastatin therapy is warranted, CPIC recommends limiting the dose to <20 mg/day.

Other genetic and clinical factors may also influence the metabolism and toxicity of simvastatin.

Triple therapy (peginterferon alfa-2a/b & ribavirin)

Infections / Antivirals

GENE	GENOTYPE	PHENOTYPE
IFNL3	rs11881222 **GA** rs12979860 **TC** rs8099917 **GT**	

Patients with the rs11881222 AG genotype and hepatitis C or HIV **may have a poorer response (SVR) to treatment with peginterferon alpha-2a/2b in combination with ribavirin** as compared to patients with the AA genotype. ⭐⭐

Patients with the s12979860 CT genotype and hepatitis C infection **may have an intermediate response (SVR) when administered peg interferon alpha-2a/2b in combination with ribavirin**, decreased compared to patients with the CC genotype but increased compared to patients with the TT genotype. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the rs12979860 CT genotype and hepatitis C infection **may have lower response rates (SVR) to triple therapy (telaprevir or boceprevir, peginterferon alfa-2a/b and ribavirin)** as compared to patients with the CC genotype. However, conflicting evidence has been reported. ⭐⭐⭐

According to CPIC, rs12979860 is the strongest baseline predictor of response to peginterferon and ribavirin therapy in patients with hepatitis C. Patients with this genotype have approximately a 30% chance for SVR after 48 weeks of treatment. If the regimen is combined with protease inhibitors, there is approximately 60% chance for SVR after 24-48 weeks of treatment and approximately 50% of patients are eligible for shortened therapy (24-48 weeks).

Patients with the rs8099917 GT genotype and chronic hepatitis C infection **may have a decreased response (SVR) to peginterferon alfa-2a/2b in combination with ribavirin** as compared to patients with the TT genotype. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the rs8099917 GT genotype and hepatitis C infection **may have lower response rates (SVR) to triple therapy (telaprevir, peginterferon alfa-2a/b, and ribavirin)** as compared to patients with the TT genotype. ⭐⭐

Other genetic and clinical factors may also influence response to triple therapy. Importantly, the impact of the genotype may be dampened in patients with prior treatment failure.

Warfarin

Cardiovascular / Antiplatelets & Anticoagulants

GENE	GENOTYPE	PHENOTYPE
CYP2C9	***1*1**	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may require a higher dose of warfarin** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

Patients carrying the CYP2C9*1*1 genotype **may require less time to achieve a stable dose when treated with warfarin** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐

Patients carrying the CYP2C9*1*1 genotype **may have a decreased risk of over-anticoagulation and bleeding when treated with warfarin** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

Other genetic and clinical factors may also influence the required dose, efficacy, and toxicity of warfarin.

GENE	GENOTYPE	PHENOTYPE
CYP4F2	rs2108622 **CC**	

Patients with the rs2108622 CC genotype **may have decreased warfarin dosage requirements** as compared to patients with the CT or TT genotype. However, conflicting evidence has been reported. ⭐⭐⭐

Other genetic and clinical factors may also affect warfarin dosage requirements.

GENE	GENOTYPE	PHENOTYPE
VKORC1	rs2359612 **AG** rs2884737 **CA** rs61742245 **CC** rs7294 **CT** rs8050894 **GC** rs9923231 **TC** rs9934438 **AG**	

Patients with the rs2359612 AG genotype **may require a decreased dose of warfarin** as compared to patients with the GG genotype. ⭐⭐⭐

Patients with the rs2884737 AC genotype **may require a higher dose of warfarin** as compared to patients with the CC genotype. ⭐⭐

Patients with the rs61742245 CC genotype **may require a decreased dose of warfarin** as compared to patients with the AA or AC genotype. However, conflicting evidence has been reported. ⭐⭐

Patients with the rs7294 CT genotype **may require a higher dose of warfarin** as compared to patients with the CC genotype. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the rs8050894 CG genotype **may require a lower dose of warfarin** as compared to patients with the CC genotype. ⭐⭐⭐

Patients with the rs9923231 CT genotype **may require a decreased dose of warfarin** as compared to patients with the CC genotype or an increased dose as compared to patients with the TT genotype. They **may have an increased risk of over-anticoagulation when treated with warfarin** as compared with patients with the CC genotype. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the rs9923231 CT genotype **may have an increased risk of bleeding when treated with warfarin** as compared to patients with the CC genotype. However, conflicting evidence has been reported. ⭐⭐

Patients with the rs9923231 CT genotype **may require shorter time to therapeutic INR when treated with warfarin** and **may spend less time in the INR therapeutic range (TTR) when treated with warfarin** as compared with patients with the CC genotype. However, conflicting evidence has been reported. ⭐⭐

Patients with the rs9934438 AG genotype **may require a lower dose of warfarin as compared to patients with the GG genotype, and a higher dose as compared to patients with the AA genotype**. However, conflicting evidence has been reported. ⭐⭐⭐

Other genetic and clinical factors may also influence warfarin dose requirement and response to warfarin.

Acenocoumarol

Cardiovascular / Antiplatelets & Anticoagulants

GENE	GENOTYPE	PHENOTYPE
CYP2C9	*1*1	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may require a higher dose of acenocoumarol** as compared to patients carrying at least one copy of a decreased function or no function allele. However, conflicting evidence has been reported. ⭐⭐⭐

Patients carrying the CYP2C9*1*1 genotype **may have a decreased risk of over-anticoagulation when treated with acenocoumarol** as compared to patients carrying at least one copy of a decreased function or no function allele. However, conflicting evidence has been reported. ⭐⭐⭐

Patients carrying the CYP2C9*1*1 genotype **may have a decreased risk of bleeding when treated with acenocoumarol** as compared to patients carrying at least one copy of a decreased function or no function allele. However, conflicting evidence has been reported. ⭐⭐

Other genetic and clinical factors may also influence the required dose, toxicity, and risk of bleeding during acenocoumarol treatment.

GENE	GENOTYPE	PHENOTYPE
CYP4F2	rs2108622 **CC**	

Patients with the rs2108622 CC genotype who are treated with **acenocoumarol may require a lower dose** as compared to patients with the CT or TT genotype. However, conflicting evidence has been reported. ⭐⭐

Other genetic and clinical factors may also influence acenocoumarol dosage.

GENE	GENOTYPE	PHENOTYPE
VKORC1	rs9923231 **TC** rs9934438 **AG**	

Patients with the rs9923231 CT genotype **may require a decreased dose of acenocoumarol** as compared to patients with the CC genotype. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the rs9934438 AG genotype **may require a decreased dose of acenocoumarol** as compared to patients with the GG genotype. ⭐⭐

Other genetic and clinical factors may also influence acenocoumarol dose requirements.

Allopurinol

Immunology, Rheumatology & Oncology / Antihyperuricemic & Antigout Agents

GENE	GENOTYPE	PHENOTYPE
ABCG2	rs2231142 **GG**	

Patients with the rs2231142 GG genotype **may require a decreased dose of allopurinol** as compared to patients with the GT or TT genotypes. ⭐⭐⭐

Patients with the rs2231142 GG genotype and gout **may have increased response when treated with allopurinol** as compared to patients with the GT or TT genotype. ⭐⭐⭐

Other genetic and clinical factors may also influence allopurinol dose requirements and response.

Amitriptyline

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of amitriptyline** compared to patients who carry a decreased or no function allele and **decreased metabolism of amitriptyline** compared to patients who carry a normal function allele in combination with an increased function allele or two increased function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence amitriptyline metabolism.

Azathioprine

Immunology, Rheumatology & Oncology / Immunosuppressants

GENE	GENOTYPE	PHENOTYPE
NUDT15	***1*1**	Normal Metabolizer

The NUDT15*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (rs116855232 CC) and inflammatory bowel diseases who are treated with azathioprine **may have a reduced, but not absent risk of myelosuppression** as compared to patients who carry no function alleles. ⭐⭐⭐

CPIC recommends starting with a normal starting dose (e.g., 2-3 mg/kg/day) and adjusting doses of azathioprine based on disease-specific guidelines. Allow 2 weeks to reach steady state after each dose adjustment.

Other genetic and clinical factors may also influence risk of azathioprine related side effects.

GENE	GENOTYPE	PHENOTYPE
TPMT	***1*1**	Normal Metabolizer

The TPMT*1 allele is assigned as a normal allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have a decreased likelihood of dose reduction when treated with azathioprine** as compared to patients who carry one or two no function alleles. ⭐⭐⭐

Patients with the *1*1 genotype **may have a decreased likelihood of experiencing toxicity when treated with azathioprine** as compared to patients carrying no function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

For normal TPMT metabolizers, CPIC recommends starting with a normal starting dose of azathioprine (e.g., 2-3 mg/kg/day) and then adjusting doses based on disease-specific guidelines. Allow 2 weeks to reach steady state after each dose adjustment.

Other genetic and clinical factors may also influence azathioprine dosage and toxicity.

Bupropion

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2B6	***1*6**	Likely Intermediate Metabolizer

The CYP2B6*1 allele is assigned as a normal function allele by CPIC. The CYP2B6*6 allele is assigned as a decreased function allele by CPIC. Patients with the *1*6 genotype (likely intermediate metabolizers) **may have decreased metabolism of bupropion** compared to patients who carry a combination of normal and/or increased function alleles. ⭐⭐

Other genetic and clinical factors may also affect bupropion metabolism.

Capecitabine

Immunology, Rheumatology & Oncology / Antimetabolites

GENE	GENOTYPE	PHENOTYPE
DPYD	rs3918290 **CC** rs55886062 **AA** rs56038477 **CC** rs67376798 **TT** rs75017182 **GG**	

No DPYD variants were detected. Patients with this genotype and cancer who are treated with capecitabine **may have decreased, but not absent, risk of drug toxicity** as compared to patients who carry a genetic variant. However, conflicting evidence has been reported. ⭐⭐⭐

Other genetic and clinical factors may also influence risk of capecitabine toxicity.

Celecoxib

Pain / NSAIDs

GENE	GENOTYPE	PHENOTYPE
CYP2C9	***1*1**	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of celecoxib** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

CPIC recommends initiating therapy with a recommended starting dose. In accordance with the prescribing information, use the lowest effective dosage for the shortest duration consistent with individual patient treatment goals.

Other genetic and clinical factors may also influence celecoxib metabolism.

Citalopram

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of citalopram** compared to patients with a no or decreased function allele and **decreased metabolism of citalopram** compared to patients who carry a normal function allele in combination with an increased function allele or two increased function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the *1*1 genotype who are treated with citalopram **may have a decreased, but not absent, risk of treatment-related side effects or intolerance** compared with patients with a no or decreased function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence citalopram metabolism and adverse effects.

Clomipramine

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of clomipramine** compared to patients with a decreased or no function allele and **decreased metabolism of clomipramine** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence clomipramine metabolism.

Clopidogrel

Cardiovascular / Antiplatelets & Anticoagulants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of clopidogrel** compared to patients with a decreased or no function allele and **decreased metabolism of clopidogrel** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. ⭐⭐⭐

Patients with the *1*1 genotype who are treated with clopidogrel **may have increased platelet inhibition and decreased residual platelet aggregation** compared to patients with a decreased or no function allele but **decreased platelet inhibition and increased residual platelet aggregation** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the *1*1 genotype who are treated with clopidogrel **may have a decreased, but not absent, risk for adverse cardiac and cerebrovascular events** compared to patients with a decreased or no function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends using clopidogrel at standard dose (75 mg/day).

Other genetic and clinical factors may also influence clopidogrel metabolism, efficacy, and adverse effects.

GENE	GENOTYPE	PHENOTYPE
CES1	rs71647871 **CC**	

Patients with the rs71647871 CC genotype who are treated with clopidogrel **may have decreased exposure to clopidogrel** as compared to patients with the CT or TT genotype. ⭐⭐

Patients with the rs71647871 CC genotype who are treated with clopidogrel **may have increased platelet aggregation** as compared to patients with the CT or TT genotypes. ⭐⭐

Other genetic and clinical factors may also influence clopidogrel dose requirement and response to clopidogrel.

Doxepin

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of doxepin** compared to patients with a no or decreased function allele. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence doxepin metabolism.

Escitalopram

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype **may have increased metabolism of escitalopram** compared to patients with a decreased or a no function allele but **decreased metabolism of escitalopram** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence escitalopram metabolism.

Fluorouracil

Immunology, Rheumatology & Oncology / Antimetabolites

GENE	GENOTYPE	PHENOTYPE
DPYD	rs115232898 **TT** rs1801160 **CC** rs1801266 **GG** rs1801268 **CC** rs3918290 **CC** rs55886062 **AA** rs56038477 **CC** rs59086055 **GG** rs67376798 **TT** rs72549306 **CC** rs72549309 **GG** rs75017182 **GG** rs78060119 **CC**	

No DPYD variants that impact drug toxicity have been detected. Patients with this genotype and cancer who are treated with fluorouracil **may have decreased, but not absent, risk of drug toxicity** as compared to patients who carry such a genetic variant. However, conflicting evidence has been reported. ⭐⭐⭐

Other genetic and clinical factors may also influence risk of fluorouracil toxicity.

Flurbiprofen

Pain / NSAIDs

GENE	GENOTYPE	PHENOTYPE
CYP2C9	*1*1	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of flurbiprofen** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

CPIC recommends initiating therapy with a recommended starting dose. In accordance with the prescribing information, use the lowest effective dosage for the shortest duration consistent with individual patient treatment goals.

Other genetic and clinical factors may also influence flurbiprofen metabolism.

Ibuprofen

Pain / NSAIDs

GENE	GENOTYPE	PHENOTYPE
CYP2C9	*1*1	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of ibuprofen** as compared to patients carrying at least one copy of a decreased function or no function allele. However, conflicting evidence has been reported. ⭐⭐⭐

CPIC recommends initiating therapy with a recommended starting dose. In accordance with the prescribing information, use the lowest effective dosage for the shortest duration consistent with individual patient treatment goals.

Other genetic and clinical factors may also influence ibuprofen metabolism.

Imipramine

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	*1*1	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of imipramine** compared to patients with a decreased or a no function allele but **decreased metabolism of imipramine** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence imipramine metabolism.

Lornoxicam

Pain / NSAIDs

GENE	GENOTYPE	PHENOTYPE
CYP2C9	*1*1	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of lornoxicam** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

CPIC recommends initiating therapy with a recommended starting dose. In accordance with the prescribing information, use the lowest effective dosage for the shortest duration consistent with individual patient treatment goals.

Other genetic and clinical factors may also influence lornoxicam metabolism.

Meloxicam

Pain / NSAIDs

GENE	GENOTYPE	PHENOTYPE
CYP2C9	*1*1	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of meloxicam** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

CPIC recommends initiating therapy with a recommended starting dose. In accordance with the prescribing information, use the lowest effective dosage for the shortest duration consistent with individual patient treatment goals.

Other genetic and clinical factors may also influence meloxicam metabolism.

Mercaptopurine

Immunology, Rheumatology & Oncology / Antimetabolites

GENE	GENOTYPE	PHENOTYPE
NUDT15	***1*1**	Normal Metabolizer

The NUDT15*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (rs116855232 CC) **may tolerate increased doses of mercaptopurine** as compared to patients who carry no function alleles. ⭐⭐⭐

Patients with the *1*1 genotype **may be at a decreased risk of developing leukopenia or neutropenia when treated with mercaptopurine** as compared to patients who carry one or two no function alleles. ⭐⭐⭐

CPIC recommends starting with a normal starting dose (e.g., 75 mg/m^2/day or 1.5 mg/kg/day) and adjusting doses of mercaptopurine (and of any other myelosuppressive therapy) without any special emphasis on mercaptopurine compared to other agents. Allow at least 2 weeks to reach steady-state after each dose adjustment.

Other genetic and clinical factors may also influence mercaptopurine dosing and side effects.

GENE	GENOTYPE	PHENOTYPE
TPMT	***1*1**	Normal Metabolizer

The TPMT*1 allele is assigned as a normal allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have a decreased likelihood of dose reduction when treated with mercaptopurine** as compared to patients who carry one or two no function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

Patients with the *1*1 genotype **may have a decreased likelihood of experiencing toxicity when treated with mercaptopurine** as compared to patients carrying no function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

For normal TPMT metabolizers, CPIC recommends starting with a normal starting dose (e.g., 75 mg/m^2/day or 1.5 mg/kg/day) and then adjusting doses of mercaptopurine (and of any other myelosuppressive therapy) without any special emphasis on mercaptopurine compared to other agents. Allow at least 2 weeks to reach steady-state after each dose adjustment.

Other genetic and clinical factors may also influence mercaptopurine dosage and toxicity.

Methadone

Pain / Opioids

GENE	GENOTYPE	PHENOTYPE
CYP2B6	***1*6**	Likely Intermediate Metabolizer

The CYP2B6*1 allele is assigned as a normal function allele by CPIC. The CYP2B6*6 allele is assigned as a decreased function allele by CPIC. Patients with the *1*6 genotype (likely intermediate metabolizers) **may have decreased clearance of methadone** as compared to patients with two normal function alleles. However, conflicting evidence has been reported. ⭐⭐

Other genetic and clinical factors may also affect methadone metabolism.

Nevirapine

Infections / Antivirals

GENE	GENOTYPE	PHENOTYPE
CYP2B6	rs28399499 **TT** rs3745274 **TG**	

Patients with the rs28399499 TT genotype and HIV may have a **decreased risk for Stevens-Johnson Syndrome/toxic epidermal necrolysis (SJS/TEN) when treated with nevirapine** as compared to patients with the CC or CT genotype. ⭐⭐

Patients with the rs3745274 GT genotype and HIV infection may have **decreased clearance of and increased exposure** to nevirapine as compared to patients with the GG genotype. However, conflicting evidence has been reported. ⭐⭐

Other genetic and clinical factors may also influence the metabolism and toxicity of nevirapine.

Phenytoin

Psychotropic / Antiepileptic

GENE	GENOTYPE	PHENOTYPE
CYP2C9	***1*1**	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism/clearance of phenytoin** as compared to patients carrying at least one copy of a decreased function or no function allele. However, conflicting evidence has been reported. ⭐⭐⭐

Patients carrying the CYP2C9*1*1 genotype **may have a decreased, but not absent, risk of drug toxicity when treated with phenytoin** as compared to patients who carry a no function allele or two decreased function alleles. However, conflicting evidence has been reported. ⭐⭐⭐

According to CPIC, no adjustments are needed from typical dosing strategies. Subsequent doses should be adjusted according to therapeutic drug monitoring, response, and side effects.

Other genetic and clinical factors may also influence phenytoin metabolism and toxicity.

Piroxicam

Pain / NSAIDs

GENE	GENOTYPE	PHENOTYPE
CYP2C9	*1*1	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of piroxicam** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose. In accordance with the prescribing information, use the lowest effective dosage for the shortest duration consistent with individual patient treatment goals.

Other genetic and clinical factors may also influence piroxicam metabolism.

Quetiapine

Psychotropic / Antipsychotics

GENE	GENOTYPE	PHENOTYPE
CYP3A4	*1*1	Normal Metabolizer

The CYP3A4*1 allele has been assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have decreased exposure to quetiapine** as compared to patients who carry a decreased or a no function allele. ⭐⭐⭐

Other genetic and clinical factors may also influence quetiapine dose requirements.

Rabeprazole

Gastrointestinal / Proton Pump Inhibitors

GENE	GENOTYPE	PHENOTYPE
CYP2C19	*1*1	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of rabeprazole** compared to patients with at least one no function allele. However, contradictory findings are reported. ⭐⭐

According to CPIC, inconsistent findings regarding the effect of CYP2C19 genotype on the pharmacokinetics and therapeutic response to rabeprazole preclude making recommendations for this proton pump inhibitor.

Other genetic and clinical factors may also influence rabeprazole metabolism.

Siponimod

Immunology, Rheumatology & Oncology / Immunosuppressants

GENE	GENOTYPE	PHENOTYPE
CYP2C9	*1*1	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism and decreased plasma concentrations of siponimod** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

The Dutch Pharmacogenetics Working Group Guideline doesn't recommend any action for this gene-drug interaction.

Other genetic and clinical factors may also influence siponimod metabolism.

Succinylcholine

Anesthesiology / Skeletal Muscle Relaxant

GENE	GENOTYPE	PHENOTYPE
RYR1	rs111888148 **GG** rs112563513 **GG** rs118192122 **GG** rs118192124 **CC** rs118192161 **CC** rs118192162 **AA** rs118192163 **GG** rs118192168 **GG** rs118192172 **CC** rs118192175 **CC** rs118192176 **GG** rs118192177 **CC** rs118192178 **CC** rs121918592 **GG** rs121918593 **GG** rs121918594 **GG** rs121918595 **CC** rs1801086 **GG** rs193922747 **TT** rs193922753 **GG** rs193922768 **CC** rs193922770 **CC** rs193922772 **GG** rs193922802 **GG** rs193922803 **CC** rs193922807 **GG** rs193922809 **GG** rs193922816 **CC** rs193922832 **GG** rs193922843 **GG** rs193922876 **CC** rs193922878 **CC** rs28933396 **GG** rs28933397 **CC**	

No RYR1 variants were detected. Patients with this genotype **may have a decreased, but not absent, risk for malignant hyperthermia when treated with succinylcholine** as compared to patients who carry a genetic variant. ⭐⭐⭐

The CPIC recommends that clinical findings, family history, further genetic testing and other laboratory data should guide use of depolarizing muscle relaxants in patients with this genotype.

Other genetic and clinical factors may also influence the toxicity of succinylcholine.

GENE	GENOTYPE	PHENOTYPE
CACNA1S	rs1800559 **CC** rs772226819 **GG**	

Patients with the rs1800559 CC genotype **may have a decreased, but not absent, risk of malignant hyperthermia when treated with succinylcholine** as compared to patients with the TT genotype. ⭐⭐⭐

The CPIC recommends that clinical findings, family history, further genetic testing, and other laboratory data should guide the use of depolarizing muscle relaxants in patients with this genotype.

Patients with the rs772226819 GG genotype **may have a decreased, but not absent, risk of malignant hyperthermia when treated with succinylcholine** as compared to patients with the AA or AG genotype. ⭐⭐⭐

The CPIC recommends that clinical findings, family history, further genetic testing, and other laboratory data guide the use of the depolarizing muscle relaxant succinylcholine in patients with this genotype.

Other genetic and clinical factors may also influence the risk of malignant hyperthermia.

Tacrolimus

Immunology, Rheumatology & Oncology / Immunosuppressants

GENE	GENOTYPE	PHENOTYPE
CYP3A4	***1*1**	Normal Metabolizer
	rs2242480 **CC** rs4646437 **GG**	

The CYP3A4*1 allele has been assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of tacrolimus** compared to people who carry a decreased or no function allele. However, conflicting evidence has been reported. ⭐⭐

Patients with the *1*1 genotype **may require an increased dose of tacrolimus after an organ transplant** compared to people who carry a decreased or no function allele. ⭐⭐

Patients with the rs2242480 CC genotype **may have decreased metabolism of tacrolimus** as compared to patients with the CT or TT genotype. However, conflicting evidence has been reported. ⭐⭐

Patients with the rs4646437 GG genotype **may have increased dose-adjusted trough concentrations (Ctrough) of tacrolimus** as compared to patients with the AA or AG genotype. However, conflicting evidence has been reported. ⭐⭐

Other genetic and clinical factors may also influence the dosage and metabolism of tacrolimus.

GENE	GENOTYPE	PHENOTYPE
CYP3A5	***3*3**	Poor Metabolizer

The CYP3A5*3 allele has been assigned as a no function allele by CPIC. Patients with the *3*3 genotype (poor metabolizers) who are recipients of a kidney, heart, lung, or a hematopoietic stem cell transplant, or those receiving a liver from a donor with the same CYP3A5 genotype, **may have decreased metabolism of tacrolimus** and **may require a decreased dose of tacrolimus** as compared to patients carrying at least one normal function allele. However, conflicting evidence has been reported. ⭐⭐⭐

The CPIC recommends Initiating therapy with the standard recommended dose. Use therapeutic drug monitoring to guide dose adjustments.

Other genetic and clinical factors may also affect tacrolimus dose requirements.

Tegafur

Immunology, Rheumatology & Oncology / Antimetabolites

GENE	GENOTYPE	PHENOTYPE
DPYD	rs3918290 **CC** rs55886062 **AA** rs67376798 **TT**	

No DPYD variants were detected. Patients with this genotype and cancer who are treated with tegafur **may have decreased, but not absent, risk of drug toxicity** as compared to patients who carry a genetic variant. ⭐⭐⭐

Other genetic and clinical factors may also influence response to tegafur.

Tenoxicam

Pain / NSAIDs

GENE	GENOTYPE	PHENOTYPE
CYP2C9	***1*1**	Normal Metabolizer

The CYP2C9*1 allele is assigned as a normal function allele by CPIC. Patients carrying the CYP2C9*1*1 genotype (normal metabolizers) **may have increased metabolism of tenoxicam** as compared to patients carrying at least one copy of a decreased function or no function allele. ⭐⭐⭐

CPIC recommends initiating therapy with a recommended starting dose. In accordance with the prescribing information, use the lowest effective dosage for the shortest duration consistent with individual patient treatment goals.

Other genetic and clinical factors may also influence tenoxicam metabolism.

Trimipramine

Psychotropic / Antidepressants

GENE	GENOTYPE	PHENOTYPE
CYP2C19	***1*1**	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizer) **may have increased metabolism of trimipramine** compared to patients with at least one decreased or no function allele. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended starting dose.

Other genetic and clinical factors may also influence trimipramine metabolism.

Volatile Anesthetics (Desflurane, Enflurane, Halothane, Isoflurane, Methoxyflurane, Sevoflurane)

Anesthesiology / Anesthetic

GENE	GENOTYPE	PHENOTYPE
CACNA1S	rs1800559 **CC** rs772226819 **GG**	

Patients with the rs1800559 CC genotype **may have a decreased, but not absent, risk of malignant hyperthermia when treated with volatile anesthetics (desflurane, enflurane, halothane, isoflurane, methoxyflurane, sevoflurane)** as compared to patients with the TT genotype. ⭐⭐⭐

The CPIC recommends that clinical findings, family history, further genetic testing, and other laboratory data should guide the use of halogenated volatile anesthetics in patients with this genotype.

Patients with the rs772226819 GG genotype **may have a decreased, but not absent, risk of malignant hyperthermia when treated with volatile anesthetics (desflurane, enflurane, halothane, isoflurane, methoxyflurane, sevoflurane)** as compared to patients with the AA or AG genotype. ⭐⭐⭐

The CPIC recommends that clinical findings, family history, further genetic testing, and other laboratory data should guide the use of halogenated volatile anesthetics in patients with this genotype.

Other genetic and clinical factors may also influence the risk of malignant hyperthermia.

GENE	GENOTYPE	PHENOTYPE
RYR1	rs111888148 **GG** rs112563513 **GG** rs118192122 **GG** rs118192124 **CC** rs118192161 **CC** rs118192162 **AA** rs118192163 **GG** rs118192168 **GG** rs118192172 **CC** rs118192175 **CC** rs118192176 **GG** rs118192177 **CC** rs118192178 **CC** rs121918592 **GG** rs121918593 **GG** rs121918594 **GG** rs121918595 **CC** rs1801086 **GG** rs193922747 **TT** rs193922753 **GG** rs193922768 **CC** rs193922770 **CC** rs193922772 **GG** rs193922802 **GG** rs193922803 **CC** rs193922807 **GG** rs193922809 **GG** rs193922816 **CC** rs193922832 **GG** rs193922843 **GG** rs193922876 **CC** rs193922878 **CC** rs28933396 **GG** rs28933397 **CC**	

No RYR1 variants were detected. Patients with this genotype **may have a decreased, but not absent, risk for malignant hyperthermia when treated with volatile anesthetics (desflurane, enflurane, halothane, isoflurane, methoxyflurane, sevoflurane)** as compared to patients who carry a genetic variant. ⭐⭐⭐

The CPIC recommends that clinical findings, family history, further genetic testing and other laboratory data should guide use of halogenated volatile anesthetics in patients with this genotype.

Other genetic and clinical factors may also influence the toxicity of volatile anesthetics.

Voriconazole

Infections / Antifungals

GENE	GENOTYPE	PHENOTYPE
CYP2C19	*1*1	Normal Metabolizer

The CYP2C19*1 allele is assigned as a normal function allele by CPIC. Patients with the *1*1 genotype (normal metabolizers) **may have increased metabolism of voriconazole** compared to patients with at least one decreased or no function allele but **decreased metabolism of voriconazole** compared to patients with two increased function alleles or an increased function allele in combination with a normal function allele. However, conflicting evidence has been reported and some studies showed no association. ⭐⭐⭐

CPIC recommends initiating therapy with the recommended standard of care dosing.

Other genetic and clinical factors may also influence voriconazole metabolism.

Genetic test details

Genes	Genotype	Phenotype	Drugs
ABCG2	rs2231142 **GG**		Allopurinol, Rosuvastatin
CACNA1S	rs772226819 **GG** rs1800559 **CC**		Succinylcholine, Volatile Anesthetics (Desflurane, Enflurane, Halothane, Isoflurane, Methoxyflurane, Sevoflurane)
CES1	rs71647871 **CC**		Clopidogrel
CYP2B6	***1*6**	Likely Intermediate Metabolizer	Bupropion, Efavirenz, Methadone, Nevirapine, Sertraline
	rs28399499 **TT** rs3745274 **TG**		
CYP2C19	***1*1**	Normal Metabolizer	Amitriptyline, Citalopram, Clomipramine, Clopidogrel, Dexlansoprazole, Doxepin, Escitalopram, Imipramine, Lansoprazole, Omeprazole, Pantoprazole, Rabeprazole, Sertraline, Trimipramine, Voriconazole
CYP2C9	***1*1**	Normal Metabolizer	Acenocoumarol, Celecoxib, Flurbiprofen, Fluvastatin, Ibuprofen, Lornoxicam, Meloxicam, Phenytoin, Piroxicam, Siponimod, Tenoxicam, Warfarin
CYP3A4	***1*1**	Normal Metabolizer	Quetiapine, Tacrolimus
	rs2242480 **CC** rs4646437 **GG**		
CYP3A5	***3*3**	Poor Metabolizer	Tacrolimus
CYP4F2	rs2108622 **CC**		Acenocoumarol, Warfarin
DPYD	rs67376798 **TT** rs3918290 **CC** rs56038477 **CC** rs75017182 **GG** rs55886062 **AA** rs72549309 **GG** rs59086055 **GG** rs72549306 **CC** rs78060119 **CC** rs115232898 **TT** rs1801268 **CC** rs1801266 **GG** rs1801160 **CC**		Capecitabine, Fluorouracil, Tegafur
IFNL3	rs11881222 **GA** rs8099917 **GT**		Triple therapy (peginterferon alfa-2a/b & ribavirin)

Genes	Genotype	Phenotype	Drugs
	rs12979860 **TC**		
MTHFR	rs1801133 **AA**		Methotrexate
NUDT15	***1*1**	Normal Metabolizer	Azathioprine, Mercaptopurine
RYR1	rs118192163 **GG** rs193922803 **CC** rs193922772 **GG** rs111888148 **GG** rs193922878 **CC** rs193922876 **CC** rs118192172 **CC** rs118192168 **GG** rs193922747 **TT** rs121918594 **GG** rs121918592 **GG** rs118192122 **GG** rs193922768 **CC** rs118192162 **AA** rs1801086 **GG** rs193922843 **GG** rs118192178 **CC** rs193922753 **GG** rs28933397 **CC** rs28933396 **GG** rs121918595 **CC** rs121918593 **GG** rs118192161 **CC** rs193922816 **CC** rs112563513 **GG** rs193922809 **GG** rs193922807 **GG** rs193922802 **GG** rs193922770 **CC** rs118192124 **CC** rs193922832 **GG** rs118192175 **CC** rs118192176 **GG** rs118192177 **CC**		Succinylcholine, Volatile Anesthetics (Desflurane, Enflurane, Halothane, Isoflurane, Methoxyflurane, Sevoflurane)
SLCO1B1	***1*15**	Intermediate Metabolizer	Atorvastatin, Fluvastatin, Lovastatin, Pitavastatin, Pravastatin, Rosuvastatin, Simvastatin
TPMT	***1*1**	Normal Metabolizer	Azathioprine, Mercaptopurine
VKORC1	rs9934438 **AG** rs9923231 **TC** rs8050894 **GC** rs2359612 **AG** rs7294 **CT** rs2884737 **CA** rs61742245 **CC**		Acenocoumarol, Phenprocoumon, Warfarin

About the report

This test does not report polymorphisms other than those specifically listed, and mutations in other genes associated with drug metabolism will not be detected.

Metabolizer type reporting is limited to the following alleles:

CYP2B6: *1, *2, *4, *5, *6, *9, *18, *22, *26, *28, *38
CYP2C9: *1, *2, *3, *4, *5, *6, *8, *11, *12, *13, *15, *27
CYP2C19: *1, *2, *3, *4, *5, *6, *7, *8, *9, *10 & *17
CYP3A4: *1, *3, *18, *20 & *22.
CYP3A5: *1, *3, *6 & *7
NUDT15: *1 & *3
SLCO1B1: *1, *4, *5, *9, *14, *15, *19, *20, *23, *24, *25, *28, *31, *32, *37, *40, *45, *46 & *47
TPMT: *1, *2, *3A, *3B, *3C, & *4
Any allele identified as a default star-allele (CYP2B6*1, CYP2C9 *1, CYP2C19 *1, CYP3A4 *1, CYP3A5 *1, NUD15*1, SLCO1B1*1, TPMT *1) indicates the absence only of the other alleles listed and does not imply that other variants in the gene are absent.

Gene deletions and duplications are not analyzed in this report.