GeneDose Genetic Response Report

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This report combines (i) an analysis of the patient's DNA by GX Sciences, LLC, identifying relevant genetic variants that are informative for medication efficacy, safety, and dosing, with (ii) an interpretation of the identified DNA variants by Coriell Life Sciences to bring you immediately actionable clinical guidance regarding safer, more effective medications and dosages for the patient. The Medication Report section lists the type of PGx guidance present on FDA-approved drug labels. Medications with no established FDA PGx guidance are provided solely for educational purposes.

Patient: 2022A, APOE-03
Date of Birth: Mar 04, 2022
Sex: Female

Physician: Proficiency Testing
Practice: N/A

Date Collected: Mar 04, 2022
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Specimen type: Buccal Swab
Sample ID: PGX2022-00059

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Genetic Summary Information

† When multiple activities are listed, check information in Medication Report Details (Pg. 10) for specific medication of interest.
Uncertain = No known diplotype/result (name) or activity for this combination of genetic variants; Uninterpretable Genotype.

Genetic Summary

Gene	Result	Activity †
ApoE	ε2|ε3	See ApoE Genotype Info
COMT(Val158Met)	G|G	Normal function
CYP1A2	*1A|*1F	Rapid metabolizer
CYP2B6	*1A|*5	Normal metabolizer
CYP2C19	*1|*17	Rapid metabolizer
CYP2C9	*1|*3	Intermediate metabolizer
CYP2D6	*4A|*6A or *4J|*6C	Poor metabolizer
CYP3A4	*1A|*1A	Normal metabolizer
CYP3A5	*3|*3; or *3|*3D; or *3D|*3D	Poor metabolizer
Factor V Leiden	Normal	See Thrombosis Profile
MTHFR (A1298C)	Normal	See Thrombosis Profile
MTHFR (C677T)	Variant	See Thrombosis Profile
Prothrombin (F2)	Normal	See Thrombosis Profile
SLCO1B1	*1|*1	Normal liver uptake activity
VKORC1	*1|*2	Medium sensitivity to warfarin

Thrombosis Profile

Tested Gene (Allele)	Genotype	Predicted Phenotype	Clinical Guidance
Prothrombin (F2)	Normal	Normal risk expected based on the patient's genotype.	The absence of these variant alleles of Prothrombin (Factor II) and Factor V Leiden suggests that the patient does not have the elevated risk of thrombosis associated with these genetic markers.
Factor V Leiden	Normal		
MTHFR (A1298C)	Normal		
MTHFR (C677T)	Homozygous variant		

General Description

Genetic analyses of three genes (four alleles) considered to increase the risk for venous thromboembolism were performed using molecular genetic techniques. The presence of the Prothrombin (Factor 2) gene allele c.*97G>A (previously designated as 20210G>A) and Factor V Leiden allele c.1601G>A (previously designated as 1691G>A) are risk factors for venous thromboembolism. This risk may be further increased by the use of estrogen therapy, oral contraceptives, pregnancy, and surgery.

Patients who are homozygous for MTHFR C677T or MTHFR A1298C may have a further increased risk for venous thromboembolism if they also possess the Factor V Leiden c.1601G>A allele. However, the MTHFR alleles alone do not predict a significant risk for venous thromboembolism.

References

- Zhang S, et al.; ACMG Laboratory Quality Assurance Committee. Venous thromboembolism laboratory testing (factor V Leiden and factor II c.*97G>A), 2018 update: a technical standard of the American College of Medical Genetics and Genomics (ACMG). Genet Med. 2018 Dec;20(12):1489-1498. doi: 10.1038/s41436-018-0322-z. Epub 2018 Oct 5. PMID: 30297698.
- Bhatt S, et al.; ACMG Professional Practice and Guidelines Committee. Addendum: American College of Medical Genetics consensus statement on factor V Leiden mutation testing. Genet Med. 2021 Mar 5. doi: 10.1038/s41436-021-01108-x. Epub ahead of print. PMID: 33674767.
- Lim MY, et al.; Thrombophilic risk of individuals with rare compound factor V Leiden and prothrombin G20210A polymorphisms: an international case series of 100 individuals. Eur J Haematol. 2016 Oct;97(4):353-60. doi: 10.1111/ejh.12738. Epub 2016 Feb 18. PMID: 26773706.
- Saemundsson Y, et al.; Homozygous factor V Leiden and double heterozygosity for factor V Leiden and prothrombin mutation. J Thromb Thrombolysis. 2013 Oct;36(3):324-31. doi: 10.1007/s11239-012-0824-5. PMID: 23054468.
- Stevens SM, et al.; Guidance for the evaluation and treatment of hereditary and acquired thrombophilia. J Thromb Thrombolysis. 2016 Jan;41(1):154-64. doi: 10.1007/s11239-015-1316-1. PMID: 26780744; PMCID: PMC4715840.

ApoE Genotype Information†

Tested Genes (Alleles)	Genotype	Predicted Phenotype	Clinical Guidance
ApoE (ε2, ε3, ε4)	ε2|ε3		There is a potential association with a lower risk of coronary heart disease when compared to those with the ε3/ε3 genotype.

General Description

Genetic analysis in the ApoE gene was performed using molecular genetic techniques. The genotype is based on genotyping results for this patient at SNPs rs429358 and rs7412.

ApoE ε3 is the most common allele—found in about 60% of people. The presence of ε2 or ε4 alleles may be a risk factor for multiple conditions including cardiovascular disease. ApoE ε2 carriers may be more likely to develop familial dysbetalipoproteinemia or type III hyperlipoproteinemia.

† Predicted phenotype, clinical significance, relative risk, and interpretations reported for each genotype are associated with cardiovascular risk only. The interpretations should not be used to determine the relative risk of other diseases. Other factors important to understanding total risk should be considered.

Medication Summary

Cardiac			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
Antiarrhythmics		Flecainide Propafenone	
Anticoagulants	Warfarin	Acenocoumarol	
Anticonvulsants		Phenytoin	
Antiplatelet Agents	Prasugrel Ticagrelor	Clopidogrel	
Beta Blockers	Nebivolol Propranolol	Carvedilol Metoprolol Timolol	

Cardiac

Therapeutic Class	Standard Precautions	Caution / Info	Change recommended
Statins	Atorvastatin Simvastatin		

Gastroenterology

Therapeutic Class	Standard Precautions	Caution / Info	Change recommended
Antidepressants	Mirtazapine Trazodone		Amitriptyline (CYP2D6) Clomipramine (CYP2D6) Desipramine Doxepin (CYP2D6) Imipramine (CYP2C19, CYP2D6) Nortriptyline
Antiemetics		Ondansetron Tropisetron	
Endocrine-Metabolic Agents		Eliglustat	
Immunosuppressants	Cyclosporine		
Nonsteroidal Anti-Inflamatory Drugs (NSAIDs)		Celecoxib	
Prokinetic agents		Metoclopramide	
Proton Pump Inhibitors (PPIs)		Dexlansoprazole Esomeprazole Lansoprazole Omeprazole Pantoprazole Rabeprazole	
Selective Serotonin Reuptake Inhibitors			Citalopram Escitalopram

Gastroenterology			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
(SSRIs)			Paroxetine

Infectious Disease			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
Antifungals	Ketoconazole		Voriconazole

Oncology			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
Estrogen Agonists/ Antagonists			Tamoxifen

Pain			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
Analgesics, Opioid	Methadone (CYP2B6)		
Anticonvulsants		Clobazam Phenytoin	
Antidepressants	Mirtazapine Trazodone	Duloxetine Moclobemide Vortioxetine	Amitriptyline (CYP2D6) Clomipramine (CYP2D6) Desipramine Doxepin (CYP2D6) Imipramine (CYP2C19, CYP2D6) Nortriptyline Protriptyline Venlafaxine
Antipsychotics	Olanzapine		

Pain

Therapeutic Class	Standard Precautions	Caution / Info	Change recommended
Beta Blockers	Nebivolol Propranolol	Timolol	
Endocrine-Metabolic Agents		Eliglustat	
Immunosuppressants	Cyclosporine	Tacrolimus	
Muscle Relaxants		Carisoprodol	
Nonsteroidal Anti-Inflamatory Drugs (NSAIDs)		Celecoxib Diclofenac Flurbiprofen Meloxicam	
Opioids	Buprenorphine Fentanyl Oxycodone	Hydrocodone Oxycodone (CYP3A5) Tramadol	Codeine
Selective Serotonin Reuptake Inhibitors (SSRIs)	Fluoxetine	Fluvoxamine Sertraline	Citalopram Escitalopram Paroxetine

Psychotropic

Therapeutic Class	Standard Precautions	Caution / Info	Change recommended
Anti-ADHD Agents	Amphetamine Dexmethylphenidate Dextroamphetamine Guanfacine Lisdexamfetamine Methylphenidate (COMT)	Atomoxetine	
Anticonvulsants		Clobazam Phenytoin	

Psychotropic

Therapeutic Class	Standard Precautions	Caution / Info	Change recommended
Antidementia Agents		Donepezil	
Antidepressants	Mirtazapine Trazodone	Duloxetine Moclobemide Vortioxetine	Amitriptyline (CYP2D6) Amoxapine Clomipramine (CYP2D6) Desipramine Doxepin (CYP2D6) Imipramine (CYP2C19, CYP2D6) Nortriptyline Protriptyline Trimipramine Trimipramine (CYP2C19) Venlafaxine
Antipsychotics	Flupenthixol Olanzapine Quetiapine	Aripiprazole Brexpiprazole Clozapine Haloperidol Iloperidone Perphenazine Pimozide Risperidone Zuclopenthixol	Thioridazine
Anxiolytics	Alprazolam Buspirone Clonazepam	Diazepam	
Beta Blockers	Propranolol		
Central Monoamine-Depleting Agents		Tetrabenazine	
Central Nervous System Agents			Dextromethorphan-Quinidine
Cholinesterase Inhibitors		Galantamine	

Psychotropic			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
Hypnotics	Eszopiclone		
Selective Serotonin Reuptake Inhibitors (SSRIs)	Fluoxetine	Fluvoxamine Sertraline	Citalopram Escitalopram Paroxetine

Surgery			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
Anticholinergic Agents		Tolterodine	
Antiemetics		Ondansetron Tropisetron	
Opioids	Fentanyl		

Other Drugs			
Therapeutic Class	**Standard Precautions**	**Caution / Info**	**Change recommended**
Alpha-1 Blockers		Tamsulosin	
Anticholinergic Agents		Fesoterodine	
Antidiabetics	Saxagliptin	Gliclazide Glimepiride Glyburide Tolbutamide	
Anti-Retroviral Agents	Efavirenz Nevirapine		
Beta-3 Adrenergic Agonists	Mirabegron		
Cholinergic Agonists		Cevimeline	

Other Drugs

Therapeutic Class	Standard Precautions	Caution / Info	Change recommended
EGFR Inhibitors		Gefitinib	
Immunosuppressants	Sirolimus		
Vesicular monoamine transporter 2 inhibitor		Valbenazine	

Legend

- Typical response is expected
- Consider alternative therapy
- Change recommended
- Additional information available
- Response is uncertain

Clinical Evidence Level

- Strong
- Moderate
- Emerging

Medication Report Details (by therapeutic class)

Drug	Finding	Recommendation	Concern	Evidence
Alpha-1 Blockers				
Tamsulosin (Flomax) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	Moderate
Analgesics, Opioid				
Methadone (CYP2B6) *FDA drug label: Not established for PGx*	CYP2B6: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		Strong

Drug	Finding	Recommendation	Concern	Evidence
Anti-ADHD Agents				
Amphetamine (Adzenys, Evekeo) *FDA drug label: Not established for PGx*	COMT(Val158Met): Normal function. Two normal function alleles.	Individuals with normal function of this gene are expected to show typical response. No additional therapeutic recommendations.		
Atomoxetine (Strattera) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose; monitor the patient's response to guide dosing.	ADR	
Dexmethylphenidate (Focalin) *FDA drug label: Not established for PGx*	COMT(Val158Met): Normal function. Two normal function alleles.	Individuals with normal function of this gene are expected to show typical response. No additional therapeutic recommendations.		
Dextroamphetamine (Zenzedi, Dexedrine) *FDA drug label: Not established for PGx*	COMT(Val158Met): Normal function. Two normal function alleles.	Individuals with normal function of this gene are expected to show typical response. No additional therapeutic recommendations.		
Guanfacine (Tenex, Intuniv) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Lisdexamfetamine (Vyvanse) *FDA drug label: Not established for PGx*	COMT(Val158Met): Normal function. Two normal function alleles.	Individuals with normal function of this gene are expected to show typical response. No additional therapeutic recommendations.		
Methylphenidate (COMT) (Concerta, Metadate, Ritalin, Ritalin LA, Quillivant, Daytrana, Methylin) *FDA drug label: Not established for PGx*	COMT(Val158Met): Normal function. Two normal function alleles.	Individuals with normal function of this gene are expected to show typical response. No additional therapeutic recommendations.		

Drug	Finding	Recommendation	Concern	Evidence
Antiarrhythmics				
Flecainide (Tambocor) *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Propafenone (Rythmol) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Anticholinergic Agents				
Fesoterodine (Toviaz) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Tolterodine (Detrol) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Anticoagulants				
Acenocoumarol (Sintrom, Acitrom) *FDA drug label: Not established for PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication frequently present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Warfarin (Coumadin) *FDA drug label: Actionable PGx*	Multigenic: VKORC1, CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Individuals with this combination of alleles may benefit from the standard dose of Warfarin. The FDA table recommends a therapeutic dose of 3-4 mg/day.		

Drug	Finding	Recommendation	Concern	Evidence
Anticonvulsants				
Clobazam (Onfi) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. Be alert to lack of efficacy; monitor the patient's response to guide dosing.	Efficacy	
Phenytoin (Dilantin) *FDA drug label: Actionable PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Antidementia Agents				
Donepezil (Aricept) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Antidepressants				
Amitriptyline (CYP2D6) (Elavil) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Amoxapine (Asendin) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Clomipramine (CYP2D6) (Anafranil) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Desipramine (Norpramin) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Doxepin (CYP2D6) (Deptran) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Duloxetine (Cymbalta) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Imipramine (CYP2C19, CYP2D6) (Tofranil-PM, Tofranil) *FDA drug label: Actionable PGx*	Multigenic: CYP2D6, CYP2C19: Poor metabolizer. Two little or no function alleles.; Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Individuals with this combination of alleles frequently present with significantly increased risk of pharmacotherapy failure. This medication should be avoided.	Efficacy	
Mirtazapine *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Typical response expected. No additional therapeutic recommendations.		
Moclobemide (Manerix, Aurorix, Amira, Clobemix, Depnil) *FDA drug label: Not established for PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Be alert to lack of efficacy.	Efficacy	
Nortriptyline (Pamelor) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Protriptyline (Vivactil) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Trazodone (Oleptro, Desyrel) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Trimipramine (Surmontil) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Trimipramine (CYP2C19) (Surmontil) *FDA drug label: Not established for PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication frequently present with lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. This medication should be avoided.	Efficacy	
Venlafaxine (Effexor) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with lower plasma concentrations of the active medication/ medication ratio, thus an increased risk of side effects and/or pharmacotherapy failure. This medication should be avoided.	ADR & Efficacy	
Vortioxetine (Brintellix) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Antidiabetics				
Gliclazide *FDA drug label: Not established for PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication, frequently present with increased medication efficacy. No additional therapeutic recommendations.	Efficacy	
Glimepiride *FDA drug label: Not established for PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication, frequently present with increased medication efficacy. No additional therapeutic recommendations.	Efficacy	
Glyburide (Glibenclamide) *FDA drug label: Not established for PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Saxagliptin (Onglyza) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Tolbutamide (Orinase) *FDA drug label: Not established for PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Antiemetics				
Ondansetron (Zofran) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with higher plasma concentrations of the active medication. Monitor the patient's response to guide dosing.	ADR	
Tropisetron (Navoban, Setrovel) *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Antifungals				
Ketoconazole (Nizoral) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Voriconazole (Vfend) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication frequently present with lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. This medication should be avoided.	Efficacy	
Antiplatelet Agents				
Clopidogrel *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication frequently present with higher plasma concentrations of the active medication, frequently present with increased medication efficacy. No additional therapeutic recommendations.	Efficacy	
Prasugrel *FDA drug label: Informative PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Typical response expected. No additional therapeutic recommendations.		
Ticagrelor (Brilinta) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		

Drug	Finding	Recommendation	Concern	Evidence
Antipsychotics				
Aripiprazole (Abilify) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Brexpiprazole (Rexulti) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose.	ADR	
Clozapine *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Flupenthixol *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Typical response expected. No additional therapeutic recommendations.		
Haloperidol (Haldol) *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Iloperidone *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose.	ADR	
Olanzapine (Zalasta, Zyprexa) *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Typical response expected. No additional therapeutic recommendations.		
Perphenazine (Trilafon) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Pimozide (Orap) *FDA drug label: Testing required*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose.	ADR	
Quetiapine (Seroquel) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Risperidone (Risperdal) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Thioridazine *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Zuclopenthixol *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Anti-Retroviral Agents				
Efavirenz *FDA drug label: Actionable PGx*	CYP2B6: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Nevirapine *FDA drug label: Not established for PGx*	CYP2B6: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		

Drug	Finding	Recommendation	Concern	Evidence
Anxiolytics				
Alprazolam (Xanax, Niravam) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Buspirone (Buspar) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Clonazepam (Klonopin) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Diazepam *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Be alert to lack of efficacy; monitor the patient's response to guide dosing.	Efficacy	
Beta-3 Adrenergic Agonists				
Mirabegron (Myrbetriq) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication. No additional therapeutic recommendations.		

Drug	Finding	Recommendation	Concern	Evidence
Beta Blockers				
Carvedilol (Coreg) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions.	ADR	
Metoprolol (Lopressor) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Nebivolol (Bystolic) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Typical response expected. No additional therapeutic recommendations.		
Propranolol (Inderal) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Typical response expected. No additional therapeutic recommendations.		
Timolol (Blocadren) *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Central Monoamine-Depleting Agents				
Tetrabenazine (Xenazine) *FDA drug label: Testing required*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose.	ADR	
Central Nervous System Agents				
Dextromethorphan-Quinidine (Nuedexta) *FDA drug label: Testing recommended*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Cholinergic Agonists				
Cevimeline (Evoxac) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Cholinesterase Inhibitors				
Galantamine (Razadyne, Razadyne ER, Nivalin, Lycoremine, Reminyl) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
EGFR Inhibitors				
Gefitinib (Iressa) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Endocrine-Metabolic Agents				
Eliglustat *FDA drug label: Testing required*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider alternative medication, or reducing the dose.	ADR	
Estrogen Agonists/Antagonists				
Tamoxifen (Soltamox, Nolvadex) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. This medication should be avoided.	Efficacy	

Drug	Finding	Recommendation	Concern	Evidence
Hypnotics				
Eszopiclone (Lunesta) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Immunosuppressants				
Cyclosporine (Gengraf, Neoral) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Sirolimus (Rapamune) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Tacrolimus (Prograf, Hecoria) *FDA drug label: Not established for PGx*	CYP3A5: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with higher plasma concentrations of the active medication, frequently present with increased medication efficacy. No additional therapeutic recommendations.	Efficacy	
Muscle Relaxants				
Carisoprodol (Soma) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with notably lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Be alert to lack of efficacy; consider alternative medication.	Efficacy	

Drug	Finding	Recommendation	Concern	Evidence
Non-drug				
ApoE	ApoE: E2|E3	There is a potential association with a lower risk of coronary heart disease when compared to those with the ε3/ε3 genotype.		
COMT(Val158Met)	COMT(Val158Met): Normal function. Two normal function alleles.	Typical response is expected; no additional therapeutic recommendations.		
CYP1A2	CYP1A2: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	No additional therapeutic recommendations.		
CYP2B6	CYP2B6: Normal metabolizer. Two normal function alleles.	No additional therapeutic recommendations.		

Drug	Finding	Recommendation	Concern	Evidence
Nonsteroidal Anti-Inflamatory Drugs (NSAIDs)				
Celecoxib (Celebrex) *FDA drug label: Actionable PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose; monitor the patient's response to guide dosing.	ADR	
Diclofenac (Cataflam) *FDA drug label: Not established for PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Be alert to adverse reactions; monitor the patient's response to guide dosing.	ADR	
Flurbiprofen (Ocufen) *FDA drug label: Actionable PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication frequently present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose; monitor the patient's response to guide dosing.	ADR	
Meloxicam (Mobic) *FDA drug label: Actionable PGx*	CYP2C9: Intermediate metabolizer. One normal function allele and one little or no function allele.	Intermediate metabolizers of this medication may present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	

Drug	Finding	Recommendation	Concern	Evidence
Opioids				
Buprenorphine (Butrans, Buprenex) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Codeine *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. This medication should be avoided.	Efficacy	
Fentanyl (Duragesic, Sublimaze) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Hydrocodone *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Be alert to lack of efficacy; monitor the patient's response to guide dosing.	Efficacy	
Oxycodone (Oxycontin) *FDA drug label: Not established for PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Typical response expected. No additional therapeutic recommendations.		
Oxycodone (CYP3A5) (Oxycontin) *FDA drug label: Not established for PGx*	CYP3A5: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication may present with notably lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Be alert to lack of efficacy; monitor the patient's response to guide dosing.	Efficacy	
Tramadol (Ultracet, Ultram) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. Be alert to lack of efficacy; monitor the patient's response to guide dosing.	Efficacy	

Drug	Finding	Recommendation	Concern	Evidence
Prokinetic agents				
Metoclopramide (Primperan, Reglan) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose.	ADR	
Proton Pump Inhibitors (PPIs)				
Dexlansoprazole (Dexilant, Kapidex) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Consider increasing the dose.	Efficacy	
Esomeprazole (Nexium) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Consider increasing the dose.	Efficacy	
Lansoprazole (Prevacid) *FDA drug label: Informative PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Consider increasing the dose.	Efficacy	
Omeprazole (Prilosec, Zegerid) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Consider increasing the dose.	Efficacy	
Pantoprazole (Protonix) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Consider increasing the dose.	Efficacy	
Rabeprazole (Aciphex) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication may present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Consider increasing the dose.	Efficacy	

Drug	Finding	Recommendation	Concern	Evidence
Selective Serotonin Reuptake Inhibitors (SSRIs)				
Citalopram (Celexa) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication frequently present with lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. This medication should be avoided.	Efficacy	
Escitalopram (Lexapro) *FDA drug label: Actionable PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication frequently present with lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. This medication should be avoided.	Efficacy	
Fluoxetine (Prozac) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Typical response expected. No additional therapeutic recommendations.		
Fluvoxamine (Luvox) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose, or using an alternative medication.	ADR	
Paroxetine (Paxil) *FDA drug label: Informative PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus a significantly increased risk of side effects. This medication should be avoided.	ADR	
Sertraline (Zoloft) *FDA drug label: Not established for PGx*	CYP2C19: Rapid metabolizer status. One allele showing normal activity and one showing increased activity.	Rapid metabolizers of this medication frequently present with lower plasma concentrations of the active medication, thus a significantly increased risk of pharmacotherapy failure. Be alert to lack of efficacy; consider alternative medication.	Efficacy	

Drug	Finding	Recommendation	Concern	Evidence
Statins				
Atorvastatin (Lipitor, Caduet) *FDA drug label: Not established for PGx*	CYP3A4: Normal metabolizer. Two normal function alleles.	Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations.		
Simvastatin (Zocor) *FDA drug label: Informative PGx*	SLCO1B1: Normal function. Two normal function alleles.	Individuals with normal SLCO1B1 liver uptake activity are expected to have a typical response to a standard dose of simvastatin.		
Vesicular monoamine transporter 2 inhibitor				
Valbenazine (Ingrezza) *FDA drug label: Actionable PGx*	CYP2D6: Poor metabolizer. Two little or no function alleles.	Poor metabolizers of this medication frequently present with notably higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose.	ADR	

Clinical Evidence Levels

Strong

- Includes gene-drug pairs approved by the Coriell Institute for Medical Research Pharmacogenomics Advisory Group.
- Includes gene-drug pairs supported by multiple studies documenting consistent effects of specific genetic variant(s) on clinical outcomes.
- Includes gene-drug pairs approved by the Dutch Pharmacogenetics Working Group (DPWG) and/or guidelines published in Clinical Pharmacology and Therapeutics by the Clinical Pharmacogenetics Implementation Consortium (CPIC).

Moderate

- Includes gene-drug pairs supported by pharmacokinetic, pharmacodynamic, or molecular/cellular functional studies showing consistent effects of genetic variant(s).
- Includes Drug product information (e.g. This interpretation is based on guidance available in the FDA (Food and Drug Administration) drug label for ABILIFY® (10/2013).
- Includes gene-drug pairs for which potential clinical outcomes are inferred from similar gene-drug interactions approved by the Dutch Pharmacogenetics Working Group (DPWG), and/or guidelines published in Clinical Pharmacology and Therapeutics by the Clinical Pharmacogenetics Implementation Consortium (CPIC), and/or pharmacogenomic reports and submission from the Coriell Institute for Medical Research.

Emerging

- Includes gene-drug pairs supported by published studies of the drug, related drug, or a probing compound of interest involving limited data and/or inconsistent findings.

Patient Information Card

This card contains an abbreviated genetic summary.
It is not intended as a replacement for the complete GeneDose™ report.

GX Sciences, LLC
http://www.gxsciences.com/

Patient: 2022A, APOE-03
DOB: 2022-03-04
Sample ID: PGX2022-00059

This card shows information about your genetics that relate to drug metabolism. Show to your doctors before being prescribed new medications.

Pharmacogenomic Summary

ApoE	ε2|ε3	See full GeneDose report
COMT(Val158Met)	G|G	Normal function
CYP1A2	*1A|*1F	Rapid metabolizer
CYP2B6	*1A|*5	Normal metabolizer
CYP2C19	*1|*17	Rapid metabolizer
CYP2C9	*1|*3	Intermediate metabolizer
CYP2D6	*4A|*6A or *4J|*6C	Poor metabolizer
CYP3A4	*1A|*1A	Normal metabolizer
CYP3A5	*3|*3; or *3|*3D; or *3D|*3D	Poor metabolizer
Factor V Leiden	Normal	See full GeneDose report
MTHFR (A1298C)	Normal	See full GeneDose report
MTHFR (C677T)	Variant	See full GeneDose report
Prothrombin (F2)	Normal	See full GeneDose report
SLCO1B1	*1|*1	Normal liver uptake activity
VKORC1	*1|*2	Reduced (with respect to Warfarin)

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