

CLS PGx Research Review

Coriell Life Sciences
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Presented here are the results of the Coriell Life Sciences systematic review of available guidance and research literature. The CLS PGx Research Review is a general purpose research assistance service intended to provide users with relevant medical reference information related to identified gene variations and their drug associations. This research review reflects the professional opinions of the CLS research team, and are intended solely for general purpose research use and are not intended for use in clinical diagnosis or treatment. Independent review of the same evidence can be performed, with referenced sources documented at coriell.com/refs.

Patient:
Date of Birth:

Sample ID: 2402098002

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Genetic Research Summary Information

† Key: Indeterminant, Uncertain = No known diplotype or activity; Negative = wild type alleles; Positive = heterozygous or homozygous alleles; n/a = no gene information available.

Genetic Research Summary

| Gene | Diplotype | Activity † |
|-----------------|-----------|---------------------------|
| ApoE | E3 E3 | See ApoE Research Summary |
| COMT(Val158Met) | G A | Decreased function |
| CYP1A2 | *1N *1W | Unknown Metabolizer |
| CYP2B6 | *1 *1 | Normal metabolizer |
| CYP2C19 | *1 *2 | Intermediate metabolizer |
| CYP2C9 | *1 *1 | Normal metabolizer |

| Gene | Diplotype | Activity † |
|------------------|---------------------------------------|---------------------------------|
| CYP2D6 | *2A *2B; or *2A *2A; or *2B *2B | Normal metabolizer |
| CYP3A4 | *1A *1A | Normal metabolizer |
| CYP3A5 | *1 *3 | Intermediate metabolizer |
| Factor V Leiden | Normal | See Thrombosis Research Summary |
| MTHFR (A1298C) | T G | See Thrombosis Research Summary |
| MTHFR (C677T) | G G | See Thrombosis Research Summary |
| Prothrombin (F2) | Normal | See Thrombosis Research Summary |
| SLCO1B1 | *1 *1 | Normal function |
| VKORC1 | *1 *1 | Low sensitivity to warfarin |

Thrombosis Research Summary

| Tested Gene (Allele) | Diplotype Classification | Research Summary |
|----------------------|--------------------------|---|
| 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) | Heterozygous | |
| MTHFR (C677T) | Normal | |





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.
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- 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 Research Summary

| Tested Gene (Alleles) | Diplotype | Research Summary |
|-----------------------|-----------|---|
| ApoE (ε2, ε3, ε4) | ε3 ε3 | Two wild-type alleles. Typical cardiovascular disease risk expected. |

Medication Research Summary

| Addiction | | | |
|--------------------|--|--|--|
| Therapeutic Class |  Standard Precautions |   Caution / Info |  Change Indicated |
| Analgesics, Opioid | Buprenorphine Methadone (CYP2B6) | | |

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| Cardiology | | | |
|---------------------|---|---------------------------|------------------|
| Therapeutic Class | Standard Precautions | Caution / Info | Change Indicated |
| Antiarrhythmics | Flecainide Propafenone | | |
| Anticoagulants | Acenocoumarol | Warfarin (CYP2C9, VKORC1) | |
| Antiplatelet Agents | Prasugrel Ticagrelor | | Clopidogrel |
| Beta Blockers | Carvedilol Metoprolol Nebivolol Propranolol Timolol | | |
| Statins | Atorvastatin Simvastatin | | |





| Dyskinesia | | | |
|---|----------------------|----------------|------------------|
| Therapeutic Class | Standard Precautions | Caution / Info | Change Indicated |
| Vesicular monoamine transporter 2 inhibitor | Deutetrabenazine | | |

| Endocrinology | | | |
|--|---|----------------|------------------|
| Therapeutic Class | Standard Precautions | Caution / Info | Change Indicated |
| Dipeptidyl peptidase-4 (DPP-4) inhibitor | Saxagliptin | | |
| Sulfonylurea | Gliclazide Glimepiride Glyburide Tolbutamide | | |

| Gastroenterology | | | |
|---|----------------------------|--|--------------------|
| Therapeutic Class | ✔ Standard Precautions | ⚠️ ⓘ Caution / Info | ❌ Change Indicated |
| Antiemetics | Ondansetron Tropisetron | | |
| Proton Pump Inhibitors (PPIs) | | Dexlansoprazole Esomeprazole Lansoprazole Omeprazole Pantoprazole Rabeprazole | |
| Gaucher's disease | | | |
| Therapeutic Class | ✔ Standard Precautions | ⚠️ ⓘ Caution / Info | ❌ Change Indicated |
| Enzyme Inhibitors | Eliglustat | | |
| Immunology | | | |
| Therapeutic Class | ✔ Standard Precautions | ⚠️ ⓘ Caution / Info | ❌ Change Indicated |
| Cholinergic Agonists | Cevimeline | | |
| Immunosuppressants | Cyclosporine Sirolimus | Tacrolimus (CYP3A5) | |
| Infectious Disease | | | |
| Therapeutic Class | ✔ Standard Precautions | ⚠️ ⓘ Caution / Info | ❌ Change Indicated |
| Antifungals | Ketoconazole | Voriconazole | |
| Non-nucleoside reverse transcriptase inhibitors | Efavirenz Nevirapine | | |

| Neurology | | | |
|------------------------------------|--|--------------------------|--------------------|
| Therapeutic Class | ✔ Standard Precautions | ⚠️ ⓘ Caution / Info | ❌ Change Indicated |
| Anticonvulsants | Phenytoin | Brivaracetam Clobazam | |
| Benzodiazepines | Alprazolam Clonazepam | Diazepam | |
| Central Monoamine-Depleting Agents | Tetrabenazine | | |
| Central Nervous System Agents | Dextromethorphan-Quinidine | | |
| Cholinesterase Inhibitors | Donepezil Galantamine | | |
| Oncology | | | |
| Therapeutic Class | ✔ Standard Precautions | ⚠️ ⓘ Caution / Info | ❌ Change Indicated |
| Antimetabolites | | Methotrexate | |
| EGFR Inhibitors | Gefitinib | | |
| Pain | | | |
| Therapeutic Class | ✔ Standard Precautions | ⚠️ ⓘ Caution / Info | ❌ Change Indicated |
| Analgesics, Opioid | Buprenorphine Codeine Fentanyl Hydrocodone Methadone (CYP2B6) Oxycodone Tramadol | Oxycodone (CYP3A5) | |
| Atypical antipsychotics | Olanzapine | | |

| Pain | | | |
|--|--|---------------------|---------------------|
| Therapeutic Class | ✓ Standard Precautions | ⚠️ ⓘ Caution / Info | ✖️ Change Indicated |
| Muscle Relaxants | | Carisoprodol | |
| Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) | Celecoxib Diclofenac Flurbiprofen Ibuprofen Lornoxicam Meloxicam Piroxicam | | |
| Selective Serotonin Reuptake Inhibitors (SSRIs) | Vortioxetine | | |
| Serotonin and Norepinephrine Reuptake Inhibitors (SSNRI) | Duloxetine Venlafaxine | | |
| Serotonin Receptor Antagonists and Reuptake Inhibitors (SARIs) | Trazodone | | |
| Tetracyclic antidepressants | Mirtazapine | | |
| Tricyclic antidepressants | Amitriptyline (CYP2D6) Clomipramine (CYP2D6) Desipramine Doxepin (CYP2D6) Imipramine (CYP2C19, CYP2D6) Nortriptyline Protriptyline | | |

| Psychiatry | | | |
|---|---|---|---|
| Therapeutic Class |  Standard Precautions |   Caution / Info |  Change Indicated |
| Alpha-2-adrenergic agonists | Guanfacine | | |
| Anxiolytics | Buspirone | | |
| Atypical antipsychotics | Aripiprazole Brexipiprazole Clozapine Iloperidone Olanzapine Quetiapine Risperidone | | |
| CNS Stimulants | | Amphetamine Dexmethylphenidate Dextroamphetamine Lisdexamfetamine Methylphenidate (COMT) | |
| Hypnotics | Eszopiclone | | |
| Monoamine Oxidase Inhibitors | | Moclobemide | |
| Selective Serotonin Reuptake Inhibitors (SSRIs) | Fluoxetine Fluvoxamine Paroxetine Vortioxetine | Citalopram Escitalopram Sertraline | |
| Serotonin and Norepinephrine Reuptake Inhibitors (SSNRI) | Atomoxetine Duloxetine Venlafaxine | | |
| Serotonin Receptor Antagonists and Reuptake Inhibitors (SARIs) | Trazodone | | |
| Tetracyclic | Mirtazapine | | |

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| Psychiatry | | | |
|---|--|----------------|------------------|
| Therapeutic Class | Standard Precautions | Caution / Info | Change Indicated |
| antidepressants | | | |
| Tricyclic antidepressants | Amitriptyline (CYP2D6) Clomipramine (CYP2D6) Desipramine Doxepin (CYP2D6) Imipramine (CYP2C19, CYP2D6) Nortriptyline Protriptyline | | |
| Typical antipsychotics | Flupenthixol Haloperidol Perphenazine Pimozide Thioridazine Zuclopenthixol | | |
| Reproductive | | | |
| Therapeutic Class | Standard Precautions | Caution / Info | Change Indicated |
| Contraceptives | Estrogen-containing oral contraceptives | | |
| Urology | | | |
| Therapeutic Class | Standard Precautions | Caution / Info | Change Indicated |
| Adrenergic alpha-1 Receptor Antagonists | Tamsulosin | | |
| Anticholinergic Agents | Fesoterodine Tolterodine | | |
| Beta-3 Adrenergic Agonists | Mirabegron | | |

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Other Drugs

Therapeutic Class




 **Standard Precautions**



  **Caution / Info**

 **Change Indicated**

Legend

Research Summary





-  Typical response is expected
-  Consider alternative therapy
-  Change Indicated

-  Additional information available
-  Response is uncertain

Evidence Level

-  Strong
-  Moderate
-  Emerging

Medication Research Details (by therapeutic class)

| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|--|---------|---|
| Adrenergic alpha-1 Receptor Antagonists | | | | |
| Tamsulosin (Flomax) |  CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Alpha-2-adrenergic agonists | | | | |
| Guanfacine (Tenex, Intuniv) |  CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |

| Drug | Finding | Research Summary | Concern | Evidence |
|---|--|--|----------|----------|
| Analgesics, Opioid | | | | |
| Buprenorphine (Butrans, Buprenex) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Codeine | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Fentanyl (Duragesic, Sublimaze) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Hydrocodone | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Methadone (CYP2B6) (Dolophine, Methadose) | ✓ CYP2B6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Oxycodone (Oxycontin) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Typical response expected. No additional therapeutic recommendations. | | ● |
| Oxycodone (CYP3A5) (Oxycontin) | ⚠ CYP3A5: Intermediate metabolizer. One normal function allele and one little or no function allele. | Intermediate 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 | ○ |
| Tramadol (Ultracet, Ultram) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |















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| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|---|----------------|----------|
| Antiarrhythmics | | | | |
| Flecainide (Tambocor) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Propafenone (Rythmol) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Anticholinergic Agents | | | | |
| Fesoterodine (Toviaz) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Tolterodine (Detrol) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Anticoagulants | | | | |
| Acenocoumarol (Sintrom, Acitrom) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Warfarin (CYP2C9, VKORC1) (Coumadin) | ⚠ Multigenic: VKORC1, CYP2C9: Normal metabolizer. Two normal function alleles. | Individuals with this combination of alleles may benefit from an increased dose of Warfarin. The FDA table recommends a therapeutic dose of 5-7 mg/day. | ADR & Efficacy | ● |











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| Drug | Finding | Research Summary | Concern | Evidence |
|---|--|--|---------|---|
| Anticonvulsants | | | | |
| Brivaracetam (Briviact, Nubriveo, Brivajoy) |  CYP2C19: *1 *2 | Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication, thus an increased risk of side effects. Consider reducing the dose. | ADR |  |
| Clobazam (Onfi) |  CYP2C19: *1 *2 | Intermediate metabolizers of this medication may 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 |  |
| Phenytoin (Dilantin) |  CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Antiemetics | | | | |
| Ondansetron (Zofran) |  CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Tropisetron (Navoban, Setrovel) |  CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Antifungals | | | | |
| Ketoconazole (Nizoral) |  CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Voriconazole (Vfend) |  CYP2C19: *1 *2 | Intermediate metabolizers of this medication may present with higher plasma concentrations of the active medication. Be alert to adverse reactions; monitor the patient's response to guide dosing. | ADR |  |

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| Drug | Finding | Research Summary | Concern | Evidence |
|---|---|---|----------|---|
| Antimetabolites | | | | |
| Methotrexate (Trexall, Rheumatrex, Otrexup) |  Multigenic: MTHFR (C677T), MTHFR (A1298C): Normal function. Two normal function alleles.; Decreased function. One normal function allele and one decreased function allele. | Individuals with decreased function of this gene frequently present with increased risk of side effects. Consider reducing the dose, or using an alternative medication. | ADR |  |
| Antiplatelet Agents | | | | |
| Clopidogrel (Plavix) |  CYP2C19: *1 *2 | Intermediate 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 |  |
| Prasugrel (Effient) |  CYP2C19: *1 *2 | Typical response expected. No additional therapeutic recommendations. | |  |
| Ticagrelor (Brilinta) |  CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Anxiolytics | | | | |
| Buspirone (Buspar) |  CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |

| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|--|---------|----------|
| Atypical antipsychotics | | | | |
| Aripiprazole (Abilify) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Brexpiprazole (Rexulti) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Clozapine (Clozaril, Leponex, Versacloz) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Iloperidone (Fanapt) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Olanzapine (Zalasta, Zyprexa) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Typical response expected. No additional therapeutic recommendations. | | ● |
| Quetiapine (Seroquel) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Risperidone (Risperdal) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |

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| Drug | Finding | Research Summary | Concern | Evidence |
|---------------------------------------|--|---|---------|----------|
| Benzodiazepines | | | | |
| Alprazolam (Xanax, Niravam) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Clonazepam (Klonopin) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Diazepam (Valium) | ⚠ CYP2C19: *1 *2 | 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 | ◐ |
| Beta-3 Adrenergic Agonists | | | | |
| Mirabegron (Myrbetriq) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Beta Blockers | | | | |
| Carvedilol (Coreg) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Metoprolol (Lopressor) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Nebivolol (Bystolic) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Typical response expected. No additional therapeutic recommendations. | | ● |
| Propranolol (Inderal) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Typical response expected. No additional therapeutic recommendations. | | ● |
| Timolol (Blocadren) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |

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| Drug | Finding | Research Summary | Concern | Evidence |
|---|--|--|---------|----------|
| Central Monoamine-Depleting Agents | | | | |
| Tetrabenazine (Xenazine) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Central Nervous System Agents | | | | |
| Dextromethorphan-Quinidine (Nuedexta) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Cholinergic Agonists | | | | |
| Cevimeline (Evoxac) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Cholinesterase Inhibitors | | | | |
| Donepezil (Aricept) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Galantamine (Razadyne, Razadyne ER, Nivalin, Lycoremine, Reminyl) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |

| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|--|----------|---|
| CNS Stimulants | | | | |
| Amphetamine (Adzenys, Evekeo) |  COMT(Val158Met): Decreased function. One normal function allele and one decreased function allele. | Individuals with decreased function of this gene may present with increased risk of pharmacotherapy failure. Be alert to lack of efficacy. | Efficacy |  |
| Dexmethylphenidate (Focalin) |  COMT(Val158Met): Decreased function. One normal function allele and one decreased function allele. | Individuals with decreased function of this gene may present with increased risk of pharmacotherapy failure. Be alert to lack of efficacy. | Efficacy |  |
| Dextroamphetamine (Zenedi, Dexedrine) |  COMT(Val158Met): Decreased function. One normal function allele and one decreased function allele. | Individuals with decreased function of this gene may present with increased risk of pharmacotherapy failure. Be alert to lack of efficacy. | Efficacy |  |
| Lisdexamfetamine (Vyvanse) |  COMT(Val158Met): Decreased function. One normal function allele and one decreased function allele. | Individuals with decreased function of this gene may present with increased risk of pharmacotherapy failure. Be alert to lack of efficacy. | Efficacy |  |
| Methylphenidate (COMT) (Concerta, Metadate, Ritalin, Ritalin LA, Quillivant, Daytrana, Methylin) |  COMT(Val158Met): Decreased function. One normal function allele and one decreased function allele. | Individuals with decreased function of this gene may present with increased risk of pharmacotherapy failure. Be alert to lack of efficacy. | Efficacy |  |
| Contraceptives | | | | |
| Estrogen-containing oral contraceptives |  F5: Two wild-type alleles. | Individuals with wild type alleles are expected to show typical response. No additional therapeutic recommendations. | |  |
| Dipeptidyl peptidase-4 (DPP-4) inhibitor | | | | |
| Saxagliptin (Onglyza) |  CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |











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| Drug | Finding | Research Summary | Concern | Evidence |
|---|--|---|----------|----------|
| EGFR Inhibitors | | | | |
| Gefitinib (Iressa) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Enzyme Inhibitors | | | | |
| Eliglustat (Cerdelga) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Hypnotics | | | | |
| Eszopiclone (Lunesta) | ✓ 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) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Sirolimus (Rapamune) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Tacrolimus (CYP3A5) (Prograf, Hecoria) | ⚠ CYP3A5: Intermediate metabolizer. One normal function allele and one little or no function allele. | Intermediate metabolizers of this medication frequently present with lower plasma concentrations of the active medication, thus an increased risk of pharmacotherapy failure. Consider increasing the dose; monitor the patient's response to guide dosing. | Efficacy | ● |
| Monoamine Oxidase Inhibitors | | | | |
| Moclobemide (Manerix, Aurorix, Amira, Clobemix, Depnil) | ⚠ CYP2C19: *1 *2 | 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 | ◐ |

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| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|---|---------|---|
| Muscle Relaxants | | | | |
| Carisoprodol (Soma) |  CYP2C19: *1 *2 | 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, or consider alternative medication. | ADR |  |
| Non-drug | | | | |
| ApoE |  ApoE: Two wild-type alleles. | Typical cardiovascular disease risk expected. | | |
| COMT(Val158Met) |  COMT(Val158Met): Decreased function. One normal function allele and one decreased function allele. | No additional therapeutic recommendations. | | |
| CYP1A2 |  CYP1A2: Indeterminate metabolizer. Two uncertain function alleles. | No additional therapeutic recommendations. | | |
| CYP2B6 |  CYP2B6: Normal metabolizer. Two normal function alleles. | Typical response is expected; no additional therapeutic recommendations. | | |
| Non-nucleoside reverse transcriptase inhibitors | | | | |
| Efavirenz (Sustiva) |  CYP2B6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Nevirapine (Viramune) |  CYP2B6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |

| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|--|---------|----------|
| Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) | | | | |
| Celecoxib (Celebrex) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Diclofenac (Cataflam) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Flurbiprofen (Ocufer) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Ibuprofen (Motrin, Advil) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Lornoxicam (Xefo) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Meloxicam (Mobic) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Piroxicam (Feldene) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |















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| Drug | Finding | Research Summary | Concern | Evidence |
|---|--|---|---------|---|
| Proton Pump Inhibitors (PPIs) | | | | |
| Dexlansoprazole (Dexilant, Kapidex) |  CYP2C19: *1 *2 | 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 |  |
| Esomeprazole (Nexium) |  CYP2C19: *1 *2 | Intermediate metabolizers of this medication may 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 |  |
| Lansoprazole (Prevacid) |  CYP2C19: *1 *2 | 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 |  |
| Omeprazole (Prilosec, Zegerid) |  CYP2C19: *1 *2 | 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 |  |
| Pantoprazole (Protonix) |  CYP2C19: *1 *2 | 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 |  |
| Rabeprazole (Aciphex) |  CYP2C19: *1 *2 | Intermediate metabolizers of this medication may 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 |  |

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| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|---|---------|---|
| Selective Serotonin Reuptake Inhibitors (SSRIs) | | | | |
| Citalopram (Celexa) |  CYP2C19: *1 *2 | Intermediate metabolizers of this medication may 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 |  |
| Escitalopram (Lexapro) |  CYP2C19: *1 *2 | Intermediate metabolizers of this medication may 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 |  |
| Fluoxetine (Prozac) |  CYP2D6: Normal metabolizer. Two normal function alleles. | Typical response expected. No additional therapeutic recommendations. | |  |
| Fluvoxamine (Luvox) |  CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Paroxetine (Paxil) |  CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |
| Sertraline (Zoloft) |  CYP2C19: *1 *2 | Intermediate 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; monitor the patient's response to guide dosing. | ADR |  |
| Vortioxetine (Trintellix) |  CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | |  |

| Drug | Finding | Research Summary | Concern | Evidence |
|---|--|---|---------|----------|
| Serotonin and Norepinephrine Reuptake Inhibitors (SSNRI) | | | | |
| Atomoxetine (Strattera) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Duloxetine (Cymbalta) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Venlafaxine (Effexor) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Serotonin Receptor Antagonists and Reuptake Inhibitors (SARIs) | | | | |
| Trazodone (Oleptro, Desyrel) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Statins | | | | |
| Atorvastatin (Lipitor, Caduet) | ✓ CYP3A4: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Simvastatin (Zocor) | ✓ SLCO1B1: 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 | Research Summary | Concern | Evidence |
|--|--|--|---------|----------|
| Sulfonylurea | | | | |
| Gliclazide (Diamicon, Diaprel, Azukon) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Glimepiride (Amaryl) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Glyburide (Glibenclamide) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Tolbutamide (Orinase) | ✓ CYP2C9: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Tetracyclic antidepressants | | | | |
| Mirtazapine (Remeron) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Typical response expected. No additional therapeutic recommendations. | | ● |

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| Drug | Finding | Research Summary | Concern | Evidence |
|--|---|--|---------|----------|
| Tricyclic antidepressants | | | | |
| Amitriptyline (CYP2D6) (Elavil) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Clomipramine (CYP2D6) (Anafranil) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Desipramine (Norpramin) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Doxepin (CYP2D6) (Deptran) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Imipramine (CYP2C19, CYP2D6) (Tofranil-PM, Tofranil) | ✓ Multigenic: CYP2D6, CYP2C19: Normal metabolizer. Two normal function alleles. | Individuals with this combination of alleles are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Nortriptyline (Pamelor) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Protriptyline (Vivactil) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |

| Drug | Finding | Research Summary | Concern | Evidence |
|--|--|--|---------|----------|
| Typical antipsychotics | | | | |
| Flupenthixol (Depixol, Fluanxol) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Typical response expected. No additional therapeutic recommendations. | | ● |
| Haloperidol (Haldol) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Perphenazine (Trilafon) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Pimozide (Orap) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Thioridazine (Mellaril, Melleril) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Zuclopenthixol (Cisordinol, Clopixol) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |
| Vesicular monoamine transporter 2 inhibitor | | | | |
| Deutetrabenazine (Austedo) | ✓ CYP2D6: Normal metabolizer. Two normal function alleles. | Normal metabolizers of this medication are expected to show typical response. No additional therapeutic recommendations. | | ● |

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Evidence Levels

Strong

- 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 Coriell Pharmacogenomics Advisory Group.
- Includes gene-drug pairs with guidelines supported by a pharmacogenomics consortium.

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 from regulatory agency-approved drug labels.
- Includes gene-drug pairs for which potential clinical outcomes are inferred from similar gene-drug interactions with guidelines supported by a pharmacogenomics consortium.

Emerging

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

Patient Information Card

This card contains an abbreviated genetic research summary.
It is not intended as a replacement for the complete CLS PGx Research Review.

| | | | | | |
|---|---------|---------------------------|------------------|---------------------------------------|---------------------------------|
| | | | CYP2C9 | *1 *1 | Normal metabolizer |
| Coriell Life Sciences www.coriell.com/ | | | CYP2D6 | *2A *2B; or *2A *2A; or *2B *2B | Normal metabolizer |
| Patient: PINCKNEY, LILLIE DOB: 1946-10-18 Sample ID: 2402098002 | | | CYP3A4 | *1A *1A | Normal metabolizer |
| This card shows information about your genetics that relate to drug metabolism. Show to your doctors before being prescribed new medications. | | | CYP3A5 | *1 *3 | Intermediate metabolizer |
| Genetic Research Summary | | | Factor V Leiden | Normal | See Thrombosis Research Summary |
| ApoE | ε3 ε3 | See ApoE Research Summary | MTHFR (A1298C) | T G | See Thrombosis Research Summary |
| COMT(Val158Met) | G A | Decreased function | MTHFR (C677T) | G G | See Thrombosis Research Summary |
| CYP1A2 | *1N *1W | Unknown Metabolizer | Prothrombin (F2) | Normal | See Thrombosis Research Summary |
| CYP2B6 | *1 *1 | Normal metabolizer | SLCO1B1 | *1 *1 | Normal function |
| CYP2C19 | *1 *2 | Intermediate metabolizer | VKORC1 | *1 *1 | Low sensitivity to warfarin |

↑ Cut on dotted lines.

↑ Fold Here

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