

Drug-Gene Associations, Clinical Recommendations, Evidence Levels, and Differences in Dosing or Use Recommendations for Drugs Listed in Both FDA Table of Pharmacogenetic Associations and CPIC Guidelines ^{ab} (As of Q2 2022)								
Unique Drugs (n = 44)	Associated Genes	FDA Table Section Classification	CPIC Guideline Classification of Recommendation	CPIC Level	PharmGKB Level	PGx Info on FDA Label	Differences in Use Recommendations in CPIC Guideline(s) and FDA Table	
Abacavir	HLA-B	Recommendation	Strong	A	1A	Testing required	None	
Allopurinol	HLA-B	Potential Impact	Strong	A	1A	NA	CPIC states contraindicated if HLA-B*5801 positive; FDA states higher risk of adverse reaction	
Amitriptyline	CYP2C19	Not included	Optional UM/RM, moderate PM	A	1A	NA	CPIC recommends avoiding amitriptyline in UMs/RMs/PMs	
	CYP2D6	PK Only	Strong UM/PM, moderate IM	A	1A	Actionable PGx	CPIC lists additional gene (CYP2C19) and provides dose guidance in IMs and PMs and avoid in UMs; FDA states alters systemic concentrations	
Atomoxetine	CYP2D6	Recommendation	Strong or moderate depending on AS and children vs adults	A	1A	Actionable PGx	CPIC provides dose guidance for all phenotypes and indicates potential for adverse reactions and improved efficacy compared with non-PMs; FDA states adverse reaction risk in PMs	
Atorvastatin	SLCO1B1	PK Only	Moderate	A	1A	NA	CPIC recommends initiating 40 mg or less in decreased function and 20 mg or less in poor function. FDA states poor function transporters may result in higher systemic concentrations.	
	TPMT	Recommendation	Strong IM/PM	A	1A	Testing recommended	CPIC provides dose guidance for IMs and for malignancy in PMs, advises considering alternatives for other PMs; FDA indicates consider alternatives in PM and dose reduction in CPIC, provides dose guidance for IMs; FDA indicates insufficient data available for dosing guidance for IMs	
	NUDT15	Recommendation	Strong	A	1A	Testing recommended		
Capecitabine	DPYD	Recommendation	Strong or moderate depending on AS	A	1A	Actionable PGx		
Carbamazepine	HLA-B	Recommendation	Strong/optional	A	1A	Testing required	CPIC states avoid use if HLA-A*31:01 positive; FDA states consider risk and benefit; CPIC and FDA have different dosing recommendations	
	HLA-A	Potential impact	Strong/optional	A	1A	Actionable PGx		
Celecoxib	CYP2C9	Recommendation	Moderate IM (AS of 1) and PM	A	1A	Actionable PGx	None	
Citalopram	CYP2C19	Recommendation	Strong IM, moderate PM/UM	A	1A	Actionable PGx	CPIC recommends 50% dose reduction in PMs and alternative therapy in UMs; FDA recommends maximum dose of 20 mg in PMs	
Clomipramine	CYP2D6	PK Only	Optional	B	1A	Actionable PGx	CPIC lists additional gene (CYP2C19), provides dose guidance, and suggests alternative therapy in UMs and PMs; FDA states alters systemic concentrations only	
	CYP2C19	Not included	Optional UM/RM/PM	B	1A	NA	CPIC provides optional recommendation to avoid tertiary amines in UMs/RMs/PMs	
Clopidogrel	CYP2C19	Recommendation	Strong PM, moderate IM	A	1A	Actionable PGx	None	
Codeine	CYP2D6	Recommendation and potential impact	Strong UM, moderate IM, optional PM	A	1A	Actionable PGx	CPIC recommends avoiding use in UMs and PMs; FDA states drug contraindicated in children under 12 years of age, regardless of phenotype	
Desipramine	CYP2D6	PK Only	Optional	B	1A	Actionable PGx	CPIC provides dose guidance and suggests alternative therapy in UMs and PMs; FDA states alters systemic concentrations only	
Dexlansoprazole	CYP2C19	PK Only	Moderate for RM, NM, and PM	B	1A	Actionable PGx	CPIC provides optional dosing recommendations for all phenotypes; FDA states IMs and PMs may have higher systemic concentrations	
Doxepin	CYP2C19	PK Only	Optional	B	1A	Actionable PGx	CPIC provides dose guidance; FDA states alters systemic concentrations only	
	CYP2D6	PK Only	Optional	B	1A	Actionable PGx	CPIC states alternative therapy in UMs and provides dose guidance in PMs; FDA states alters systemic concentrations only	
Efavirenz	CYP2B6	Potential Impact	Moderate PM/IM	A	1A	Actionable PGx	CPIC provides dose guidance in IMs and PMs; FDA states higher concentrations and QT prolongation in PMs	
Escitalopram	CYP2C19	PK Only	Moderate PM/UM	A	1A	Actionable PGx	CPIC recommends considering alternative for UMs and dose reduction for PMs; FDA states alters systemic concentrations (drug was 1 of 2 drugs that were subject of FDA warning letter to INOVA Health)	
Fluorouracil	DPYD	Recommendation	Strong or moderate depending on AS	A	1A	Actionable PGx	CPIC provides dose guidance for IMs; FDA indicates insufficient data available for dose guidance for IMs	
Flurbiprofen	CYP2C9	Recommendation	Moderate IM (AS of 1) and PM	A	1A	Actionable PGx	None	
Fluvoxamine	CYP2D6	PK Only	Optional PM	B	1A	Actionable PGx	CPIC recommends dose reduction in PMs; FDA states use with caution	
Fosphenytoin	CYP2C9	Recommendation	Strong NM/PM, Moderate IM	A		Actionable PGx	CPIC recommends using 25% less for the typical maintenance dose in IMs with an AS=1 and 50% less for the typical maintenance dose in PMs after a standard loading dose. FDA recommends consideration of avoiding fosphenytoin as an alternative to carbamazepine in patients who are CYP2C9*3 carriers due to higher risk of severe cutaneous reactions.	
	HLA-B	Recommendation	Strong	A		Actionable PGx	CPIC recommends avoiding fosphenytoin/phenytoin in phenytoin naive patients and avoid carbamazepine and oxcarbazepine. FDA recommends consideration of avoiding fosphenytoin as an alternative to carbamazepine in patients who are positive for HLA-B*15:02.	
Ibuprofen	CYP2C9	PK Only	Moderate PM	A	1A		CPIC recommends dose reduction in PMs; FDA states *3 allele carriers or PMs may have higher systemic concentrations	
Imipramine	CYP2C19	Not included	Optional UM/RM/PM	B	1A	NA	CPIC provides optional recommendation to avoid tertiary amines in UM/RM/PMs	
	CYP2D6	PK Only	Optional	B	1A	Actionable PGx	CPIC lists additional gene (CYP2C19), provides dose guidance, and states alternative therapy in UMs and PMs; FDA states alters systemic concentrations	
Lansoprazole	CYP2C19	PK Only	Optional UM, Moderate PM	A	1A	Informative PGx	CPIC provides optional recommendation to increase the starting daily dose by 100% in UMs. CPIC provides optional recommendation to initiate standard starting daily dose. For chronic therapy (> 12 weeks) with efficacy achieved, consider 50% reduction in daily dose. FDA states higher systemic concentrations in PMs.	
Meloxicam	CYP2C9	Recommendation	Moderate IM (AS of 1) and PM	A	1A	Actionable PGx	CPIC recommends dose reduction in IMs with AS of 1 and recommends alternative therapy in PMs; FDA states PMs or *3 allele carriers have higher systemic concentrations and advises considering dose reductions in PMs	
Mercaptopurine	TPMT	Recommendation	Strong PM/IM	A	1A	Testing recommended	CPIC recommends dose guidance in PMs and IMs; FDA provides dose guidance in PMs and states IMs may require dosage reduction based on tolerability	
	NUDT15	Recommendation	Strong PM/IM	A	1A	Testing recommended	CPIC recommends dose guidance in PMs and IMs; FDA provides dose guidance in PMs and states IMs may require dosage reduction based on tolerability	
Nortriptyline	CYP2D6	PK Only	Strong UM/PM, moderate IM	A	1A	Actionable PGx	CPIC provides dose guidance; FDA states alternative therapy in UMs and PMs or dose reduction in PMs	
Omeprazole	CYP2C19	PK Only	Moderate for RM, NM, and PM	A	1A	Actionable PGx	CPIC provides dosing recommendations for all phenotypes; FDA states IM and PMs may have higher systemic concentrations only	

Oxcarbazepine	HLA-A	Not included	Strong/optional	C	3	NA	CPIC recommends avoiding use if oxcarbazepine naive and alternative agents are available; FDA does not mention HLA-A
	HLA-B	Potential Impact	Strong/optional	A	1A	Testing recommended	CPIC recommends avoiding use if oxcarbazepine naive and alternative agents are available; FDA states higher adverse reaction risk only
Pantoprazole	CYP2C19	Recommendation	Moderate for RM, NM, and PM	A	1A	Actionable PGx	CPIC provides dosing recommendations for all phenotypes; FDA states PMs may have higher systemic concentrations and advises considering dose reduction in children
Paroxetine	CYP2D6	PK Only	Strong UM, optional PM	A	1A	Informative PGx	CPIC recommends alternative for UMs and dose reduction for PMs; FDA states alters systemic concentrations only
Phenytoin	CYP2C9	Recommendation	Strong NM/PM, Moderate IM	A	1A	Actionable PGx	CPIC recommends using 25% less for the typical maintenance dose in IMs with an AS=1 and 50% less for the typical maintenance dose in PMs after a standard loading dose. FDA recommends consideration of avoiding fosphenytoin as an alternative to carbamazepine in patients who are CYP2C9*3 carriers due to higher risk of severe cutaneous reactions. .
	HLA-B	Recommendation	Strong	A	1A	Actionable PGx	CPIC recommends avoiding fosphenytoin/phenytoin in phenytoin naive patients and avoid carbamazepine and oxcarbazepine. FDA recommends consideration of avoiding fosphenytoin as an alternative to carbamazepine in patients who are positive for HLA-B*15:02.
Piroxicam	CYP2C9	Recommendation	Moderate PM/IM	A	1A	Actionable PGx	CPIC recommends avoiding use in IMs with AS of 1 and PMs; FDA states consider reducing dosage in PMs
	SLCO1B1	PK Only	Strong for decreased, Moderate for poor	A	1A	Actionable PGx	CPIC states in decreased function there is increased risk of myopathy with doses >20mg. In poor function CPIC recommends starting at 20 mg or less. FDA states poor function transporters may result in higher systemic concentrations.
Rosuvastatin	ABCG2	Not Included	Strong for normal, Moderate for decreased/poor	A	1A	NA	CPIC includes recommendations for normal, decreased and poor function. Gene-drug pair not included in FDA table.
	SLCO1B1	Potential Impact	Strong	A	1A	NA	CPIC provides dose guidance and states consider alternative statins as an option; FDA states risk of adverse reaction is higher at high doses only
Simvastatin	SLCO1B1	Potential Impact	Strong	A	1A	NA	CPIC provides dose guidance and states consider alternative statins as an option; FDA states risk of adverse reaction is higher at high doses only
Succinylcholine	BCHE	Recommendation	Strong (selected genes)	B/C	3	Actionable PGx	CPIC guidelines mention 2 genes (CACNA15 and RYR1); FDA recommendations are based on a different gene: BCHE
	CACNA15	Not included	Strong	A	1A	Actionable PGx	CPIC provides dose guidance; FDA states may result in lower systemic concentrations and adjust dose based on trough concentrations
	RYR1	Not included	Strong	A	1A	Actionable PGx	CPIC provides dose and drug selection guidance; FDA states impact on efficacy not well established
Tacrolimus	CYP3A5	Recommendation	Strong NM/IM	A	1A	NA	CPIC recommends dose guidance in PMs and IMs; FDA provides dose guidance in PMs and states IMs may require dosage reduction based on tolerability
Tamoxifen	CYP2D6	PK Only	Strong or moderate depending on AS	A	1A	Actionable PGx	CPIC provides dose and drug selection guidance; FDA states impact on efficacy not well established
Thioguanine	TPMT	Recommendation	Strong PM, moderate IM	A	3	Testing recommended	CPIC recommends dose guidance in PMs and IMs; FDA provides dose guidance in PMs and states IMs may require dosage reduction based on tolerability
	NUDT15	Recommendation	Strong PM, moderate IM	A	3	Testing recommended	CPIC recommends dose guidance in PMs and IMs; FDA provides dose guidance in PMs and states IMs may require dosage reduction based on tolerability
Tramadol	CYP2D6	Recommendation	Strong UM/PM	A	1A	Actionable PGx	CPIC recommends avoiding use in UMs and PMs; FDA states risks in UMs and avoid use in children under 12
	CYP2D6	PK Only	Optional	B	1A	Actionable PGx	CPIC lists additional gene (CYP2C19) and lists dose guidance or alternative therapy in UMs and PMs
Voriconazole	CYP2C19	Not included	Optional UM/RM/PM	B	1A	NA	CPIC provides optional recommendation to avoid tertiary amines in UMs/RMs/PMs. Gene-drug pair not included in FDA table.
	CYP2C19	PK Only	Moderate UM/RM/PM	A	1A	Actionable PGx	CPIC recommends alternative for UMs, RMs, and PMs; FDA states higher concentrations in IM and PMs
	CYP2C9	Recommendation	Strong or moderate	A	1A	Actionable PGx	CPIC provides specific dose guidance and algorithm; FDA states may alter systemic concentrations and dosage requirements
Warfarin	CYP4F2	Recommendation	Optional	A	1A	NA	CPIC provides specific dose guidance and algorithm; FDA states may alter systemic concentrations and dosage requirements
	VKORC1	Recommendation	Strong or moderate	A	1A	Actionable PGx	CPIC provides specific dose guidance and algorithm; FDA states may alter systemic concentrations and dosage requirements

Abbreviations: AS, activity score; CPIC; Clinical Pharmacogenetics Implementation Consortium; FDA; Food and Drug Administration; IM, intermediate metabolizer; NA, not applicable; NM, normal metabolizer; PGx, pharmacogenetics; PM, poor metabolizer; RM, rapid metabolizer; UM, ultrarapid metabolizer.

^aOchre color denotes drugs listed in both CPIC guidelines and the FDA Table for which dosing or use recommendations provided in the 2 sources differ; red denotes drugs for which additional or different gene-drug associations are mentioned.

^b"Recommendations" denotes therapeutic management recommendations; "Potential Impact," potential impact on safety or response; "PK Only," impact on pharmacokinetics only.