BIODECODE | İstanbul Genetik Grubu

All Clinical Areas panel

Pharmacogenomic Report

67 gene regions and 157 active substances; according to CPIC, DPWG and FDA guidelines.

Name	Date of birth / sex	Requesting physician	Report date
			18 Nov 2026
Protocol / sample	**National ID no.**	**Specimen type**	**Specimen received**
		Peripheral blood (K3-EDTA)	

Sequencing ID ORNEK_L01_00 Panel Twist BIODECODE PGx V2

Result

The genotype changes the treatment decision for **14 of 157** active substances.

Recommendations (p. 9) are given in the guideline's own wording.

HLA risk allele

B*58:01 positive: allopurinol. Source and details in the HLA analysis (p. 19).



8	✕ Alternative drug	amitriptyline, clomipramine, doxepin and 5 more (p. 9)	3 genes
6	▲ Dose adjustment	hydralazine, dexlansoprazole, lansoprazole and 3 more (p. 9)	4 genes
14	◆ Standard start, monitor	citalopram, escitalopram, atomoxetine and 11 more (p. 9)	5 genes
121	● Standard use	Genotype requires no change; full list in the drug guide (p. 2).	
8	○ No result	Gene not readable in this sample; do not assume standard use (p. 23).	

Genotype

enzymes that determine the verdicts; all (p. 23)

CYP2C19	NAT2	CYP2B6	CYP2C9	CYP2D6	CYP3A4	NUDT15
***1/*17**	***4/*4**	***1/*1**	***1/*1**	***1/*1**	***1/*1**	***1/*1**
Rapid	**Rapid**	Normal	Normal	Normal	Normal	Normal

Basis of this result

Seven analyses were assessed together.

67 gene regions	67 regions	5 genes with altered function.	(p. 23)
Exon and intron reading	whole gene	Whole gene read, not only known positions.	(p. 23)
Loss-of-function screening	39 variants	ACMG-based screening; no finding to report.	(p. 22)
HLA analysis	1 positive	HLA-A, HLA-B and HLA-C typed; B*58:01 positive.	(p. 19)
CYP2D6 confirmation	determined	Diplotype determined with the CYP2D6 module.	(p. 19)
CPIC, DPWG and FDA	28 active substances	Recommendations in the guidelines' own wording.	(p. 9)
Phenoconversion	6 active substances	If added, other recommendations change; ask first.	(p. 20)

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A clinical decision-support tool; to be interpreted together with the diagnosis, history, concomitant drugs and the physician's judgment. For research use · not IVD-approved.

Clinical section

Drug guide

157 active substances: use in this patient, by clinical area and drug class. The mark tells you what to do.

Neuropsychiatry

49 active substances · same classes as the Neuropsychiatry report

Antidepressants

19 active substances

✕ **Alternative drug**	amitriptyline, clomipramine, doxepin, imipramine, trimipramine	CYP2C19
◆ **Standard start, monitor**	citalopram, escitalopram	CYP2C19
● **Standard use**	amoxapine, bupropion, desipramine, fluoxetine, fluvoxamine, mirtazapine, nortriptyline, paroxetine, protriptyline, sertraline, venlafaxine, vortioxetine	

Antipsychotics

12 active substances

● **Standard use**	aripiprazole, aripiprazole lauroxil, brexpiprazole, clozapine, haloperidol, iloperidone, perphenazine, pimozide, quetiapine, risperidone, thioridazine, zuclopenthixol	

Antiepileptics and anxiolytics

8 active substances

● **Standard use**	brivaracetam, carbamazepine, clobazam, diazepam, fosphenytoin, lamotrigine, oxcarbazepine, phenytoin	

ADHD and addiction treatment

3 active substances

◆ **Standard start, monitor**	atomoxetine	CYP2D6
● **Standard use**	amphetamine, lofexidine	

Neurology, other

7 active substances

◆ **Standard start, monitor**	tetrabenazine	CYP2D6
● **Standard use**	deutetrabenazine, donepezil, galantamine, pitolisant, siponimod, valbenazine	

Cardiology

18 active substances · same classes as the Cardiology report

Beta-blockers

3 active substances

● **Standard use**	carvedilol, labetalol, metoprolol	

Clinical section

Drug guide cont.

Statins and lipid-lowering agents

7 active substances

● **Standard use**	atorvastatin, fluvastatin, lovastatin, pitavastatin, pravastatin, rosuvastatin, simvastatin	

Antiarrhythmics and cardiac agents

3 active substances

● **Standard use**	flecainide, procainamide, propafenone	

Antithrombotics and anticoagulants

4 active substances

▲ **Dose adjustment**	warfarin	CYP4F2, VKORC1
● **Standard use**	acenocoumarol, clopidogrel, phenprocoumon	

Antihypertensives

1 active substance

▲ **Dose adjustment**	hydralazine	NAT2

Oncology and Hematology

17 active substances · same classes as the Oncology and Hematology report

Cytotoxic and targeted agents

13 active substances

● **Standard use**	capecitabine, dabrafenib, erdafitinib, fluorouracil, gefitinib, mercaptopurine, tegafur, thioguanine	
○ **No result**	belinostat, irinotecan, nilotinib	UGT1A1
	lapatinib	HLA-DRB1
	pazopanib	HLA-B

Supportive care and other agents

2 active substances

◆ **Standard start, monitor**	tamoxifen	CYP2D6
● **Standard use**	rasburicase	

Antithrombotics and anticoagulants	Four active substances are listed under Cardiology; in the Oncology and Hematology report they appear in this class.

Clinical section

Drug guide cont.

Antihemorrhagic drugs

2 active substances

● **Standard use**	avatrombopag, eltrombopag	

Other clinical areas

73 active substances · clinical areas without a dedicated report

Infectious Diseases

14 active substances

✕ **Alternative drug**	voriconazole≠	CYP2C19
● **Standard use**	abacavir, dapsone, efavirenz, isoniazid, nalidixic acid, nevirapine, nitrofurantoin, primaquine, sulfamethoxazole / trimethoprim, tafenoquine	
○ **No result**	atazanavir, dolutegravir, raltegravir	UGT1A1

Anesthesiology and Pain

14 active substances

◆ **Standard start, monitor**	desflurane≠, enflurane, halothane, isoflurane≠, methoxyflurane, sevoflurane≠	CACNA1S, RYR1
	succinylcholine≠	CACNA1S, RYR1, BCHE
● **Standard use**	carisoprodol, codeine, hydrocodone, lidocaine, mivacurium, oliceridine, tramadol	

Rheumatology and Pain

10 active substances

✕ **Alternative drug**	allopurinol≠	HLA-B
● **Standard use**	celecoxib, flurbiprofen, ibuprofen, lesinurad, lornoxicam, meloxicam, pegloticase, piroxicam, tenoxicam	

Endocrinology and Metabolism

6 active substances

● **Standard use**	chlorpropamide, glimepiride, glipizide, glyburide, tolazamide, tolbutamide	

Gastroenterology

9 active substances

▲ **Dose adjustment**	dexlansoprazole, lansoprazole, omeprazole, pantoprazole	CYP2C19
● **Standard use**	dronabinol, metoclopramide, ondansetron, sulfasalazine, tropisetron	

Clinical section

Drug guide cont.

Rheumatology, Immunology and Transplantation

5 active substances

● **Standard use**	azathioprine, cevimeline, chloroquine, hydroxychloroquine, tacrolimus	

Other

15 active substances

✕ **Alternative drug**	ivacaftor	CFTR
◆ **Standard start, monitor**	eliglustat, meclizine	CYP2D6
● **Standard use**	amifampridine, amifampridine phosphate, dextromethorphan, elagolix, flibanserin, methylene blue, mirabegron, sodium nitrite, tamsulosin, timolol, tolterodine, toluidine blue	

≠ Guidelines diverge; views in the drug recommendations (p. 13). Guideline texts for the 28 active substances with a recommendation (p. 9). Alphabetical list of all active substances (p. 6). “No result”: the gene could not be read in this sample; do not assume standard use. Not in this guide: 93 active substances without a pharmacogenetic guideline. Names are active substance names; brand names are not used.

Clinical section

Drug list

All 157 active substances in the panel, alphabetically; each row gives the verdict and its determining gene.

≠ Active substance on which guidelines diverge (p. 13). Recommendation texts (p. 9). The Gene column shows the gene behind the verdict; gene results for this sample (p. 23).

Active substance	Verdict	Gene
Abacavir	Standard use	HLA-B
Acenocoumarol	Standard use	CYP4F2
Allopurinol≠	Alternative drug	HLA-B
Amifampridine	Standard use	NAT2
Amifampridine Phosphate	Standard use	NAT2
Amitriptyline	Alternative drug	CYP2C19
Amoxapine	Standard use	CYP2D6
Amphetamine	Standard use	CYP2D6
Aripiprazole	Standard use	CYP2D6
Aripiprazole Lauroxil	Standard use	CYP2D6
Atazanavir	No result	UGT1A1
Atomoxetine	Standard start, monitor	CYP2D6
Atorvastatin	Standard use	SLCO1B1
Avatrombopag	Standard use	CYP2C9, F5
Azathioprine	Standard use	NUDT15, TPMT
Belinostat	No result	UGT1A1
Brexpiprazole	Standard use	CYP2D6
Brivaracetam	Standard use	CYP2C19
Bupropion	Standard use	CYP2B6
Capecitabine	Standard use	DPYD
Carbamazepine	Standard use	HLA-B
Carisoprodol	Standard use	CYP2C19
Carvedilol	Standard use	CYP2D6
Celecoxib	Standard use	CYP2C9
Cevimeline	Standard use	CYP2D6
Chloroquine	Standard use	G6PD
Chlorpropamide	Standard use	G6PD
Citalopram	Standard start, monitor	CYP2C19
Clobazam	Standard use	CYP2C19
Clomipramine	Alternative drug	CYP2C19
Clopidogrel	Standard use	CYP2C19
Clozapine	Standard use	CYP2D6
Codeine	Standard use	CYP2D6
Dabrafenib	Standard use	G6PD
Dapsone	Standard use	G6PD
Desflurane≠	Standard start, monitor	CACNA1S, RYR1
Desipramine	Standard use	CYP2D6
Deutetrabenazine	Standard use	CYP2D6
Dexlansoprazole	Dose adjustment	CYP2C19
Dextromethorphan	Standard use	CYP2D6
Diazepam	Standard use	CYP2C19
Dolutegravir	No result	UGT1A1
Donepezil	Standard use	CYP2D6
Doxepin	Alternative drug	CYP2C19
Dronabinol	Standard use	CYP2C9
Efavirenz	Standard use	CYP2B6
Elagolix	Standard use	SLCO1B1
Eliglustat	Standard start, monitor	CYP2D6
Eltrombopag	Standard use	F5
Enflurane	Standard start, monitor	CACNA1S, RYR1
Erdafitinib	Standard use	CYP2C9

Clinical section

Drug list cont.

Active substance	Verdict	Gene
Escitalopram	Standard start, monitor	CYP2C19
Flecainide	Standard use	CYP2D6
Flibanserin	Standard use	CYP2C19
Fluorouracil	Standard use	DPYD
Fluoxetine	Standard use	CYP2D6
Flurbiprofen	Standard use	CYP2C9
Fluvastatin	Standard use	CYP2C9, SLCO1B1
Fluvoxamine	Standard use	CYP2D6
Fosphenytoin	Standard use	HLA-B
Galantamine	Standard use	CYP2D6
Gefitinib	Standard use	CYP2D6
Glimepiride	Standard use	G6PD
Glipizide	Standard use	G6PD
Glyburide	Standard use	G6PD
Haloperidol	Standard use	CYP2D6
Halothane	Standard start, monitor	CACNA1S, RYR1
Hydralazine	Dose adjustment	NAT2
Hydrocodone	Standard use	CYP2D6
Hydroxychloroquine	Standard use	G6PD
Ibuprofen	Standard use	CYP2C9
Iloperidone	Standard use	CYP2D6
Imipramine	Alternative drug	CYP2C19
Irinotecan	No result	UGT1A1
Isoflurane≠	Standard start, monitor	CACNA1S, RYR1
Isoniazid	Standard use	NAT2
Ivacaftor	Alternative drug	CFTR
Labetalol	Standard use	CYP2D6

Active substance	Verdict	Gene
Lamotrigine	Standard use	HLA-B
Lansoprazole	Dose adjustment	CYP2C19
Lapatinib	No result	HLA-DRB1
Lesinurad	Standard use	CYP2C9
Lidocaine	Standard use	G6PD
Lofexidine	Standard use	CYP2D6
Lornoxicam	Standard use	CYP2C9
Lovastatin	Standard use	SLCO1B1
Meclizine	Standard start, monitor	CYP2D6
Meloxicam	Standard use	CYP2C9
Mercaptopurine	Standard use	NUDT15, TPMT
Methoxyflurane	Standard start, monitor	CACNA1S, RYR1
Methylene Blue	Standard use	G6PD
Metoclopramide	Standard use	CYP2D6
Metoprolol	Standard use	CYP2D6
Mirabegron	Standard use	CYP2D6
Mirtazapine	Standard use	CYP2D6
Mivacurium	Standard use	BCHE
Nalidixic Acid	Standard use	G6PD
Nevirapine	Standard use	CYP2B6
Nilotinib	No result	UGT1A1
Nitrofurantoin	Standard use	G6PD
Nortriptyline	Standard use	CYP2D6
Oliceridine	Standard use	CYP2D6
Omeprazole	Dose adjustment	CYP2C19
Ondansetron	Standard use	CYP2D6
Oxcarbazepine	Standard use	HLA-B
Pantoprazole	Dose adjustment	CYP2C19
Paroxetine	Standard use	CYP2D6

Clinical section

Drug list cont.

Active substance	Verdict	Gene
○ Pazopanib	No result	HLA-B
● Pegloticase	Standard use	G6PD
● Perphenazine	Standard use	CYP2D6
● Phenprocoumon	Standard use	CYP4F2
● Phenytoin	Standard use	HLA-B
● Pimozide	Standard use	CYP2D6
● Piroxicam	Standard use	CYP2C9
● Pitavastatin	Standard use	SLCO1B1
● Pitolisant	Standard use	CYP2D6
● Pravastatin	Standard use	SLCO1B1
● Primaquine	Standard use	G6PD
● Procainamide	Standard use	NAT2
● Propafenone	Standard use	CYP2D6
● Protriptyline	Standard use	CYP2D6
● Quetiapine	Standard use	CYP3A4
○ Raltegravir	No result	UGT1A1
● Rasburicase	Standard use	G6PD
● Risperidone	Standard use	CYP2D6
● Rosuvastatin	Standard use	ABCG2
● Sertraline	Standard use	CYP2C19
◆ Sevoflurane≠	Standard start, monitor	CACNA1S, RYR1
● Simvastatin	Standard use	SLCO1B1
● Siponimod	Standard use	CYP2C9
● Sodium Nitrite	Standard use	G6PD
◆ Succinylcholine≠	Standard start, monitor	CACNA1S, RYR1, BCHE
● Sulfamethoxazole / Trimethoprim	Standard use	NAT2
● Sulfasalazine	Standard use	NAT2
● Tacrolimus	Standard use	CYP3A5
● Tafenoquine	Standard use	G6PD
◆ Tamoxifen	Standard start, monitor	CYP2D6
● Tamsulosin	Standard use	CYP2D6
● Tegafur	Standard use	DPYD
● Tenoxicam	Standard use	CYP2C9
◆ Tetrabenazine	Standard start, monitor	CYP2D6
● Thioguanine	Standard use	NUDT15, TPMT
● Thioridazine	Standard use	CYP2D6
● Timolol	Standard use	CYP2D6
● Tolazamide	Standard use	G6PD
● Tolbutamide	Standard use	G6PD
● Tolterodine	Standard use	CYP2D6
● Toluidine Blue	Standard use	G6PD
● Tramadol	Standard use	CYP2D6
✕ Trimipramine	Alternative drug	CYP2C19
● Tropisetron	Standard use	CYP2D6
● Valbenazine	Standard use	CYP2D6
● Venlafaxine	Standard use	CYP2D6
✕ Voriconazole≠	Alternative drug	CYP2C19
● Vortioxetine	Standard use	CYP2D6
▲ Warfarin	Dose adjustment	CYP4F2, VKORC1
● Zuclopenthixol	Standard use	CYP2D6

Clinical section

Drug recommendations

28 active substances with a guideline recommendation. Each row is the named guideline's own recommendation; its strength is on the right.

✖ Alternative drug

8 active substances

Allopurinol HLA-B risk alleles screened: *15:02 negative · *57:01 negative · *58:01 positive CPIC guideline · PMID 26094938	✖	**HLA-B *58:01 POSITIVE — see the guideline recommendation below. [CPIC A]** **FDA: pre-treatment testing recommended · HLA-B — this patient's HLA-B result is available in this report**	
	CPIC	**HLA-B:** Allopurinol is contraindicated	strong
	DPWG	**ABCG2:** Use 1.25 times the standard dose. This equates to a dose titration schedule of 100, 200, 400 and 500 mg/day instead of the usual schedule of 100, 200, 300 and 400 mg/day. **HLA-B:** Choose an alternative, such as febuxostat Another option is to induce allopurinol tolerance first: To induce allopurinol tolerance, the allopurinol dose is increased every 3 days until a dose of 100 mg/day has been achieved on Day 28. The consecutive daily doses in the induction protocol are 50 µg, 100 µg, 200 µg, 500 µg, 1 mg, 5 mg, 10 mg, 25 mg, 50 mg and 100 mg.	
	FDA	**HLA-B:** "The use of [allopurinol] is not recommended in HLA-B*58:01 positive patients unless the benefits clearly outweigh the risks." See label for more information. *	
Amitriptyline CYP2C19 rapid · CYP2D6 normal CPIC guideline · PMID 27997040	CPIC	Consider alternative drug not metabolized by CYP2C19; If amitriptyline is warranted, utilize therapeutic drug monitoring to guide dose adjustment.	optional
Clomipramine CYP2C19 rapid · CYP2D6 normal CPIC guideline · PMID 27997040	CPIC	Consider alternative drug not metabolized by CYP2C19; If clomipramine is warranted, utilize therapeutic drug monitoring to guide dose adjustment.	optional
Doxepin CYP2C19 rapid · CYP2D6 normal CPIC guideline · PMID 27997040	CPIC	Consider alternative drug not metabolized by CYP2C19; If doxepin is warranted, utilize therapeutic drug monitoring to guide dose adjustment.	optional
Imipramine CYP2C19 rapid · CYP2D6 normal CPIC guideline · PMID 27997040	CPIC	Consider alternative drug not metabolized by CYP2C19; If imipramine is warranted, utilize therapeutic drug monitoring to guide dose adjustment.	optional
Ivacaftor CFTR ivacaftor non-responsive (in cf patients) CPIC guideline · PMID 24598717		**FDA: pre-treatment testing REQUIRED · CFTR — this patient's CFTR result is available in this report**	
	CPIC	Ivacaftor is not recommended	moderate

Clinical section

Drug recommendations cont.

Trimipramine CYP2C19 rapid · CYP2D6 normal CPIC guideline · PMID 27997040	CPIC	Consider alternative drug not metabolized by CYP2C19; If trimipramine is warranted, utilize therapeutic drug monitoring to guide dose adjustment.	optional
Voriconazole CYP2C19 rapid CPIC guideline · PMID 27981572	CPIC	**Adults:** Choose an alternative agent that is not dependent on CYP2C19 metabolism as primary therapy in lieu of voriconazole. Such agents include isavuconazole, liposomal amphotericin B, and posaconazole.	moderate
		Pediatrics: Initiate therapy with recommended standard of care dosing. Use therapeutic drug monitoring to titrate dose to therapeutic trough concentrations.	moderate

▲ Dose adjustment

6 active substances

Dexlansoprazole, Lansoprazole, Omeprazole, Pantoprazole CYP2C19 rapid CPIC guideline · PMID 32770672	CPIC	Initiate standard starting daily dose. Consider increasing dose by 50-100% for the treatment of H. pylori infection and erosive esophagitis. Daily dose may be given in divided doses. Monitor for efficacy.	optional
Hydralazine NAT2 rapid CPIC guideline	CPIC	Consider a starting total daily dose of at least 75 mg. Titrate up to 300 mg total daily hydralazine dose as tolerated. NAT2 rapid metabolizers typically require a 50-100% higher maintenance dose compared to poor metabolizers.	moderate
Warfarin CYP2C9 normal CYP4F2 genotype only VKORC1 -1639 gg FDA labeling · PMID 28198005	FDA	Table 1 in the drug label provides ranges of expected maintenance daily doses of warfarin (COUMADIN) based on CYP2C9*2, CYP2C9*3 and VKORC1−1639G>A (rs9923231) genotypes. For CYP2C9*1/*1, VKORC1 GG (rs9923231CC), the range of expected maintenance daily dose is 5-7 mg. *	

◆ Standard start, monitor

14 active substances

Atomoxetine CYP2D6 normal CPIC guideline · PMID 30801677	CPIC	**Adults:** Initiate with a dose of 40 mg/day and increase to 80 mg/day after 3 days. If no clinical response and in the absence of adverse events after 2 weeks, consider increasing dose to 100 mg/day. If no clinical response observed after 2 weeks, consider obtaining a peak plasma concentration (1 to 2 hours after dose administered). If <200 ng/mL, consider a proportional increase in dose to approach 400 ng/mL. Dosages greater than 100 mg/day may be needed to achieve target concentrations.	moderate

Clinical section

Drug recommendations cont.

Atomoxetine cont.		**Pediatrics:** Initiate with a dose of 0.5 mg/kg/day and increase to 1.2 mg/kg/day after 3 days. If no clinical response and in the absence of adverse events after 2 weeks, consider obtaining a peak plasma concentration (1 to 2 hours after dose administered). If < 200 ng/mL, consider a proportional increase in dose to approach 400 ng/mL.	moderate
Citalopram, Escitalopram CYP2C19 rapid CPIC guideline · PMID 37032427	CPIC	Initiate therapy with recommended starting dose. If patient does not adequately respond to recommended maintenance dosing, consider titrating to a higher maintenance dose or switching to a clinically appropriate alternative antidepressant not predominantly metabolized by CYP2C19.	optional
Desflurane CACNA1S uncertain susceptibility RYR1 uncertain susceptibility CPIC guideline · PMID 30499100	CPIC FDA	Clinical findings, family history, further genetic testing and other laboratory data should guide use of halogenated volatile anesthetics or depolarizing muscle relaxants. "The use of SUPRANE [desflurane] is contraindicated in... [cases of k]nown or suspected genetic susceptibility to malignant hyperthermia...SUPRANE [desflurane] can induce malignant hyperthermia in patients with known or suspected susceptibility based on genetic factors or family history, including those with certain inherited ryanodine receptor (RYR1) or dihydropyridine receptor (CACNA1S) variants. " See label for more information. *	strong
Eliglustat CYP2D6 FDA labeling	FDA	**FDA: pre-treatment testing REQUIRED · CYP2D6 — this patient's CYP2D6 result is available in this report** CYP2D6 normal metabolizers have a recommended dose of 84 mg orally twice daily. * Basis — CYP2D6 — FDA labeling contains a genetic testing requirement; there is no published CPIC guideline	
Enflurane, Halothane, Methoxyflurane CACNA1S uncertain susceptibility RYR1 uncertain susceptibility CPIC guideline · PMID 30499100	CPIC	Clinical findings, family history, further genetic testing and other laboratory data should guide use of halogenated volatile anesthetics or depolarizing muscle relaxants.	strong
Isoflurane CACNA1S uncertain susceptibility RYR1 uncertain susceptibility CPIC guideline · PMID 30499100	CPIC	Clinical findings, family history, further genetic testing and other laboratory data should guide use of halogenated volatile anesthetics or depolarizing muscle relaxants.	strong

Clinical section

Drug recommendations cont.

Isoflurane cont.	FDA	"CONTRAINDICATIONS...with known or suspected genetic susceptibility to malignant hyperthermia...FORANE [isoflurane] can induce malignant hyperthermia in patients with known or suspected susceptibility based on genetic factors or family history, including those with certain inherited ryanodine receptor (RYR1) or dihydropyridine receptor (CACNA1S) variants." See label for more information. *	
Meclizine CYP2D6 FDA labeling	FDA	The meclizine (ANTIVERT) label states: "... when ANTIVERT® is administered to patients with CYP2D6 polymorphism, monitor for adverse reactions and clinical effect accordingly." "The genetic polymorphism of CYP2D6 that results in poor-, intermediate-, extensive-, and ultrarapid metabolizer phenotypes could contribute to large inter-individual variability in meclizine exposure." See label for more information. *	
Sevoflurane CACNA1S uncertain susceptibility RYR1 uncertain susceptibility CPIC guideline · PMID 30499100	CPIC FDA	Clinical findings, family history, further genetic testing and other laboratory data should guide use of halogenated volatile anesthetics or depolarizing muscle relaxants. "CONTRAINDICATIONS: Known or suspected genetic susceptibility to malignant hyperthermia...ULTANE [sevoflurane] can induce malignant hyperthermia in patients with known or suspected susceptibility based on genetic factors or family history, including those with certain inherited ryanodine receptor (RYR1) or dihydropyridine receptor (CACNA1S) variants." See label for more information. *	strong
Succinylcholine CACNA1S uncertain susceptibility RYR1 uncertain susceptibility CPIC guideline · PMID 30499100	CPIC FDA	Clinical findings, family history, further genetic testing and other laboratory data should guide use of halogenated volatile anesthetics or depolarizing muscle relaxants. "ANECTINE [succinylcholine] is contraindicated in patients with...[k]nown or suspected genetic susceptibility to malignant hyperthermia...Anectine [succinylcholine] can induce malignant hyperthermia in patients with known or suspected susceptibility based on genetic factors or family history, including those with certain inherited ryanodine receptor (RYR1) or dihydropyridine receptor (CACNA1S) variants...Succinylcholine is metabolized by plasma cholinesterase and should be used with caution, if at all, in patients known to be or suspected of being homozygous for the atypical plasma cholinesterase gene [BCHE] ." See label for more information. *	strong

Clinical section

Drug recommendations cont.

Tamoxifen CYP2D6 normal CPIC guideline · PMID 29385237	CPIC	Avoid moderate and strong CYP2D6 inhibitors. Initiate therapy with recommended standard of care dosing (tamoxifen 20 mg/day).	strong
Tetrabenazine CYP2D6 FDA labeling	FDA	**FDA: CYP2D6 genotyping is required before exceeding 50 mg/day · CYP2D6 — this patient's CYP2D6 result is available in this report** "Genotyped patients who are identified as extensive (EMs) or intermediate metabolizers (IMs) of CYP2D6, who need doses of XENAZINE [tetrabenazine] above 50 mg per day, should be titrated up slowly at weekly intervals by 12.5 mg daily, to allow the identification of a tolerated dose that reduces chorea. Doses above 50 mg per day should be given in a three times a day regimen. The maximum recommended daily dose is 100 mg and the maximum recommended single dose is 37.5 mg. If adverse reactions such as akathisia, parkinsonism, depression, insomnia, anxiety or sedation occur, titration should be stopped and the dose should be reduced. If the adverse reaction does not resolve, consideration should be given to withdrawing XENAZINE [tetrabenazine] treatment or initiating other specific treatment." See label for more information * Basis — CYP2D6 — FDA labeling contains a genetic testing requirement; there is no published CPIC guideline	

Active substances on which guidelines diverge

6 active substances

The guidelines differ for the same genotype. This report's verdict comes from the highest-priority source: CPIC, then DPWG, then FDA labeling. Which to apply is the physician's decision.

Active substance	Verdict in this report	Source of the verdict	Diverging view
Allopurinol	✖ **Alternative drug**	CPIC: alternative drug	DPWG: use 1.25 times the standard dose.; DPWG: alternative drug; FDA: alternative drug
Voriconazole	✖ **Alternative drug**	CPIC (adults): choose an alternative agent that is not dependent on CYP2C19 metabolism as primary therapy in lieu of voriconazole.	CPIC (pediatrics): initiate therapy with recommended standard of care dosing.
Desflurane	◆ **Standard start, monitor**	CPIC: other guidance	FDA: alternative drug

Clinical section

Drug recommendations cont.

Active substance	Verdict in this report	Source of the verdict	Diverging view
Isoflurane	◆ **Standard start, monitor**	CPIC: other guidance	FDA: alternative drug
Sevoflurane	◆ **Standard start, monitor**	CPIC: other guidance	FDA: alternative drug
Succinylcholine	◆ **Standard start, monitor**	CPIC: other guidance	FDA: alternative drug

What may change this interpretation

ask before prescribing

Concomitant drug	In this report, six active substances, if added to treatment, change other recommendations: bupropion, fluoxetine, paroxetine, mirabegron, fluvoxamine, voriconazole. Details (p. 20).
Non-drug factors	Pregnancy (CYP2D6) · Severe inflammation / acute infection (CYP2D6) · St John's wort (CYP2C19, CYP3A4) · Oral contraceptive (ethinylestradiol) (CYP2C19) · Grapefruit and citrus juice (CYP3A4) · Smoking / tobacco smoke (CYP1A2) · Chargrilled meat, cruciferous vegetables (CYP1A2): may change drug levels.
Organ function, age, pregnancy	Genotype-based advice is weighed with liver and kidney function, age and pregnancy.
Guideline update	DPYD × fluoropyrimidines: CPIC has announced an update moving the HapB3 activity value from 0.5 to 0.75 and the starting dose in affected heterozygotes from 50% to 75%. Until the final guideline is published, this report applies the current one.
	Antipsychotics × CYP2D6 / CYP3A4 / CYP2C19: The CPIC antipsychotic guideline is under development. Recommendations for these active substances come from FDA labeling and DPWG and are not shown as CPIC guidance.

Versions of the DPWG and FDA texts (p. 26), source publications (p. 27).

Clinical section

Pharmacodynamic findings

Variants linked to an active substance's effect and what to watch in follow-up. Not a guideline recommendation; changes no verdict in the guide (p. 2).

An associated allele was detected in 5 of 30 associations.

Detected variants

5 associations, watch during follow-up

Active substance	Gene and detected genotype	Point to watch
Oxazepam	**UGT2B15** *2 (Asp85Tyr): *1/*2 **Detected allele: *2, one copy**	Do not change the oxazepam or lorazepam dose; if unexpected sedation occurs, reduced clearance is one possible explanation. Basis: The *2 allele is linked to a copy-number-proportional fall in oxazepam clearance (about half in *2/*2); no genotype-related difference in sedation or cognitive measures has been shown. Consistency: partly consistent, 3 sources.
Thiopurines azathioprine, mercaptopurine, thioguanine	**ITPA** 94C>A (Pro32Thr): Pro32/Thr32 (heterozygous) **Detected allele: 94A (Thr32), one copy**	Dose thiopurines by the TPMT and NUDT15 results; if intolerance develops with both genes normal, this variant is one possible explanation. Basis: In a 2022 meta-analysis (30 studies) carriage of 94C>A was associated with neutropenia during thiopurine use (odds ratio 2.39); an earlier meta-analysis and two cohorts found no association. Consistency: inconsistent, 4 sources.
Paclitaxel	**CYP2C8** Arg139Lys: heterozygous Lys399Arg: heterozygous **Detected allele: *3, one copy**	Do not change the dose on this result; for NSAIDs the guideline uses CYP2C9. Basis: No association with paclitaxel clearance was found in 97 patients; a meta-analysis of taxane-induced peripheral neuropathy counted the *3 components among associated variants. Consistency: inconsistent, 3 sources.
Repaglinide	**CYP2C8** Arg139Lys: heterozygous Lys399Arg: heterozygous **Detected allele: *3, one copy**	Do not change the dose on this result; for NSAIDs the guideline uses CYP2C9. Basis: With the *1/*3 genotype repaglinide exposure was about 45–48% lower; no difference in blood glucose response was shown. Consistency: inconsistent, 2 sources.
Rosiglitazone, Pioglitazone	**CYP2C8** Arg139Lys: heterozygous Lys399Arg: heterozygous **Detected allele: *3, one copy**	Do not change the dose on this result; for NSAIDs the guideline uses CYP2C9. Basis: In a cohort of 833 patients *3 was linked to weaker glycemic response to rosiglitazone and less weight gain; no effect on pioglitazone response was seen. Consistency: inconsistent, 1 source.

Clinical section

Pharmacodynamic findings cont.

Not detected or not determined

25 associations

Active substance	Gene and detected genotype	Result
SSRI and SNRI antidepressants	**HTR2A** rs7997012: G/G; 102T/C: C/T; −1438A/G: G/A	No specific allele is defined in the studies; genotype given for information. Topic: treatment response and adverse effects. Consistency: inconsistent, 3 sources.
	SLC6A4 5-HTTLPR: cannot be determined with short reads (a targeted test is needed)	No specific allele is defined in the studies; genotype given for information. Topic: treatment response and tolerability. Consistency: inconsistent, 5 sources.
Citalopram	**HTR2A** rs7997012: G/G	A/A genotype not detected. Topic: treatment response. Consistency: inconsistent, 1 source.
P-glycoprotein substrate antidepressants amitriptyline, citalopram, escitalopram, paroxetine, venlafaxine	**ABCB1** 2677G>T/A: T/T; 1236C>T: T/T; rs2032583: T/T; rs2235015: G/G	No specific allele is defined in the studies; genotype given for information. Topic: treatment response (remission). Consistency: inconsistent, 4 sources.
Antipsychotics (studied at class level)	**DRD2** −141C Ins/Del: Ins/Ins	Del allele not detected. Topic: treatment response. Consistency: inconsistent, 3 sources.
	HTR2A His452Tyr: His452/His452	No specific allele is defined in the studies; genotype given for information. Topic: adverse effect (tardive dyskinesia). Consistency: inconsistent, 1 source.
Risperidone	**DRD2** −241A/G: A/A	No specific allele is defined in the studies; genotype given for information. Topic: treatment response. Consistency: inconsistent, 2 sources.
Clozapine	**HTR2A** His452Tyr: His452/His452	452Tyr allele not detected. Topic: treatment response. Consistency: inconsistent, 2 sources.
Olanzapine	**HTR2C** Cys23Ser: Cys23/Cys23 (X-linked gene; single copy in males)	No specific allele is defined in the studies; genotype given for information. Topic: adverse effect (weight gain). Consistency: largely negative, 1 source.
Clozapine, Olanzapine, Risperidone	**HTR2C** Cys23Ser: Cys23/Cys23 (X-linked gene; single copy in males)	No specific allele is defined in the studies; genotype given for information. Topic: adverse effect (weight gain). Consistency: largely negative, 2 sources.
Lorazepam	**UGT2B15** *2 (Asp85Tyr): *1/*2	*2/*2 genotype not detected. Topic: drug exposure (clearance). Consistency: partly consistent, 1 source.

Clinical section

Pharmacodynamic findings cont.

Active substance	Gene and detected genotype	Result
Temazepam	**UGT2B15** *2 (Asp85Tyr): *1/*2	No specific allele is defined in the studies; genotype given for information. Topic: drug metabolism (in vitro). Consistency: partly consistent, 1 source.
Methylphenidate	**CES1** Gly143Glu: Gly143/Gly143	Glu143 allele not detected. Topic: drug exposure. Consistency: partly consistent, 3 sources.
Naltrexone	**OPRM1** 118A>G (Asn40Asp): Asn40/Asn40	118G allele not detected. Topic: treatment response. Consistency: partly consistent, 2 sources.
Opioid analgesics	**OPRM1** 118A>G (Asn40Asp): Asn40/Asn40	118G allele not detected. Topic: opioid requirement. Consistency: partly consistent, 1 source.
	COMT Val158Met: Val158/Val158	Met158 allele not detected. Topic: opioid requirement. Consistency: partly consistent, 2 sources.
Antiepileptics (drug-resistant epilepsy)	**ABCB1** 3435C>T: TT	No specific allele is defined in the studies; genotype given for information. Topic: treatment resistance. Consistency: largely negative, 3 sources.
Clopidogrel	**CES1** Gly143Glu: Gly143/Gly143	Glu143 allele not detected. Topic: drug exposure and platelet response. Consistency: partly consistent, 2 sources.
Digoxin	**ABCB1** 3435C>T: TT	No specific allele is defined in the studies; genotype given for information. Topic: drug exposure. Consistency: largely negative, 1 source.
Beta-blockers	**ADRB2** Arg16Gly: kodon 16 referans (Gly16)	No specific allele is defined in the studies; genotype given for information. Topic: treatment response. Consistency: largely negative, 1 source.
Platinum compounds cisplatin, oxaliplatin	**GSTM1** gene deletion (null): hedefli test gerekir	No specific allele is defined in the studies; genotype given for information. Topic: treatment response. Consistency: inconsistent, 3 sources.
Succinylcholine, Mivacurium	**BCHE** Asp70Gly (atypical allele): not detected	Atypical allele not detected. Topic: duration of effect (neuromuscular block). Consistency: partly consistent, 4 sources.
Salbutamol, Salmeterol	**ADRB2** Arg16Gly: kodon 16 referans (Gly16)	No specific allele is defined in the studies; genotype given for information. Topic: bronchodilator response. Consistency: largely negative, 5 sources.
Oseltamivir	**CES1** Gly143Glu: Gly143/Gly143	Glu143 allele not detected. Topic: drug activation (ex vivo). Consistency: partly consistent, 1 source.

Clinical section

Pharmacodynamic findings cont.

Active substance	Gene and detected genotype	Result
Estrogen-containing combined oral contraceptives and menopausal hormone therapy hormonal contraceptives for systemic use	**F5** Factor V Leiden: not detected	Leiden allele not detected. Topic: adverse effect (venous thromboembolism). Consistency: consistent, 2 sources.

“Consistency” is how far studies replicate the association; it is not a CPIC level of evidence. A “detected allele” alone does not predict risk or response. References (p. 27). Other active substances mapped to these genes: ABCB1 (fentanyl, methotrexate, nevirapine, ondansetron, simvastatin); COMT (citalopram, escitalopram, naltrexone, nicotine); CYP2C8 (diclofenac, ibuprofen); F5 (avatrombopag, eltrombopag); ITPA (interferon alfa-2b, recombinant); OPRM1 (naloxone).

Analytical evidence

CYP2D6 confirmation and HLA analysis

The two regions hardest for short reads get their own method and checks.

CYP2D6 confirmation

BIODECODE CYP2D6 module

Diplotype determined: ***1/*1**, normal metabolizer.

Activity score

2.0 normal metabolizer

0	0.25 – 1	1.25 – 2.25	above 2.25
poor	**intermediate**	**normal**	**ultrarapid**

Copy number estimate	Could not be assessed — the run contains 4 samples (at least 16 are required). The result was produced on the assumption of two gene copies; a gene deletion or copy gain could not be excluded in this sample.

The diplotype was determined with the BIODECODE CYP2D6 module and passed to the BIODECODE PGx engine; phenotype assignment follows the CPIC activity score table, and the guideline verdict follows CPIC/DPWG/FDA. For CYP2D6 substrates the verdict rests on this phenotype; see the drug recommendations.

HLA analysis

drug hypersensitivity risk alleles

HLA-B*58:01 positive: related active substances and source in the table below.

Risk allele	Result	Related active substances	Source
HLA-B*58:01	✖ positive	allopurinol	CPIC
HLA-B*57:01	negative	abacavir	CPIC
HLA-B*15:02	negative	carbamazepine, oxcarbazepine, phenytoin, fosphenytoin, lamotrigine	CPIC
HLA-A*31:01	negative	carbamazepine	CPIC
HLA-B*13:01	negative	dapsone	DPWG/literature

HLA-A A*24:03 (second allele varies between solutions) · **HLA-B** B*58:01 (second allele varies between solutions)

A risk allele is counted as positive when it is seen in all typing solutions; if the solutions diverge the result is reported as “uncertain”, not as negative.

Analytical evidence

Phenoconversion and LoF screening

The genotype does not change; concomitant drugs and rare variants can change the result.

Phenoconversion

effect of concomitant drugs

The main focus is **CYP2D6**: if a strong inhibitor is added, the recommendation changes for 35 active substances.

Gene, result	If added	The gene behaves as	Recommendation changes for
CYP2D6 normal	Strong inhibitor: **bupropion**, **fluoxetine**, **paroxetine**, quinidine, terbinafine	**normal → poor**	codeine, desipramine, eliglustat, fluvoxamine, metoprolol, nortriptyline, tamoxifen, thioridazine, tramadol, venlafaxine, vortioxetine: **alternative drug**; aripiprazole, atomoxetine, brexpiprazole, clozapine, deutetrabenazine, flecainide, haloperidol, hydrocodone, iloperidone, metoclopramide, oliceridine, paroxetine, pimozide, pitolisant, propafenone, risperidone, tetrabenazine, valbenazine, zuclopenthixol: **dose adjustment**; cevimeline, fluoxetine, gefitinib, lofexidine, tamsulosin: **standard start, monitor**
	Moderate inhibitor: **mirabegron**, abiraterone, cinacalcet, duloxetine	**normal → intermediate**	eliglustat, propafenone, tamoxifen, thioridazine: **alternative drug**; atomoxetine, codeine, desipramine, flecainide, hydrocodone, nortriptyline, paroxetine, pimozide, tetrabenazine, tramadol, zuclopenthixol: **dose adjustment**
CYP2C19 rapid	Strong inhibitor: **fluoxetine**, **fluvoxamine**, fluconazole, ticlopidine	**rapid → poor**	citalopram, clopidogrel, escitalopram, sertraline: **alternative drug**; brivaracetam, clobazam: **dose adjustment**; carisoprodol, flibanserin: **standard start, monitor**
	Moderate inhibitor: **voriconazole**	**rapid → intermediate**	clopidogrel: **alternative drug**; citalopram, escitalopram, sertraline: **dose adjustment**; amitriptyline, clomipramine, doxepin, imipramine, trimipramine: **standard use**
	Strong inducer: rifampicin	**rapid → ultrarapid**	citalopram, escitalopram: **alternative drug**
CYP3A4 normal	Strong inhibitor: **voriconazole**, clarithromycin, itraconazole, ketoconazole, ritonavir	**normal → poor**	quetiapine: **alternative drug**

Analytical evidence

Phenoconversion and LoF screening cont.

Gene, result	If added	The gene behaves as	Recommendation changes for
CYP3A4 normal	Moderate inhibitor: **fluvoxamine**, diltiazem, erythromycin, fluconazole, verapamil	**normal → intermediate**	none
	Strong inducer: **carbamazepine**, **fosphenytoin**, **phenytoin**, rifampicin	**normal → rapid**	quetiapine: **level falls**; not defined in the guideline
CYP1A2 not genotyped	Inhibitor: **fluvoxamine**, ciprofloxacin, mexiletine, vemurafenib, zileuton; smoking cessation	activity decreases	clozapine: **level rises**
	Inducer: **carbamazepine**, **fosphenytoin**, **phenytoin**, rifampicin, teriflunomide; smoking / tobacco smoke	activity increases	clozapine: **level falls**

Do not change the class	Alone, these active substances in this report do not change the phenotype class; effects may add up. CYP2D6: citalopram, clobazam, escitalopram, fluvoxamine, haloperidol, hydroxychloroquine, propafenone, sertraline · CYP2C19: carbamazepine, efavirenz, fosphenytoin, isoniazid, lansoprazole, omeprazole, oxcarbazepine, phenytoin, sertraline · CYP3A4: clobazam, oxcarbazepine · CYP1A2: omeprazole.
Shift not calculated	These active substances in this report inhibit or induce the enzyme, but the effect size is too poorly documented to assign a phenotype class; monitor clinically when combined. CYP2D6: perphenazine, thioridazine.
Non-drug factors	Pregnancy: CYP2D6 activity increases · Severe inflammation / acute infection: CYP2D6 activity decreases · St John's wort: CYP2C19, CYP3A4 activity increases · Oral contraceptive (ethinylestradiol): CYP2C19 activity decreases · Grapefruit and citrus juice: CYP3A4 activity decreases · Smoking / tobacco smoke: CYP1A2 activity increases · Chargrilled meat, cruciferous vegetables: CYP1A2 activity increases.

Bold: active substances in this report. Changes are derived by looking up the guideline data with the shifted phenotype and applying the report's verdict rules. The patient's current medication is not part of the analysis; ask before prescribing, including over-the-counter and herbal products. The table does not add up two simultaneous factors. Shift rules: Literature-based activity-score multiplier (strong ×0 · moderate ×0.5 · weak ×1). Neither CPIC nor DPWG has published a phenoconversion rule.

Analytical evidence

Phenoconversion and LoF screening cont.

Loss-of-function (LoF) screening

31 genes outside HLA, exons and introns

No loss-of-function finding; two variants could not be scored.

31	› 39	› 37	› 0 + 2
genes screened	**variants examined**	**benign**	**reported, not scorable**
regions outside HLA	outside the star-allele definitions	population frequency or in-silico evidence	no variant to report

Variants are scored with the BIODECODE ACMG scoring system. They do not change the recommendation; phenotype is assigned only from a confirmed allele. For 2 unscorable variants, data are insufficient for classification; these variants are not counted as benign. Score and class thresholds (p. 24).

Analytical evidence

67 gene regions

Status of each panel region in this sample. No result is never counted as normal; the reason is given.



35
genotype determined
diplotype or genotype call

21
passed loss-of-function screening
regions without a star-allele call

9
HLA region
outside risk screening

2
targeted test
cannot be resolved with short reads

0
not readable
no result in this sample

Each region is read with its exons and introns; a result is given where read depth is at least 20×.

Regions with a determined genotype

35 regions

Altered function 5	**CYP2C19** *1/*17 rapid · **CYP3A5** *3/*3 non-expresser · **NAT2** *4/*4 rapid · **ABCG2** rs2231142 G/T decreased function · **HLA-B** *58:01 positive
Function at expected level 15	CYP2B6 · CYP2C9 · CYP2D6 · CYP3A4 · NUDT15 · TPMT · SLCO1B1 · DPYD · G6PD · UGT1A1 (*80/*80+*28) · CACNA1S (uncertain susceptibility) · CFTR (ivacaftor non-responsive) · RYR1 (uncertain susceptibility) · VKORC1 (-1639 GG) · HLA-A (no risk allele)
Genotype reported only 15	CYP4F2 *1/*4 · IFNL3 rs12979860 C/T · CYP2C8 R139K het, K399R het · COMT Val158/Val158 · ITPA Pro32/Thr32 · UGT2B15 *1/*2 · ABCB1 3435 TT · ADRB2 Gly16/Gly16, Glu27/Glu27 · DRD2 −141C Ins/Ins, −241 A/A · HTR2A His452/His452 · HTR2C Cys23 · OPRM1 Asn40/Asn40 · BCHE atypical variant absent · CES1 Gly143/Gly143 · F5 Leiden absent. The guidelines define no class such as “poor” or “normal” for these genes; follow-up notes (p. 15).

Regions without a star-allele call

21 regions

No call does not mean “reference”; these regions go through loss-of-function screening.

No variant to report 21	CYP1A2 · CYP2A6 · CYP2E1 · CYP2J2 · CYP3A7 · POR · GSTA1 · UGT2B7 · ABCC2 · ABCC4 · SLC22A1 · SLC22A2 · SLC22A6 · SLC22A8 · SLC47A1 · SLC47A2 · SLCO1B3 · SLCO2B1 · ADH1B · ALDH2 · SCN1A

Regions that give no result with this method

11 regions

HLA, outside risk screening 9	HLA-C: no defined risk allele. HLA-DPA1 · DPB1 · DQA1 · DQB1 · DRB1 · DRB3 · DRB4 · DRB5: not typed in this panel.
Targeted test required 2	GSTM1 (copy number) · SLC6A4 (5-HTTLPR length). Targeted test on request.

Technical appendix

Methods and limitations

How the result is produced, what each step checks and what the method cannot see.

1 **Sample**
peripheral blood, genomic DNA

› 2 **Sequencing**
targeted capture, NGS; 67 regions

› 3 **Alignment**
GRCh38 reference genome; variant calling, quality recalibration

› 4 **Allele and phenotype**
star-allele diplotype, CPIC phenotype

› 5 **Recommendation**
from CPIC, DPWG, FDA tables; doses not calculated

Method

step by step

Reading rule	A position read at a depth of at least 20× with no variant record counts as the reference allele. A position below the threshold is reported as “not readable”, never assumed normal.
CYP2D6	Resolved by a separate module: allele-combination matching, allele-fraction and alignment-quality checks and read-based phasing, compared with two independent algorithms. Copy number is estimated from read depth normalized within the run; if not two copies, no diplotype or phenotype is reported.
HLA	Risk alleles are screened on the HLA-A and HLA-B typing solutions. An allele present in all solutions is positive, in none negative; if solutions diverge the result is uncertain and is not reported as negative.
Loss-of-function screening	Variants outside star-allele definitions are scored with the BIODECODE ACMG scoring system: each gets ACMG/AMP criterion codes and a total score. Missense variants are also scored with REVEL and AlphaMissense, as supporting evidence only. A variant seen in over 5% of the population counts as benign. HLA regions are not screened.

−6 and below	−5 to 0	1 to 6	8 to 10	12 and above
benign	**likely benign**	**uncertain**	**likely pathogenic**	**pathogenic**

Technical appendix

Methods and limitations cont.

Limitations of the method

what this test cannot see

- Phasing is applied only in CYP2D6; elsewhere two variants cannot be assigned to the same chromosome.
- CYP2D6 copy number is not independently confirmed; hybrid alleles and four or more copies cannot be determined. If critical, use MLPA or long-read sequencing.
- SLC6A4 5-HTTLPR, GSTM1 copy number, HLA-C and HLA class II give no result here.
- Genes outside the panel and rare variants cannot be excluded; an unreported allele is not proven absent.
- 51 active substances linked only to genes outside the panel are not in this report: amisulpride, paliperidone, ziprasidone, l-methylfolate, amikacin, dibekacin, gentamicin, kanamycin, neomycin, netilmicin, plazomicin, ribostamycin, streptomycin, tobramycin, paromomycin, atenolol, esmolol, cerivastatin, furosemide, hydrochlorothiazide, spironolactone, bucindolol, captopril, carboplatin, cetuximab, cyclophosphamide, daunorubicin, epirubicin, etoposide, gemcitabine, idarubicin, rituximab, divalproex sodium, valproic acid, caffeine, metformin, alendronate, risedronate, raloxifene, adalimumab, etanercept, infliximab, mycophenolic acid, sildenafil, budesonide, fluticasone propionate, fluticasone/salmeterol, carglumic acid, velaglucerase alfa, latanoprost, triamcinolone.

Technical appendix

Definitions and source versions

Phenotype classes, guideline evidence levels and the knowledge base used.

Phenotype classes

by gene class

Enzymes

Ultrarapid	enzyme activity markedly increased
Rapid	activity above normal
Normal	expected activity
Intermediate	activity partly reduced
Poor	activity severely reduced or absent

Transporters and other genes

Increased function	activity above expected
Normal function	works at the expected level
Decreased function	exposure may change
Poor function	severely reduced activity
Expresser	used instead of “normal” for CYP3A5 and CYP3A7

Direction depends on the active substance: for an active drug, slow metabolism causes accumulation and fast metabolism loss of effect. For prodrugs (codeine, tramadol) the reverse holds.

CPIC levels of evidence

actionability tier

A	Guideline recommends a genotype-based prescribing change; a dose or drug recommendation exists.
B	Guideline offers a genotype-based change as an option; the alternative is at least as effective and safe.
C	No prescribing change is recommended; evidence is limited.
D	Evidence is insufficient; no clinical action defined.

The letter rates how actionable the gene–active substance pair is, not measurement reliability. Recommendation strength (strong, moderate, optional) is a separate axis, shown at the right of each row.

Knowledge base versions

biodecode-kb 2.0, build 14 Nov 2026

Source	Updated
CPIC gene–drug pairs list	5 Aug 2026
CPIC provisional list	5 Aug 2026
BIODECODE curated drug database	22 Apr 2026
DPWG guideline pairs	10 Nov 2026
BIODECODE PGx engine guideline data	14 Nov 2026
Report template	version 5.0, 15 Nov 2026

Pending update: DPYD × fluoropyrimidines: CPIC has announced an update moving the HapB3 activity value from 0.5 to 0.75 and the starting dose in affected heterozygotes from 50% to 75%. Until the final guideline is published, this report applies the current one. Antipsychotics × CYP2D6 / CYP3A4 / CYP2C19: The CPIC antipsychotic guideline is under development. Recommendations for these active substances come from FDA labeling and DPWG and are not shown as CPIC guidance.

Technical appendix

References

Guideline publications behind the recommendations, research bibliography, local context.

Guideline publications

used in this report

Topic	Source	PMID
Abacavir: HLA-B	CPIC guideline	24561393 · 22378157
Allopurinol: HLA-B	CPIC guideline	23232549 · 26094938
Amitriptyline, clomipramine, desipramine, doxepin and 3 more: CYP2C19, CYP2D6	CPIC guideline	23486447 · 27997040
Atazanavir: UGT1A1	CPIC guideline	26417955
Atomoxetine: CYP2D6	CPIC guideline	30801677
Atorvastatin, fluvastatin, lovastatin, pitavastatin and 3 more: SLCO1B1, CYP2C9, ABCG2	CPIC guideline	35152405 · 22617227 · 24918167
Capecitabine, fluorouracil, tegafur: DPYD	CPIC guideline	23988873 · 29152729
Carbamazepine, oxcarbazepine: HLA-A, HLA-B	CPIC guideline	23695185 · 29392710
Carvedilol, labetalol, metoprolol: ADRB2, CYP2D6	CPIC guideline	38951961
Celecoxib, flurbiprofen, ibuprofen, lornoxicam and 3 more: CYP2C9, CYP2C8	CPIC guideline	32189324
Citalopram, escitalopram, fluoxetine, fluvoxamine and 4 more: CYP2C19, CYP2D6, HTR2A, SLC6A4, CYP2B6	CPIC guideline	25974703 · 37032427
Clopidogrel: CYP2C19	CPIC guideline	21716271 · 23698643 · 35034351
Desflurane, enflurane, halothane, isoflurane and 3 more: CACNA1S, RYR1	CPIC guideline	30499100
Dexlansoprazole, lansoprazole, omeprazole, pantoprazole: CYP2C19	CPIC guideline	32770672
Efavirenz: CYP2B6	CPIC guideline	31006110
Fosphenytoin, phenytoin: CYP2C9, HLA-B	CPIC guideline	25099164 · 32779747
Ivacaftor: CFTR	CPIC guideline	24598717
Azathioprine, mercaptopurine, thioguanine: NUDT15, TPMT	CPIC guideline	21270794 · 23422873 · 30447069
Chloroquine, chlorpropamide, dabrafenib, dapsone and 16 more: G6PD	CPIC guideline	36049896 · 24787449
Ondansetron, tropisetron: CYP2D6	CPIC guideline	28002639 · 41979467
Quetiapine: CYP3A4	DPWG guideline	37002327
Tacrolimus: CYP3A5	CPIC guideline	25801146

Technical appendix

References cont.

Topic	Source	PMID
Tamoxifen: CYP2D6	CPIC guideline	29385237
Codeine, hydrocodone, tramadol: CYP2D6, COMT, OPRM1	CPIC guideline	33387367 · 22205192 · 24458010
Voriconazole: CYP2C19	CPIC guideline	27981572
Warfarin: CYP2C9, CYP4F2, VKORC1	CPIC guideline	21900891 · 28198005
CYP2D6 genotype-to-phenotype standard	CPIC and DPWG 2020	31647186
Variant classification criteria	ACMG/AMP 2015	25741868

DPWG recommendations come from the DPWG guideline pairs, FDA ones from the pharmacogenomic biomarker table and labeling; versions on (p. 26). Allele names follow PharmVar nomenclature.

Research bibliography

sources of the pharmacodynamic findings, PMID

HTR2A	33097827 · 23733030 · 37032427 · 16642436 · 15857569 · 8916101 · 9629566
SLC6A4	17146470 · 20615496 · 22137564 · 32421611 · 34945806
ABCB1	18215618 · 36681895 · 18382661 · 33147643 · 20605481 · 19178561 · 25550900 · 10716719
DRD2	20194480 · 9858029 · 33147643 · 18855532 · 28696411
HTR2C	22967772 · 20504252 · 42480244
UGT2B15	19916996 · 15044558 · 12386133 · 15961980 · 40543327
CES1	28087982 · 18485328 · 41567292 · 25704243 · 31504375 · 27228223
OPRM1	25760804 · 31961981 · 37774182
COMT	37774182 · 36426809
ADRB2	38951961 · 15500895 · 19932356 · 17030231 · 26505596 · 32986886
ITPA	35034963 · 17697198 · 17065060 · 33804051
CYP2C8	16299241 · 35892315 · 20421446 · 14534525 · 15961978 · 27271184
GSTM1	28572675 · 30341887 · 31281468
BCHE	15731585 · 15731589 · 11812719 · 33061533
F5	27121914 · 22283630

Local context

use in Türkiye

Product information	Recommendations are from CPIC, DPWG and the FDA. For any product prescribed in Türkiye, also check the current TİTCK SmPC.
Population	Allele frequencies vary between populations. Ancestry does not replace genotyping; findings rest on the patient's measured genotype.
Numerical doses	Dose statements are quoted from the source guideline; re-check at the bedside against product, indication, age, organ function and concomitant drugs.

Technical appendix

Institutional information and responsibility

Who produces and approves the report, sample details, conditions of use.

1 **Sample receipt and storage**
İstanbul Genetik Grubu

› 2 **Laboratory analysis**
İstanbul Genetik Grubu

› 3 **Bioinformatics and interpretation**
BIODECODE

› 4 **Medical approval**
İstanbul Genetik Grubu

Responsible parties

chain of responsibility

Responsible medical genetics diagnostic center

İstanbul Genetik Grubu Sağlık Hizmetleri Ltd. Şti.
Genetic Diseases Evaluation Center
Türkali Mah. Nüzhetiye Cad. No: 38/A Beşiktaş, İstanbul
Tel 0212 227 52 54 · igg@istanbulgenetik.com

Medically approves the report and holds clinical responsibility. Clinical and result queries go to this center.

Software, interpretation and report generation

BIODECODE
Clinical Pharmacogenomics

Runs the bioinformatic analysis and produces the report. Approval lies with the center.

Commercial distribution: PHARMADECODE. No part in analysis, interpretation or approval; not responsible for medical content.

Sample and method details

ORNEK_L01_00

Specimen **Peripheral blood (K3-EDTA)**	Date received _____	Test **All Clinical Areas panel**	Method **Targeted sequencing (NGS)**
Panel **BIODECODE PGx, 67 regions**	Reference genome **GRCh38**	Interpretation source **CPIC, DPWG, FDA**	Active substances assessed **157**

Approval and signature

report date 18 Nov 2026

Medical approval

Dr. Rıdvan Seçkin Özen
Head of the Genetic Diseases Evaluation Center · Dok.Dip.No: 94
İstanbul Genetik Grubu

Report prepared by

Asst. Prof. Burak Berber
Molecular Biologist · Head of BIODECODE
BIODECODE

Valid clinically with the medical approval signature; the preparer's signature records the analysis.

Conditions of use

legal and ethical responsibilities

- For research use; not IVD-approved. The results are used as clinical decision support.
- No substitute for diagnosis, history, concomitant drugs or the physician's judgment.
- Drug response also depends on non-genetic factors: drug interactions, liver and kidney function, age, pregnancy, smoking. A sample taken after stem-cell transplantation or recent transfusion may not reflect the patient's genotype.
- The physician must consult current product information and relevant clinical guidelines.
- Special-category health data under Turkish Law No. 6698; shared only with the patient's explicit consent or as legislation provides.