AUSTRALIAN Clinicallabs

Pharmacogenetics (PGx)

For Oncologists

Recommended by Guidelines, pharmacotherapeutic genotyping is one of multiple pieces of information that oncologists should consider when making their therapeutic choice for each patient. Preemptive use of testing could significantly optimise drug outcomes and be particularly useful for patients undergoing multiple treatments or experiencing poor drug responses. See below a selection of pharmacogenetic (PGx) tests that may be useful for your practice. *To view our full pharmacogenetics offering, scan the QR code below.*

Clinical Labs' Comprehensive PGx Gene Panel

Clinical Labs' **Comprehensive PGx Gene Panel** includes a family of enzymes that catalyse the metabolism of many drugs and xenobiotics, particularly in areas such as oncology, mental health, cardiology and pain management. With our Comprehensive PGx Gene Panel, you will receive a comprehensive report that will indicate the genotype and the predicted phenotypes, such as the metaboliser status, along with potential drug-gene interactions and Guidelines' recommendations. Please specify any medications of interest if you want them to be included in the report. The genes can be ordered separately or together - for individual genes, only genotyping/phenotyping will be reported. ***See reverse for a list of genes tested and examples of drugs metabolised.***

Genes included in our Comprehensive PGx Panel
CYP2D6
CYP2C19
CYP2C9
CYP3A4
CYP3A5
CYP1A2
VKORC1
SLCO1B1

Single Gene Tests for Oncology

- ***CYP2D6* (Tamoxifen PGx):** is the primary enzyme responsible for the metabolism of many commonly used medications, especially oncology (tamoxifen and 5-HT3 receptor antagonists) (Goetz et al., 2018). *CYP2D6* is highly polymorphic, with over 130 identified allelic variants and sub-variants identified (www.PharmVar.org; *CYP2D6* Allele Definition). *CYP2D6* alleles have been extensively studied in multiple geographically, racially, and ethnically diverse groups, and significant differences in allele frequencies have been observed.

- ***TPMT*:** Thiopurine methyltransferase (*TPMT*) is the primary enzyme responsible for the metabolism of thiopurine drugs (azathioprine, 6-mercaptopurine, and 6-thioguanine). It is recommended that physicians order *TPMT* genotyping before prescribing thiopurines to avoid bone marrow toxicity and subsequent neutropenia. *Medicare rebate available.*

- ***DPYD*:** Mutations in the dihydropyrimidine dehydrogenase gene (*DPYD*) interfere with the breakdown of chemotherapeutic cancer drugs with structures similar to pyrimidines, such as 5-fluorouracil and capecitabine. As a result, these drugs can accumulate in the body, leading to severe reactions and neurological manifestations due to *DPYD* deficiency.

- ***UGT1A1*:** *UGT1A1* gene polymorphism is associated with toxicity and clinical efficacy of irinotecan-based chemotherapy, which is used in patients with advanced solid tumours, including colorectal and lung cancers.

Ordering Pharmacogenetic Testing at Clinical Labs

- **When to order:** At the time of drug prescribing and dispensing for patients with genotypes that require action, such as dose reductions.
- **What to put on the request form:** Fill out our routine Clinical Labs request form, list the gene required or group of genes and prescribed medications if available.
- **Turnaround time:** Results within 7-10 business days from the sample receipt date.
- **Specimen details:** 2x EDTA blood samples.
- **Test cost:** Apart from the *TPMT* gene, an out-of-pocket fee applies.
  Scan QR or visit clinicallabs.com.au/pharmacogenetictesting for current pricing.

Pharmacogenetic (PGx) Testing *Examples of drugs metabolised and genes tested*

Medication	Gene(s)
Cardiology	
Carvedilol	*CYP2D6*
Clopidogrel	*CYP2C19*
Flecainide	*CYP2D6*
Metoprolol	*CYP2D6*
Warfarin	*VKORC1, CYP2C9*
Lipid Lowering Medication	
Atorvastatin	*SLCO1B1, CYP3A4*
Fluvastatin	*SLCO1B1, CYP2C9*
Lovastatin	*SLCO1B1*
Pitavastatin	*SLCO1B1*
Pravastatin	*SLCO1B1*
Rosuvastatin	*SLCO1B1*
Simvastatin	*SLCO1B1*
Gastroenterology	
Anti-Emetic	
Metoclopramide	*CYP2D6*
Ondansetron	*CYP2D6*
Tropisetron	*CYP2D6*
Proton Pump Inhibitors	
Esomeprazole	*CYP2C19*
Lansoprazole	*CYP2C19*
Omeprazole (Losec)	*CYP2C19*
Pantoprazole	*CYP2C19*
Rabeprazole	*CYP2C19*
Mental Health	
Anti-ADHD	
Atomoxetine	*CYP2D6*
Dextroamphetamine	*CYP2D6*
Lisdexamfetamine	*CYP2D6*
Anti-Depressants (MOAs)	
Moclobemide	*CYP2C19*
Anti-Depressants (SNRIs)	
Venlafaxine	*CYP2D6*
Anti-Depressants (SSRIs)	
Citalopram	*CYP2C19*
Escitalopram	*CYP2C19*
Fluoxetine (Prozac)	*CYP2D6*
Fluvoxamine	*CYP2D6*
Paroxetine	*CYP2D6*
Sertraline (Zoloft)	*CYP2C19*

Medication	Gene(s)
Mental Health	
Anti-Depressants (TCAs)	
Amitriptyline	*CYP2D6, CYP2C19*
Clomipramine	*CYP2D6, CYP2C19*
Desipramine	*CYP2D6, CYP2C19*
Dosulepin	*CYP2D6, CYP2C19*
Doxepin	*CYP2D6, CYP2C19*
Imipramine	*CYP2D6, CYP2C19*
Nortriptyline	*CYP2D6*
Trimipramine	*CYP2C19*
Anti-Depressants (Other)	
Vortioxetine	*CYP2D6*
Anti-Psychotics	
Aripiprazole	*CYP2D6*
Brexpiprazole	*CYP2D6*
Chlorpromazine	*CYP2D6*
Haloperidol	*CYP2D6*
Olanzapine	*CYP1A2*
Quetiapine	*CYP3A4*
Risperidone	*CYP2D6*
Zuclopenthixol	*CYP2D6*
Benzodiazepines (Anxiolytics)	
Clobazam	*CYP2C19*
Diazepam (Valium)	*CYP2C19*
Neurology	
Anti-Dementia	
Donepezil	*CYP2D6*
Galantamine	*CYP2D6*
Anti-Epileptics	
Phenytoin/ Fosphenytoin	*CYP2C9*
Multiple Sclerosis	
Siponimod	*CYP2C9*

Medication	Gene(s)
Oncology	
Atazanavir	*UGT1A1**
Azathioprine	*TPMT**
Belinostat	*UGT1A1**
Binimetinib	*UGT1A1**
Capecitabine	*DPYD**
Cisplatin	*TPMT**
Gefitinib	*CYP2D6*
Irinotecan	*UGT1A1**
Mercaptopurine	*TPMT**
Nilotinib	*UGT1A1**
Pazopanib	*UGT1A1**
Tamoxifen	*CYP2D6*
Tegafur	*DPYD**
Thioguanine	*TPMT**
5-Fluorouracil	*DPYD**
Organ Transplant	
Tacrolimus	*CYP3A5*
Pain Management	
NSAIDs	
Celecoxib	*CYP2C9*
Flurbiprofen	*CYP2C9*
Ibuprofen	*CYP2C9*
Piroxicam	*CYP2C9*
Meloxicam	*CYP2C9*
Opioids	
Codeine (prodrug)	*CYP2D6*
Dihydrocodeine	*CYP2D6*
Tramadol	*CYP2D6*
Urology	
Darifenacin	*CYP2D6*
Mirabegron	*CYP2D6*
Tamsulosin	*CYP2D6*
Tolterodine	*CYP2D6*
Anti-Fungal	
Voriconazol	*CYP2C19*

Please note that this is a guide for gene selection. Some specific medications may not be reported if they are listed under a drug class that is metabolised by the relevant gene.

*The following genes are not included in our Comprehensive PGx Gene Panel and need to be ordered individually: UGT1A1, TPMT and DPYD.

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