

■ Review article

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A review of pharmacokinetic drug interactions between antimicrobial and antiseizure medications in children

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Antiseizure medications with inducing/inhibiting properties

Antiseizure	CYP and proteins affected	Antiseizure	CYP and proteins affected
Brivaracetam	CYP2B6, 3A4 CYP2C19, Epoxide hydrolase	Phenytoin	CYP3A4, 2C9, 1A2, UGY, P-gp, CYP2C19
Cannabidiol	CYP1A2, 2B6 CYP1A2, 2B6, 2C8, 2C9, 2C19, UGT, P-gp	Phenobarbital	CYP3A4, 2C9, 1A2, P-gp
Carbamazepine	CYP3A4, 2C9, 1A2, UGT, P-gp	Primidone	CYP3A4, 2C9, 1A2, P-gp
Eslicarbazepine acetate	CYP3A4, UGT CYP2C19	Rufinamide	CYP3A4
Felbamate	CYP3A4 CYP2C19	Stiripentol	CYP3A4 CYP1A2, 3A4, 2C19, 2D6, P-gp
Midazolam	P-gp	Topiramate	CYP3A4 CYP2C19
Oxcarbazepine	CYP3A4, UGT, CYP2C19	Valproate	CYP2C9, 2C19, 3A4, UGT, Epoxide hydrolase
Perampanel	CYP2B6, 3A4/5 CYP2C8, UGT		

■ Strong Inhibition

■ Mild Inhibition

■ Strong induction

■ Mild induction

Pathways and effects on cytochromes and proteins of antibacterials and antimycotics

Antibacterials	CYP and proteins affected		CYP and proteins affected
Amikacin	P-gp substrate	Sulfadiazine	CYP2C9/10
Ciprofloxacin	P-gp substrate	Sulfasalazine	BCRP substrate
Clarithromycin	CYP3A4	Tobramycin	P-gp substrate
Cholramphenicol	CYP 3A4, CYP 2C19	Trimethoprim	CYP2C9 substrate
Doxycycline	CYP3A4 Also substrate	Antimycotics	
Erythromycin	CYP 3A4 Also P-gp substrate		
Ertapenem Imipenem and cilastin/meropenem	hepatic acylpeptide hydrolase	Bedaquiline	CYP3A4 substrate
Gentamicin	P-gp substrate	Fluconazole	CYP3A4, CYP2C9/10
Isoniazid	CYP3A4, CYP2C19	Rifapentine	CYP3A4, CYP2C9/10
Levofloxacin	Unknown	Rifampicine	CYP 1A2, 2B6, 2C8, 2C9, 2C19, and 3A4, UGT, and P-gp
Metronidazole	CYP3A4 and CYP2C9/10	Voriconazole	CYP3A4, CYP2C9/10 and CYP2C19 and substrate
Sulfamethoxazole and trimethoprim	CYP2C9/10 Also substrate		

CYP = cytochromes

P-gp = P-glycoprotein

BCRP = Breast Cancer Resistance Protein

■ Strong Inhibition

■ Mild Inhibition

■ Strong induction

■ Mild induction

Pathways and effects on cytochromes and proteins of main antivirals

Antiviral	CYP and proteins affected	Antiviral	CYP and proteins affected
Atazanavir/ritonavir	CYP3A4 and a P-gp substrate. CYP3A4, UGT1A1 and 2D6	Maraviroc	CYP3A4, CYP3A5 and P-gp substrate
Darunavir/cobicistat	CYP3A4 and CYP2D6 substrate. CYP3A, CYP2D6 and P-gp.	Nevirapine	CYP3A4 substrate
Dolutegravir	CYP3A4 and Pgp substrate	Tipranavir	CYP3A substrate CYP1A2, CYP2C9 and CYP 2C19
Efavirenz	CYP3A4 and substrate. CYP2C9, CYP2C19 CYP2B6 and UGT1A4	Zidovudine	UGT substrate
Etravirine	CYP3A4, CYP2C9, CYP2C19 and UDPGT substrate. CYP2C9, CYP2C19 and P-gp, CYP3A4	Tenofovir	BCRP and P-gp substrate
Fosamprenavir (amprenavir)	CYP3A4 and substrate	Glecaprevir/Pibren tasvir	P-gp, BCRP and substrates. CYP3A, CYP1A2, and UGT1A1
Indinavir	CYP3A4 and substrate	Ledipasvir/sofosbu vir	P-gp and BCRP and substrates
Lopinavir/ritonavir	CYP3A, CYP2C9, CYP2C19 substrate, UGT	Sofosbuvir	P-gp and BCRP substrates

■ Strong Inhibition

■ Mild Inhibition

■ Strong induction

■ Mild induction