

CRITICAL VALUES FOR THERAPEUTIC DRUG LEVELS

The concept of critical values for drug levels was originally developed by the late Daniel M. Baer, MD, and first published in the April 1982 issue of MLO. This table lists the critical values for common therapeutic drugs updated in 2024 by reputed laboratories in the US. Ranges are approximate and may vary with laboratory and/or assay. Proper interpretation of therapeutic drug concentrations requires that the specimen be drawn at an appropriate time in relation to drug administration.

Drug	Indication	Therapeutic Range	Critical Value	Method
Acetaminophen ¹	Analgesic	10.0-30.0 µg/mL	>150.0 µg/mL 4 hrs. after ingestion: >40 µg/mL 12 hrs. after ingestion	Spectrophotometry
Amikacin ¹	Antimicrobial	Peak: 20.0-30.0 µg/mL Trough: 4.0-8.0 µg/mL	Peak: 30.1 µg/mL or greater Trough: 8.1 µg/mL or greater	Immunoassay
Amiodarone ¹	Antiarrhythmic	0.5-2.0 µg/mL	>2.5 µg/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Total Amitriptyline ¹	Antidepressant/ analgesic (neuropathic pain)	95.0-250.0ng/mL	>500.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Total Carbamazepine ¹	Antiepileptic/ mood stabilizer	4.0-12.0 µg/mL	>15.0 µg/mL	Quantitative Enzyme Multiplied Immunoassay Technique
Cyclosporine A ¹	Immunosuppressant	100.0-400.0 ng/mL	>700.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Digoxin ¹	Antiarrhythmic	0.8-2.0 ng/mL	>2.4 ng/mL	Quantitative Enzyme Multiplied Immunoassay Technique
Total Doxepin ¹	Antidepressant	100.0-300.0 ng/mL	>500.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Ethosuximide ¹	Antiepileptic	40.0-10.00 µg/mL	>150.0 µg/mL	Quantitative Enzyme Immunoassay
Everolimus ¹	Immunosuppressant	3.0-8.0 ng/mL	>15.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Flecainide ¹	Antiarrhythmic	0.2-1.0 µg/mL	>1.5 µg/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Fluconazole ¹	Antifungal	5.0-20.0 µg/mL	None established	Quantitative High Performance Liquid Chromatography-Tandem Mass Spectrometry
Flucytosine ¹	Antifungal	Peak: 30.0-45.0 µg/mL	>100.0 µg/mL	Quantitative Bioassay
Gentamicin ¹	Antimicrobial	Peak: 5.0-10.0 µg/mL Trough: 0.5-2.0 µg/mL	Peak: >12.0 µg/mL Trough: >2.0 µg/mL	Immunoassay
Itraconazole ¹	Antifungal	>0.5 µg/mL (localized) >1.0 µg/mL (systemic)	Itraconazole and hydroxyitraconazole concentrations combined should not exceed 10.0 µg/mL.	Quantitative High Performance Liquid Chromatography-Tandem Mass Spectrometry
Lamotrigine ¹	Antiepileptic/ mood stabilizer	3-15.0 µg/mL	≥20.0 µg/mL	Quantitative Enzyme Immunoassay
Lidocaine ¹	Antiarrhythmic	1.2-5.0 µg/mL	>9.0 µg/mL	Immunoassay
Lithium ¹	Mood stabilizer	0.5-1.2 mmol/L	≥1.6 mmol/L	Colorimetry
Nortriptyline ¹	Antidepressant/ analgesic (neuropathic pain)	50.0-15.00 ng/mL	>500.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Phenobarbital ¹	Antiepileptic	15.0-30.0 µg/mL (<2-month-old) 15.0-40.0 µg/mL (>3-month-old)	≥40.1 µg/mL (<2-month-old) ≥50.1 µg/mL (>3-month-old)	Enzyme Multiplied Immunoassay Technique (EMIT)
Phenytoin ¹	Antiepileptic	6.0-14.0 µg/mL (<2-month-old) 10.0-20.0 µg/mL (>3-month-old)	≥14.1 µg/mL (<2-month-old) ≥30.1 µg/mL (>3-month-old)	Enzyme Immunoassay
Posaconazole ¹	Antifungal	>0.7 µg/mL (Trough)	None established	Quantitative High Performance Liquid Chromatography-Tandem Mass Spectrometry
Primidone ¹	Antiepileptic	5.0-12.0 µg/mL	≥15.0 µg/mL	Enzyme Multiplied Immunoassay Technique (EMIT)
Procainamide (PA) + NAPA ²	Antiarrhythmic	PA: 4.0-10.0 µg/mL NAPA: 12.0-18.0 µg/mL	>12.0 µg/mL ≥40.0 µg/mL	Immunoassay
Protriptyline ¹	Antidepressant	70.0-240.0 ng/mL	>400.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Quinidine ²	Antiarrhythmic	2-5 µg/mL	≥6.0 µg/mL	Kinetic Interaction of Microparticles in Solution (KIMS)
Salicylate ¹	Analgesic, Anti-inflammatory	2.0-10.0 mg/dL 10.0-30.0 mg/dL	≥31.0 mg/dL	Spectrophotometry
Sirolimus ¹	Immunosuppressant	4.0-12.0 ng/mL Kidney transplant (in combination with cyclosporine)	>25.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Tacrolimus ¹	Immunosuppressant	7.0-20.0 ng/mL Post kidney transplant <3 months 5.0-15.0 ng/mL >3 months 10.0-20.0 ng/mL Post heart transplant <3 months 5.0-15.0 ng/ml >3 months 5.0-20.0 ng/mL Post liver transplant 1-12 months	>25.0 ng/mL	Quantitative Liquid Chromatography-Tandem Mass Spectrometry
Theophylline ¹	Bronchodilator	6.0-12.0 µg/mL <5 months 10.0-20.0 µg/mL >6 months	≥20.1 µg/mL ≥25.1 µg/mL	Enzyme Immunoassay
Tobramycin ¹	Antibacterial	Peak: 5.0 – 10 µg/mL Trough: 0.5 – 2.0 µg/mL	≥ 12.1 µg/mL ≥2.1 µg/mL	Immunoassay
Valproic acid ¹	Antiepileptic/ mood stabilizer	Epilepsy: 50.0-100.0 µg/mL Mania: 50.0-125.0 µg/mL	≥151.0 µg/mL	Fluorescence Polarization Immunoassay
Vancomycin ²	Antimicrobial	Peak: 20.0-40.0 µg/mL Trough: 5.0-20.0 µg/mL	>60.0 µg/mL >20.1 µg/mL	Kinetic Immunoassay
Voriconazole ¹	Antifungal	1.0-6.0 µg/mL	>6.0 µg/mL	Quantitative High Performance Liquid Chromatography-Tandem Mass Spectrometry

REFERENCES:

1. ARUP Laboratories. Last Updated February 2024. Accessed May 3, 2024.
2. Michigan Medicine Laboratories Accessed May 3, 2024