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Therapeutic Drug Monitoring (TDM) Guidelines in Blood for Pediatrics and Adults

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Drug	Peak/ Trough	Sampling Time	Therapeutic Values Red = Flagged L or H by Cerner/ EPIC Blue = Included in Interpretation Statement	Toxic Values Red = Flagged L or H by Cerner/ EPIC Blue = Included in Interpretation Statement	Time to Steady State
Acetaminophen[1,5] (Tylenol®) *Therapeutic Drug Monitoring*	---	2 hours post dose	5-20 µg/mL	>50 µg/mL	Peak: 1-2 hours
Acetaminophen[1,5] (Tylenol®) *Possible Overdose*	---	4 hours post dose	---	>50 µg/mL <u>Additional information:</u> Serious toxicity occurs >200 ug/mL.	
	---	12 hours post dose	---	>50 µg/mL	
Amikacin[7,9] (Amikin®)	Peak	30-60 minutes post IV infusion 60-90 minutes post IM injection	20-35 µg/mL <u>Additional information:</u> For most infections, 20-35 µg/mL is recommended. Some serious infections may require a peak range of 28-35 µg/mL.	>35 µg/mL	Neonate: 10-45 hours Child: 3-13 hours Adult: 10-15 hours
	Trough	Within 30 minutes before next dose	0-3 µg/mL <u>Additional information:</u> For most infections, <4 µg/mL is recommended. For severe infections, 4-8 µg/mL may be acceptable, with guidance from an infectious disease specialist.	>9 µg/mL	
	Random	Daily dosing: 8-12 hours after dose	4-35 µg/mL	>35 µg/mL	**(Note: 2)**
Amitriptyline[3] (Elavil®)	Trough	10-14 hours post dose	Total Amitriptyline + Nortriptyline: 120-250 ng/mL	Total Amitriptyline + Nortriptyline: >500 ng/mL	Adult: 3-8 days
	Amitriptyline is reported as the total concentration of Amitriptyline and Nortriptyline (metabolite of Amitriptyline). See Nortriptyline for more information.				

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Carbamazepine[2,9] (Tegretol®)	Trough	Before next dose	4-12 µg/mL Additional information: Single drug regimen: 4-12 µg/mL Multiple drug regimen: 4-8 µg/mL	>15 µg/mL Additional information: Single Drug Regimen: >15 µg/mL Multiple drug regimen: >8 µg/mL Serious toxicity occurs >50 µg/mL.	Variable due to autoinduction Adult: 2-4 days
Carbamazepine, Free[2,9]	Trough	Before next dose	Free: 0.6-4.1 µg/mL Bound: 66-84%	Not established	(**Note: 2**)
Clorazepate[1,9] (Tranxene®)	Trough	Before next dose	Monitored as the metabolite, Nordiazepam, only. See Nordiazepam for more information.		Adult: 8-21 days (**Note: 2**)
Cyclosporine[8,19]	Trough	≤6 months post-transplant	225-338 ng/mL	Indicating non-compliance: <20 ng/mL Toxic: >450 ng/mL	Varies by patient and type of transplant
		>6 months post-transplant	90-225 ng/mL		
		≤1 month post LIVER transplant	315-405 ng/mL		
		2-6 months post LIVER transplant	225-315 ng/mL		
		>6 months post LIVER transplant	153-216 ng/mL		
		≤6 weeks post CARDIAC transplant:	270-378 ng/mL		
		6-12 weeks post CARDIAC transplant:	162-270 ng/mL		
		>12 weeks post-CARDIAC transplant:	108-162 ng/mL		
Desipramine[3,9] (Norpramin®)	Trough	≥12 hours post dose	150-250 ng/mL	>500 ng/mL	Adult: 4-19 days (**Note: 2**)
Diazepam[1,9] (Valium®)	Trough	Before next dose Based on normal dosage amounts	200-1000 ng/mL	Not established	Adult: 13-56 days (**Note: 2**)
	Nordiazepam and Oxazepam (metabolites of Diazepam) are reported with Diazepam. See Nordiazepam and Oxazepam for more information.				

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Digoxin[1,4] (Lanoxin®)	---	>6 hours, post dose	0.8-2.0 ng/mL Additional information: Congestive Heart Failure: 0.8-1.5 ng/mL Arrhythmia: 1.5-2.0 ng/mL Concurrent use of Quinidine, DigiFab, and DigiBind will elevate the Digoxin level.	0-10 years: >3.0 ng/mL >10 years: >2.5 ng/mL	Adult: 5-7 days
Doxepin[3] (Sinequan®, Adapin®)	---	10-14 hours post dose	Total Doxepin + Nordoxepin: 150-250 ng/mL	Total Doxepin + Nordoxepin: >500 ng/mL	Adult: 2-8 days
	Doxepin is reported as the total concentration of Doxepin and Nordoxepin (metabolite of Doxepin).				
Ethosuximide[9] (Zaronin®)	Trough	Before next dose	40-100 µg/mL	>100 µg/mL	≈11 days (**Note: 2**)
Felbamate	Trough	Before next dose	No ill effects demonstrated: 40-100 µg/mL	>200 µg/mL	Adult: 3-4 days

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Gentamicin[7,9] (Garamycin®)	Peak	30-60 minutes post IV infusion 60-90 minutes post IM injection	5.0-8.0 µg/mL Additional information: For most infections, 5.0-8.0 µg/mL is recommended. For certain severe infections, 8.0-10.0 µg/mL may be acceptable, with guidance from an infectious disease specialist. For synergy against gram positive infections, a range of 3.0-5.0 µg/mL is recommended.	>10.0 µg/mL	Adult: 10-15 hours
	Trough	Within 30 minutes before next dose	0.0-0.9 µg/mL Additional information: For most infections, <1 µg/mL is recommended. For certain severe infections, <2 µg/mL may be acceptable, with guidance from an infectious disease specialist.	>2.0 µg/mL	
	12 hour	Daily dosing: 12 hours after dose	0.0-3.4 µg/mL	>3.4 µg/mL	(**Note: 2**)
Haloperidol[1,9] (Haldol®)	Trough	Before next dose	2-15 ng/mL	Not well established	Adult: 1-5 days (**Note: 2**)
Imipramine[3] (Tofranil®)	Trough	≥12 hours post dose	Total Imipramine + Desipramine: 150-350 ng/mL	Total Imipramine + Desipramine: >500 ng/mL	Adult: 2-5 days
	Imipramine is reported as the total concentration of Imipramine and Desipramine (metabolite of Imipramine). See Desipramine for more information.				
Lamotrigine[2]	Trough	Before next dose	3-14 µg/mL	Not established	Adult: 1-14 days
Levitirecetam[19]	Trough	Before next dose	5-30 µg/mL	>150 µg/mL Additional information: Not well established. Lab will notify providers of potential toxicity for values >150 µg/mL.	30 – 40 hours **(Note: 2)**

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Lidocaine[4] (Xylocaine®)	----	<30 minutes post IV dose	1.5-5.0 μg/mL	>6.0 μg/mL Signs and symptoms of toxicity: CNS, Cardiovascular depression: 6.0-8.0 μg/mL Seizures, obtundation, decreased cardiac output: >8.0 μg/mL	Adult: 0.5-1.5 hours with loading dose 5-10 hours without loading dose
Lithium[3] (Eskalith®)	Trough	6-12 hours post dose	0.6-1.2 mmol/L	>1.5 mmol/L	Adult: 4-6 days
Mephobarbital[19]	Trough	Before next dose	Monitored as the metabolite, Phenobarbital, only. See Phenobarbital for more information.		
Methadone[9] (Dolophine®)	Trough	Single dose	30-80 ng/mL	>2,000 ng/mL Additional information: Interpret with caution as therapeutic and toxic ranges have significant overlap due to large variation in patient opioid tolerance.	Adult: 3-5 days (**Note: 2**)
		Maintenance	200-1,100 ng/mL		
Methotrexate[9,10] (Rheumatrex, Folex)	Trough	Low Dose: 1-2 weeks post	See toxic values: Varies with time and dose	>0.02 μmol/L	Adult: 2-3 days
		High Dose: 24 hours post		≥5.00 μmol/L	
		High Dose: 48 hours post		≥0.50 μmol/L	
		High Dose: 72 hours post		0.05 μmol/L	(**Note: 2**)
Nordiazepam[19] (metabolite of Diazepam)	Trough	Before next dose Based on normal dosage amounts	60-1800 ng/mL	>2500	8-41 days (**Note: 2**)
Nortriptyline[9] (Aventyl®)	Trough	10-14 hours post dose	50-150 ng/mL	>500 ng/mL	Adult: 4-19 days (**Note: 2**)
Oxazepam[19] (Serax®)	Trough	Before next dose Based on normal dosage amounts	200-1400 ng/mL	>2000 ng/mL	1-3 days (**Note: 2**)

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Pentobarbital[9] (Nembutal®)	Trough	Before next dose	Sedation: 1-5 μg/mL Intracranial pressure therapy: 30-40 μg/mL Therapeutic coma: 20-50 μg/mL	>10 μg/mL (Sedation)	Adult: 3-6 days (**Note: 2**)
Phenobarbital[2] (Luminal®)	Trough	Before next dose	15-40 μg/mL	<1 year: >40 μg/mL (Serious toxicity occurs >60 μg/mL.) ≥1 year: >40 μg/mL Signs and symptoms of toxicity: Slowness, ataxia nystagmus: 35-80 μg/mL Coma with reflexes: 65-117 μg/mL Coma without reflexes (serious): >100 μg/mL	Newborn: 0-4 weeks: 21-28 days 1-12 months: 12-14 days Child: 10-29 days Adult: 10-29 days (**Note: 2**)
Phenytoin[2] (Dilantin®)	Trough	Before next dose Minimum times for collection post dose, IM: >4 hours; IV: >2 hours.	0-3 months: 6-11 μg/mL >3 months: 10-20 μg/mL	>30 μg/mL Serious toxicity occurs >160 μg/mL.	1-3 weeks
Phenytoin, Free	Trough	Before next dose	Free: 1.0-2.0 μg/mL Bound: 85-95%	Free: >3.0 μg/mL Bound: Not established	
Primidone[2,9] (Mysoline®)	Trough	Before next dose	5-12 μg/mL	>15 μg/mL Serious toxicity occurs >40 μg/mL.	Adult: 16-64 hours (**Note: 2**)
	Phenobarbital (metabolite of Primidone) is reported with Primidone. See Phenobarbital for more information.				

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Salicylates[9]	Trough	Before next dose	2.0-10.0 mg/dL Additional information: Analgesia, antipyresis: 2.0-10.0 mg/dL Anti-inflammatory: 15.0-30.0 mg/dL	>10.0 mg/dL Signs and symptoms of toxicity: Gastric intolerance, impaired homeostasis: >10.0 mg/dL Deafness, headache, vertigo, tinnitus: 15.0-30.0 mg/dL Nausea, vomiting, hyperventilation: 25.0-40.0 mg/dL Intoxication: >50.0 mg/dL	Adult: 12-15 hours (**Note: 2**)
Sirolimus[19] (Rapamycin, Rapamune®)	Trough	Before next dose	3.0-20.0 ng/mL	>20.0 ng/mL	10-16 days (**Note: 2**)
Tacrolimus[12] (FK506, Prograf®)	Trough	12 hours post-transplant	5.0-20.0 ng/mL The therapeutic range is not clearly defined, but a target. Higher concentrations are associated with an increased incidence of adverse effects.	Not established	Child: 1-2 days Adult: 2-4 days
		≥24 hours post-transplant	3.0-13.0 ng/mL	Not established	(**Note: 2**)
Temazepam[19]	Trough	Before next dose	Not established	Not established	1-4 days (**Note: 2**)
	Oxazepam (metabolite of Temazepam) is reported with Temazepam. See Oxazepam for more information.				
Theophylline[1,6]	Trough	Varies with type of administration. (**Note: 1**)	0-5 months: 6-11 µg/mL >5 months: 8-20 µg/mL	0-5 months: >14 µg/mL >5 months: >20 µg/mL	Premature: 6 days Newborn: 5 days Infant: 1-5 days Child: 1-2 days Adult: 2-3 days

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Tobramycin[9] (Nebcin®)	Peak	Post IV infusion: 30-60 minutes post IM infusion: 60-90 minutes	5.0-8.0 µg/mL Additional information: For most infections, 5.0-8.0 µg/mL is recommended. For severe infections, 8.0-10.0 µg/mL may be acceptable, with guidance from an infectious disease specialist. For synergy against gram positive infections, a range of 3.0-5.0 µg/mL is recommended.	>10.0 µg/mL	Adult: 10-15 hours
	Trough	Within 30 minutes before next dose	0.0-0.9 µg/mL Additional Information: For most infections, <1 µg/mL is recommended. For certain severe infections, <2 µg/mL may be acceptable, with guidance from an infectious disease specialist.	>2.0 µg/mL	
	12 Hour	Daily Dosing: 8-12 hours after dose	0.0-3.4 µg/mL	>3.4 µg/mL	
Topiramate[2] (Topamax®)	Trough	Before next dose	5-20 µg/mL	>40 µg/mL Additional information: Not well established. Lab will notify providers of potential toxicity for values >40 µg/mL.	4-5 days
Valproic Acid[2], Total (Depakene®)	Trough	Before next dose	50-120 µg/mL	>120 µg/mL Seizure control may improve at levels over 100 µg/mL, but toxicity may occur at levels of 100-150 µg/mL in some patients. Serious toxicity occurs >200 µg/mL.	Newborn: 41 hours Child: 41-55 hours Adult: 41-74 hours
Valproic Acid, Free[2]			Free: 2.0-20.0 µg/mL Bound: 80-95%	Not established	(**Note: 2**)

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Vancomycin[1,7,8] (Vancocin®)	Peak	Approximately 2 hours after a 60 minute infusion	20-40 µg/mL	>49 µg/mL	Adult: 24-39 hours (**Note: 2**)
	Trough	Within 30 minutes before next dose	10-20 µg/mL Additional information: For complicated infections (*i.e.*, endocarditis, osteomyelitis, meningitis, and hospital-acquired pneumonia caused by MRSA) or MRSA with an MIC >1 µg/mL, 15-20 µg/mL is recommended. For all other infections, 10-15 µg/mL is recommended.	>25 µg/mL	
	Random	Varies	10-40 µg/mL	>49 µg/mL	

NOTES AND COMMENTS:

1. Contact the physician or pharmacy pharmacokinetic specialist for patient-specific information.
2. Based on 5 half-lives.[9]

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