## APPENDIX E

**Table E.1 Pharmacokinetic and Pharmacodynamic Parameters for Selected Drugs[1]**

| Drug | Oral Availability (%) | Urinary Excretion (%) | Bound in Plasma (%) | Clearance[2] (mL/min) | Volume of Distribution (L) | Half-Life (hr) | Effective[3] Concentrations | Toxic[3] Concentrations |
|---|---|---|---|---|---|---|---|---|
| Acetaminophen | 88 ± 15 | 3 ± 1 | 0 | 350 ± 100 | 67 ± 8 | 2.0 ± 0.4 | 10–20 µg/mL | >300 µg/mL |
| Acyclovir | 15–30 | 75 ± 10 | 15 ± 4 | 330 ± 80 | 48 ± 13 | 2.4 ± 0.7 | | |
| Alendrenate | 0.59 (0.58 –0.98) | | | | | very long (related to bone turnover) | | |
| Alprazolam | 88 ± 16 | 20 | 71 ± 3 | 0.74 ± 0.14 ml/min/kg | 0.72 ± 0.12 L/Kg | 12 ± 2 | 20–40 ng/mL | |
| Alteplase (TPA) | — | LOW | — | 10 ± 4 ml/min/kg | 0.1 ± 0.01 L/Kg | 0.08 ± 0.04 | | |
| Amikacin | | 98 | 4 | 91 ± 42 | 19 ± 4 | 2.3 ± 0.4 | | |
| Amoxicillin | 93 ± 10 | 86 ± 8 | 18 | 180 ± 28 | 15 ± 2 | 1.7 ± 0.3 | | |
| Amphotericin B | | 2–5 | >90 | 32 ± 14 | 53 ± 36 | 18 ± 7 | | |
| Ampicillin | 62 ± 17 | 82 ± 10 | 18 ± 2 | 270 ± 50 | 20 ± 5 | 1.3 ± 0.2 | | |
| Aspirin[4] | 68 ± 3 | 1.4 ± 1.2 | 49 | 650 ± 80 | 11 ± 2 | 0.25 ± 0.3 | See Salicyclic acid | |
| Atenolol | 56 ± 30 | 94 ± 8 | <5 | 170 ± 14 | 67 ± 11 | 6.1 ± 2.0 | 1 µg/mL | |
| Atropine | 50 | 57 ± 8 | 14–22 | 410 ± 250 | 120 ± 49 | 4.3 ± 1.7 | | |
| Captopril | 65 | 38 ± 11 | 30 ± 6 | 840 ± 100 | 57 ± 13 | 2.2 ± 0.5 | 50 ng/mL | |
| Carbamazepine [4] | >70 | <1 | 74 ± 3 | 89 ± 37 | 98 ± 26 | 15 ± 5 | 6.5 ± 3 µg/mL | >9 µg/mL |
| Cephalexin | 90 ± 9 | 91 ± 18 | 14 ± 3 | 300 ± 80 | 18 ± 2 | 0.90 ± 0.18 | | |
| Cephalothin | | 52 | 71 ± 3 | 470 ± 120 | 18 ± 8 | 0.57 ± 0.32 | | |
| Chloramphenicol | 75–90 | 25 ± 15 | 53 ± 5 | 170 ± 14 | 66 ± 4 | 2.7 ± 0.8 | | |
| Chlordiazepoxide [4] | 100 | <1 | 96.5 ± 1.8 | 38 ± 34 | 21 ± 2 | 10 ± 3 | >0.7 µg/mL | |
| Chloroquine [4] | 89 ± 16 | 61 ± 4 | 61 ± 9 | 750 ± 120 | 13,000 ± 4600 | 8.9 ± 3.1 days | 15–30 ng/mL | 0.25 µg/mL |
| Chlorpropamide | >90 | 20 ± 18 | 96 ± 1 | 2.1 ± 0.4 | 6.8 ± 0.8 | 33 ± 6 | | |
| Cimetidine | 62 ± 6 | 62 ± 20 | 19 | 540 ± 130 | 70 ± 14 | 1.9 ± 0.3 | 0.8 µg/mL | |
| Ciprofloxacin | 60 ± 12 | 65 ± 12 | 40 | 420 ± 84 | 130 ± 28 | 4.1 ± 0.9 | | |
| Clonidine | 95 | 62 ± 11 | 20 | 210 ± 84 | 150 ± 30 | 12 ± 7 | 0.2–2 ng/mL | |
| Cyclosporine | 23.7 | <1 | 93 ± 2 | 410 ± 70 | 85 ± 15 | 5.6 ± 2 | 100–400 ng/mL | >400 ng/mL |
| Diazepam [4] | 100 | <1 | 98.7 ± 0.2 | 27 ± 4 | 77 ± 20 | 43 ± 13 | 300–400 ng/mL | |
| Digitoxin | >90 | 32 ± 15 | 97 ± 1 | 3.9 ± 1.3 | 38 ± 10 | 6.7 ± 1.7 days | >10 ng/mL | >35 ng/mL |
| Digoxin | 70 ± 13 | 60 ± 11 | 25 ± 5 | 130 ± 67 | 440 ± 150 | 39 ± 13 | >0.8 ng/mL | >2 ng/mL |
| Diltiazem [4] | 44 ± 10 | <4 | 78 ± 3 | 840 ± 280 | 220 ± 85 | 3.7 ± 1.2 | | |
| Diflunisal | 90 | 6 ± 3 | 99.9 ± | 0.1 ± 0.02 | 0.1 ± 0.02 | 11 ± 2 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 0.01 | mL/min/kg | L/kg | | | |
| Dirithromycin | 10% (6–14) abs bio (urinary data) | 17–25 | 10–30 | 226–1040 mL/min | 800 L (504 –1041) | 44 (16–65) | | |
| Disopyramide | 83 ± 11 | 55 ± 6 | Dose-dependent | 84 ± 28 | 41 ± 11 | 6.0 ± 1.0 | 3 ± 1 µg/mL | >8 µg/mL |
| Erythromycin | 35 ± 25 | 12 ± 7 | 84 ± 3 | 640 ± 290 | 55 ± 31 | 1.6 ± 0.7 | | |
| Erythropoietin | | | | 7.88 mL/min | 3.70 L per 1.73 $m^2$ | 4.92 | | |
| Ethambutol | 77 ± 8 | 79 ± 3 | <5 | 600 ± 60 | 110 ± 14 | 3.1 ± 0.4 | | >10 µg/mL |
| Ethosuximide | — | 25 ± 15 | 0 | 0.19 ± 0.04 mL/min/kg | 0.72 ± 0.16 L/kg | 45 ± 8 | 40–100 µg/mL | |
| Famciclovir | 77 ± 8 | 74 ± 9 | <20 | 8.0 ± 1.5 mL/min/kg | 0.98 ± 0.13 L/kg | 2.3 ± 0.4 | | |
| Famotidine | 45 ± 14 | 67 ± 15 | 17 ± 7 | 7.1 ± 1.7 mL/min/kg | 1.3 ± 0.2 L/kg | 2.6 ± 1.0 | 13 ng/ml | |
| Fluoxetine | >60 | <2.5 | 94 | 9.6 ± 6.9 mL/min/kg | 35 ± 21 L/kg | 53 ± 41 | <500 ng/mL | |
| Furosemide | 61 ± 17 | 66 ± 7 | 98.8 ± 0.2 | 140 ± 30 | 7.7 ± 1.4 | 1.5 ± 0.1 | | 25 µg/mL |
| Ganciclovir | 3 | 73 ± 31 | 1–2 | 4.6 ± 1.8 mL/min/kg | 1.1 ± 0.3 L/kg | 4.3 ± 1.6 | | |
| Gentamicin | | >90 | <10 | 90 ± 25 | 18 ± 6 | 2–3 | | |
| Hydralazine | 20–60 | 1–15 | 87 | 3900 ± 900 | 105 ± 70 | 1.0 ± 0.3 | 100 ng/mL | |
| Imipramine [4] | 40 ± 12 | <2 | 90.1 ± 1.4 | 1050 ± 280 | 1600 ± 600 | 18 ± 7 | 100–300 ng/mL | >1 µg/mL |
| Indinavir | | | | | | ~3 | | |
| Indomethacin | 98 | 15 ± 8 | 90 | 140 ± 30 | 18 ± 5 | 2.4 ± 0.4 | 0.3–3 µg/mL | >5 µg/mL |
| Labetalol | 18 ± 5 | <5 | 50 | 1750 ± 700 | 660 ± 240 | 4.9 ± 2.0 | 0.13 µg/mL | |
| Lidocaine | 35 ± 11 | 2 ± 1 | 70 ± 5 | 640 ± 170 | 77 ± 28 | 1.8 ± 0.4 | 1.5–6 µg/mL | >6 µg/mL |
| Lithium | 100 | 95 ± 15 | 0 | 25 ± 8 | 55 ± 24 | 22 ± 8 | 0.5–1.25 meq/L | >2 meq/L |
| Lomefloxacin | 97 ± 2 | 65 ± 9 | 10 | 3.3 ± 0.5 mL/min/kg | 2.3 ± 0.3 L/kg | 8.0 ± 1.4 | | |
| Lovastatin | <5 | negligible | 95 | 4–18 mL/min/kg | — | 1.1–1.7 hr | — | |
| Meperidine | 52 ± 3 | 1–25 | 58 ± 9 | 1200 ± 350 | 310 ± 60 | 3.2 ± 0.8 | 0.4–0.7 µg/mL | |
| Methotrexate | 70 ± 27 | 48 ± 18 | 34 ± 8 | 150 ± 60 | 39 ± 13 | 7.2 ± 2.1 | | 10 µM |
| Metoprolol | 38 ± 14 | 10 ± 3 | 11 ± 1 | 1050 ± 210 | 290 ± 50 | 3.2 ± 0.2 | 25 ng/mL | |
| Metronidazole [4] | 99 ± 8 | 10 ± 2 | 10 | 90 ± 20 | 52 ± 7 | 8.5 ± 2.9 | 3–6 µg/mL | |
| Mexiletine | 87 ± 13 | 4–15 | 63 ± 3 | 6.3 ± 2.7 ml/min/kg | 4.9 ± 0.5 L/kg | 9.2 ± 2.1 hr | 0.5–2.0 µg/mL | >2.0 µg/mL |
| Midazolam | 44 ± 17 | 56 ± 26 | 95 ± 2 | 460 ± 130 | 77 ± 42 | 1.9 ± 0.6 | | |
| Morphine | 24 ± 12 | 6–10 | 35 ± 2 | 1600 ± 700 | 230 ± 60 | 1.9 ± 0.5 | 65 ng/mL | |
| Moxalactam | | 76 ± 12 | 50 | 120 ± 30 | 19 ± 6 | 2.1 ± 0.7 | | |
| Notilmicin | — | 80–90 | <10 | 1.3 ± 0.2 ml/min/kg | 0.2 ± 0.02 L/kg | 2.3 ± 0.7 hr | | |
| Nifedipine | 50 ± 13 | 0 | 96 ± 1 | 490 ± 130 | 55 ± 15 | 1.8 ± 0.4 | 47 ± 20 ng/mL | |
| Nortriptyline [4] | 51 ± 5 | 2 ± 1 | 92 ± 2 | 500 ± 130 | 1300 ± 300 | 31 ± 13 | 50–140 ng/mL | >500 ng/mL |
| Phenobarbital | 100 ± 11 | 24 ± 5 | 51 ± 3 | 4.3 ± 0.9 | 38 ± 2 | 4.1 ± 0.8 days | 10–25 µg/mL | >30 µg/mL |
| Phenytoin | 90 ± 3 | 2 | 89 ± 23 | Dose-dependent | 45 ± 3 | Dose-dependent | >10 µg/mL | >20 µg/mL |
| Pravastatin | 18 ± 8 | 47 ± 7 | 43–48 | 3.5 ± 2.4 ml/min/kg | 0.46 ± 0.04 L/kg | 1.8 ± 0.8 hr | | |
| Prazosin | 68 ± 17 | <1 | 95 ± 1 | 210 ± 20 | 42 ± 9 | 2.9 ± 0.8 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Procainamide [4] | 83 ± 16 | 67 ± 8 | 16 ± 5 | 350–840 | 130 ± 20 | 3.0 ± 0.6 | 3–14 µg/mL | >14 µg/mL |
| Propranolol [4] | 26 ± 10 | <0.5 | 87 ± 6 | 840 ± 210 | 270 ± 40 | 3.9 ± 0.4 | 20 ng/mL | |
| Pyridostigmine | 14 ± 3 | 80–90 | | 600 ± 120 | 77 ± 21 | 1.9 ± 0.2 | 50–100 ng/mL | |
| Quinidine [4] | 80 ± 15 | 18 ± 5 | 87 ± 3 | 330 ± 130 | 190 ± 80 | 6.2 ± 1.8 | 2–6 µg/mL | >8 µg/mL |
| Ranitidine | 52 ± 11 | 69 ± 6 | 15 ± 3 | 730 ± 80 | 91 ± 28 | 2.1 ± 0.2 | 100 ng/mL | |
| Ribavirin | 45 ± 5 | 35 ± 8 | 0 | 5 ± 1.0 ml/min/kg | 9.3 ± 1.5 L/kg | 28 ± 7 hr | | |
| Rifampin [4] | | 7 ± 3 | 89 ± 1 | 240 ± 110 | 68 ± 25 | 3.5 ± 0.8 | | |
| Ritonavir | <5 | | high (AAG) | | | ~3 hr | | |
| Saquinavir | <5 | | high (AAG) | *<989 L/hr | *<1503 L | 7–12 hr (beta) (1.38 hr) | | |
| Salicylic acid | 100 | 2–30 | 80–90[5] | 14[5] | 12 ± 2 | 10–15[5] | 150–300 µg/mL | >200 µg/mL |
| Simvastatin | <5 | negligible | 94 | 7.6 ml/min/kg | — | 1.9 hr | — | — |
| Sotalol | 90–100 | >75 | 0 | 2.6 ± 0.5 ml/min/kg | 2.0 ± 0.4 L/kg | 12 ± 3 hr | | |
| Sulfamethoxazole | 100 | 14 ± 2 | 62 ± 5 | 22 ± 3 | 15 ± 1.4 | 10 ± 5 | | |
| Sulfisoxazole | 96 ± 14 | 49 ± 8 | 91 ± 1 | 23 ± 3.5 | 10.5 ± 1.4 | 6.6 ± 0.7 | | |
| Sumatriptan | 14 ± 5 (oral) | 22 ± 4 | 14–21 | 16 ± 2 ml/min/kg | 0.65 ± 0.1 L/kg | 1.9 ± 0.3 hr | | |
| Tamoxifen | 97 ± 16 (SQ) — | <1 | >98 | 1.4 ml/min/kg | 50–60 L/kg | 4–11 days | | |
| Terbutaline | 14 ± 2 | 56 ± 4 | 20 | 240 ± 40 | 125 ± 15 | 14 ± 2 | 2.3 ± 1.8 ng/mL | |
| Tetracycline | 77 | 58 ± 8 | 65 ± 3 | 120 ± 20 | 105 ± 6 | 11 ± 1.5 | | |
| Theophylline | 96 ± 8 | 18 ± 3 | 56 ± 4 | 48 ± 21 | 35 ± 11 | 8.1 ± 2.4 | 10–20 µg/mL | >20 µg/mL |
| Tobramycin | | 90 | <10 | 77 | 18 ± 6 | 2.2 ± 0.1 | | |
| Tocainide | 89 ± 5 | 38 ± 7 | 10 ± 15 | 180 ± 35 | 210 ± 15 | 14 ± 2 | 6–15 µg/mL | |
| Tolbutamide | 93 ± 10 | 0 | 96 ± 1 | 17 ± 3 | 7 ± 1 | 5.9 ± 1.4 | 80–240 µg/mL | |
| Trimethoprim | 100 | 69 ± 17 | 44 | 150 ± 40 | 130 ± 15 | 11 ± 1.4 | | |
| Tubocurarine | | 63 ± 35 | 50 ± 8 | 135 ± 42 | 27 ± 8 | 2.0 ± 1.1 | 0.6 ± 0.2 µg/mL | |
| Valproic acid | 100 ± 10 | 1.8 ± 2.4 | 93 ± 1 | 7.7 ± 1.4 | 9.1 ± 2.8 | 14 ± 3 | 30–100 µg/mL | >150 µg/mL |
| Vancomycin | | 79 ± 11 | 30 ± 10 | 98 ± 7 | 27 ± 4 | 5.6 ± 1.8 | | |
| Verapamil | 22 ± 8 (oral) | <3 | 90 ± 2 | 15 ± 6 ml/min/kg | 5.0 ± 2.1 L/kg | 4.0 ± 1.5 hr | 120 ± 20 ng/mL | |
| | 35 ± 13 (Sublingual) | | | | | | | |
| Warfarin | 93 ± 8 | <2 | 99 ± 1 | 3.2 ± 1.7 | 9.8 ± 4.2 | 37 ± 15 | 2.2 ± 0.4 µg/mL | |
| Zidovudine | 63 ± 13 | 18 ± 5 | <25 | 26 ± 6 ml/min/kg | 1.4 ± 0.4 L/kg | 1.1 ± 0.2 hr | | |
| Zalcitabine | 88 ± 17 | 65 ± 17 | <4 | 4.1 ± 1.2 ml/min/kg | 0.53 ± 0.13 L/kg | 2.0 ± 0.8 hr | | |

[1]The values in this table represent the parameters determined when the drug is administered to healthy normal volunteers or to patients who are generally free from disease except for the condition for which the drug is being prescribed. The values presented here are adapted, with permission, from Hardman JG: Design and optimization of dosage regimens: Pharmacokinetic data. In: *Goodman and Gilman's The Pharmacological Basis of Therapeutics.* 9th ed. Gilman AG et al (editors). McGraw-Hill, 1995. This source must be consulted for the effects of disease states on the pertinent pharmacokinetic parameters.

[2]For a standard 70-kg person.

[3]No pharmacodynamic values are given for antibiotics since these vary depending upon the infecting organism.

[4]One or more metabolites are active. Clearance given for aspirin is for conversion to the active metabolite, salicylic acid; see that compound

for further clearance data.

[5]The values are within the therapeutic range for drugs exhibiting dose-dependent pharmacokinetics.

[6]Volume of distribution and clearance determined orally (when F is unknown, *Cl*/F, or $V_D$/F) are listed as less than actual since F may be less than 1.

[7]Effective levels for antibiotics are variable depending on the susceptibility of the microorganisms.

[8]Generally, the beta half-life is listed, but it may be essential to consult the alpha half-life if the effective concentration is high or the distributive phase is long.

[9]The percent of urinary drug excretion is 100 fe, fe is the fraction of drug excreted unchanged."100–100 fe" yields the percent of drug eliminated by other routes, often assumed to be metabolism. It is worth noting that in some cases the mass balance may be off, and sometimes biliary excretion is significant.

[10]For simplicity, most PK parameters are listed without consideration of the curvilinear phase which is present for most drugs.

[11]Some parameters are listed on a per kilogram basis, whereas others are parameters based on average BW or body surface reported in the study.

*From Katzung BG: Basic & Clinical Pharmacology. 7th ed. Norwalk, CT, Appleton & Lange, 1998.*

Physician's Desk Reference, 1997

Dirithromycin:

Sides GD et al, Anti Micr. Chem. 31; Supp C: P65–75, 1993

Erythropoetin:

Jensen-JD et al: J-Am-Soc-Nephrol. 1994 Aug; 5(2):177–85

Indinavir:

Lin JH et al: Drug Metab Dispos 1996 Oct;24(10):1111–1120

Alendronate:

Gertz BJ, Holland SD, Kline WF, Matuszewski BK, Freeman A, Quan H, Lasseter KC, Mucklow JC, Porras: Clin Pharmacol Ther, 1995 Sep (3):288–298

Protease inhibitors:

Barry M, Gibbons S, Back D, Mulcahy F: Clin Pharmacokinet 1997 Mar;32(3):194–209

Zidovudine, zalcitabine, and saquinavir:

Vanhove GF, Kastrissios H, Gries JM, Verotta D, Park K, Collier AC, Squires K, Sheiner LB, Blaschke: Antimicrob Agents Chemother 1997 Nov;2428–2432