Adults: (≥ 17 years)

$$CrCl\,(\text{ml/min}) = \frac{(140\text{-Age}) \cdot Wt}{72 \cdot SrCr} \cdot (0.85 + Sex \cdot 0.15)$$

If the patient is < IBW, use Wt = ActBW.
If the patient is > IBW and BMI < 25 Kg/m^2, Wt = IBW
If the patient has a BMI ≥ 25 Kg/m^2, Wt = AdjWT

Neonates: (<2 months)

$$CrCl(\text{ml/min}/1.73\text{m}^2) = \frac{0.45 \cdot (CmHt.)}{SrCr}$$

Pediatrics: (2 months – 16 years)

$$CrCl(\text{ml/min}/1.73\text{m}^2) = \frac{3.5 \cdot Age + 23.6}{SrCr}$$

IBW (males)
50 Kg + 2.3 Kg/inch over 5 feet
IBW (females)
45.5 Kg + 2.3 Kg/inch over 5 feet

BMI = Wt (Kg) / (Ht (In) * 0.0254)^2

If ActBW is > 30% over IBW, then
DWT = IBW + 0.4*(ActBW – IBW)
If BMI ≥ 25 Kg/m^2, then
CrCl-WT = AdjWT = IBW + 0.4*(ActBW – IBW)

$$BSA = Wt^{0.5378} \cdot Ht^{0.3964} \cdot 0.024265$$

CrCl Norm = CrCl * 1.73 /BSA

$$GFR = 175 \cdot SrCr^{-1.154} \cdot Age^{-0.203} \cdot (0.742 + Sex \cdot 0.258) \cdot (1 + 0.21 \cdot Black)$$

Black = 1, else = 0,
Sex: Male = 1, female = 0

$$GFR\ (CKD - EPI) = (144 - (Sex * 3)) * (1 + 0.155 * Black) * 0.993^{Age} * \left(\frac{SrCr}{(0.7 + (0.2 * Sex))}\right)^{-0.329 - SrCrExp}$$

[where Sex = 1 for male, 0 for female, Black = 1 for Black, 0 for other races. and
If SrCr > (0.7 + 0.2*Sex) Then SrCrExp = 0.88 , Else SrCrExp = Sex*0.082]

Population Estimates

Volume of distribution (V)

Aminoglycosides: (DWT is ActBW, IBW or AdjWT)
V_{ss} (L) = 0.225 L/kg x DWT
V_{ss} (dehydrated) = 0.15 L/kg x DWT
V_{ss} (Fluid overload) = 0.30 L/kg x DWT
Vancomycin:
V_{ss} (L) = 0.7 L/Kg x ActBW

Elimination rate constant (k)

Gentamicin
Ke = 0.015 + (0.00285 x CrCl)
Tobramycin
Ke = 0.010 + (0.0031 x CrCl)
Amikacin
Ke = 0.010 + (0.0024 x CrCl)
Vancomycin
Ke = [44 + (8.3 x CrCl)] / 10000

Target Drug Concentrations

	Trough	Peak (Life Threatening infection)	Peak (Serious Infection)	Peak (Synergy/UTI)	Infusion Time
Gentamicin	< 2 mg/L	8 to 10 mg/L	6 to 8 mg/L	4 to 6 mg/L	0.5 Hr.
Tobramycin	< 2 mg/L	8 to 10 mg/L	6 to 8 mg/L	4 to 6 mg/L	0.5 Hr.
Amikacin	< 10 mg/L	25 to 30 mg/L	20 to 25 mg/L	15 to 20 mg/L	0.5 Hr.
Vancomycin	~ 15 mg/L		30 to 40 mg/L	1.5 Hr. (≤ 1.25 g) 2 Hr. (1.5 – 2 g)	

1. Calculate the elimination rate constant.

$$k_e = \frac{\ln C_1 - \ln C_2}{t_2 - t_1} = \frac{\ln C_{pk} - \ln C_{tr}}{t_{tr} - t_{pk}} = \frac{\ln(C_{pk} / C_{tr})}{\tau - t_{inf} - t_{pi}}$$

2. Calculate C_0 (t_{pk} = elapsed time from start of infusion)

$$C_0 = \frac{C_{pk}}{e^{-k_e(t_{pk} - t_{\inf})}}$$

3. Calculate the half-life.

$$t_{1/2} = \frac{\ln 2}{k_e}$$

4. Calculate the volume of distribution.

$$V_{ss} = \frac{R_0}{k_e} \cdot \frac{1 - e^{-k_e t_{\inf}}}{(C_0 - C_{tr} \cdot e^{-k_e t_{\inf}})}$$

5. Calculate the dosing interval.

$$\tau = \frac{\ln(C_{Max,desired} / C_{Min,desired})}{k_e} + t_{\inf}$$

6. Calculate the new infusion rate.

$$\boldsymbol{R_0 = C_{Max,desired} \cdot k_e \cdot V_{ss} \cdot \frac{(1 - e^{-k_e \tau})}{(1 - e^{-k_e t_{\inf}})}}$$

7. Calculate the new peak.

$$C_{ss,pk} = \frac{R_0}{V_{ss} \cdot k_e} \cdot \frac{(1 - e^{-k_e t_{\inf}})}{(1 - e^{-k_e \tau})}$$

8. Calculate the new trough.

$$C_{ss,tr} = C_{ss,pk} \cdot e^{-k_e(\tau - t_{\inf})}$$