

Heart Age Algorithms

Where

TOT = Total Cholesterol (mg/dl)
 HDL = HDL Cholesterol (mg/dl?)
 DIAB = 1 if prevalent diabetes, 0 otherwise
 SMK = 1 if smoking in previous year, 0 otherwise
 SBP = Systolic Blood Pressure (mmHg)
 "Ln" = natural logarithm

FULL ALGORITHM (TC, HDL-C & SBP known)

→ Calculate 10-year CVD Risk :

Men on Antihypertensive Rx:

$$1 - 0.88936 e^{3.06117 \ln(\text{Age}) + 1.12370 \ln(\text{TOT}) - 0.93263 \ln(\text{HDL}) + 0.57367 \text{DIAB} + 0.65451 \text{SMK} + 1.99881 \ln(\text{SBP}) - 23.9802}$$

Men not on Antihypertensive Rx:

$$1 - 0.88936 e^{3.06117 \ln(\text{Age}) + 1.12370 \ln(\text{TOT}) - 0.93263 \ln(\text{HDL}) + 0.57367 \text{DIAB} + 0.65451 \text{SMK} + 1.93303 \ln(\text{SBP}) - 23.9802}$$

Women on Antihypertensive Rx:

$$1 - 0.95012 e^{2.32888 \ln(\text{Age}) + 1.20904 \ln(\text{TOT}) - 0.70833 \ln(\text{HDL}) + 0.69154 \text{DIAB} + 0.52873 \text{SMK} + 2.82263 \ln(\text{SBP}) - 26.1931}$$

Women not on Antihypertensive Rx:

$$1 - 0.95012 e^{2.32888 \ln(\text{Age}) + 1.20904 \ln(\text{TOT}) - 0.70833 \ln(\text{HDL}) + 0.69154 \text{DIAB} + 0.52873 \text{SMK} + 2.76157 \ln(\text{SBP}) - 26.1931}$$

→ Calculate Heart Age :

Men < 60 years:

$$e^{\frac{1}{3.06117} \ln \left(\frac{\log_{0.88936}(1 - \text{CVDRisk})}{e^{1.12370 \ln(180) - 0.93263 \ln(45) + 1.93303 \ln(125) - 23.9802}} \right)}$$

Men >= 60 years:

$$e^{\frac{1}{3.06117} \ln \left(\frac{\log_{0.88936}(1 - \text{CVDRisk})}{e^{1.12370 \ln(180) - 0.93263 \ln(45) + 1.93303 \ln(130) - 23.9802}} \right)}$$

Women < 60 years:

$$e^{\frac{1}{2.32888} \ln \left(\frac{\log_{0.95012}(1 - \text{CVDRisk})}{e^{1.20904 \ln(180) - 0.70833 \ln(45) + 2.76157 \ln(125) - 26.1931}} \right)}$$

Women >= 60 years:

$$e^{\frac{1}{2.32888} \ln \left(\frac{\log_{0.95012}(1 - \text{CVDRisk})}{e^{1.20904 \ln(180) - 0.70833 \ln(45) + 2.76157 \ln(130) - 26.1931}} \right)}$$

ALTERNATIVE ALGORITHM #1 (TC & HDL-C known, SBP unknown)

→ Calculate 10-year CVD Risk:

Men:

$$1 - 0.88970 e^{3.22476 \ln(\text{Age}) + 1.11551 \ln(TOT) - 0.93052 \ln(HDL) + 0.58180 \ln(HTN) + 0.64151 \ln(DIAB) + 0.63505 \ln(SMK) - 15.3561}$$

Women:

$$1 - 0.94875 e^{2.74587 \ln(\text{Age}) + 1.32797 \ln(TOT) - 0.75601 \ln(HDL) + 0.71993 \ln(HTN) + 0.70137 \ln(DIAB) + 0.52307 \ln(SMK) - 15.1058}$$

→ Calculate Heart Age:

Men:

$$\frac{1}{e^{3.22476}} \ln \left(\frac{\log_{0.88970}(1 - CVDRisk)}{e^{1.11551 \ln(180) - 0.93052 \ln(45) - 15.3561}} \right)$$

Women:

$$\frac{1}{e^{2.74587}} \ln \left(\frac{\log_{0.94875}(1 - CVDRisk)}{e^{1.32797 \ln(180) - 0.75601 \ln(45) - 15.1058}} \right)$$

ALTERNATIVE ALGORITHM #2 (TC, SBP, BMI known, HDL unknown)

→ Calculate 10-year CVD Risk:

Men on Antihypertensive Rx:

$$1 - 0.88675 e^{3.03720 \ln(\text{Age}) + 1.01760 \ln(\text{TOT}) + 0.74442 \ln(\text{BMI}) + 0.57908 \text{DIAB} + 0.69055 \text{SMK} + 1.83625 \ln(\text{SBP}) - 28.4748}$$

Men not on Antihypertensive Rx:

$$1 - 0.88675 e^{3.03720 \ln(\text{Age}) + 1.01760 \ln(\text{TOT}) + 0.74442 \ln(\text{BMI}) + 0.57908 \text{DIAB} + 0.69055 \text{SMK} + 1.76320 \ln(\text{SBP}) - 28.4748}$$

Women on Antihypertensive Rx:

$$1 - 0.94995 e^{2.32017 \ln(\text{Age}) + 1.18269 \ln(\text{TOT}) + 0.53748 \ln(\text{BMI}) + 0.75827 \text{DIAB} + 0.60285 \text{SMK} + 2.75689 \ln(\text{SBP}) - 30.2760}$$

Women not on Antihypertensive Rx:

$$1 - 0.94995 e^{2.32017 \ln(\text{Age}) + 1.18269 \ln(\text{TOT}) + 0.53748 \ln(\text{BMI}) + 0.75827 \text{DIAB} + 0.60285 \text{SMK} + 2.69017 \ln(\text{SBP}) - 30.2760}$$

→ Calculate Heart Age:

Men <60 years:

$$\frac{1}{e^{3.03720}} \ln \left(\frac{\log_{0.88675}(1 - \text{CVDRisk})}{e^{1.01760 \ln(200) + 0.74442 \ln(22) + 1.76320 \ln(125) - 28.4748}} \right)$$

Men ≥ 60 years:

$$\frac{1}{e^{3.03720}} \ln \left(\frac{\log_{0.88675}(1 - \text{CVDRisk})}{e^{1.01760 \ln(200) + 0.74442 \ln(22) + 1.76320 \ln(130) - 28.4748}} \right)$$

Women < 60 years:

$$\frac{1}{e^{2.32017}} \ln \left(\frac{\log_{0.94995}(1 - \text{CVDRisk})}{e^{1.18269 \ln(200) + 0.53748 \ln(22) + 2.69017 \ln(125) - 30.2760}} \right)$$

Women ≥ 60 years:

$$\frac{1}{e^{2.32017}} \ln \left(\frac{\log_{0.94995}(1 - \text{CVDRisk})}{e^{1.18269 \ln(200) + 0.53748 \ln(22) + 2.69017 \ln(130) - 30.2760}} \right)$$

note. In 2013 the reference value for TC was increased to 200 to increase the sensitivity

ALTERNATIVE ALGORITHM #3 (TC, BMI known, HDL & SBP unknown)

→ Calculate 10-year CVD Risk:

Men:

$$1 - 0.88675 e^{3.17473 \ln(\text{Age}) + 1.01090 \ln(\text{TOT}) + 0.71298 \ln(\text{BMI}) + 0.55059 \ln(\text{HTN}) + 0.64062 \ln(\text{DIAB}) + 0.66596 \ln(\text{SMK}) - 20.4549}$$

Women:

$$1 - 0.94869 e^{2.72740 \ln(\text{Age}) + 1.29051 \ln(\text{TOT}) + 0.73896 \ln(\text{BMI}) + 0.69964 \ln(\text{HTN}) + 0.76749 \ln(\text{DIAB}) + 0.60289 \ln(\text{SMK}) - 20.2670}$$

→ Calculate Heart Age:

Men:

$$\frac{1}{e^{3.17473}} \ln \left(\frac{\log_{0.88675}(1 - \text{CVD Risk})}{e^{1.01090 \ln(200) + 0.71298 \ln(22) - 20.4549}} \right)$$

Women:

$$\frac{1}{e^{2.72740}} \ln \left(\frac{\log_{0.94869}(1 - \text{CVD Risk})}{e^{1.29051 \ln(200) + 0.73896 \ln(22) - 20.2670}} \right)$$

ALTERNATIVE ALGORITHM #4 (SBP & BMI known, TC & HDL cholesterol unknown)

→ Calculate 10-year CVD Risk:

Men on Antihypertensive Rx:

$$1 - 0.88431 e^{3.11296 \ln(\text{Age}) + 0.79277 \ln(\text{BMI}) + 0.53160 \text{DIAB} + 0.70953 \text{SMK} + 1.92672 \ln(\text{SBP}) - 23.9388}$$

Men not on Antihypertensive Rx:

$$1 - 0.88431 e^{3.11296 \ln(\text{Age}) + 0.79277 \ln(\text{BMI}) + 0.53160 \text{DIAB} + 0.70953 \text{SMK} + 1.85508 \ln(\text{SBP}) - 23.9388}$$

Women on Antihypertensive Rx:

$$1 - 0.94833 e^{2.72107 \ln(\text{Age}) + 0.51125 \ln(\text{BMI}) + 0.77763 \text{DIAB} + 0.61868 \text{SMK} + 2.88267 \ln(\text{SBP}) - 26.0145}$$

Women not on Antihypertensive Rx:

$$1 - 0.94833 e^{2.72107 \ln(\text{Age}) + 0.51125 \ln(\text{BMI}) + 0.77763 \text{DIAB} + 0.61868 \text{SMK} + 2.81291 \ln(\text{SBP}) - 26.0145}$$

→ Calculate Heart Age:

Men < 60 years of age:

$$\frac{1}{e^{3.11296}} \ln \left(\frac{\log_{0.88431}(1 - \text{CVD Risk})}{e^{0.79277 \ln(22) + 1.85508 \ln(125) - 23.9388}} \right)$$

Men ≥ 60 years of age:

$$\frac{1}{e^{3.11296}} \ln \left(\frac{\log_{0.88431}(1 - \text{CVD Risk})}{e^{0.79277 \ln(22) + 1.85508 \ln(130) - 23.9388}} \right)$$

Women < 60 years of age:

$$\frac{1}{e^{2.72107}} \ln \left(\frac{\log_{0.94833}(1 - \text{CVD Risk})}{e^{0.51125 \ln(22) + 2.81291 \ln(125) - 26.0145}} \right)$$

Women ≥ 60 years of age:

$$\frac{1}{e^{2.72107}} \ln \left(\frac{\log_{0.94833}(1 - \text{CVD Risk})}{e^{0.51125 \ln(22) + 2.81291 \ln(130) - 26.0145}} \right)$$

ALTERNATIVE ALGORITHM #5 (BMI known, SBP, TC & HDL cholesterol unknown)

→ Calculate 10-year CVD Risk:

Men:

$$1 - 0.88434 e^{3.25024 \cdot \ln(\text{Age}) + 0.74711 \cdot \ln(\text{BMI}) + 0.57695 \cdot (\text{HTN}) + 0.59741 \cdot \text{DIAB} + 0.68506 \cdot \text{SMK} - 15.4710}$$

Women:

$$1 - 0.94679 e^{3.18736 \cdot \ln(\text{Age}) + 0.72923 \cdot \ln(\text{BMI}) + 0.73404 \cdot (\text{HTN}) + 0.78285 \cdot \text{DIAB} + 0.61608 \cdot \text{SMK} - 15.1252}$$

→ Calculate Heart Age:

Men:

$$\frac{1}{e^{3.25024}} \ln \left(\frac{\log_{0.88434}(1 - \text{CVD Risk})}{e^{0.74711 \cdot \ln(22) - 15.4710}} \right)$$

Women:

$$\frac{1}{e^{3.18736}} \ln \left(\frac{\log_{0.94679}(1 - \text{CVD Risk})}{e^{0.72923 \cdot \ln(22) - 15.1252}} \right)$$