APPENDIX G
CALCULATION OF ESTIMATED VO$_2$ MAX

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Because the relation between heart rate and oxygen consumption is linear during exercise, we can estimate maximal oxygen consumption (VO$_2$ max) by measuring the heart rate response to known levels of submaximal work. This relation can be summed up by the equation for a line: $y = mx + b$, where y is heart rate, m is slope, x is VO$_2$, and b is the intercept. By rearranging these terms, we can derive the following equation:

Estimated VO$_2$max $= \dfrac{\textbf{PMHR – Intercept}}{\textbf{Slope}}$

Slope $= n (\Sigma\, x_i\, y_i)\ \text{slope} – (\Sigma\, x_i)\, (\Sigma\, y_i)\, /\, n\, \Sigma\, x_i{}^2 - (\Sigma x_i)^2$

PMHR $= 220 - \text{Age at interview}$

Intercept $= \overline{Y} - b\, \overline{X}$

$\overline{Y}$ = mean of End of Stage 1 Heart Rate + End of Stage 2 Heart Rate
$\overline{X}$ = mean of End of Stage 1 VO$_2$ + End of Stage 2 VO$_2$
b = slope

$$Slope = n\left(\sum x_i y_i\right) - \left(\sum x_i\right)\left(\sum y_i\right)/n\sum x_i^2 - \left(\sum x_i\right)^2$$

n = 2
$x_i = x_1, x_2$
x_1 = submax VO$_2$ at end of Stage 1
x_2 = submax VO$_2$ at end of Stage 2

$y_i = y_1, y_2$
y_1 = end of Stage 1 HR
y_2 = end of Stage 2 HR

Get end of stage VO$_2$ from Appendix H.

Example: A 40 year old man was assigned Protocol 6. Looking in Appendix G, we see that the corresponding submax VO$_2$ values for these stages are 23.3 and 31.4 ml/kg/min respectively. His heart rate at the end of Stage 1 is 120 and at the end of Stage 2 is 140 beats/min respectively. Plugging these numbers into the formulas above, we then solve our equation.

$$\text{Estimated VO}_2 \text{ max} = \frac{180 – 62.47}{2.469} = 47.6 \text{ ml/kg/min}$$