

## GAS Power Calculator Relevant Equations

GAS Power Calculator Copyright 2017 Jennifer Li Johnson  
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[http://csg.sph.umich.edu/abecasis/gas\\_power\\_calculator](http://csg.sph.umich.edu/abecasis/gas_power_calculator)

$$AAfreq = (DAF)^2 \quad (1)$$

$$ABfreq = 2 * (DAF) * (1 - DAF) \quad (2)$$

$$BBfreq = (1 - DAF)^2 \quad (3)$$

Multiplicative Disease Model

$$x = [(GRR)^2, GRR, 1.0] \quad (4)$$

Additive Disease Model

$$x = [2.0 * GRR - 1.0, GRR, 1.0] \quad (5)$$

Dominant Disease Model

$$x = [GRR, GRR, 1.0] \quad (6)$$

Recessive Disease Model

$$x = [GRR, 1.0, 1.0] \quad (7)$$

$$AAprb = \frac{x[0] * prev}{x[0] * AAfreq + x[1] * ABfreq + x[2] * BBfreq} \quad (8)$$

$$ABprob = \frac{x[1] * prev}{x[0] * AAfreq + x[1] * ABfreq + x[2] * BBfreq} \quad (9)$$

$$BBprob = \frac{x[2] * prev}{x[0] * AAfreq + x[1] * ABfreq + x[2] * BBfreq} \quad (10)$$

$$casesDAF = \frac{AAprb * AAfreq + ABprob * ABfreq * 0.5}{prev} \quad (11)$$

$$controlsDAF = \frac{(1 - AAprb) * AAfreq + (1 - ABprob) * ABfreq * 0.5}{1 - prev} \quad (12)$$

$$Vcases = casesDAF * (1 - casesDAF) \quad (13)$$

$$Vcontrols = controlsDAF * (1 - controlsDAF) \quad (14)$$

$$ncp = \frac{casesDAF - controlsDAF}{\sqrt{(\frac{Vcases}{cases} + \frac{Vcontrols}{controls}) * 0.5}} \quad (15)$$

$$C = -ninv(\alpha * 0.5) \quad (16)$$

$$P = ndist(-C - ncp, false) + ndist(C - ncp, true) \quad (17)$$

**Notes:**

- Invalid model if AAprb > 1
- Vcases: Cases Variance
- Vcontrols: Controls Variance
- ncp: noncentrality parameter
- C: significance threshold
- ndist: Standard normal distribution adapted from ID Hill, "The Normal Integral" Applied Statistics, Vol 22, pp. 424-427 available [here](#).
- ninv: Inverse normal distribution adapted from Wichura's PPND16, Algorithm AS241, Applied Statistics Vol 37 1988 pp 477 - 484 available [here](#).

For definitions of the other variables click [here](#).