

January 23rd, 1938

Dear Professor Gaddum,

It is true that Bliss uses an approximately normal distribution to replace the exact binomial, except in the case of non-dying or non-surviving, but I doubt if a more exact approach is more nearly equivalent to taking weights based on the observed frequencies rather than on the expected frequencies.

If at any concentration the observations are a dead and b living, this set of observations contributes the factor $p^a(1-p)^b$ to the likelihood of any fitted line giving p as the probability of dying. If we differentiate this with respect to the expected normal deviate Y , where

$$\frac{dp}{dY} = z$$

we have

$$z \left(\frac{a}{p} - \frac{b}{1-p} \right)$$

If now $Y = (1 + j)(x - \bar{x})$ where i and j specify the fitted line, then the ~~effective~~ ^{exact} equations satisfied by the best fitting line are

$$z \left(\frac{a}{p} - \frac{b}{1-p} \right) = 0 \quad \text{and} \quad z (x - \bar{x}) \left(\frac{a}{p} - \frac{b}{1-p} \right) = 0$$