How can I compute LD50 from logit or probit?

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Computing LD50 (median lethal dose) from logit or probit involves using mathematical equations and statistical methods to determine the dose of a substance that would be lethal to 50% of the test population. This can be achieved by converting the logit or probit values, which represent the dose-response relationship, into a dose value using regression analysis. The LD50 calculation can provide valuable information for assessing the toxicity of a substance and making informed decisions about its safe use.

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First off, what is LD50? LD50 is the median lethal dose of a toxic substance, i.e., that dose of a chemical which kills half the members of a tested population. Basically, what we have is a predictor that is the dose of a chemical and a binary response variable that indicates whether the individual dies or not.

Although, this is stated in terms of lethality and deaths, the concept is a bit more general, i.e., what is the value of the continuous predictor that results in a probability of .5 of being in the 1 category. An example is, what is the test score needed for an individual to have a 50/50 chance of

being admitted to a special program?

Let's say that you have a logit model that looks like this,

Logit(Y) = constant + coef*X

Or a probit model that looks like this,

Probit(Y) = constant + coef*X

In either case, the computation of LD50 is the same. Here is the formula,

LD50 = -constant/coef

Example LD50 for logit model.

Logit(Y) = -8.30019 + .13257*XLD50 = 8.30019/.13257 = 62.61

Example LD50 for probit model.

Probit(Y) = -4.95764 + .07925*XLD50 = 4.95764/.07925 = 62.56

Please note that although the LD50 formula is the same for both logit and probit models, the LD50 values

are not the same since they come from different probability distributions.

What if instead of a LD50, I want to compute an LD60 or LD75? This requires a small change to the formulas. However, the formula for a logit model is no longer the same as for a probit model.

Logit: LDp = (log(p/(1-p))-constant)/coefProbit: LDp = (invnormal(p)-constant)/coef

Example LD75 for logit model.

Logit(Y) = -8.30019 + .13257*XLD75 = (log(.75/(1-.75)) - -8.30019)/.13257 = (1.09861 - -8.30019)/.13257 = 70.9

Example LD75 for probit model.

Probit(Y) = -4.95764 + .07925*XLD75 = (invnormal(.75) - -4.95764)/.07925 = (.67449 - -4.95764)/.07925 = 71.1