# CBinomial

## Parametrisation

The clustered/clumped Binomial distribution is a transformation of the Binomial distribution. Let $z$ be binomial

$$\text{Prob}(z) = \binom{n}{z} p^n (1-p)^{n-z}$$

for responses $z = 0, 1, 2, \ldots, n$, where

$n$: number of trials.

$p$: probability of success in each trial.

Then the CBinomial is defined with data $y$, where

$$y = \begin{cases} 0 & z = 0 \\ 1 & z > 0 \end{cases}$$

## Link-function

The mean and variance of $y$ are given as

$$\mu = np \qquad \text{and} \qquad \sigma^2 = np(1-p)$$

and the probability $p$ is linked to the linear predictor by

$$p(\eta) = \frac{\exp(\eta)}{1 + \exp(\eta)}$$

## Hyperparameters

None.

## Specification

- family = `binomial`
- Required arguments: $y$ and $n$ (keyword `Ntrials`)

## Example

In the following example we estimate the parameters in a simulated example with binomial responses.

```
n=100
a = 1
b = 1
z = rnorm(n)
eta = a + b*z
Ntrials = sample(c(1,5,10,15), size=n, replace=TRUE)
prob = exp(eta)/(1 + exp(eta))
y = rbinom(n, size=Ntrials, prob = prob)

data = list(y=y,z=z)
formula = y ~ 1+z
result = inla(formula, family = "binomial", data = data, Ntrials=Ntrials)
summary(result)
```

## Notes

None.