# Food Oral Immunotherapy (OTI)

## Contents



# 1 Trial Design

We will assess a binary outcome with an oral food challenge at 18 months by looking at non-inferiority of low and very low dose Oral Immunotherapy (OIT) vs standard dose with (i) 3 arms and (ii) 2 arms if we cut out the very low dose arm. We expected 75% 'pass' the challenge at 18-month and define non-inferiority as an absolute difference of 15% between low dose/and very low dose OIT vs standard dose.

## 1.1 Randomisation and Sample Size

Assignment is 1:1:1 across the 3 arms. Use a single look at the data after 90 (or 120) kids have reached their 18 month of follow-up.

# 2 Model

Let $Y_i$ be the binary outcome of the $i$th participant that represents the desensitisation with an oral food challenge at 18 months and let $\theta$ be the corresponsing success rate. Thus we write the binomial model:

$$\begin{aligned} \mathbf{Y}|\theta &\sim Bino(n, \theta) && (1)\\ \theta &\sim Beta(a, b) && (2)\\ \theta|\mathbf{Y} &\sim Beta(a + y, b + n - y) && (3) \end{aligned}$$

## 2.1 Bayesian Decision Rule

The parameter of interest is $\theta$ and we define the decision criterion using posterior probability of non-inferiority,

$$P = Pr(\theta > \theta_s - \delta|\mathbf{Y}) \quad (4)$$

where, $\theta_s$ is the success rate for standard dose and $\delta$ is the threshold margin. Based in the decision criterion, we define the decision rule that $\theta$ is non-inferior if $P > \epsilon_1$ and inferior if $P < \epsilon_0$.

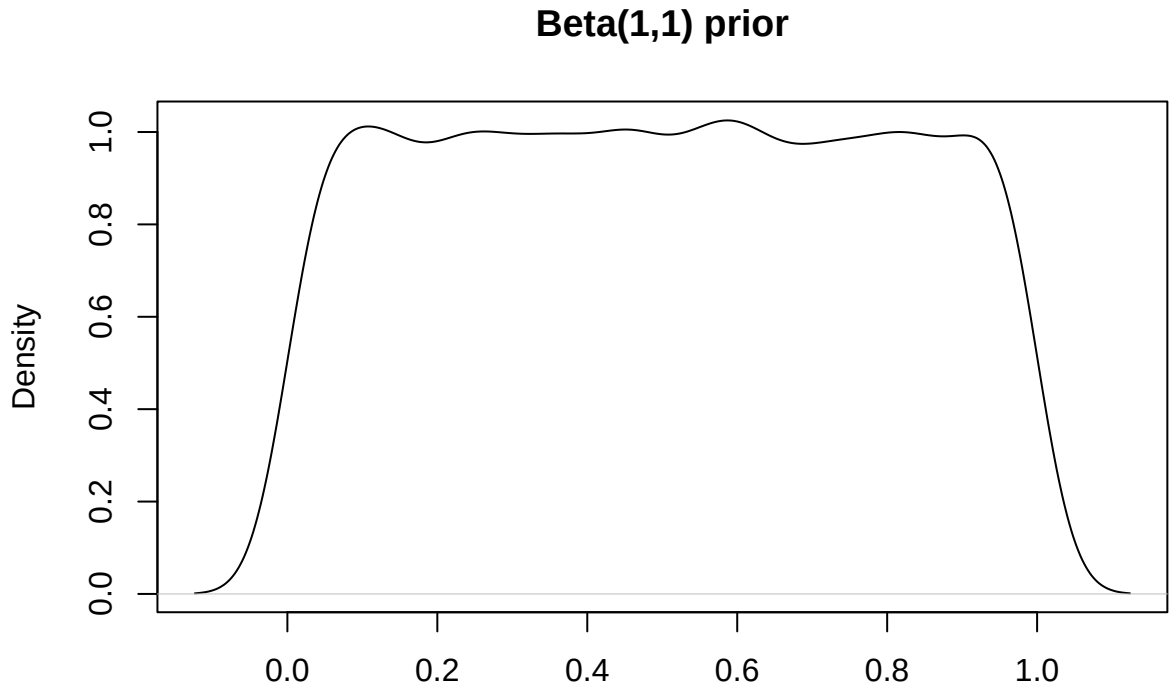
## 2.2 Trial Simulation Parameters (Operating Characteristics)

Values for $\theta$ is considered from 0.6 to 0.9 with an increment of 0.05.

```
##      [,1] [,2] [,3]
## [1,] 0.60 0.60 0.60
## [2,] 0.65 0.65 0.65
## [3,] 0.70 0.70 0.70
## [4,] 0.75 0.75 0.75
## [5,] 0.80 0.80 0.80
## [6,] 0.85 0.85 0.85
## [7,] 0.90 0.90 0.90
```

The threshold non-inferiority margin is considered as: $\delta = 0.10, 0.15, 0.20$; and the parameters for the decision rule is considered as: $\epsilon_0 = 0.025, 0.050, 0.100$; $\epsilon_1 = 0.975, 0.950, 0.900$.

We use a non-informative prior distribution for $\theta$ by considering the hyper-parameters $a = b = 1$.




### 2.3 Sample size 90

(i) 30 participants in each arm for a 3-arm trial and (ii) 45 participants per arm for a 2-arm trial, if we cut out the very low dose arm.

### 2.4 Sample size 120

(i) 40 participants in each arm for a 3-arm trial and (ii) 60 participants per arm for a 2-arm trial, if we cut out the very low dose arm.