**2. Simulation Study**

**2.2.1 Generating Data**

**a. Dichotomous example from Shao and Shapiro BBMDS software (Source)**

|  |  |  |
| --- | --- | --- |
| **Dose** | **N** | **Incidence** |
| **0** | **50** | **1** |
| **25** | **50** | **2** |
| **50** | **50** | **15** |
| **75** | **50** | **27** |

**i. fit models to data and use f-MA(dose) as true D-R**

**b. Table 1. Summary statistics for simulation data generation (seed 1234, Shao et al.)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | **Logistic** | **Probit** | **LogLogistic** | **Dichotomous Hill** | **Quantal Linear** | **Weibull** | **LogProbit** | **MultiStage(2nd)** | **Model Aveage**  **(** |
| Dose=0 | 0.016 | 0.011 | 0.030 | 0.037 | 0.030 | 0.03 | 0.03 | 0.020 | 0.020 |
| Dose=25 | 0.067 | 0.069 | 0.054 | 0.039 | 0.187 | 0.06 | 0.045 | 0.117 | 0.065 |
| Dose=50 | 0.237 | 0.253 | 0.251 | 0.373 | 0.318 | 0.244 | 0.260 | 0.300 | 0.258 |
| Dose=75 | 0.571 | 0.559 | 0.563 | 0.534 | 0.429 | 0.577 | 0.561 | 0.513 | 0.560 |
| Posterior  Weights  (BBMD) | 0.207 | 0.346 | 0.115 | 0.046 | 0.00224 | 0.0953 | 0.125 | 0.0625 | NA |
| Parameter  Estimates  (BBMD) | a\_hat=-4.08  b\_hat=4.37 | a\_hat=-2.29  b\_hat=2.44 | A\_hat=0.03  b\_hat=3.49  c\_hat=0.2 | A\_hat=0.54  B\_hat=9.33  C\_hat=4.48  G\_hat=0.07 | A\_hat=0.03  B\_hat=0.53 | A\_hat=0.03  B\_hat=2.96  C\_hat=0.83 | A\_hat=0.03  B\_hat=2.06  C\_hat=0.12 | A\_hat=0.02  B\_hat=0.12  C\_hat=0.58 |  |
| Added-Risk BMD (median) | 35.3 | 32.9 | 37.5 | 40.9 | 15.3 | 37.2 | 37.7 | 26.1 | **34.8** |
| Added-Risk BMDL (5thpercentile) | 29.8 | 27.5 | 28.0 | 29.3 | 11.8 | 27.4 | 29.0 | 18.9 | **31.9** |
| Extra-Risk  BMD (median) | 35.0 | 32.7 | 37.2 | 40.6 | 14.9 | 36.8 | 37.3 | 25.7 | **34.5** |
| Extra-Risk  BMDL (5thpercentile) | 29.2 | 26.9 | 27.7 | 29.2 | 11.6 | 27.2 | 28.8 | 18/6 | **31.5** |

We will assume that ture BMD is 34.8 for added risk and 34.5 for Extra risk **(true BMD in Grid search=35.3785)**

**Table 2. Comparison of BBMD and BMDS**

**Y\_i ~ binomial [n\_i, f(dose\_i)] is fixed in the model.**

**\* Repeat to generate the experiment from 100 new sample data set**

**2.2.2 Endpoint for Comparing Method**

**a. Coverage: Pr(BMD>BMDL\_hat)**

**b. Half-Width CI: E[BMD-BMDL\_hat]**

**c. Bias: B=E[BMD\_hat-BMD]**

**d. MSE: MSE=E[(BMD\_hat-BMD)^2]=Var(BMD\_hat)+B^2**