United States
Environmental Protection Agency

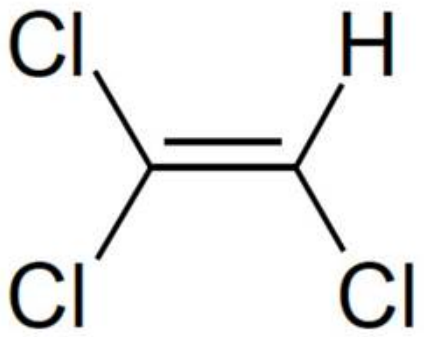
Office of Chemical Safety and
Pollution Prevention

Final Risk Evaluation for Trichloroethylene

Supplemental Information File:

Internal Dose BMD Modeling Results for Selgrade and Gilmour, 2010

CASRN: 79-01-6



November 2020

BMDS 3.0 Analysis Report

Selgrade2010_Mortality_internal_dose

For

Mortality_TotMetabBW34

Model Predictions for Mortality from Introduced Infection in Mice Following Inhalation Exposure to TCE Using Median TotMetabBW34 as the Dose Metric (Selgrade and Gilmour 2010)

Benchmark dose (BMD) modeling was conducted with the newest version of EPA's BMD software (BMDS version 3.1.2) using the internal dose metric median TotMetabBW34. All available dichotomous models (Dichotomous Hill, Gamma, Logistic, Log-Logistic, Probit, Log-Probit, Weibull, and Multistage) were fit to the incidence data for mortality due to introduced infection in mice following inhalation exposure to TCE (Selgrade and Gilmour 2010). BMRs of 1%, 5%, and 10% extra risk were used in the BMD modeling, per technical direction. All models were run using the default parameter restrictions implemented in BMDS v3.1.2, i.e. Weibull, Gamma – α (power) ≥ 1; Log Logistic, Dichotomous Hill – slope ≥ 1; Multistage – β ≥ 0; Logistic, Probit, Log-Probit – unrestricted. Adequacy of model fit was judged based on the χ^2 goodness-of-fit *p*-value ($p > 0.1$), magnitude of scaled residuals, and visual inspection of the model fit.

All models except for the 1-degree Multistage and Logistic models provided adequate overall fit to the data, based on the $\chi 2$ goodness-of-fit p-value ($p > 0.1$). The models with adequate overall fit also showed adequate fit near the predicted BMD, based on scaled residuals ($< |2|$). BMDLs for the adequately fit models at BMR = 10%, 5%, and 1% were sufficiently close (within 3-fold), so the model with the lowest AIC, the Log-Probit, was selected. Using the Log-Probit model, BMD/BMDLs at BMR = 10%, 5%, and 1% were 15.19/12.13, 11.22/8.19, and 6.35/3.84 for median TotMetabBW34, respectively.

Analysis Info

Analysis Name: Selgrade2010_Mortality_internal_dose

Analysis Description: C:\USEPA\TCE\Selgrade2010\IDmortality

Model Type: Dichotomous

Selected Models:

- Frequentist Dichotomous Hill (restricted)
- Frequentist Gamma (restricted)
- Frequentist Log-Logistic (restricted)
- Frequentist Multistage (restricted)
- Frequentist Weibull (restricted)
- Frequentist Logistic (unrestricted)
- Frequentist Log-Probit (unrestricted)
- Frequentist Probit (unrestricted)

Option Sets:

- Option Set #1
  - Risk Type: Extra Risk
  - BMR: 0.1
  - Confidence Level: 0.95
  - Background: Estimated
- Option Set #2
  - Risk Type: Extra Risk
  - BMR: 0.05
  - Confidence Level: 0.95
  - Background: Estimated
- Option Set #3
  - Risk Type: Extra Risk

- BMR: 0.01
- Confidence Level: 0.95
- Background: Estimated

Data

Mortality_TotMetabBW34		
median internal dose metric		
Dose	N	Incidence
internal dose	N	Incidence
0	118	4
2.127	38	1
4.143	39	1
9.536	78	2
16.839	116	20
28.842	78	26
47.241	38	19

Frequentist Dichotomous Hill Restricted Option Set #1

User Input

Info	
Model	frequentist Dichotomous Hill v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.37390366
BMDL	12.72000206
BMDU	18.07800065
AIC	340.7685114
P-value	0.588814655
D.O.F.	3
Chi^2	1.921706917

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.027109248
v	0.476465534

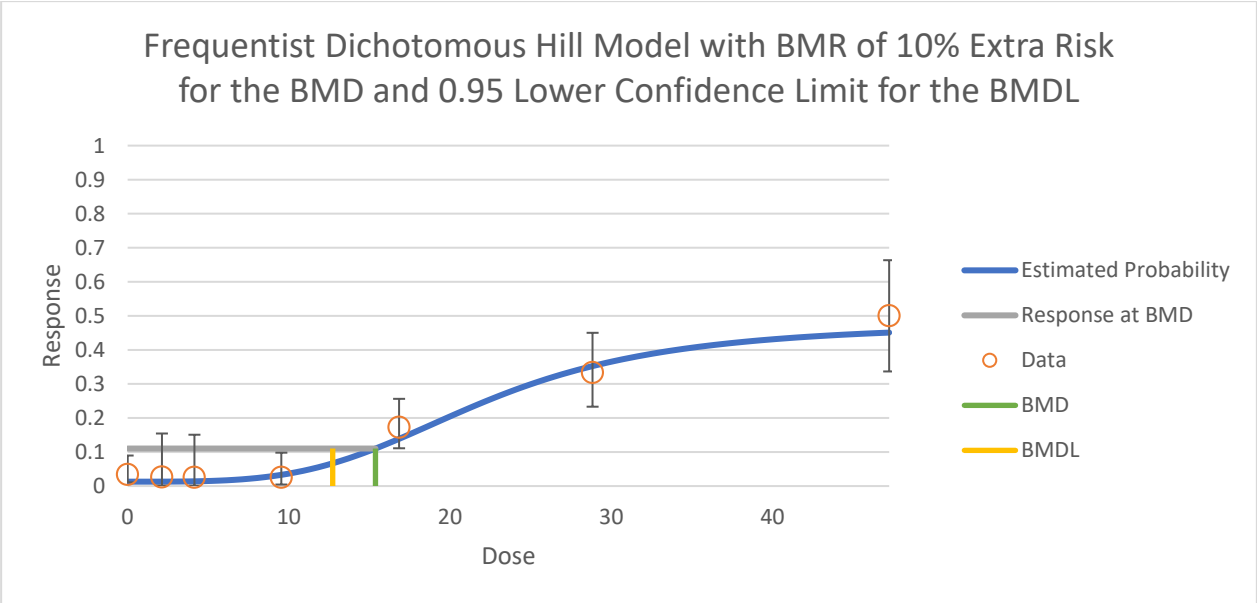
a	-11.45589653
b	3.70708305

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.027109248	3.198891256	4	118	0.4541086
2.127	0.027189758	1.033210794	1	38	-0.033126
4.143	0.028060747	1.094369125	1	39	-0.091502
9.536	0.047165324	3.678895236	2	78	-0.896718
16.839	0.152853754	17.73103548	20	116	0.5854387
28.842	0.36660001	28.59480082	26	78	-0.609707
47.241	0.464970236	17.66886896	19	38	0.4329398

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.3842557	4	2.05396111	3	0.5612827
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Dichotomous Hill Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Gamma Restricted Option Set #1

User Input

Info	
Model	frequentist Gamma v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.15513833
BMDL	11.76212035
BMDU	18.53736844
AIC	341.1612343
P-value	0.418988655
D.O.F.	4
Chi^2	3.905192666

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026271616
a	2.269376389

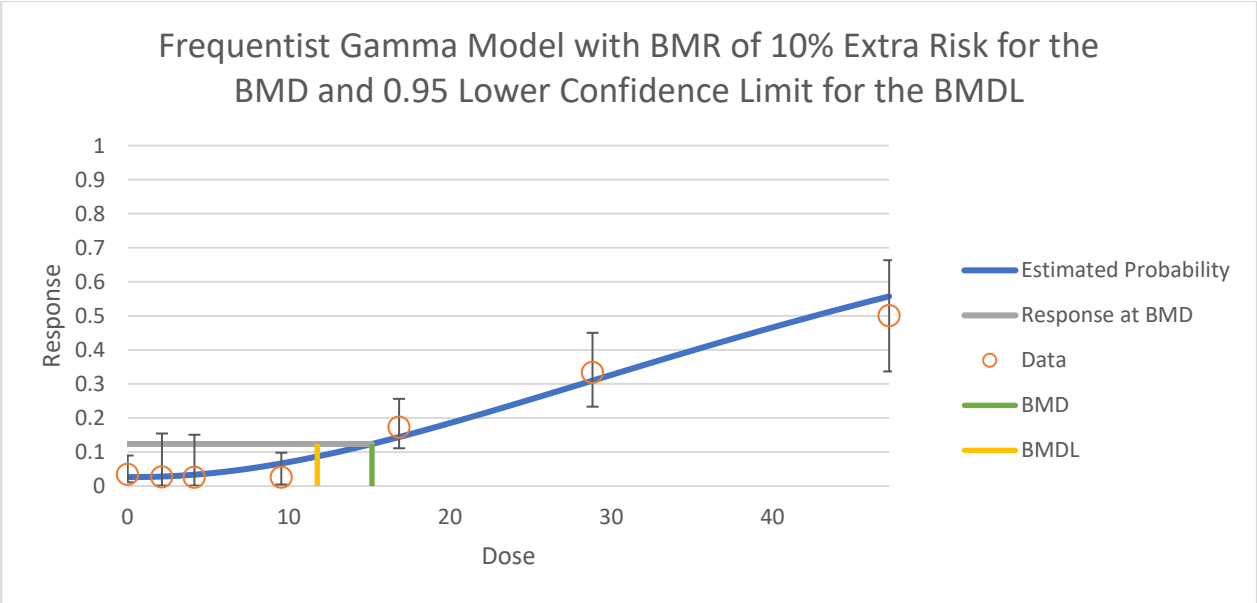
b	0.044583213

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026271616	3.100050688	4	118	0.5179821
2.127	0.027943618	1.0618575	1	38	-0.060885
4.143	0.033408494	1.302931283	1	39	-0.269937
9.536	0.066476387	5.185158173	2	78	-1.447729
16.839	0.143994251	16.70333307	20	116	0.8718367
28.842	0.309753444	24.16076861	26	78	0.4503798
47.241	0.557061956	21.16835434	19	38	-0.708134

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.5806172	3	4.44668406	4	0.3489163
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Gamma Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Log-Logistic Restricted Option Set #1

User Input

Info	
Model	frequentist Log-Logistic v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.05677985
BMDL	11.78045803
BMDU	18.41339902
AIC	340.9166626
P-value	0.454262937
D.O.F.	4
Chi^2	3.658007375

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025879125
a	-7.776564913

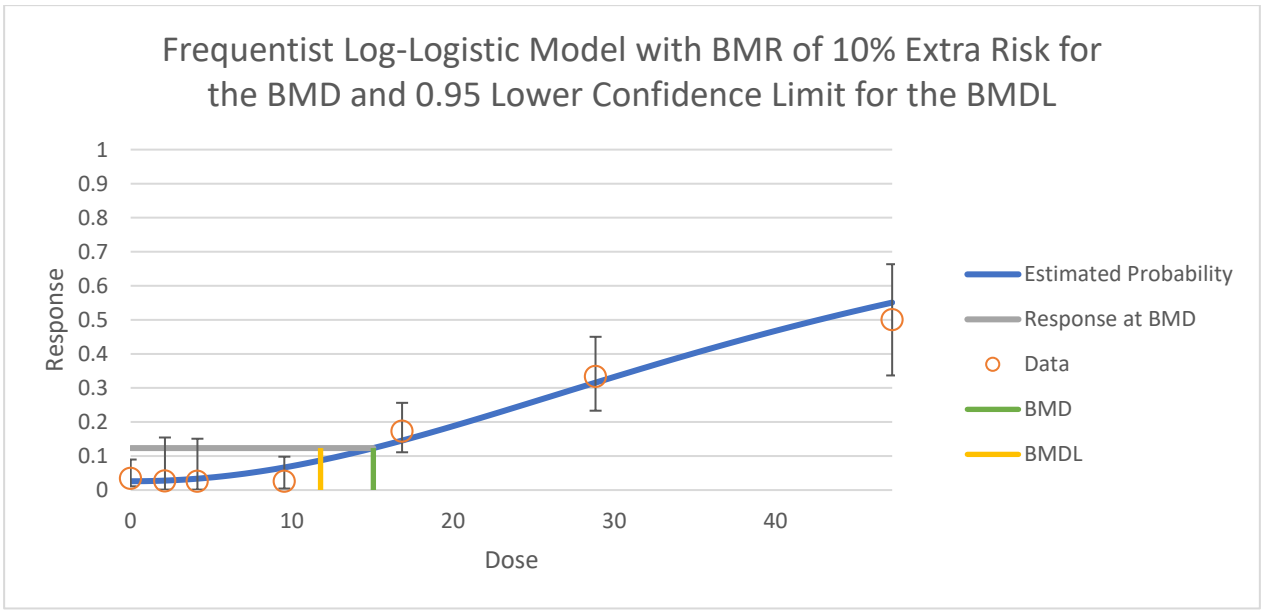
b	2.057409083

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025879125	3.053736755	4	118	0.5486429
2.127	0.027805699	1.056616556	1	38	-0.055861
4.143	0.033429761	1.303760684	1	39	-0.270593
9.536	0.066410714	5.180035704	2	78	-1.446065
16.839	0.145408253	16.86735737	20	116	0.8251027
28.842	0.315543968	24.61242951	26	78	0.3380688
47.241	0.550680701	20.92586662	19	38	-0.628068

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.4583313	3	4.20211235	4	0.3793434
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Logistic Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 6 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.64302346
BMDL	11.4232387
BMDU	18.75502595
AIC	342.6026406
P-value	0.255177995
D.O.F.	4
Chi^2	5.328961106
Slope Factor	0.008754085

Model Parameters	
# of Parameters	7
Variable	Estimate
g	0.026568571

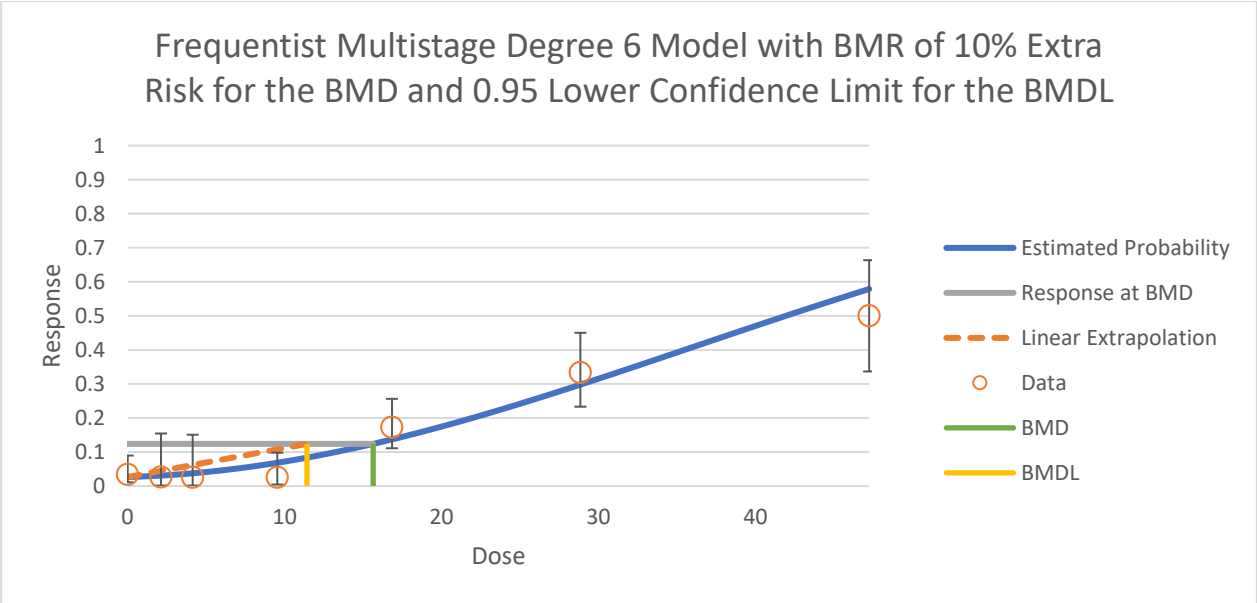
b1	0.001291084
b2	0.000348029
b3	Bounded
b4	Bounded
b5	Bounded
b6	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026568571	3.135091403	4	118	0.4950994
2.127	0.030765367	1.169083953	1	38	-0.158842
4.143	0.037528262	1.463602222	1	39	-0.390607
9.536	0.068433555	5.337817303	2	78	-1.496835
16.839	0.137010407	15.89320727	20	116	1.1089047
28.842	0.297898131	23.23605418	26	78	0.6843027
47.241	0.578788285	21.99395481	19	38	-0.983656

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013203	3	5.88809029	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 6 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 5 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.64349229
BMDL	11.42328108
BMDU	18.75508191
AIC	342.6026405
P-value	0.255169412
D.O.F.	4
Chi^2	5.329053622
Slope Factor	0.008754052

Model Parameters	
# of Parameters	6
Variable	Estimate
g	0.026570755

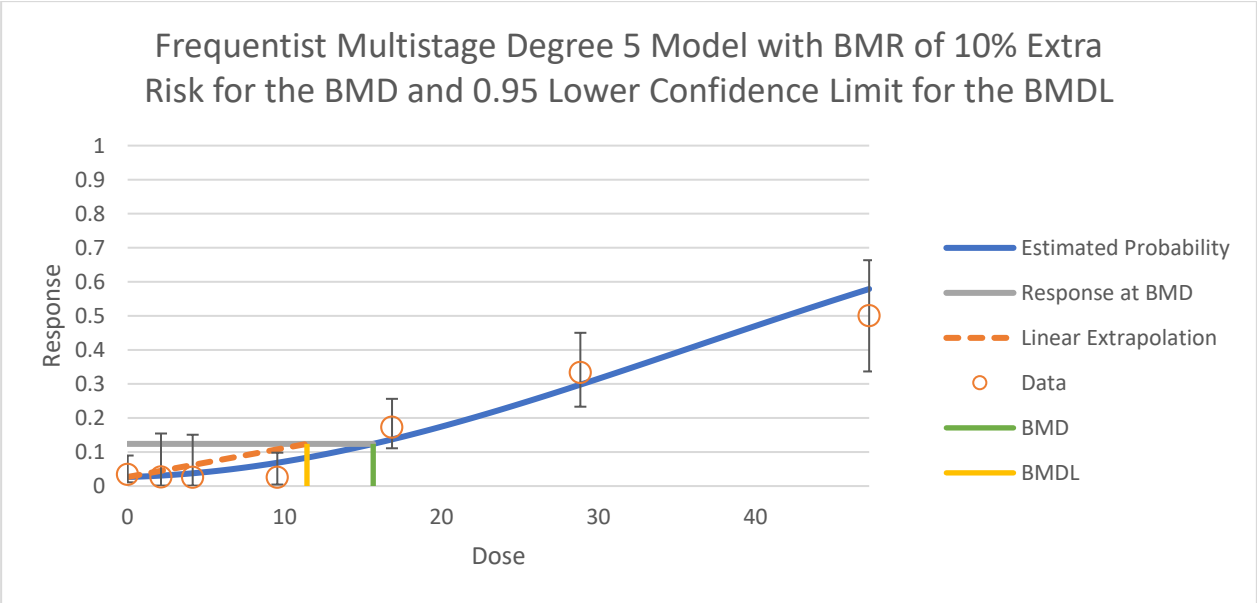
b1	0.001290264
b2	0.000348058
b3	Bounded
b4	Bounded
b5	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570755	3.135349113	4	118	0.4949321
2.127	0.030765979	1.169107188	1	38	-0.158862
4.143	0.037527632	1.463577644	1	39	-0.390589
9.536	0.068430824	5.337604266	2	78	-1.496767
16.839	0.137007543	15.89287504	20	116	1.1090042
28.842	0.297900086	23.23620672	26	78	0.6842637
47.241	0.578800251	21.99440955	19	38	-0.983809

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 5 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 4 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.64347961
BMDL	11.42326313
BMDU	18.75506671
AIC	342.6026405
P-value	0.255169806
D.O.F.	4
Chi^2	5.32904937
Slope Factor	0.008754066

Model Parameters	
# of Parameters	5
Variable	Estimate
g	0.026570727

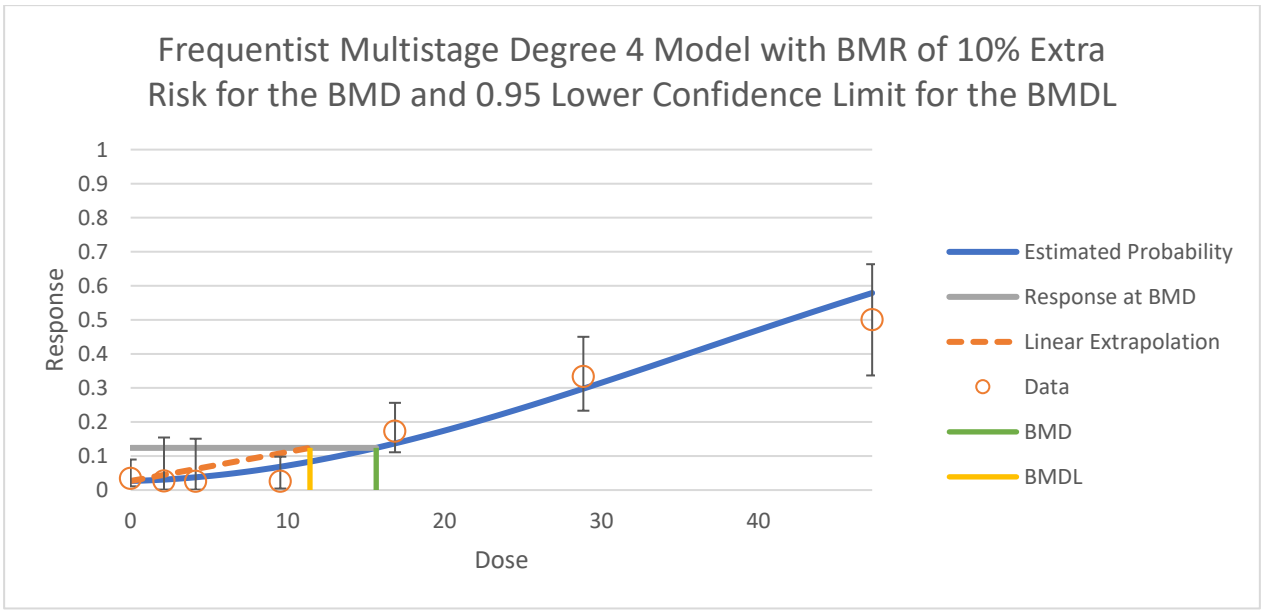
b1	0.001290289
b2	0.000348057
b3	Bounded
b4	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570727	3.135345829	4	118	0.4949343
2.127	0.030765997	1.169107885	1	38	-0.158863
4.143	0.037527686	1.46357975	1	39	-0.390591
9.536	0.068430934	5.337612848	2	78	-1.496769
16.839	0.137007643	15.89288656	20	116	1.1090007
28.842	0.297900011	23.23620085	26	78	0.6842652
47.241	0.578799842	21.99439399	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 4 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 3 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.64347961
BMDL	11.4233272
BMDU	18.75507141
AIC	342.6026405
P-value	0.255169812
D.O.F.	4
Chi^2	5.329049304
Slope Factor	0.008754017

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.026570727

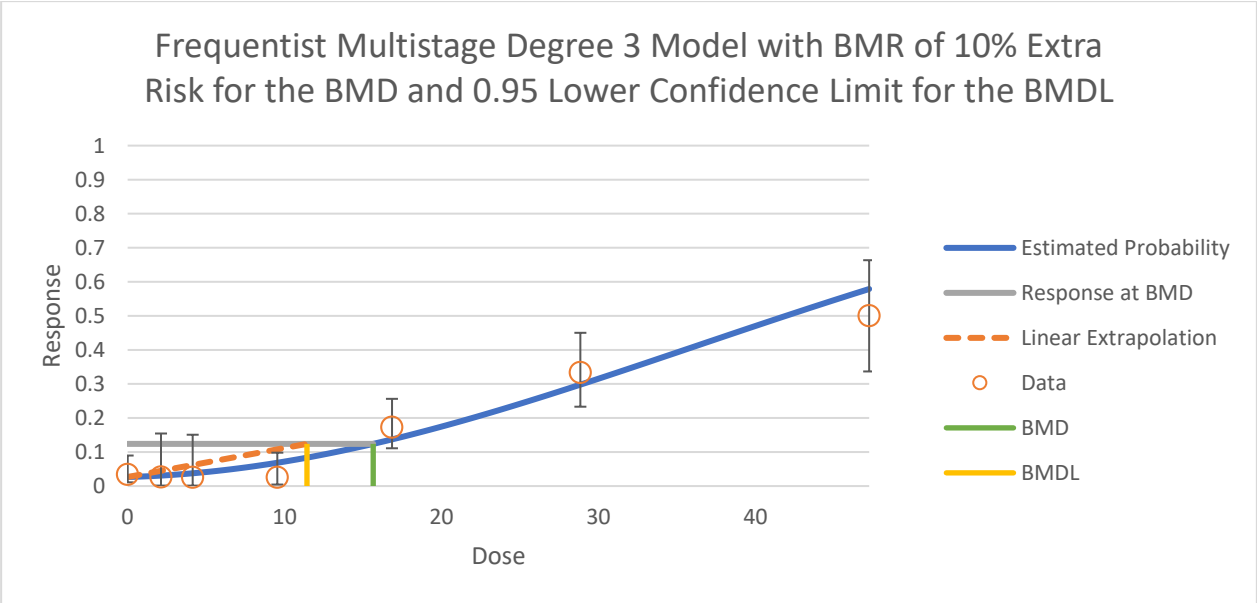
b1	0.001290289
b2	0.000348057
b3	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570727	3.135345808	4	118	0.4949343
2.127	0.030765998	1.169107914	1	38	-0.158863
4.143	0.037527687	1.463579804	1	39	-0.390591
9.536	0.068430936	5.337612994	2	78	-1.496769
16.839	0.137007643	15.89288656	20	116	1.1090007
28.842	0.297900004	23.23620029	26	78	0.6842653
47.241	0.578799824	21.9943933	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 3 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 2 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.6434768
BMDL	11.42331777
BMDU	18.6196167
AIC	342.6026405
P-value	0.255169836
D.O.F.	4
Chi^2	5.329049051
Slope Factor	0.008754024

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.02657071

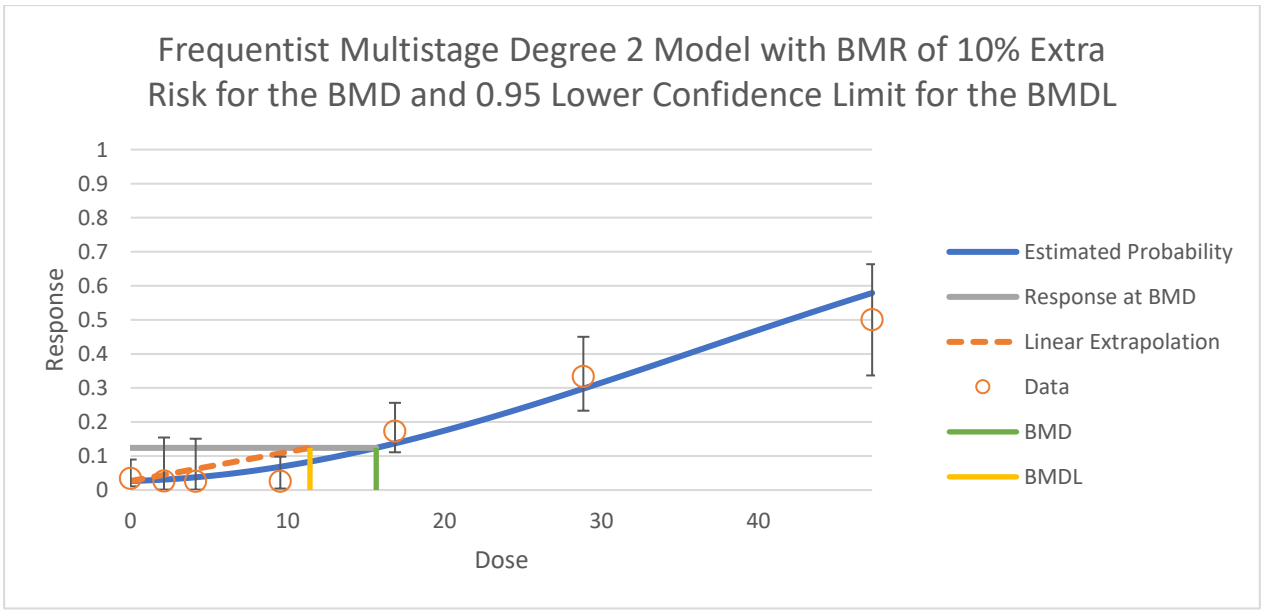
b1	0.001290293
b2	0.000348057

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.02657071	3.135343737	4	118	0.4949356
2.127	0.030765988	1.16910755	1	38	-0.158863
4.143	0.037527684	1.463579687	1	39	-0.390591
9.536	0.068430945	5.337613741	2	78	-1.49677
16.839	0.137007658	15.89288833	20	116	1.1090002
28.842	0.297900006	23.23620043	26	78	0.6842653
47.241	0.578799788	21.99439194	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 2 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 1 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	9.804412884
BMDL	7.918553702
BMDU	12.46647053
AIC	348.125535
P-value	0.054286608
D.O.F.	5
Chi^2	10.85716906
Slope Factor	0.012628569

Model Parameters	
# of Parameters	2
Variable	Estimate
g	0.020047635

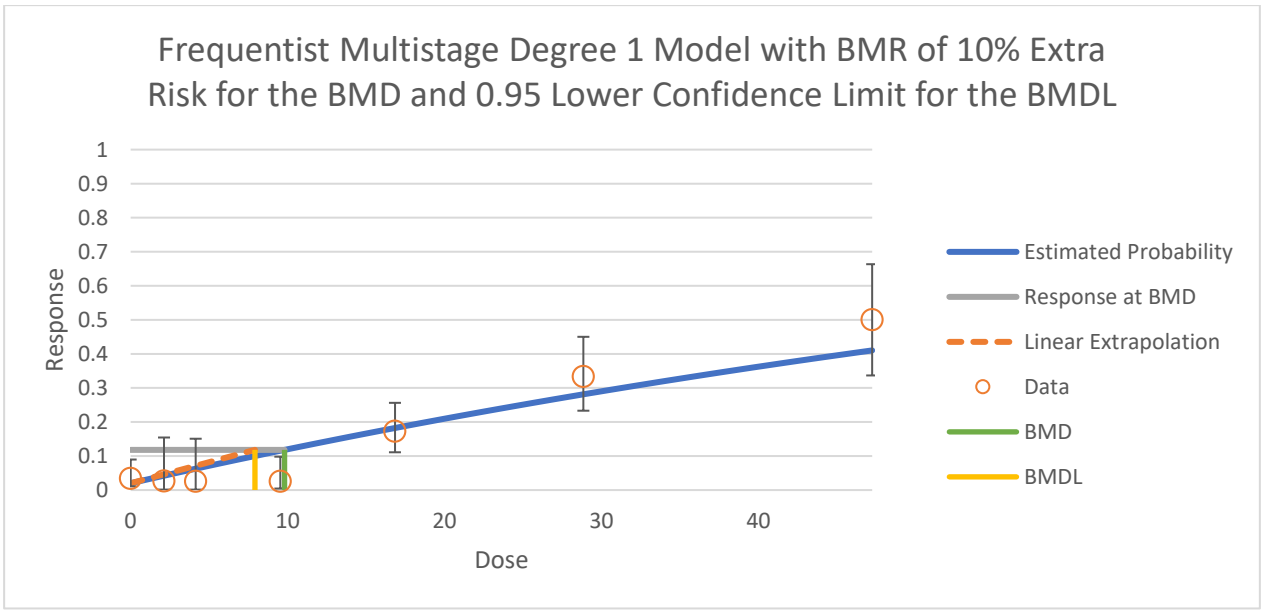
b1	0.010746234

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.020047635	2.365620906	4	118	1.0734399
2.127	0.04219259	1.603318402	1	38	-0.486853
4.143	0.062719762	2.4460707	1	39	-0.955037
9.536	0.115495253	9.008629718	2	78	-2.482868
16.839	0.182256975	21.14180906	20	116	-0.274609
28.842	0.281215856	21.93483673	26	78	1.0237916
47.241	0.410165997	15.5863079	19	38	1.1258689

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-172.0627675	2	13.4109848	5	0.0198172
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 1 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Weibull Restricted Option Set #1

User Input

Info	
Model	frequentist Weibull v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	14.85099373
BMDL	11.40096171
BMDU	18.45949724
AIC	341.9457007
P-value	0.339988982
D.O.F.	4
Chi^2	4.521642207

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025458521
a	1.735223928

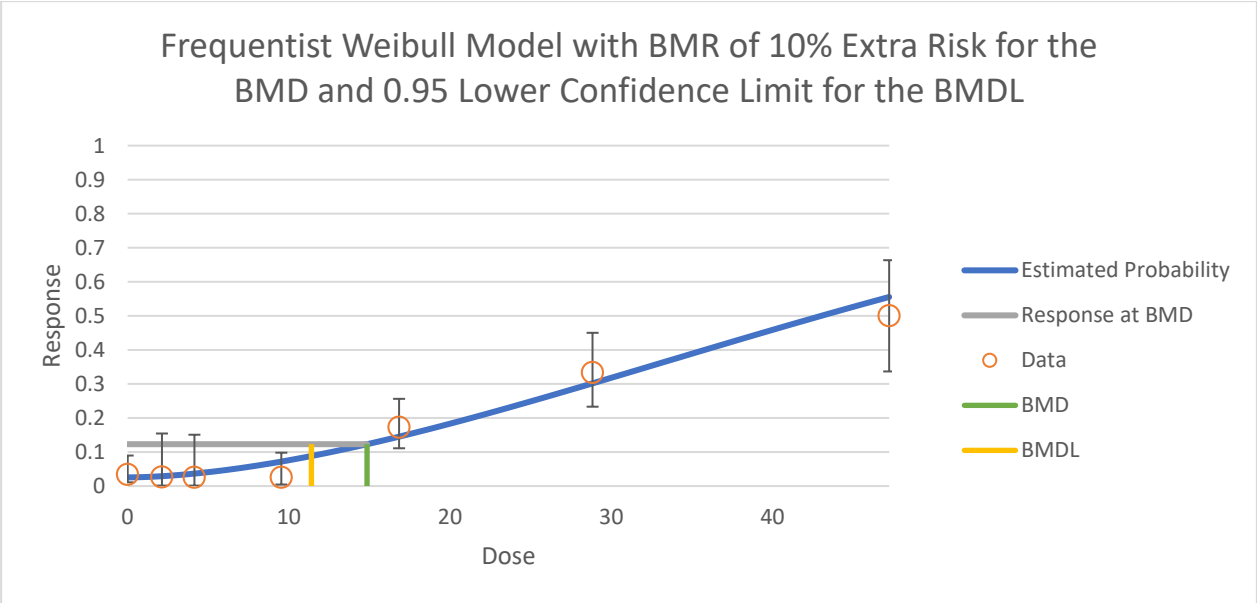
b	0.000975932

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025458521	3.0041055	4	118	0.5820437
2.127	0.028975625	1.101073735	1	38	-0.09775
4.143	0.03659904	1.427362561	1	39	-0.36444
9.536	0.071918167	5.609617028	2	78	-1.581981
16.839	0.14513598	16.83577363	20	116	0.83407
28.842	0.301716894	23.5339177	26	78	0.6083376
47.241	0.555386827	21.10469942	19	38	-0.687083

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.9728504	3	5.23115045	4	0.2643915
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Weibull Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Logistic Unrestricted Option Set #1

User Input

Info	
Model	frequentist Logistic v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

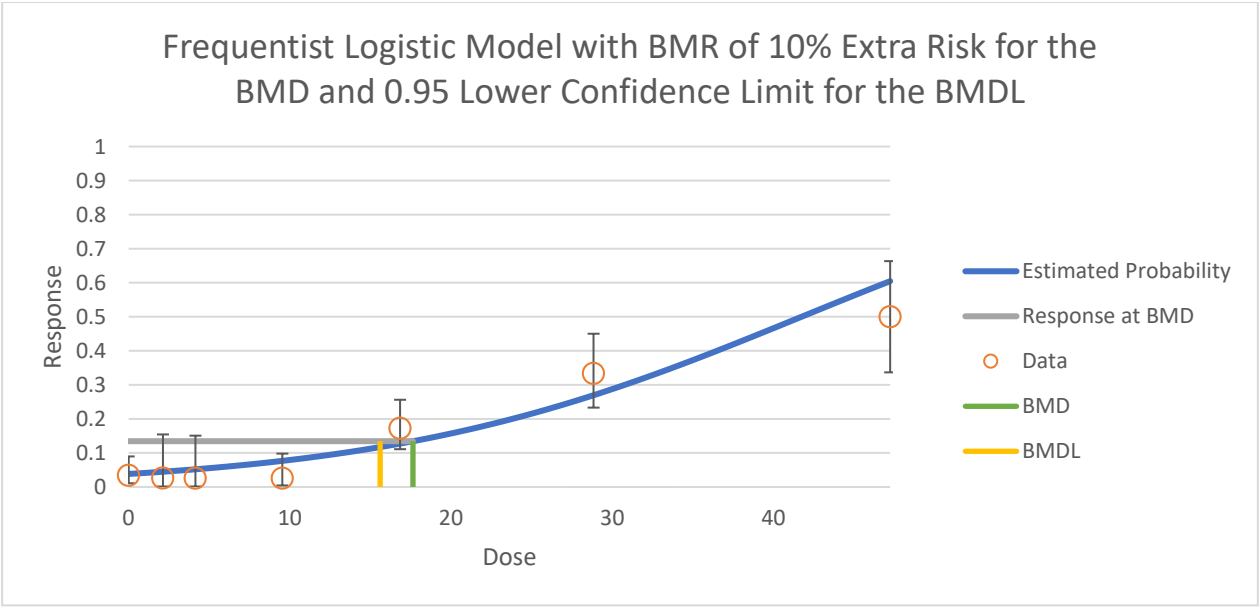
Model Results

Benchmark Dose	
BMD	17.63624358
BMDL	15.60134551
BMDU	19.94342762
AIC	344.767169
P-value	0.099800968
D.O.F.	5
Chi^2	9.241763559

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-3.224703635
b	0.077243754

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.038246592	4.51309782	4	118	-0.246281
2.127	0.04477033	1.701272525	1	38	-0.550105
4.143	0.051922562	2.024979933	1	39	-0.739747
9.536	0.076696127	5.9822979	2	78	-1.694445
16.839	0.127416617	14.78032753	20	116	1.4534422
28.842	0.269563312	21.02593836	26	78	1.2692354
47.241	0.604528136	22.97206916	19	38	-1.317829

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-170.3835845	2	10.0526187	5	0.073758
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Log-Probit Unrestricted Option Set #1

User Input

Info	
Model	frequentist Log-Probit v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	15.19068412
BMDL	12.12546197
BMDU	18.26212409
AIC	339.7966094
P-value	0.604635029
D.O.F.	4
Chi^2	2.726215871

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026965446
a	-4.541240652

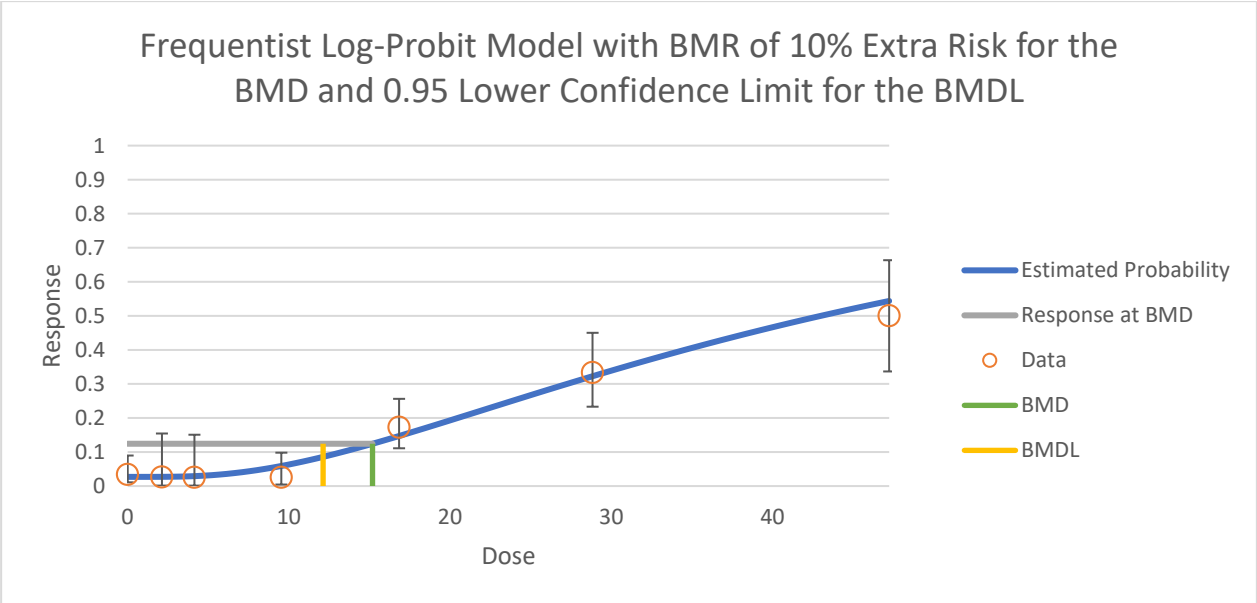
b	1.19811454

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026965446	3.181922599	4	118	0.4649277
2.127	0.027099638	1.029786255	1	38	-0.029758
4.143	0.0291726	1.137731384	1	39	-0.131052
9.536	0.059005454	4.60242543	2	78	-1.250522
16.839	0.147043758	17.05707595	20	116	0.7715488
28.842	0.322614935	25.16396496	26	78	0.2024963
47.241	0.543654982	20.65888931	19	38	-0.540278

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.8983047	3	3.08205916	4	0.5441881
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Probit Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Probit Unrestricted Option Set #1

User Input

Info	
Model	frequentist Probit v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

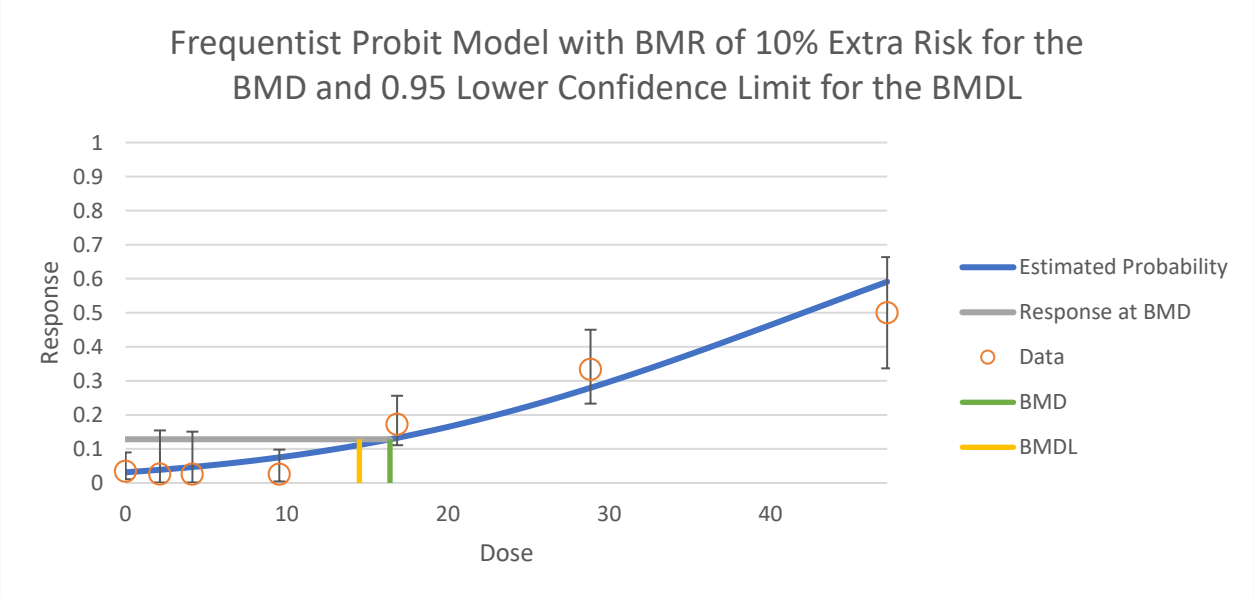
Model Results

Benchmark Dose	
BMD	16.39795074
BMDL	14.49960921
BMDU	18.57606075
AIC	342.862181
P-value	0.195357727
D.O.F.	5
Chi^2	7.357847772

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-1.85976511
b	0.04423512

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.031459383	3.712207169	4	118	0.1517766
2.127	0.038725026	1.471550988	1	38	-0.396476
4.143	0.046820245	1.825989567	1	39	-0.626092
9.536	0.075225681	5.867603121	2	78	-1.660327
16.839	0.132448799	15.36406066	20	116	1.2698054
28.842	0.279631764	21.81127757	26	78	1.0567293
47.241	0.590933217	22.45546224	19	38	-1.140113

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-169.4310905	2	8.14763071	5	0.1482849
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Dichotomous Hill Restricted Option Set #2

User Input

Info	
Model	frequentist Dichotomous Hill v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	12.33021432
BMDL	8.808572845
BMDU	16.03815205
AIC	340.7685114
P-value	0.588814655
D.O.F.	3
Chi^2	1.921706917

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.027109248
v	0.476465534

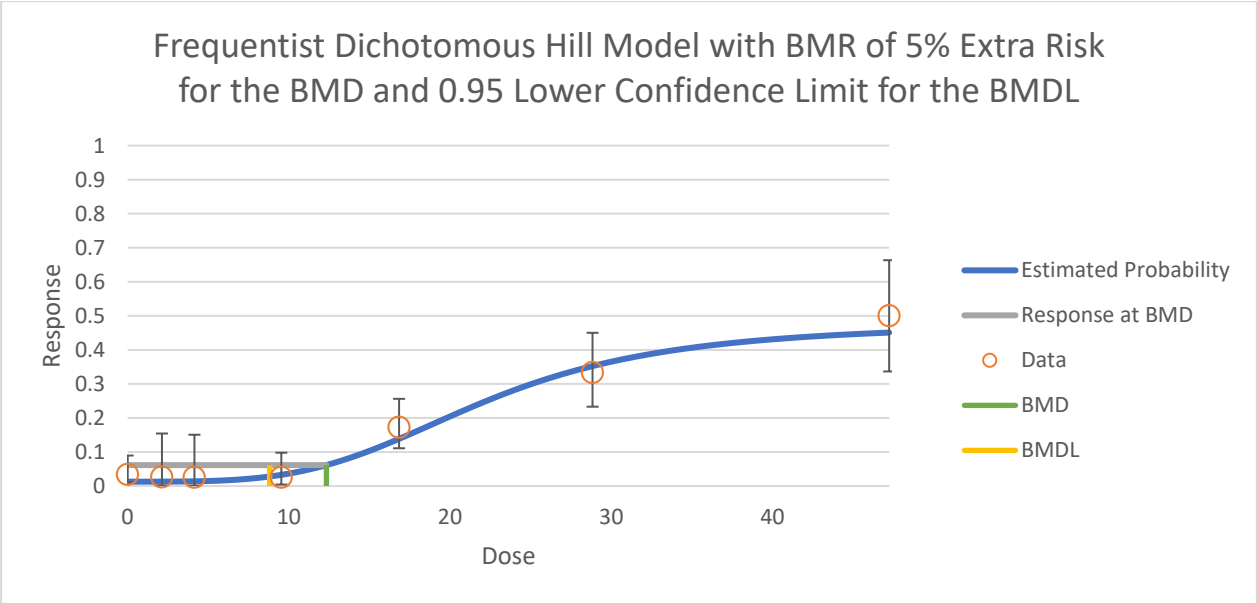
a	-11.45589653
b	3.70708305

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.027109248	3.198891256	4	118	0.4541086
2.127	0.027189758	1.033210794	1	38	-0.033126
4.143	0.028060747	1.094369125	1	39	-0.091502
9.536	0.047165324	3.678895236	2	78	-0.896718
16.839	0.152853754	17.73103548	20	116	0.5854387
28.842	0.36660001	28.59480082	26	78	-0.609707
47.241	0.464970236	17.66886896	19	38	0.4329398

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.3842557	4	2.05396111	3	0.5612827
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Dichotomous Hill Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Gamma Restricted Option Set #2

User Input

Info	
Model	frequentist Gamma v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	10.50922934
BMDL	7.150311232
BMDU	13.90735808
AIC	341.1612343
P-value	0.418988655
D.O.F.	4
Chi^2	3.905192666

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026271616
a	2.269376389

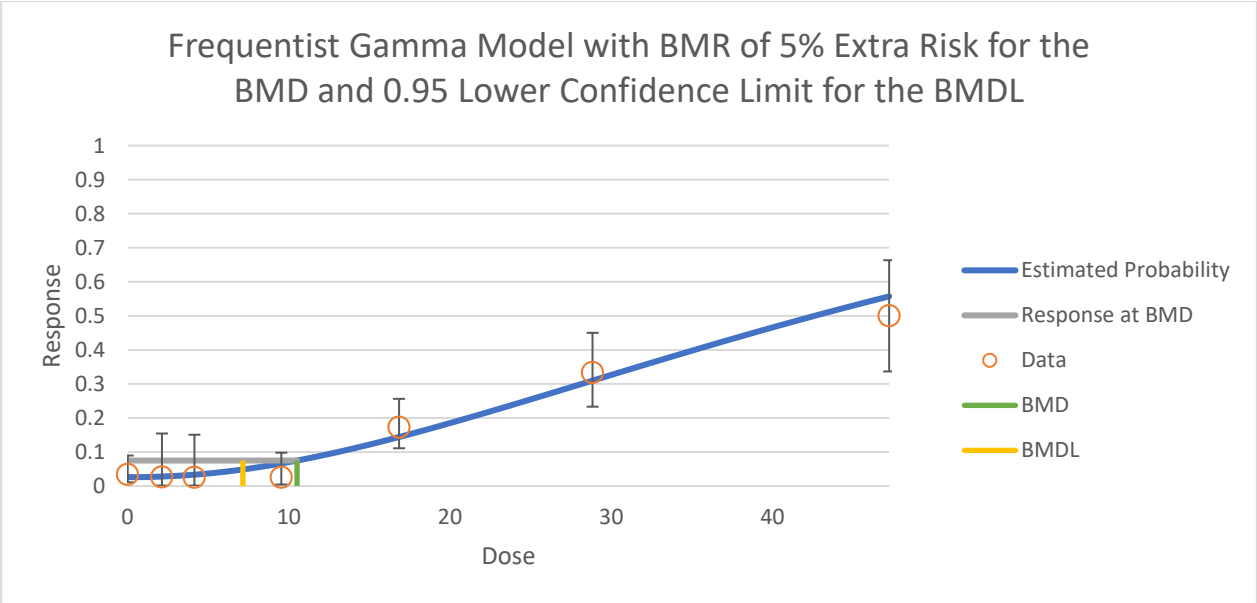
b	0.044583213

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026271616	3.100050688	4	118	0.5179821
2.127	0.027943618	1.0618575	1	38	-0.060885
4.143	0.033408494	1.302931283	1	39	-0.269937
9.536	0.066476387	5.185158173	2	78	-1.447729
16.839	0.143994251	16.70333307	20	116	0.8718367
28.842	0.309753444	24.16076861	26	78	0.4503798
47.241	0.557061956	21.16835434	19	38	-0.708134

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.5806172	3	4.44668406	4	0.3489163
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Gamma Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Log-Logistic Restricted Option Set #2

User Input

Info	
Model	frequentist Log-Logistic v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	10.47138351
BMDL	7.328947909
BMDU	13.74294236
AIC	340.9166626
P-value	0.454262937
D.O.F.	4
Chi^2	3.658007375

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025879125
a	-7.776564913

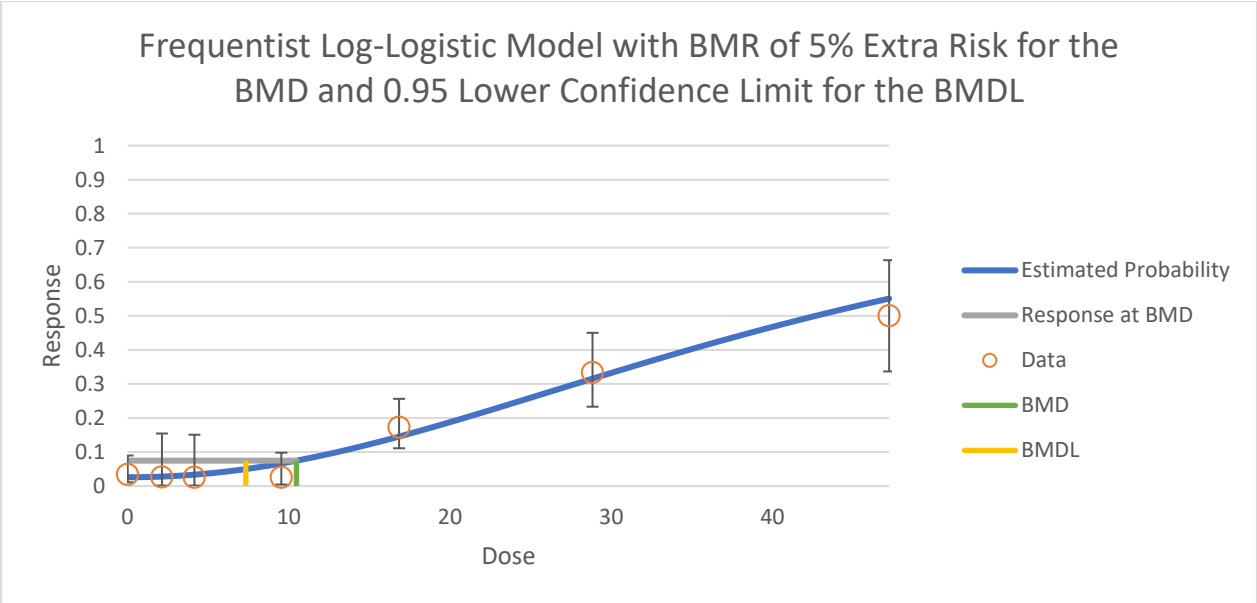
b	2.057409083

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025879125	3.053736755	4	118	0.5486429
2.127	0.027805699	1.056616556	1	38	-0.055861
4.143	0.033429761	1.303760684	1	39	-0.270593
9.536	0.066410714	5.180035704	2	78	-1.446065
16.839	0.145408253	16.86735737	20	116	0.8251027
28.842	0.315543968	24.61242951	26	78	0.3380688
47.241	0.550680701	20.92586662	19	38	-0.628068

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.4583313	3	4.20211235	4	0.3793434
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Logistic Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 6 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	10.42614341
BMDL	6.16545356
BMDU	13.2972763
AIC	342.6026406
P-value	0.255177995
D.O.F.	4
Chi^2	5.328961106
Slope Factor	0.008109703

Model Parameters	
# of Parameters	7
Variable	Estimate
g	0.026568571

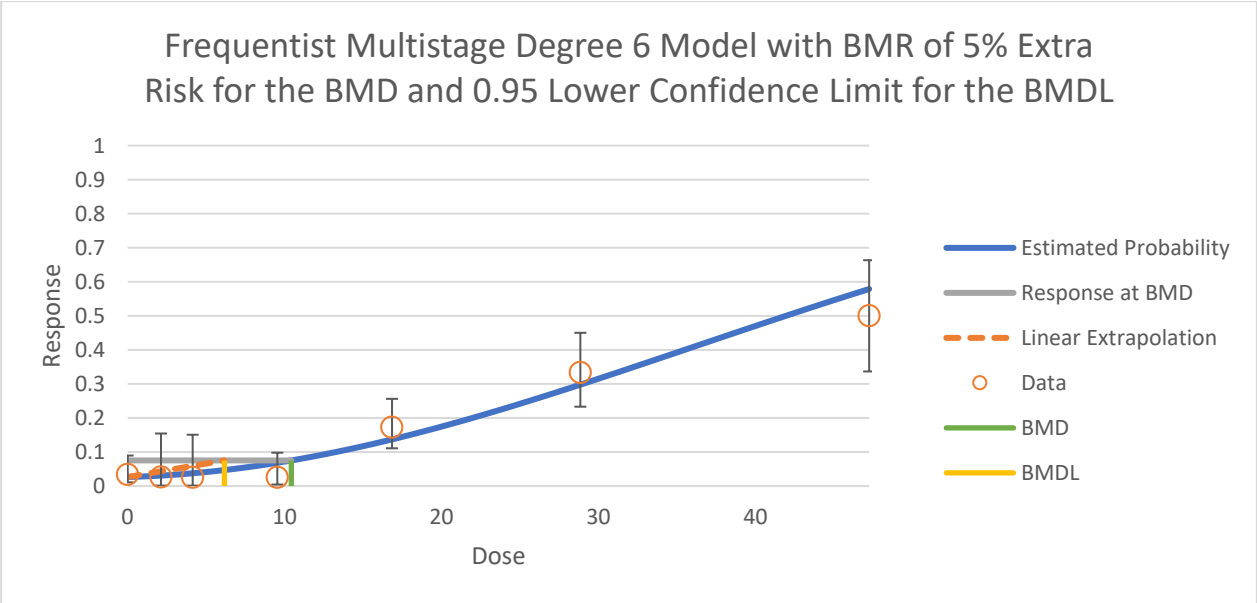
b1	0.001291084
b2	0.000348029
b3	Bounded
b4	Bounded
b5	Bounded
b6	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026568571	3.135091403	4	118	0.4950994
2.127	0.030765367	1.169083953	1	38	-0.158842
4.143	0.037528262	1.463602222	1	39	-0.390607
9.536	0.068433555	5.337817303	2	78	-1.496835
16.839	0.137010407	15.89320727	20	116	1.1089047
28.842	0.297898131	23.23605418	26	78	0.6843027
47.241	0.578788285	21.99395481	19	38	-0.983656

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013203	3	5.88809029	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 6 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 5 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	10.42677414
BMDL	6.165448345
BMDU	13.29732981
AIC	342.6026405
P-value	0.255169412
D.O.F.	4
Chi^2	5.329053622
Slope Factor	0.00810971

Model Parameters	
# of Parameters	6
Variable	Estimate
g	0.026570755

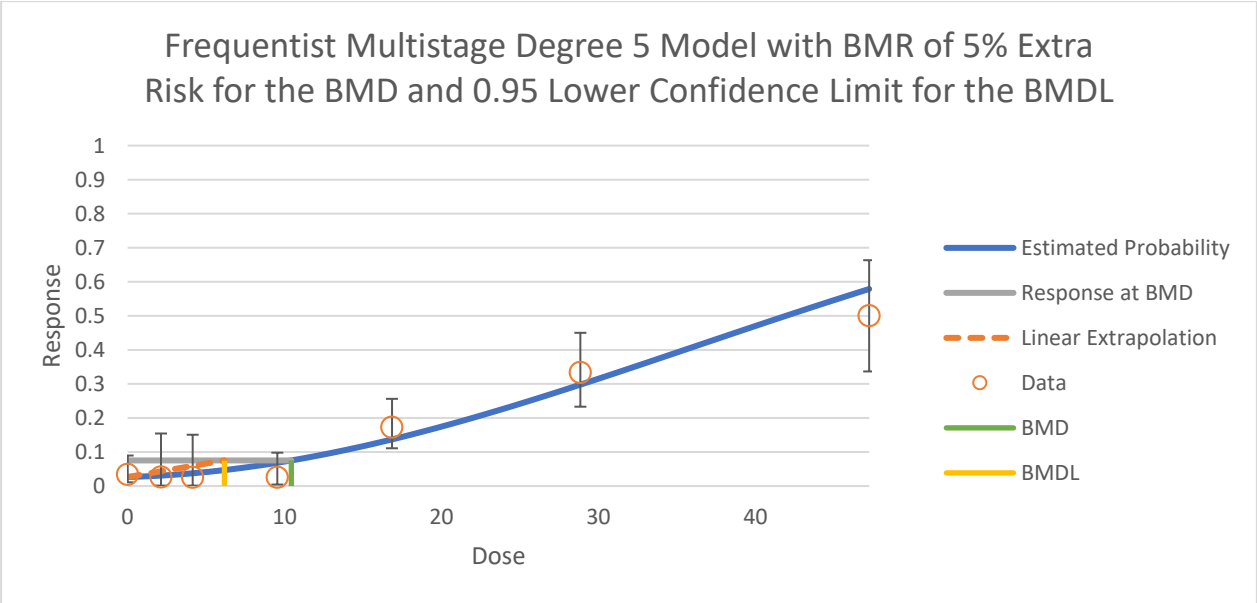
b1	0.001290264
b2	0.000348058
b3	Bounded
b4	Bounded
b5	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570755	3.135349113	4	118	0.4949321
2.127	0.030765979	1.169107188	1	38	-0.158862
4.143	0.037527632	1.463577644	1	39	-0.390589
9.536	0.068430824	5.337604266	2	78	-1.496767
16.839	0.137007543	15.89287504	20	116	1.1090042
28.842	0.297900086	23.23620672	26	78	0.6842637
47.241	0.578800251	21.99440955	19	38	-0.983809

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 5 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 4 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	10.42675584
BMDL	6.165550612
BMDU	13.29730647
AIC	342.6026405
P-value	0.255169806
D.O.F.	4
Chi^2	5.32904937
Slope Factor	0.008109576

Model Parameters	
# of Parameters	5
Variable	Estimate
g	0.026570727

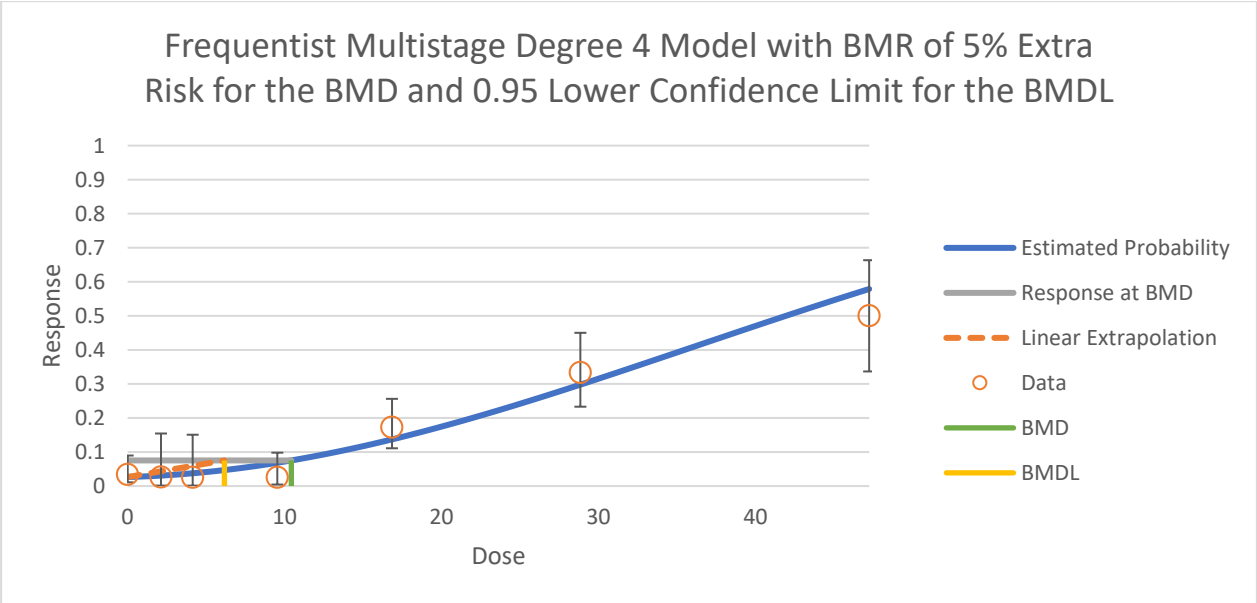
b1	0.001290289
b2	0.000348057
b3	Bounded
b4	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570727	3.135345829	4	118	0.4949343
2.127	0.030765997	1.169107885	1	38	-0.158863
4.143	0.037527686	1.46357975	1	39	-0.390591
9.536	0.068430934	5.337612848	2	78	-1.496769
16.839	0.137007643	15.89288656	20	116	1.1090007
28.842	0.297900011	23.23620085	26	78	0.6842652
47.241	0.578799842	21.99439399	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 4 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 3 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	10.42675443
BMDL	6.16542991
BMDU	13.29730467
AIC	342.6026405
P-value	0.255169812
D.O.F.	4
Chi^2	5.329049304
Slope Factor	0.008109735

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.026570727

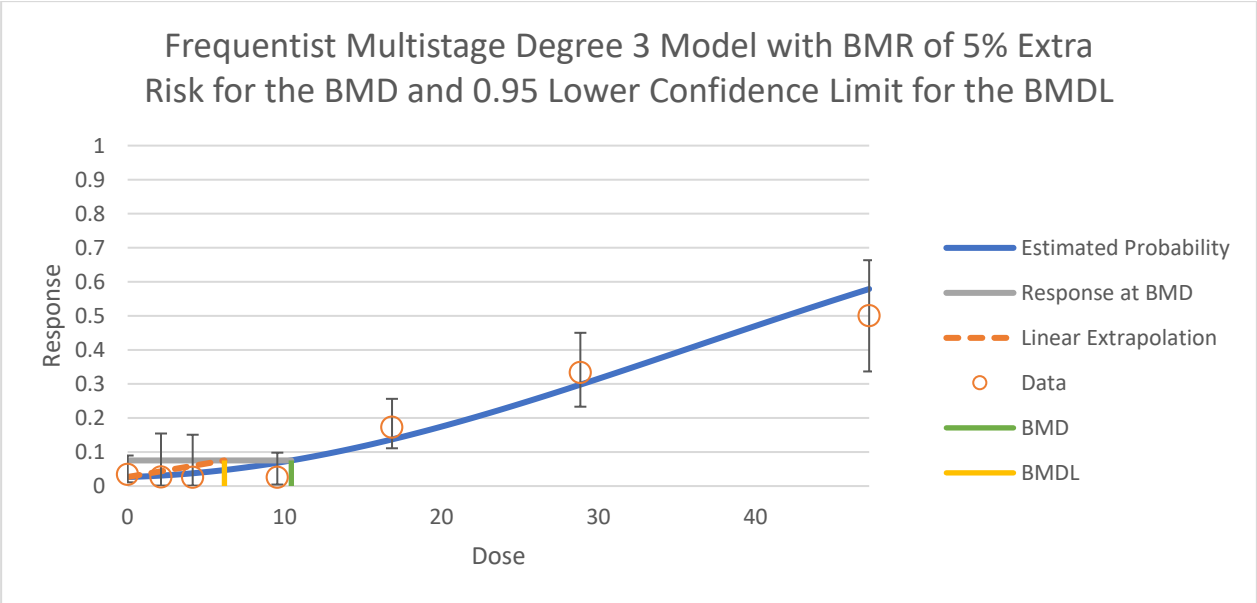
b1	0.001290289
b2	0.000348057
b3	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570727	3.135345808	4	118	0.4949343
2.127	0.030765998	1.169107914	1	38	-0.158863
4.143	0.037527687	1.463579804	1	39	-0.390591
9.536	0.068430936	5.337612994	2	78	-1.496769
16.839	0.137007643	15.89288656	20	116	1.1090007
28.842	0.297900004	23.23620029	26	78	0.6842653
47.241	0.578799824	21.9943933	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 3 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 2 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	10.42675162
BMDL	6.165409245
BMDU	12.9877449
AIC	342.6026405
P-value	0.255169836
D.O.F.	4
Chi^2	5.329049051
Slope Factor	0.008109762

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.02657071

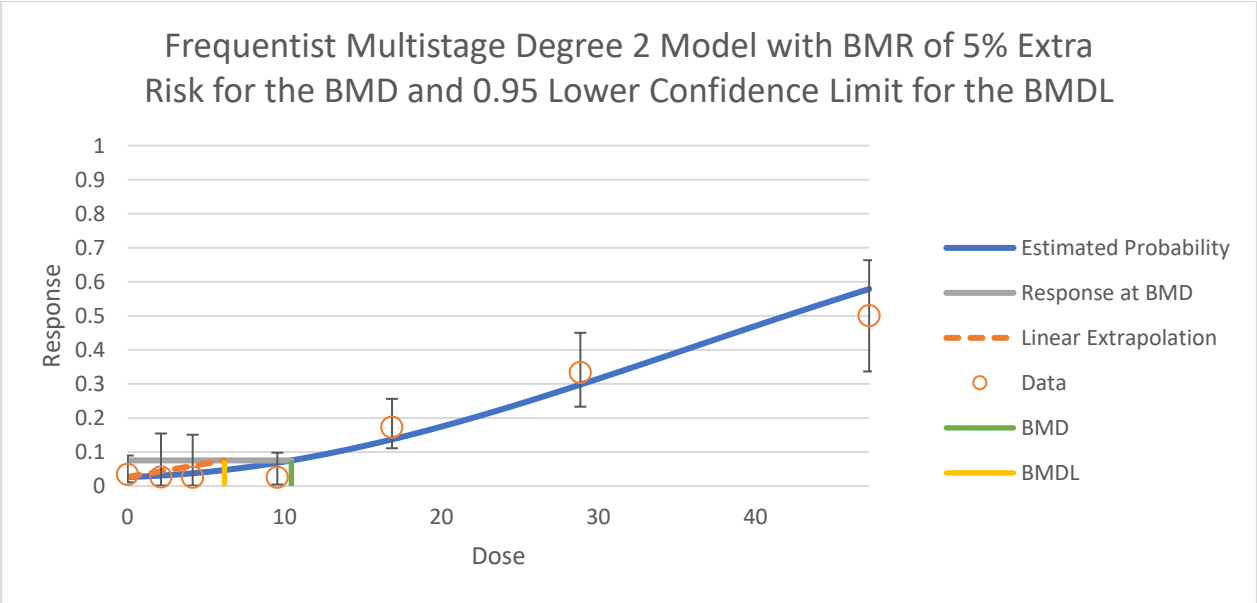
b1	0.001290293
b2	0.000348057

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.02657071	3.135343737	4	118	0.4949356
2.127	0.030765988	1.16910755	1	38	-0.158863
4.143	0.037527684	1.463579687	1	39	-0.390591
9.536	0.068430945	5.337613741	2	78	-1.49677
16.839	0.137007658	15.89288833	20	116	1.1090002
28.842	0.297900006	23.23620043	26	78	0.6842653
47.241	0.578799788	21.99439194	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 2 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 1 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	4.773140803
BMDL	3.855068058
BMDU	6.069002355
AIC	348.125535
P-value	0.054286608
D.O.F.	5
Chi^2	10.85716906
Slope Factor	0.01296994

Model Parameters	
# of Parameters	2
Variable	Estimate
g	0.020047635

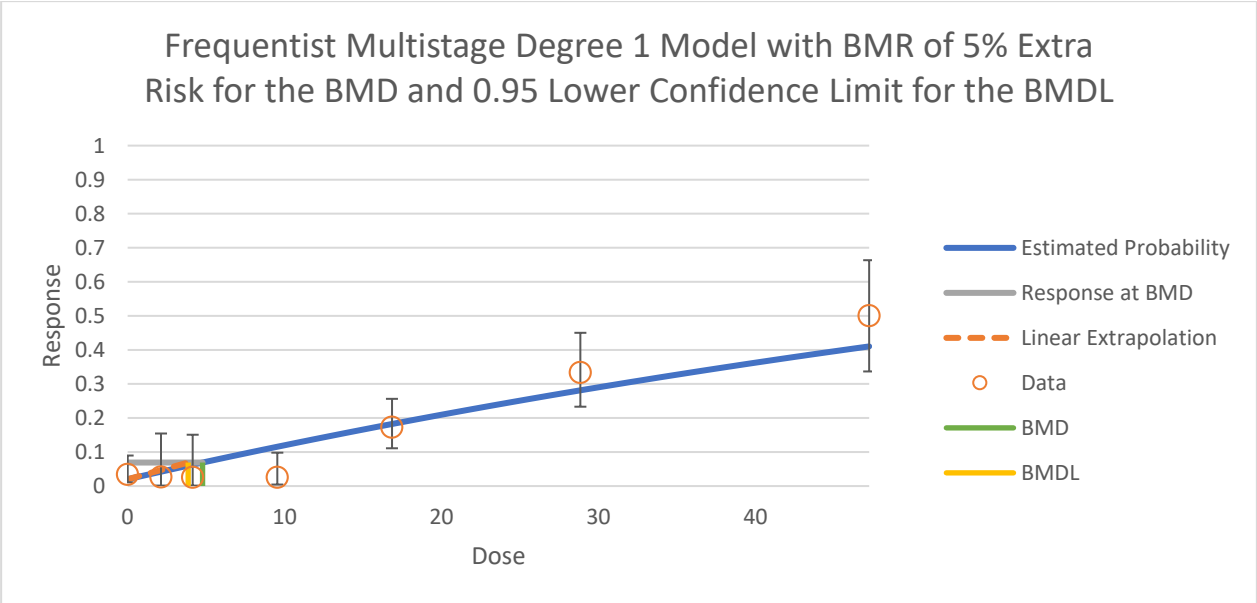
b1	0.010746234

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.020047635	2.365620906	4	118	1.0734399
2.127	0.04219259	1.603318402	1	38	-0.486853
4.143	0.062719762	2.4460707	1	39	-0.955037
9.536	0.115495253	9.008629718	2	78	-2.482868
16.839	0.182256975	21.14180906	20	116	-0.274609
28.842	0.281215856	21.93483673	26	78	1.0237916
47.241	0.410165997	15.5863079	19	38	1.1258689

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-172.0627675	2	13.4109848	5	0.0198172
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 1 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Weibull Restricted Option Set #2

User Input

Info	
Model	frequentist Weibull v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	9.808348501
BMDL	6.649774645
BMDU	13.23777505
AIC	341.9457007
P-value	0.339988982
D.O.F.	4
Chi^2	4.521642207

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025458521
a	1.735223928

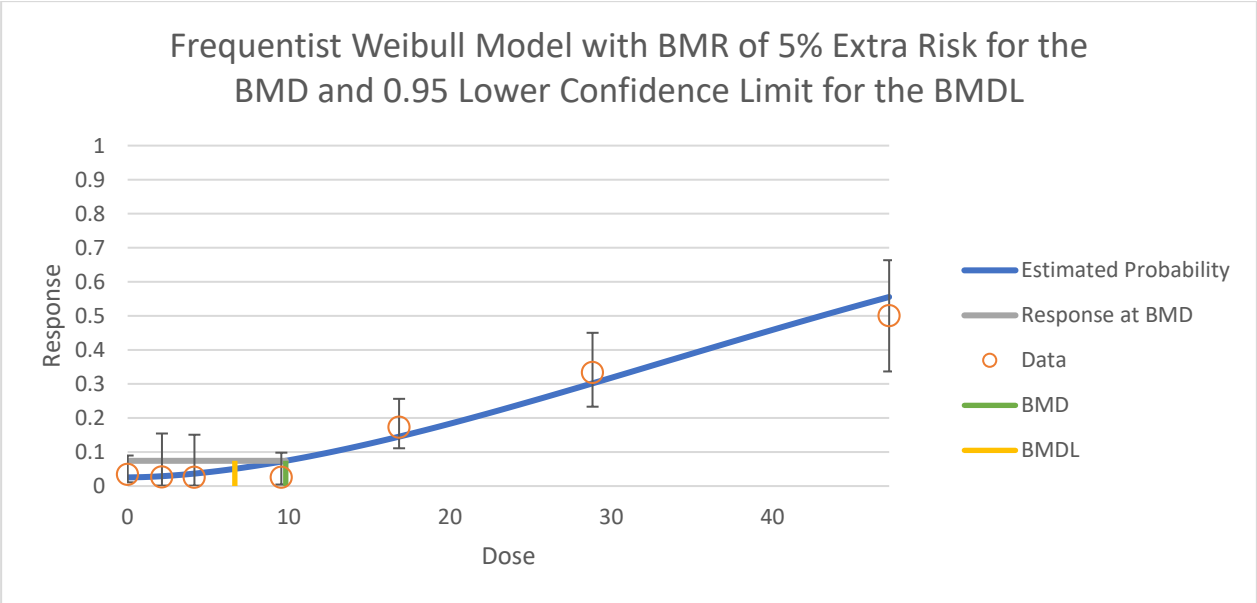
b	0.000975932

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025458521	3.0041055	4	118	0.5820437
2.127	0.028975625	1.101073735	1	38	-0.09775
4.143	0.03659904	1.427362561	1	39	-0.36444
9.536	0.071918167	5.609617028	2	78	-1.581981
16.839	0.14513598	16.83577363	20	116	0.83407
28.842	0.301716894	23.5339177	26	78	0.6083376
47.241	0.555386827	21.10469942	19	38	-0.687083

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.9728504	3	5.23115045	4	0.2643915
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Weibull Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Logistic Unrestricted Option Set #2

User Input

Info	
Model	frequentist Logistic v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

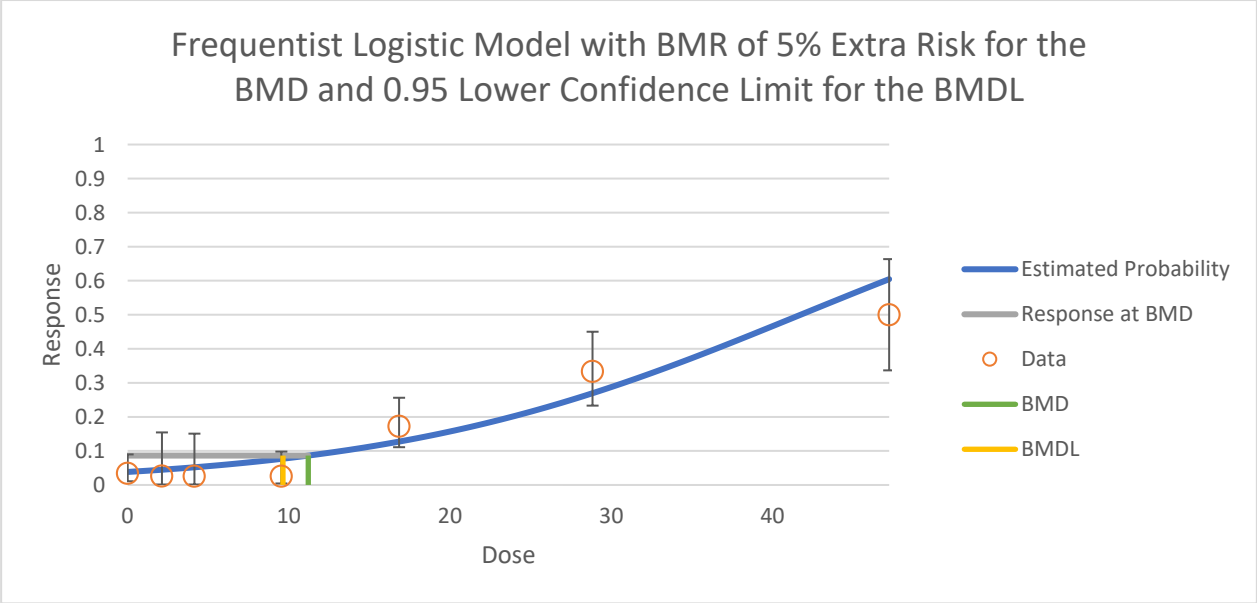
Model Results

Benchmark Dose	
BMD	11.20434113
BMDL	9.633332347
BMDU	13.01911672
AIC	344.767169
P-value	0.099800968
D.O.F.	5
Chi^2	9.241763559

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-3.224703635
b	0.077243754

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.038246592	4.51309782	4	118	-0.246281
2.127	0.04477033	1.701272525	1	38	-0.550105
4.143	0.051922562	2.024979933	1	39	-0.739747
9.536	0.076696127	5.9822979	2	78	-1.694445
16.839	0.127416617	14.78032753	20	116	1.4534422
28.842	0.269563312	21.02593836	26	78	1.2692354
47.241	0.604528136	22.97206916	19	38	-1.317829

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-170.3835845	2	10.0526187	5	0.073758
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Log-Probit Unrestricted Option Set #2

User Input

Info	
Model	frequentist Log-Probit v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	11.21726599
BMDL	8.188341858
BMDU	14.22634383
AIC	339.7966094
P-value	0.604635029
D.O.F.	4
Chi^2	2.726215871

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026965446
a	-4.541240652

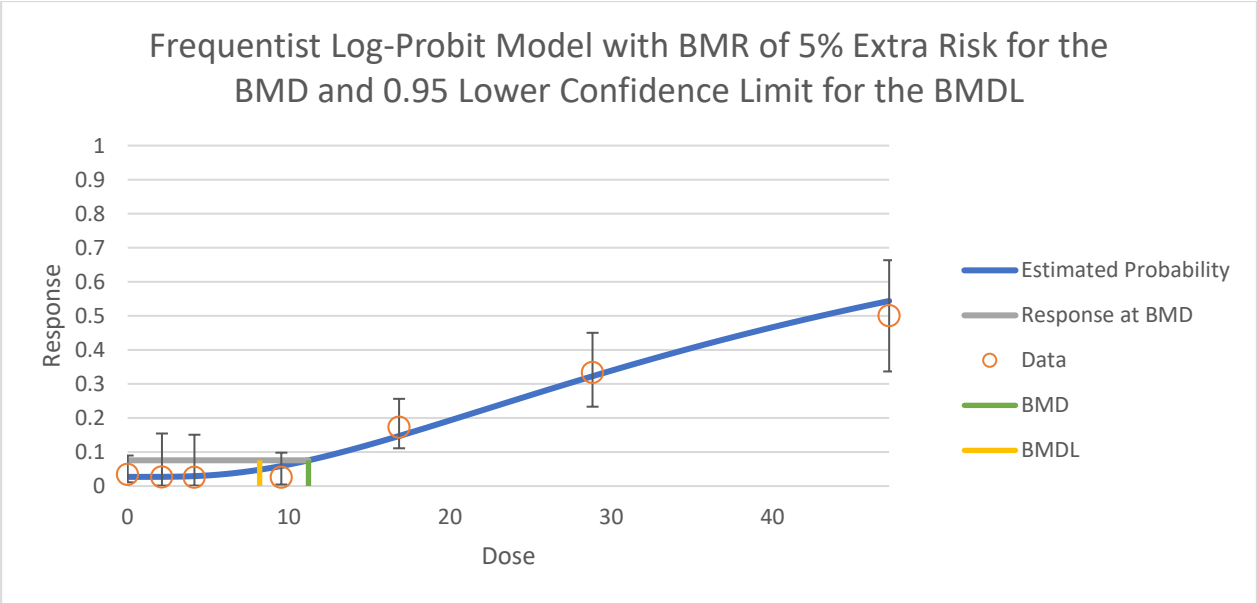
b	1.19811454

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026965446	3.181922599	4	118	0.4649277
2.127	0.027099638	1.029786255	1	38	-0.029758
4.143	0.0291726	1.137731384	1	39	-0.131052
9.536	0.059005454	4.60242543	2	78	-1.250522
16.839	0.147043758	17.05707595	20	116	0.7715488
28.842	0.322614935	25.16396496	26	78	0.2024963
47.241	0.543654982	20.65888931	19	38	-0.540278

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.8983047	3	3.08205916	4	0.5441881
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Probit Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Probit Unrestricted Option Set #2

User Input

Info	
Model	frequentist Probit v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

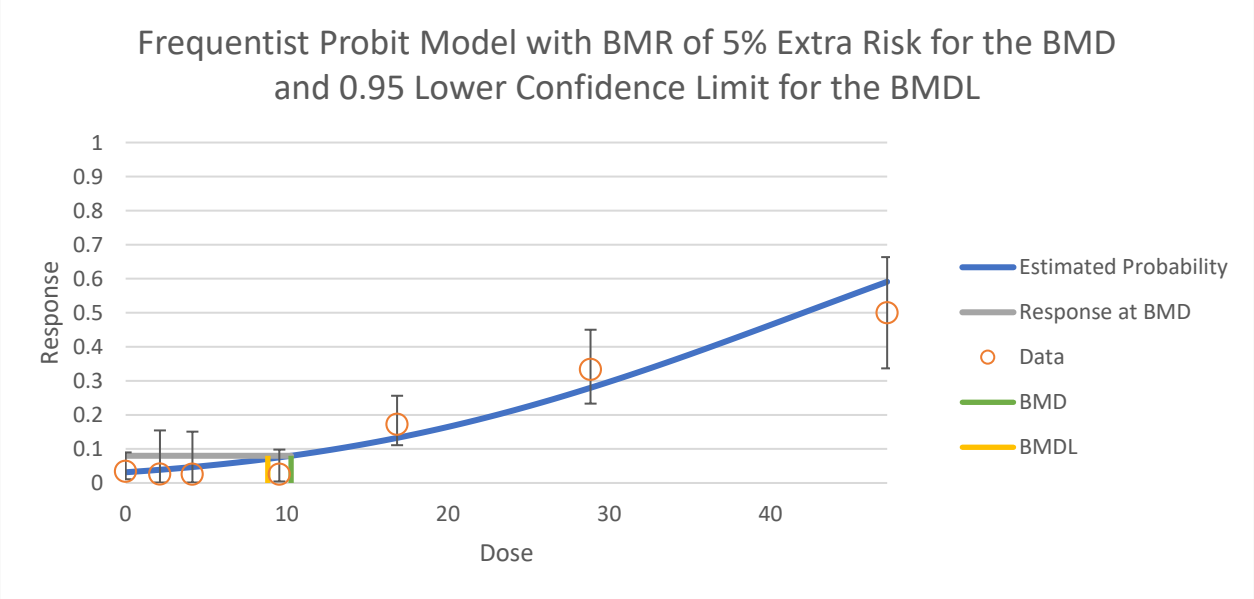
Model Results

Benchmark Dose	
BMD	10.26173546
BMDL	8.819156921
BMDU	11.94425106
AIC	342.862181
P-value	0.195357727
D.O.F.	5
Chi^2	7.357847772

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-1.85976511
b	0.04423512

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.031459383	3.712207169	4	118	0.1517766
2.127	0.038725026	1.471550988	1	38	-0.396476
4.143	0.046820245	1.825989567	1	39	-0.626092
9.536	0.075225681	5.867603121	2	78	-1.660327
16.839	0.132448799	15.36406066	20	116	1.2698054
28.842	0.279631764	21.81127757	26	78	1.0567293
47.241	0.590933217	22.45546224	19	38	-1.140113

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-169.4310905	2	8.14763071	5	0.1482849
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Dichotomous Hill Restricted Option Set #3

User Input

Info	
Model	frequentist Dichotomous Hill v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	7.796823928
BMDL	3.625172034
BMDU	Infinity
AIC	340.7685114
P-value	0.588814655
D.O.F.	3
Chi^2	1.921706917

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.027109248
v	0.476465534

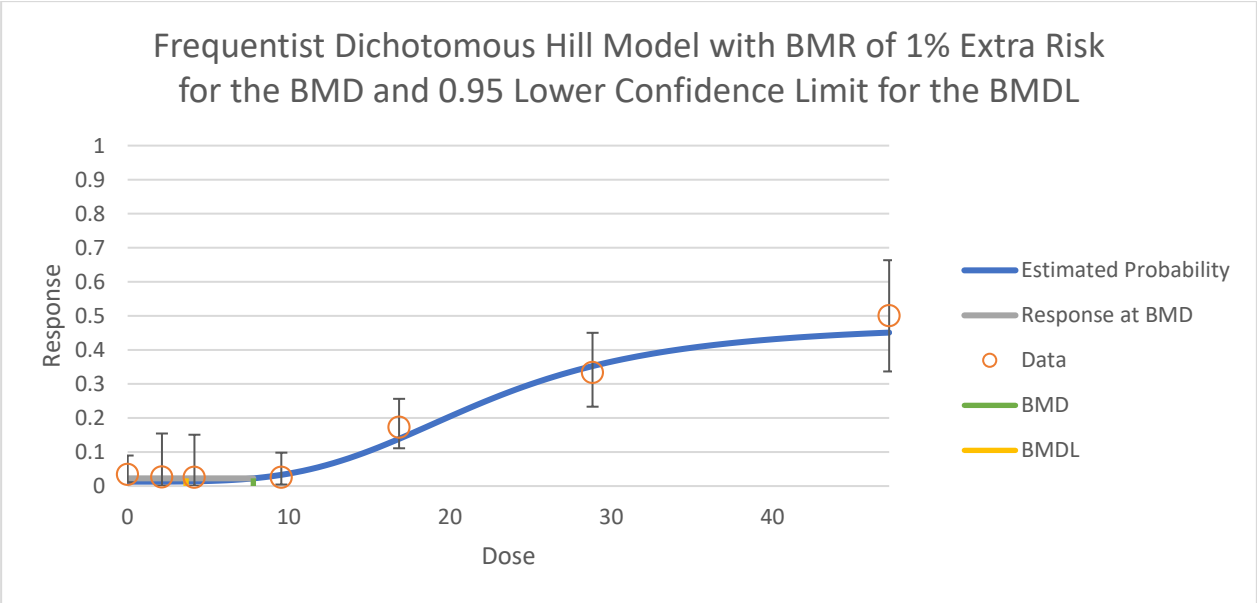
a	-11.45589653
b	3.70708305

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.027109248	3.198891256	4	118	0.4541086
2.127	0.027189758	1.033210794	1	38	-0.033126
4.143	0.028060747	1.094369125	1	39	-0.091502
9.536	0.047165324	3.678895236	2	78	-0.896718
16.839	0.152853754	17.73103548	20	116	0.5854387
28.842	0.36660001	28.59480082	26	78	-0.609707
47.241	0.464970236	17.66886896	19	38	0.4329398

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.3842557	4	2.05396111	3	0.5612827
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Dichotomous Hill Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Gamma Restricted Option Set #3

User Input

Info	
Model	frequentist Gamma v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	4.792503704
BMDL	2.317908892
BMDU	7.768658163
AIC	341.1612343
P-value	0.418988655
D.O.F.	4
Chi^2	3.905192666

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026271616
a	2.269376389

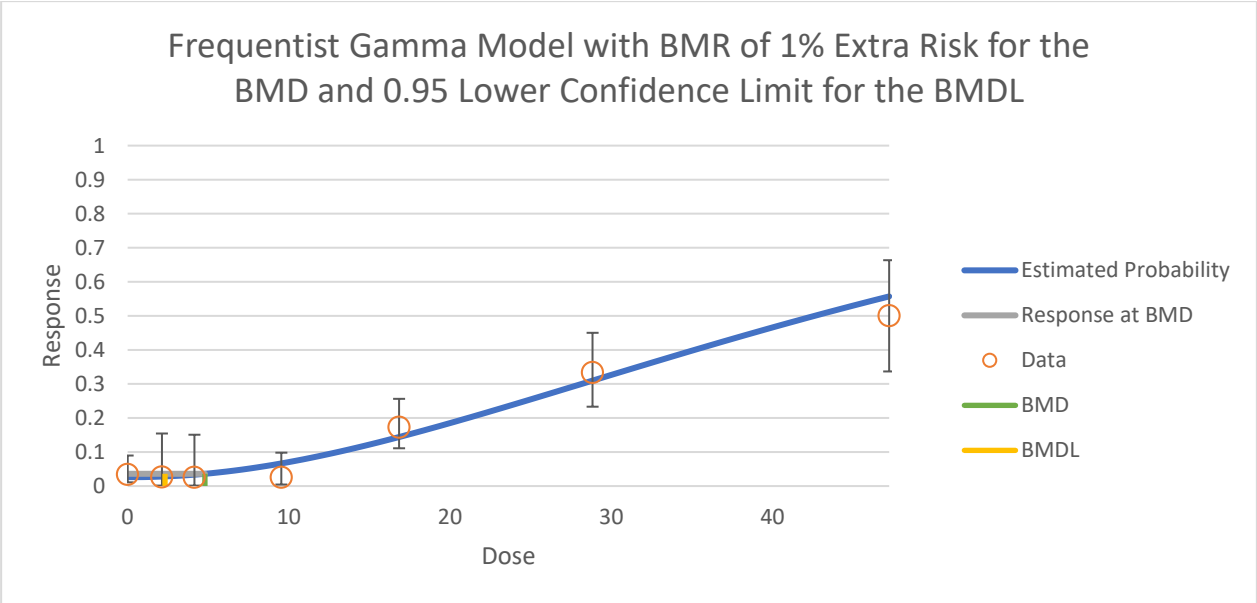
b	0.044583213

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026271616	3.100050688	4	118	0.5179821
2.127	0.027943618	1.0618575	1	38	-0.060885
4.143	0.033408494	1.302931283	1	39	-0.269937
9.536	0.066476387	5.185158173	2	78	-1.447729
16.839	0.143994251	16.70333307	20	116	0.8718367
28.842	0.309753444	24.16076861	26	78	0.4503798
47.241	0.557061956	21.16835434	19	38	-0.708134

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.5806172	3	4.44668406	4	0.3489163
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Gamma Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Log-Logistic Restricted Option Set #3

User Input

Info	
Model	frequentist Log-Logistic v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	4.694237418
BMDL	2.50032598
BMDU	7.340682444
AIC	340.9166626
P-value	0.454262937
D.O.F.	4
Chi^2	3.658007375

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025879125
a	-7.776564913

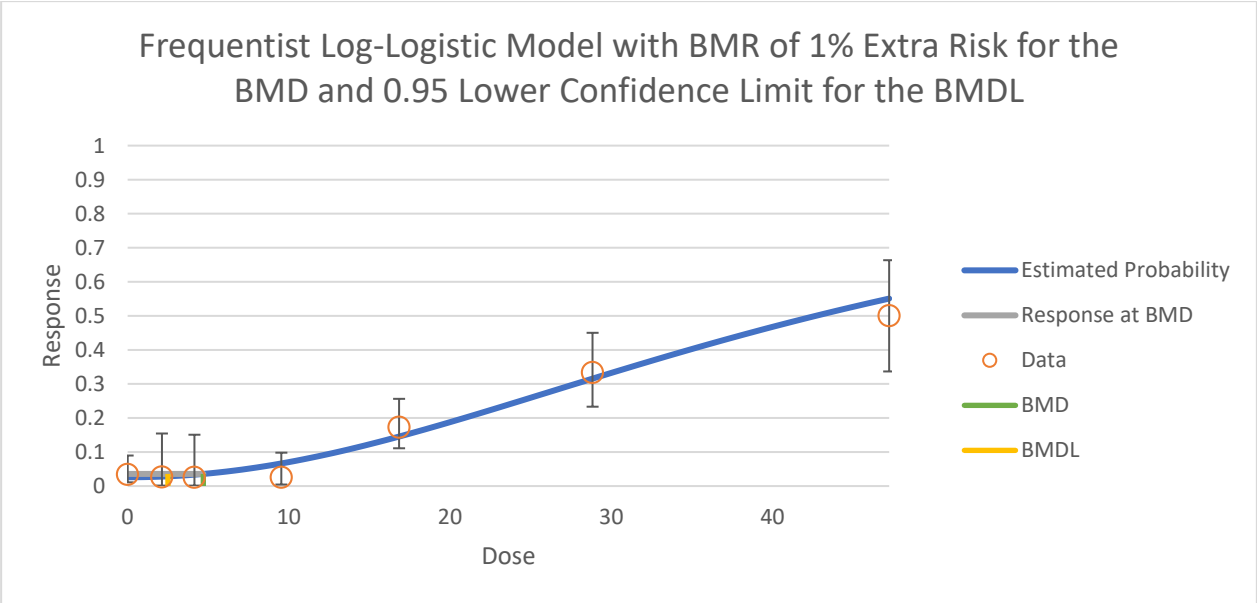
b	2.057409083

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025879125	3.053736755	4	118	0.5486429
2.127	0.027805699	1.056616556	1	38	-0.055861
4.143	0.033429761	1.303760684	1	39	-0.270593
9.536	0.066410714	5.180035704	2	78	-1.446065
16.839	0.145408253	16.86735737	20	116	0.8251027
28.842	0.315543968	24.61242951	26	78	0.3380688
47.241	0.550680701	20.92586662	19	38	-0.628068

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.4583313	3	4.20211235	4	0.3793434
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Logistic Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 6 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	3.830073122
BMDL	1.310032653
BMDU	6.068546929
AIC	342.6026406
P-value	0.255177995
D.O.F.	4
Chi^2	5.328961106
Slope Factor	0.007633398

Model Parameters	
# of Parameters	7
Variable	Estimate
g	0.026568571

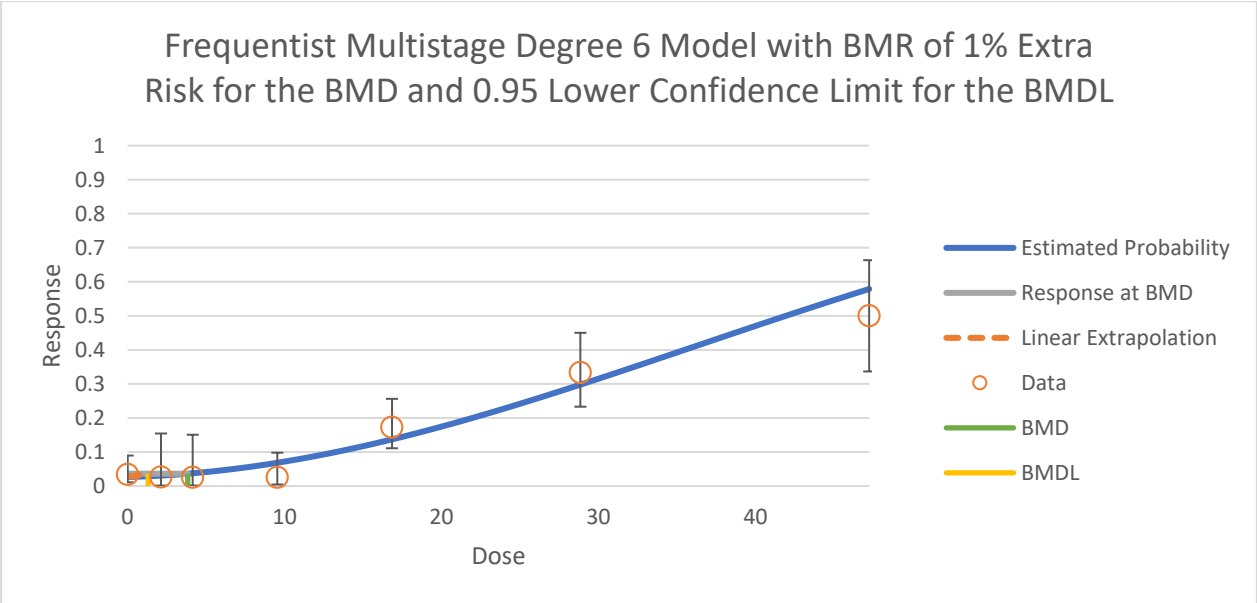
b1	0.001291084
b2	0.000348029
b3	Bounded
b4	Bounded
b5	Bounded
b6	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026568571	3.135091403	4	118	0.4950994
2.127	0.030765367	1.169083953	1	38	-0.158842
4.143	0.037528262	1.463602222	1	39	-0.390607
9.536	0.068433555	5.337817303	2	78	-1.496835
16.839	0.137010407	15.89320727	20	116	1.1089047
28.842	0.297898131	23.23605418	26	78	0.6843027
47.241	0.578788285	21.99395481	19	38	-0.983656

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013203	3	5.88809029	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 6 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 5 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	3.830760173
BMDL	1.310013243
BMDU	6.068583999
AIC	342.6026405
P-value	0.255169412
D.O.F.	4
Chi^2	5.329053622
Slope Factor	0.007633511

Model Parameters	
# of Parameters	6
Variable	Estimate
g	0.026570755

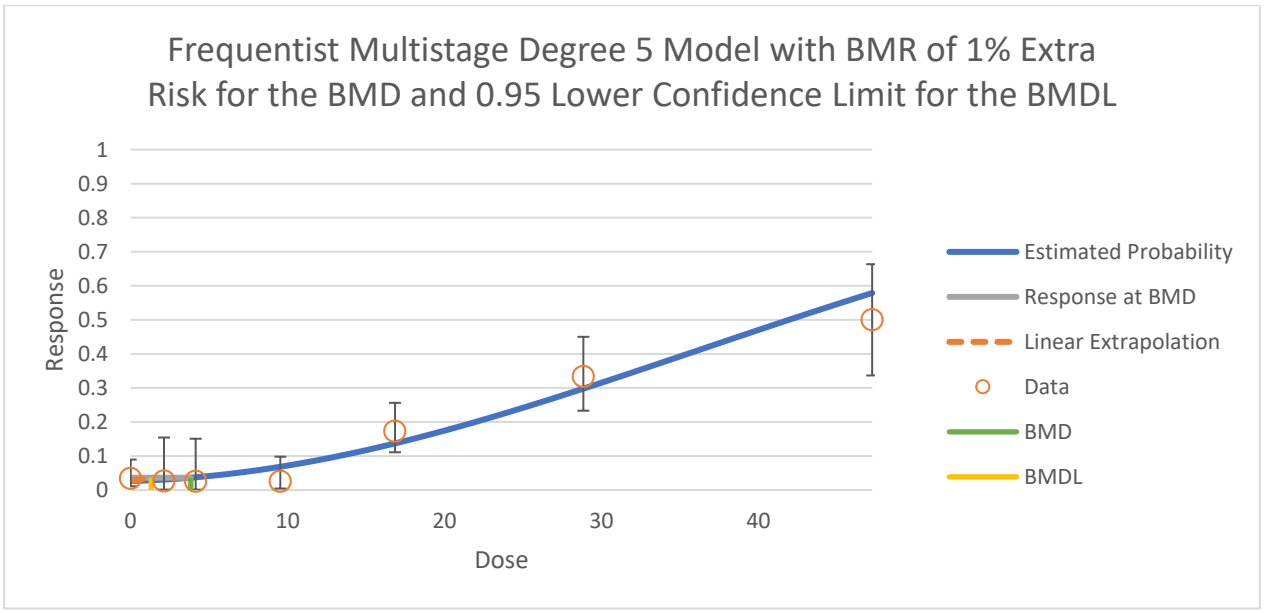
b1	0.001290264
b2	0.000348058
b3	Bounded
b4	Bounded
b5	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570755	3.135349113	4	118	0.4949321
2.127	0.030765979	1.169107188	1	38	-0.158862
4.143	0.037527632	1.463577644	1	39	-0.390589
9.536	0.068430824	5.337604266	2	78	-1.496767
16.839	0.137007543	15.89287504	20	116	1.1090042
28.842	0.297900086	23.23620672	26	78	0.6842637
47.241	0.578800251	21.99440955	19	38	-0.983809

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 5 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 4 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	3.830737646
BMDL	1.309968519
BMDU	6.068572715
AIC	342.6026405
P-value	0.255169806
D.O.F.	4
Chi^2	5.32904937
Slope Factor	0.007633771

Model Parameters	
# of Parameters	5
Variable	Estimate
g	0.026570727

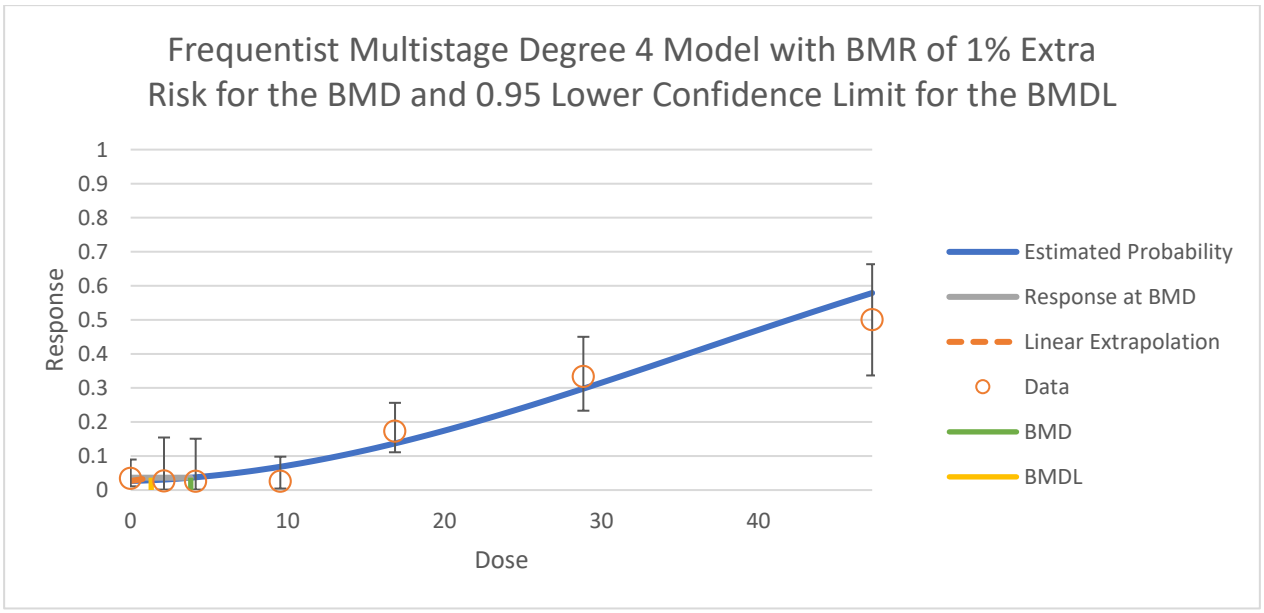
b1	0.001290289
b2	0.000348057
b3	Bounded
b4	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570727	3.135345829	4	118	0.4949343
2.127	0.030765997	1.169107885	1	38	-0.158863
4.143	0.037527686	1.46357975	1	39	-0.390591
9.536	0.068430934	5.337612848	2	78	-1.496769
16.839	0.137007643	15.89288656	20	116	1.1090007
28.842	0.297900011	23.23620085	26	78	0.6842652
47.241	0.578799842	21.99439399	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 4 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 3 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	3.830737646
BMDL	1.310040352
BMDU	6.06857103
AIC	342.6026405
P-value	0.255169812
D.O.F.	4
Chi^2	5.329049304
Slope Factor	0.007633353

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.026570727

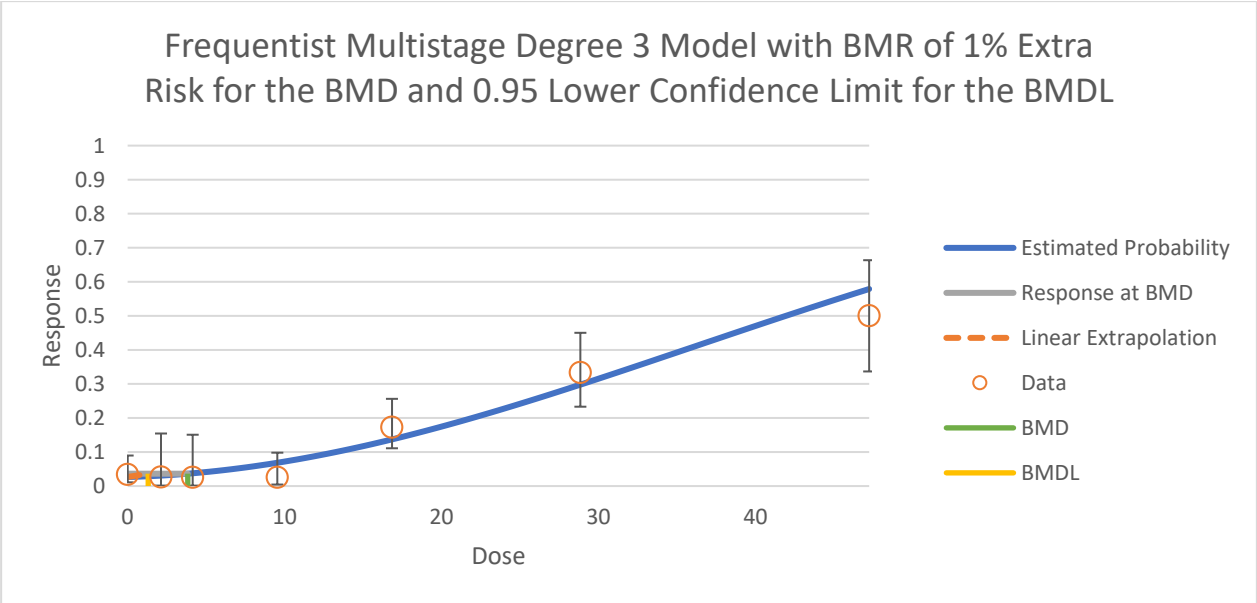
b1	0.001290289
b2	0.000348057
b3	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026570727	3.135345808	4	118	0.4949343
2.127	0.030765998	1.169107914	1	38	-0.158863
4.143	0.037527687	1.463579804	1	39	-0.390591
9.536	0.068430936	5.337612994	2	78	-1.496769
16.839	0.137007643	15.89288656	20	116	1.1090007
28.842	0.297900004	23.23620029	26	78	0.6842653
47.241	0.578799824	21.9943933	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 3 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 2 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	3.830732015
BMDL	1.331017083
BMDU	5.748662444
AIC	342.6026405
P-value	0.255169836
D.O.F.	4
Chi^2	5.329049051
Slope Factor	0.007513052

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.02657071

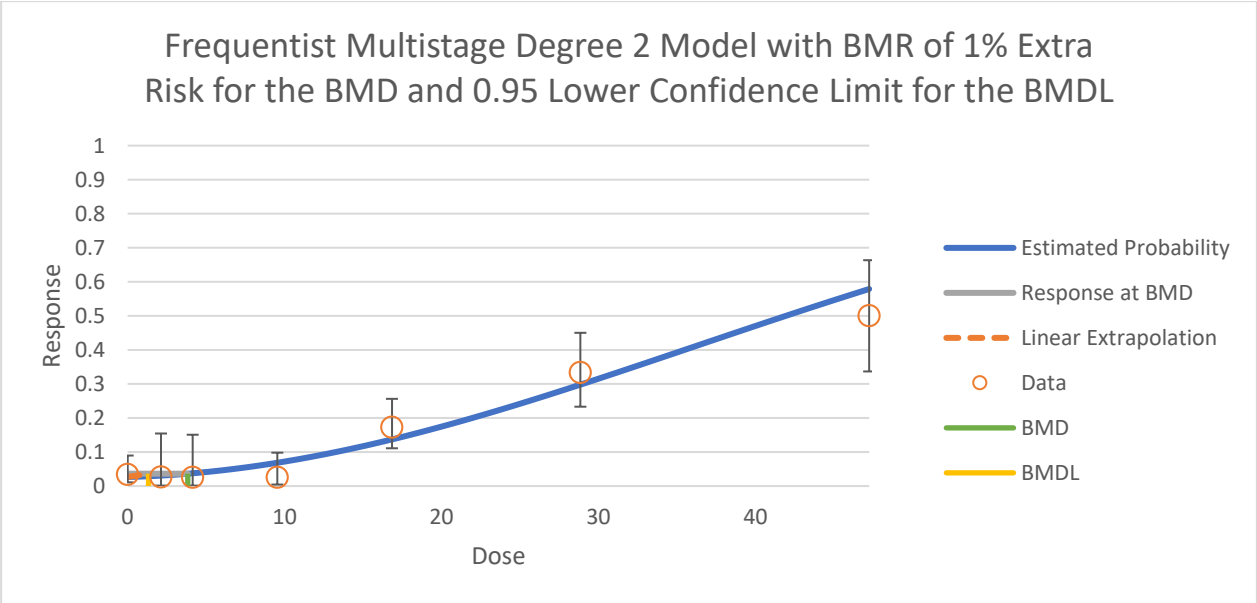
b1	0.001290293
b2	0.000348057

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.02657071	3.135343737	4	118	0.4949356
2.127	0.030765988	1.16910755	1	38	-0.158863
4.143	0.037527684	1.463579687	1	39	-0.390591
9.536	0.068430945	5.337613741	2	78	-1.49677
16.839	0.137007658	15.89288833	20	116	1.1090002
28.842	0.297900006	23.23620043	26	78	0.6842653
47.241	0.578799788	21.99439194	19	38	-0.983804

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.3013202	3	5.88809023	4	0.2076631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 2 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 1 v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data		
Dependent Variable		in
Independent Variable		
Total # of Observations		

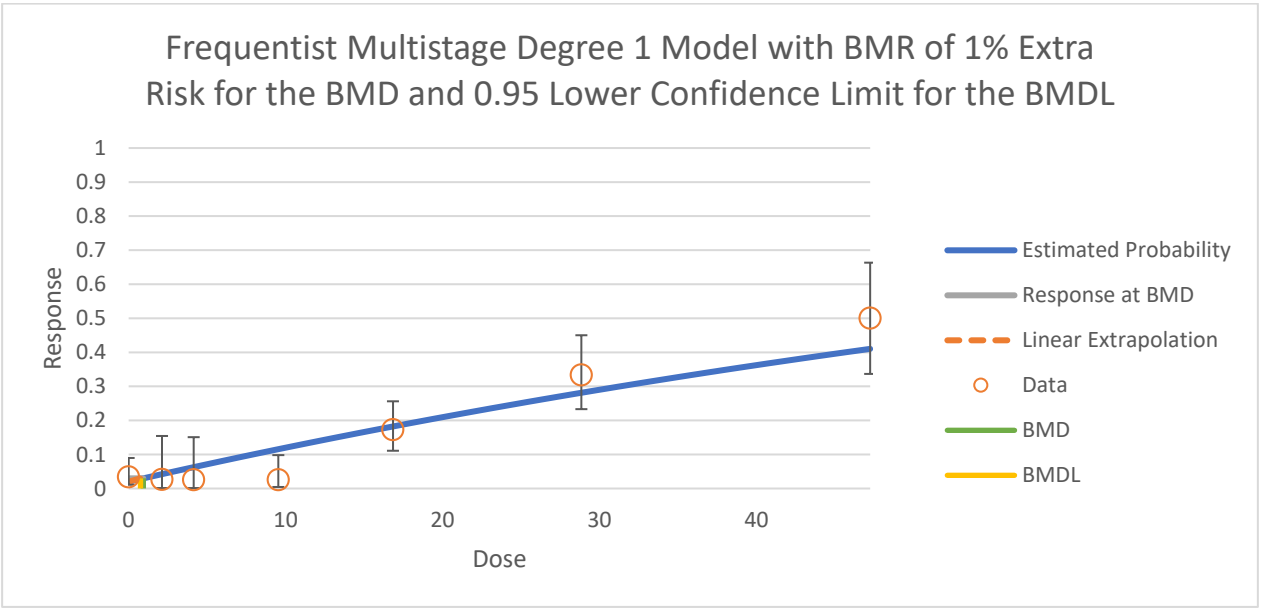
Model Results

Benchmark Dose	
BMD	0.935242621
BMDL	0.75532121
BMDU	1.189197572
AIC	348.125535
P-value	0.054286608
D.O.F.	5
Chi^2	10.85716906
Slope Factor	0.0132394

Model Parameters	
# of Parameters	2
Variable	Estimate
g	0.020047635
b1	0.010746234

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.020047635	2.365620906	4	118	1.0734399
2.127	0.04219259	1.603318402	1	38	-0.486853
4.143	0.062719762	2.4460707	1	39	-0.955037
9.536	0.115495253	9.008629718	2	78	-2.482868
16.839	0.182256975	21.14180906	20	116	-0.274609
28.842	0.281215856	21.93483673	26	78	1.0237916
47.241	0.410165997	15.5863079	19	38	1.1258689

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-172.0627675	2	13.4109848	5	0.0198172
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Weibull Restricted Option Set #3

User Input

Info	
Model	frequentist Weibull v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	3.833968406
BMDL	1.913679978
BMDU	6.336193439
AIC	341.9457007
P-value	0.339988982
D.O.F.	4
Chi^2	4.521642207

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025458521
a	1.735223928

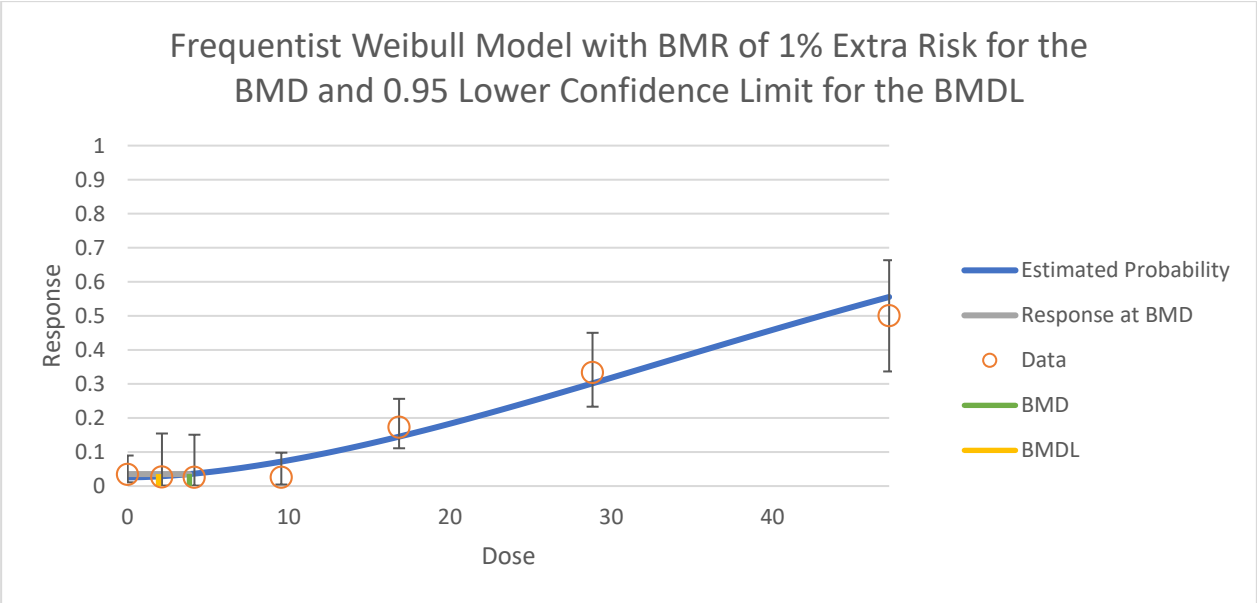
b	0.000975932

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025458521	3.0041055	4	118	0.5820437
2.127	0.028975625	1.101073735	1	38	-0.09775
4.143	0.03659904	1.427362561	1	39	-0.36444
9.536	0.071918167	5.609617028	2	78	-1.581981
16.839	0.14513598	16.83577363	20	116	0.83407
28.842	0.301716894	23.5339177	26	78	0.6083376
47.241	0.555386827	21.10469942	19	38	-0.687083

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.9728504	3	5.23115045	4	0.2643915
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Weibull Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Logistic Unrestricted Option Set #3

User Input

Info	
Model	frequentist Logistic v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

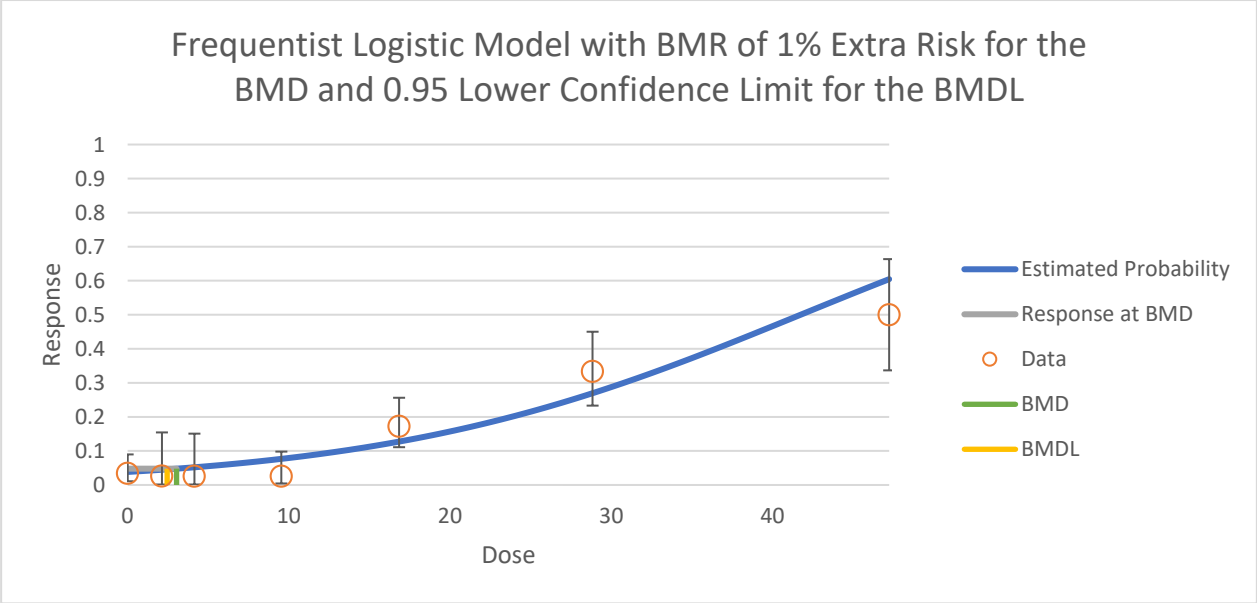
Model Results

Benchmark Dose	
BMD	3.034059791
BMDL	2.450399572
BMDU	3.827875338
AIC	344.767169
P-value	0.099800968
D.O.F.	5
Chi^2	9.241763559

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-3.224703635
b	0.077243754

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.038246592	4.51309782	4	118	-0.246281
2.127	0.04477033	1.701272525	1	38	-0.550105
4.143	0.051922562	2.024979933	1	39	-0.739747
9.536	0.076696127	5.9822979	2	78	-1.694445
16.839	0.127416617	14.78032753	20	116	1.4534422
28.842	0.269563312	21.02593836	26	78	1.2692354
47.241	0.604528136	22.97206916	19	38	-1.317829

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-170.3835845	2	10.0526187	5	0.073758
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Log-Probit Unrestricted Option Set #3

User Input

Info	
Model	frequentist Log-Probit v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	6.351230722
BMDL	3.840133987
BMDU	9.047868017
AIC	339.7966094
P-value	0.604635029
D.O.F.	4
Chi^2	2.726215871

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026965446
a	-4.541240652

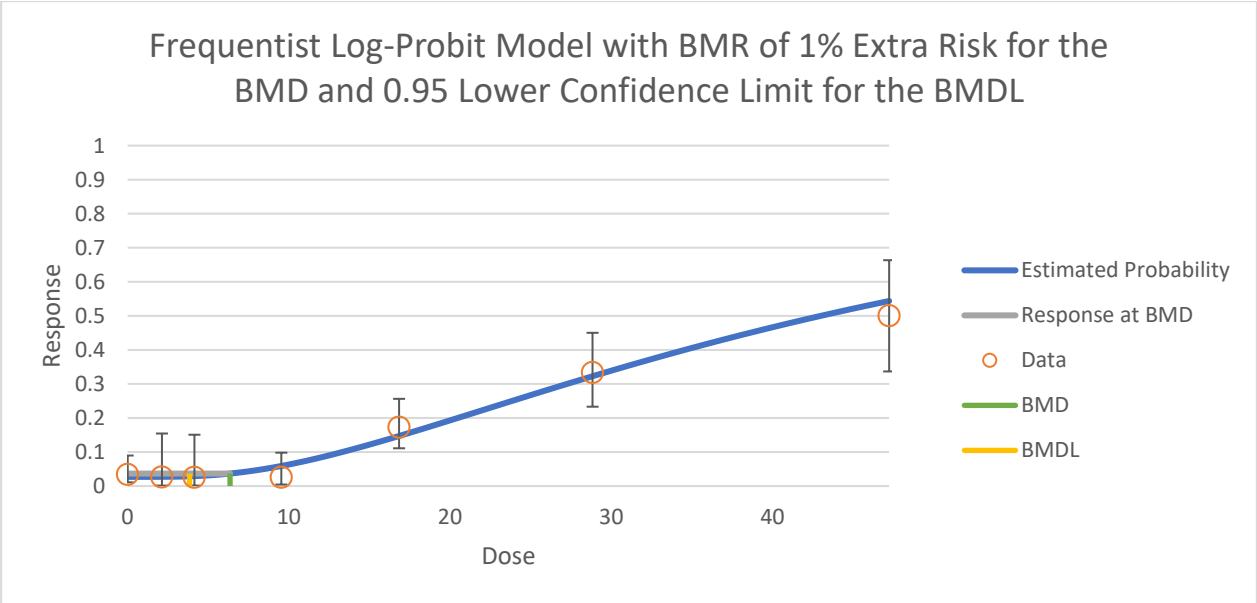
b	1.19811454

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026965446	3.181922599	4	118	0.4649277
2.127	0.027099638	1.029786255	1	38	-0.029758
4.143	0.0291726	1.137731384	1	39	-0.131052
9.536	0.059005454	4.60242543	2	78	-1.250522
16.839	0.147043758	17.05707595	20	116	0.7715488
28.842	0.322614935	25.16396496	26	78	0.2024963
47.241	0.543654982	20.65888931	19	38	-0.540278

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.8983047	3	3.08205916	4	0.5441881
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Probit Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
Dose
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Probit Unrestricted Option Set #3

User Input

Info	
Model	frequentist Probit v1.1
Dataset Name	Mortality_TotMetabBW34
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

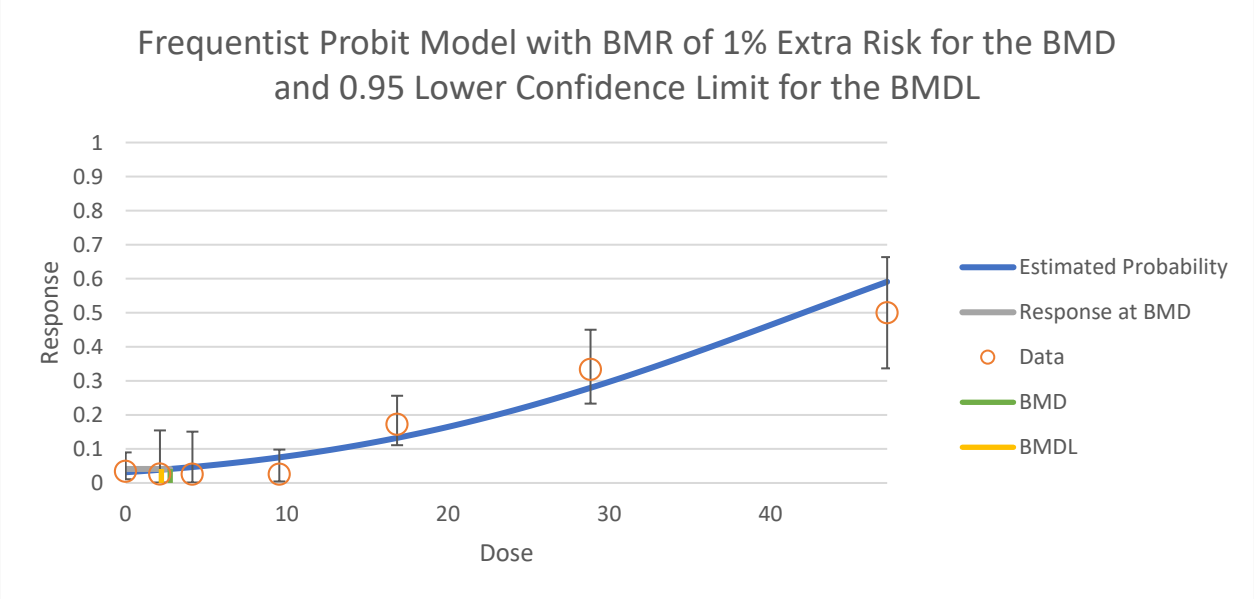
Model Results

Benchmark Dose	
BMD	2.762780829
BMDL	2.217815362
BMDU	3.538966303
AIC	342.862181
P-value	0.195357727
D.O.F.	5
Chi^2	7.357847772

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-1.85976511
b	0.04423512

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.031459383	3.712207169	4	118	0.1517766
2.127	0.038725026	1.471550988	1	38	-0.396476
4.143	0.046820245	1.825989567	1	39	-0.626092
9.536	0.075225681	5.867603121	2	78	-1.660327
16.839	0.132448799	15.36406066	20	116	1.2698054
28.842	0.279631764	21.81127757	26	78	1.0567293
47.241	0.590933217	22.45546224	19	38	-1.140113

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-169.4310905	2	8.14763071	5	0.1482849
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001

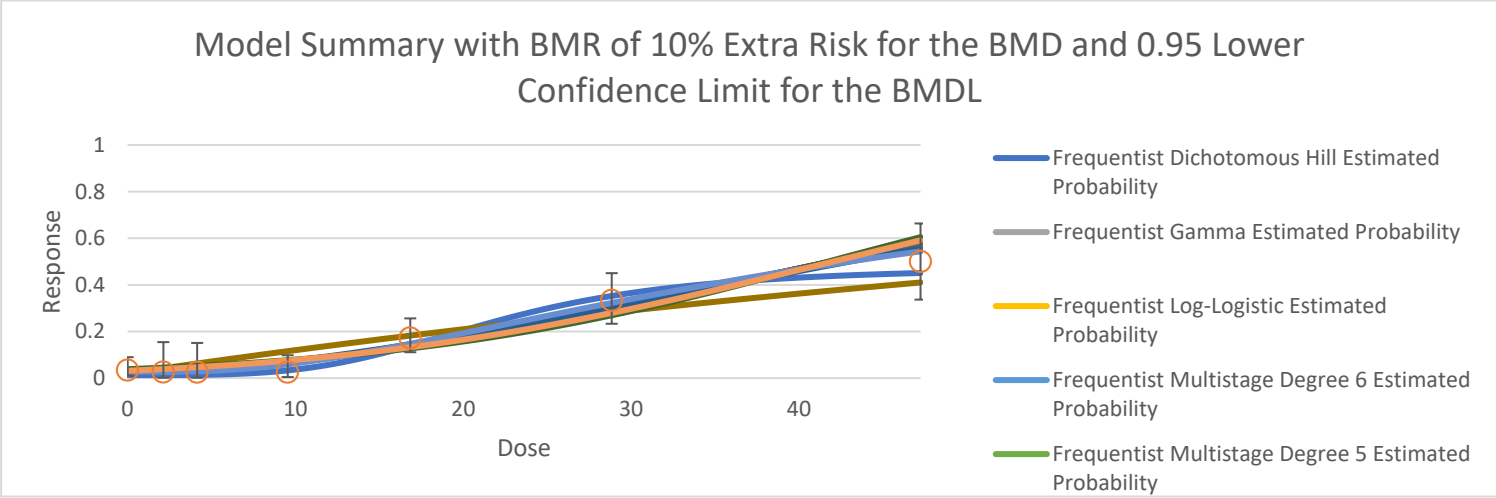


Summary of Results

Option set #1 (Hover for details)											
Model	Analysis Type	Restriction	RiskType	BMD	BMDL	BMDU	P Value	AIC	Unnormalized Log Posterior Probability	BMDS Recommendation	BMDS Recommendation Notes
Dichotomous Hill	frequentist	Restricted	Extra Risk	15.3739	12.72	18.078001	0.5888147	340.7685114	-	Viable - Alternate	
Gamma	frequentist	Restricted	Extra Risk	15.15514	11.76212	18.537368	0.4189887	341.1612343	-	Viable - Alternate	
Log-Logistic	frequentist	Restricted	Extra Risk	15.05678	11.78046	18.413399	0.4542629	340.9166626	-	Viable - Alternate	
Multistage Degree 6	frequentist	Restricted	Extra Risk	15.64302	11.42324	18.755026	0.255178	342.6026406	-	Viable - Alternate	
Multistage Degree 5	frequentist	Restricted	Extra Risk	15.64349	11.42328	18.755082	0.2551694	342.6026405	-	Viable - Alternate	
Multistage Degree 4	frequentist	Restricted	Extra Risk	15.64348	11.42326	18.755067	0.2551698	342.6026405	-	Viable - Alternate	
Multistage Degree 3	frequentist	Restricted	Extra Risk	15.64348	11.42333	18.755071	0.2551698	342.6026405	-	Viable - Alternate	
Multistage Degree 2	frequentist	Restricted	Extra Risk	15.64348	11.42332	18.619617	0.2551698	342.6026405	-	Viable - Alternate	
Multistage Degree 1	frequentist	Restricted	Extra Risk	9.804413	7.918554	12.466471	0.0542866	348.125535	-	Questionable	Goodness of fit p-value < 0.1 |Residual for Dose Group Near BMD| > 2
Weibull	frequentist	Restricted	Extra Risk	14.85099	11.40096	18.459497	0.339989	341.9457007	-	Viable - Alternate	

Logistic	frequentist	Unrestricted	Extra Risk	17.63624	15.60135	19.943428	0.099801	344.767169	-	Questionable	Goodness of fit p-value < 0.1
Log-Probit*	**frequentist**	**Unrestricted**	**Extra Risk**	**15.19068**	**12.12546**	**18.262124**	**0.604635**	**339.7966094**	**-**	**Viable - Recommended**	**Lowest AIC**
Probit	frequentist	Unrestricted	Extra Risk	16.39795	14.49961	18.576061	0.195357	342.862181	-	Viable - Alternate	

*Selected model in bold; scaled residuals for selected model for doses 0, 2.127, 4.143, 9.536, 16.839, 28.842, 47.241 were 0.454108567788347, -3.31261318788624E-02, -9.15015504587954E-02, -0.896718458417703, 0.585438742593952, -0.609707394873311, 0.432939751723155 [units], respectively.

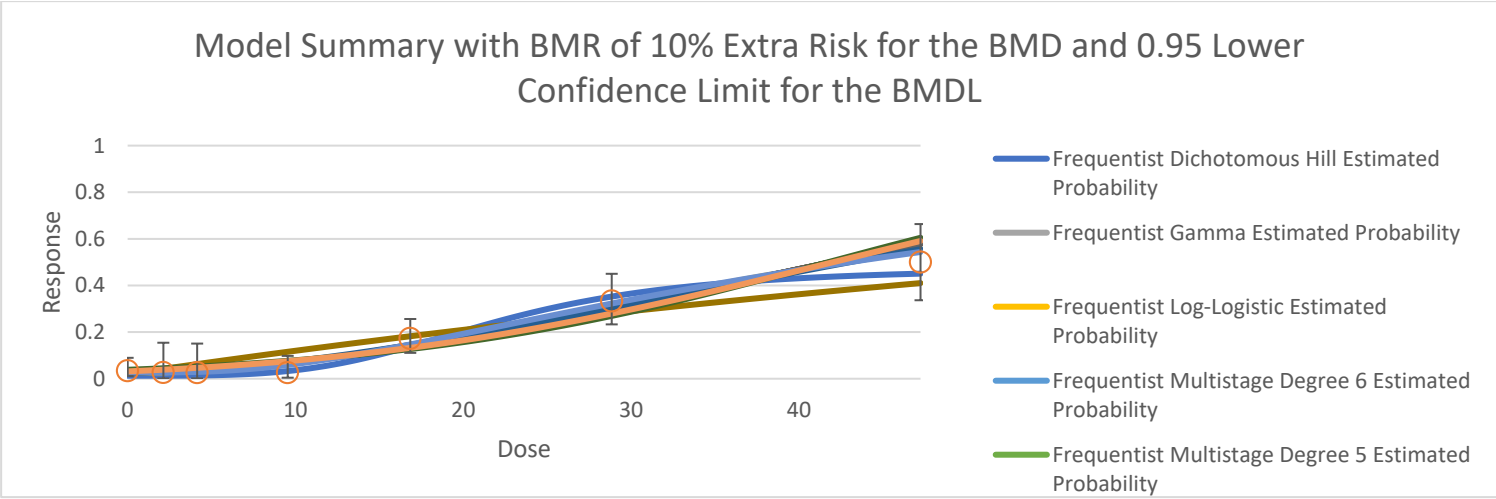


Option Set #2 (Hover for details)

Model	Analysis Type	Restriction	RiskType	BMD	BMDL	BMDU	P Value	AIC	Unnormalized Log Posterior Probability	BMDS Recommendation	BMDS Recommendation Notes
Dichotomous Hill	frequentist	Restricted	Extra Risk	12.33021	8.808573	16.03815	0.588814	340.7685114	-	Viable - Alternate	

Gamma	frequentist	Restricted	Extra Risk	10.50923	7.150311	13.907358	0.418887	341.1612343	-	Viable - Alternate	
Log-Logistic	frequentist	Restricted	Extra Risk	10.47138	7.328948	13.742942	0.454262 9	340.9166626	-	Viable - Alternate	
Multistage Degree 6	frequentist	Restricted	Extra Risk	10.42614	6.165454	13.297276	0.255178	342.6026406	-	Viable - Alternate	
Multistage Degree 5	frequentist	Restricted	Extra Risk	10.42677	6.165448	13.29733	0.255169 4	342.6026405	-	Viable - Alternate	
Multistage Degree 4	frequentist	Restricted	Extra Risk	10.42676	6.165551	13.297306	0.255169 8	342.6026405	-	Viable - Alternate	
Multistage Degree 3	frequentist	Restricted	Extra Risk	10.42675	6.16543	13.297305	0.255169 8	342.6026405	-	Viable - Alternate	
Multistage Degree 2	frequentist	Restricted	Extra Risk	10.42675	6.165409	12.987745	0.255169 8	342.6026405	-	Viable - Alternate	
Multistage Degree 1	frequentist	Restricted	Extra Risk	4.773141	3.855068	6.0690024	0.054286 6	348.125535	-	Questionable	Goodness of fit p-value < 0.1
Weibull	frequentist	Restricted	Extra Risk	9.808349	6.649775	13.237775	0.339989	341.9457007	-	Viable - Alternate	
Logistic	frequentist	Unrestricted	Extra Risk	11.20434	9.633332	13.019117	0.099801	344.767169	-	Questionable	Goodness of fit p-value < 0.1
Log-Probit*	**frequentist**	**Unrestricted**	**Extra Risk**	**11.21727**	**8.188342**	**14.226344**	**0.604635**	**339.7966094**	**-**	**Viable - Recommended**	**Lowest AIC**
Probit	frequentist	Unrestricted	Extra Risk	10.26174	8.819157	11.944251	0.195357 7	342.862181	-	Viable - Alternate	

*Selected model in bold; scaled residuals for selected model for doses 0, 2.127, 4.143, 9.536, 16.839, 28.842, 47.241 were 0.454108567788347, -3.31261318788624E-02, -9.15015504587954E-02, -0.896718458417703, 0.585438742593952, -0.609707394873311, 0.432939751723155 [units], respectively.

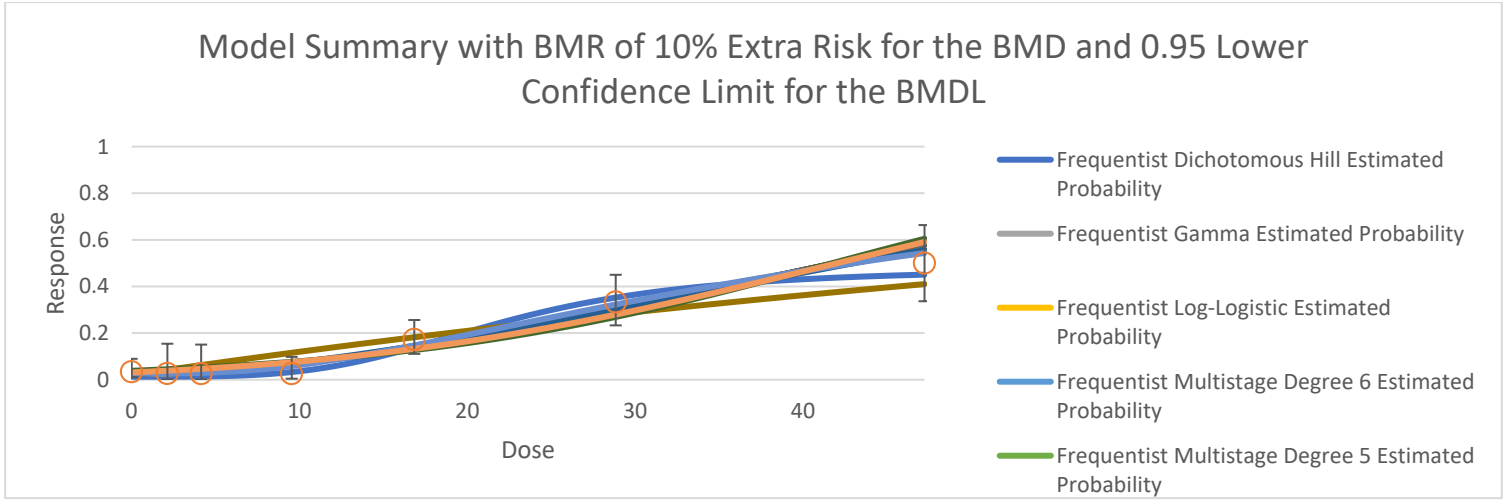


Option Set #3 (Hover for details)

Model	Analysis Type	Restriction	RiskType	BMD	BMDL	BMDU	P Value	AIC	Unnormalized Log Posterior Probability	BMDS Recommendation	BMDS Recommendation Notes
Dichotomous Hill	frequentist	Restricted	Extra Risk	7.796824	3.625172	Infinity	0.588814	340.7685114	-	Viable - Alternate	
Gamma	frequentist	Restricted	Extra Risk	4.792504	2.317909	7.768658 2	0.418988 7	341.1612343	-	Viable - Alternate	
Log-Logistic	frequentist	Restricted	Extra Risk	4.694237	2.500326	7.340682 4	0.454262 9	340.9166626	-	Viable - Alternate	
Multistage Degree 6	frequentist	Restricted	Extra Risk	3.830073	1.310033	6.068546 9	0.255178	342.6026406	-	Viable - Alternate	
Multistage Degree 5	frequentist	Restricted	Extra Risk	3.83076	1.310013	6.068584	0.255169 4	342.6026405	-	Viable - Alternate	
Multistage Degree 4	frequentist	Restricted	Extra Risk	3.830738	1.309969	6.068572 7	0.255169 8	342.6026405	-	Viable - Alternate	

Multistage Degree 3	frequentist	Restricted	Extra Risk	3.830738	1.31004	6.068571	0.2551698	342.6026405	-	Viable - Alternate	
Multistage Degree 2	frequentist	Restricted	Extra Risk	3.830732	1.331017	5.748662 4	0.2551698	342.6026405	-	Viable - Alternate	
Multistage Degree 1	frequentist	Restricted	Extra Risk	0.935243	0.755321	1.189197 6	0.0542866	348.125535	-	Questionable	Goodness of fit p-value < 0.1
Weibull	frequentist	Restricted	Extra Risk	3.833968	1.91368	6.336193 4	0.339989	341.9457007	-	Viable - Alternate	
Logistic	frequentist	Unrestricted	Extra Risk	3.03406	2.4504	3.827875 3	0.099801	344.767169	-	Questionable	Goodness of fit p-value < 0.1
Log-Probit*	**frequentist**	**Unrestricted**	**Extra Risk**	**6.351231**	**3.840134**	**9.047868**	**0.604635**	**339.7966094**	**-**	**Viable - Recommended**	**Lowest AIC**
Probit	frequentist	Unrestricted	Extra Risk	2.762781	2.217815	3.538966 3	0.1953577	342.862181	-	Viable - Alternate	

*Selected model in bold; scaled residuals for selected model for doses 0, 2.127, 4.143, 9.536, 16.839, 28.842, 47.241 were 0.454108567788347, -3.31261318788624E-02, -9.15015504587954E-02, -0.896718458417703, 0.585438742593952, -0.609707394873311, 0.432939751723155 [units], respectively.


Model Summary with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
1
0.8
0.6
0.4
0.2
0
0
10
20
30
40
Dose
Frequentist Dichotomous Hill Estimated Probability
Frequentist Gamma Estimated Probability
Frequentist Log-Logistic Estimated Probability
Frequentist Multistage Degree 6 Estimated Probability
Frequentist Multistage Degree 5 Estimated Probability

BMDS 3.0 Analysis Report

Selgrade2010_Mortality_internal_dose

For

Mortality_AUCBld

Model Predictions for Mortality from Introduced Infection in Mice Following Inhalation Exposure to TCE Using Median AUCBld as the Dose Metric (Selgrade and Gilmour 2010)

Benchmark dose (BMD) modeling was conducted with the newest version of EPA's BMD software (BMDS version 3.1.2) using the internal dose metric median AUCBld. All available dichotomous models (Dichotomous Hill, Gamma, Logistic, Log-Logistic, Probit, Log-Probit, Weibull, and Multistage) were fit to the incidence data for mortality due to introduced infection in mice following inhalation exposure to TCE (Selgrade and Gilmour 2010). BMRs of 1%, 5%, and 10% extra risk were used in the BMD modeling, per technical direction. All models were run using the default parameter restrictions implemented in BMDS v3.1.2, i.e. Weibull, Gamma – α (power) ≥ 1; Log Logistic, Dichotomous Hill – slope ≥ 1; Multistage – $\beta \geq 0$; Logistic, Probit, Log-Probit – unrestricted. Adequacy of model fit was judged based on the χ^2 goodness-of-fit *p*-value ($p > 0.1$), magnitude of scaled residuals, and visual inspection of the model fit.

All models except for the Logistic and Probit models provided adequate overall fit to the data, based on the $\chi 2$ goodness-of-fit p-value ($p > 0.1$). The models with adequate overall fit also showed adequate fit near the predicted BMD, based on scaled residuals ($< |2|$). BMDLs for the adequately fit models at BMR = 10%, 5%, and 1% were sufficiently close (within 3-fold), so the model with the lowest AIC, the Log-Probit, was selected. Using the Log-Probit model, BMD/BMDLs at BMR = 10%, 5%, and 1% were 2.87/2.08, 1.83/1.17, and 0.79/0.38 for median AUCBld, respectively.

Analysis Info

Analysis Name: Selgrade2010_Mortality_internal_dose

Analysis Description: C:\USEPA\TCE\Selgrade2010\IDmortality

Model Type: Dichotomous

Selected Models:

- Frequentist Dichotomous Hill (restricted)
- Frequentist Gamma (restricted)
- Frequentist Log-Logistic (restricted)
- Frequentist Multistage (restricted)
- Frequentist Weibull (restricted)
- Frequentist Logistic (unrestricted)
- Frequentist Log-Probit (unrestricted)
- Frequentist Probit (unrestricted)

Option Sets:

- Option Set #1
  - Risk Type: Extra Risk
  - BMR: 0.1
  - Confidence Level: 0.95
  - Background: Estimated
- Option Set #2
  - Risk Type: Extra Risk
  - BMR: 0.05
  - Confidence Level: 0.95
  - Background: Estimated
- Option Set #3
  - Risk Type: Extra Risk

- BMR: 0.01
- Confidence Level: 0.95
- Background: Estimated

Data

Mortality_AUCBid		
median internal dose metric		
Dose	N	Incidence
internal dose	N	Incidence
0	118	4
0.288	38	1
0.59	39	1
1.557	78	2
3.308	116	20
7.214	78	26
15.877	38	19

Frequentist Dichotomous Hill Restricted Option Set #1

User Input

Info	
Model	frequentist Dichotomous Hill v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.92732562
BMDL	2.260301875
BMDU	3.681059693
AIC	341.0130828
P-value	0.543012368
D.O.F.	3
Chi^2	2.144251591

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.026931831
v	0.464956094

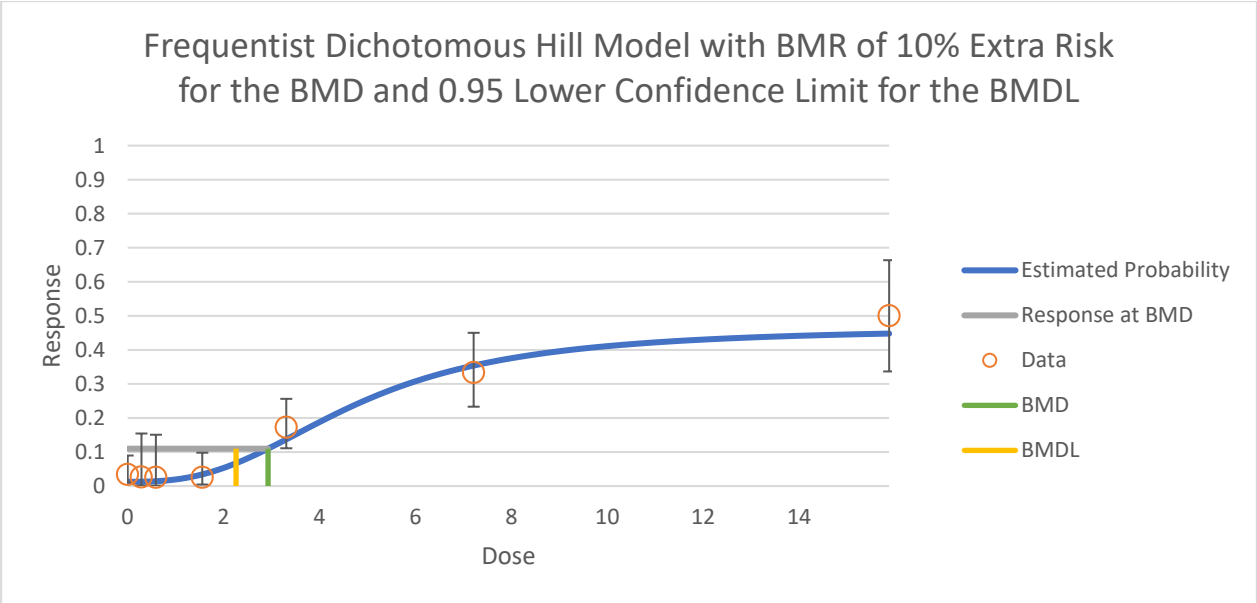
a	-4.173671276
b	2.680470372

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026931831	3.177956049	4	118	0.4674654
0.288	0.027179364	1.032815821	1	38	-0.032738
0.59	0.028618796	1.116133039	1	39	-0.111533
1.557	0.048659005	3.795402426	2	78	-0.944854
3.308	0.151576209	17.58284019	20	116	0.6258272
7.214	0.368313633	28.72846338	26	78	-0.640488
15.877	0.462273207	17.56638185	19	38	0.4664569

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.5065414	4	2.29853253	3	0.5128021
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Dichotomous Hill Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Gamma Restricted Option Set #1

User Input

Info	
Model	frequentist Gamma v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.841249418
BMDL	1.996309408
BMDU	3.862602198
AIC	342.8320964
P-value	0.250243569
D.O.F.	4
Chi^2	5.382597968

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025340723
a	1.266036419

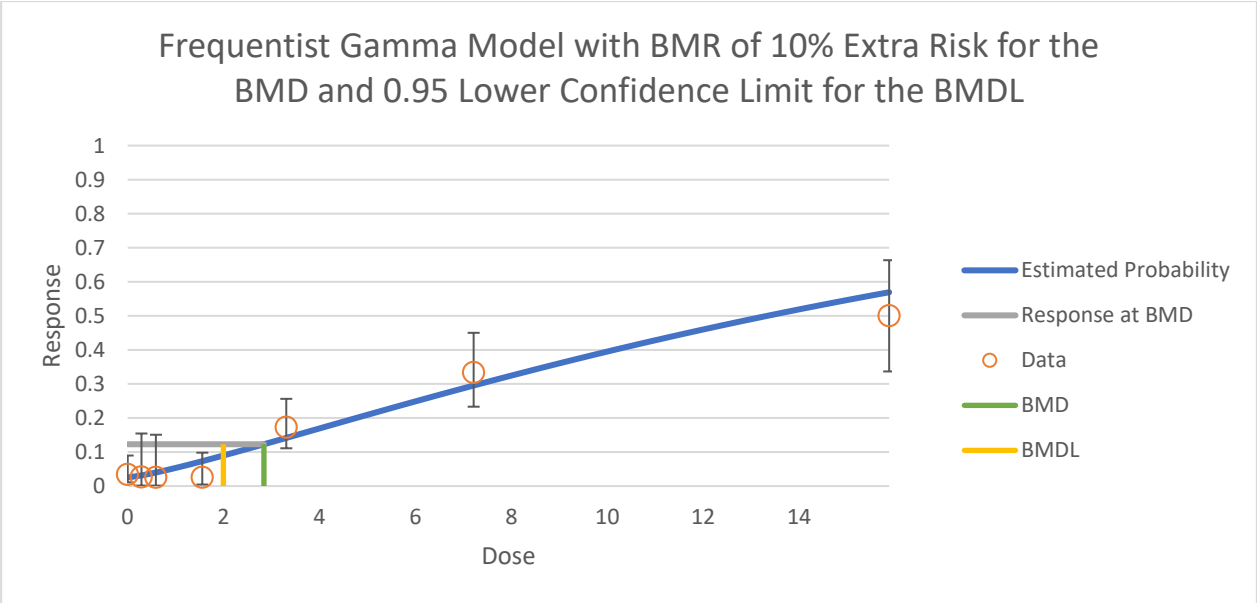
b	0.06914903

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025340723	2.990205322	4	118	0.5915019
0.288	0.031262822	1.187987232	1	38	-0.175234
0.59	0.039853432	1.554283847	1	39	-0.453731
1.557	0.073120153	5.703371911	2	78	-1.610719
3.308	0.141452731	16.40851678	20	116	0.9568791
7.214	0.295290251	23.0326396	26	78	0.7365349
15.877	0.569270404	21.63227537	19	38	-0.862339

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.4160482	3	6.11754616	4	0.1905401
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Gamma Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Log-Logistic Restricted Option Set #1

User Input

Info	
Model	frequentist Log-Logistic v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.825752978
BMDL	1.995725083
BMDU	3.789499582
AIC	341.8764519
P-value	0.342049645
D.O.F.	4
Chi^2	4.504200966

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025226573
a	-3.637879998

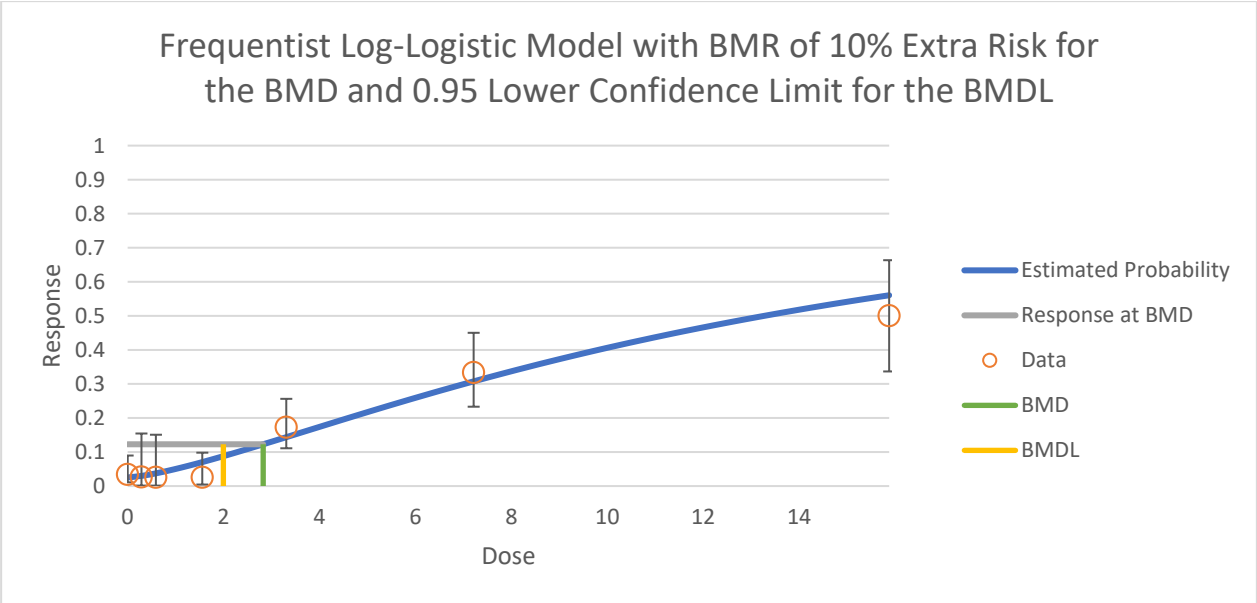
b	1.386879354

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025226573	2.976735581	4	118	0.6007114
0.288	0.029768152	1.131189784	1	38	-0.125226
0.59	0.037408893	1.458946837	1	39	-0.387277
1.557	0.070418153	5.492615964	2	78	-1.545672
3.308	0.14362057	16.65998614	20	116	0.8842556
7.214	0.307511701	23.98591268	26	78	0.49419
15.877	0.560384939	21.29462768	19	38	-0.749965

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.938226	3	5.16190163	4	0.2710851
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Logistic Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 6 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.486620186
BMDL	1.905920081
BMDU	3.638771993
AIC	343.8772904
P-value	0.201235611
D.O.F.	4
Chi^2	5.972179109
Slope Factor	0.052468097

Model Parameters	
# of Parameters	7
Variable	Estimate
g	0.023007039

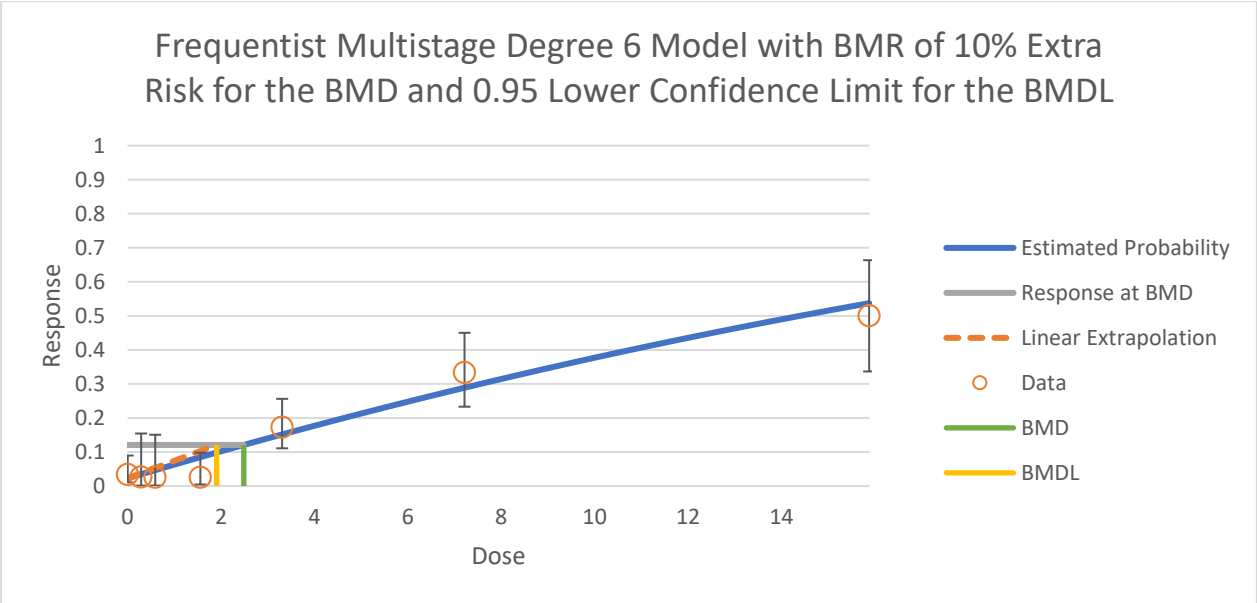
b1	0.041503508
b2	0.000348852
b3	Bounded
b4	Bounded
b5	Bounded
b6	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023007039	2.714830612	4	118	0.7891204
0.288	0.034643463	1.316451584	1	38	-0.280712
0.59	0.046755964	1.823482599	1	39	-0.624599
1.557	0.084918822	6.623668095	2	78	-1.878052
3.308	0.151586275	17.58400788	20	116	0.6255078
7.214	0.288825206	22.52836606	26	78	0.8673231
15.877	0.537063511	20.40841342	19	38	-0.45821

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 6 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 5 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.486684064
BMDL	1.905931406
BMDU	3.638766434
AIC	343.8772904
P-value	0.201221767
D.O.F.	4
Chi^2	5.972362782
Slope Factor	0.052467785

Model Parameters	
# of Parameters	6
Variable	Estimate
g	0.023005714

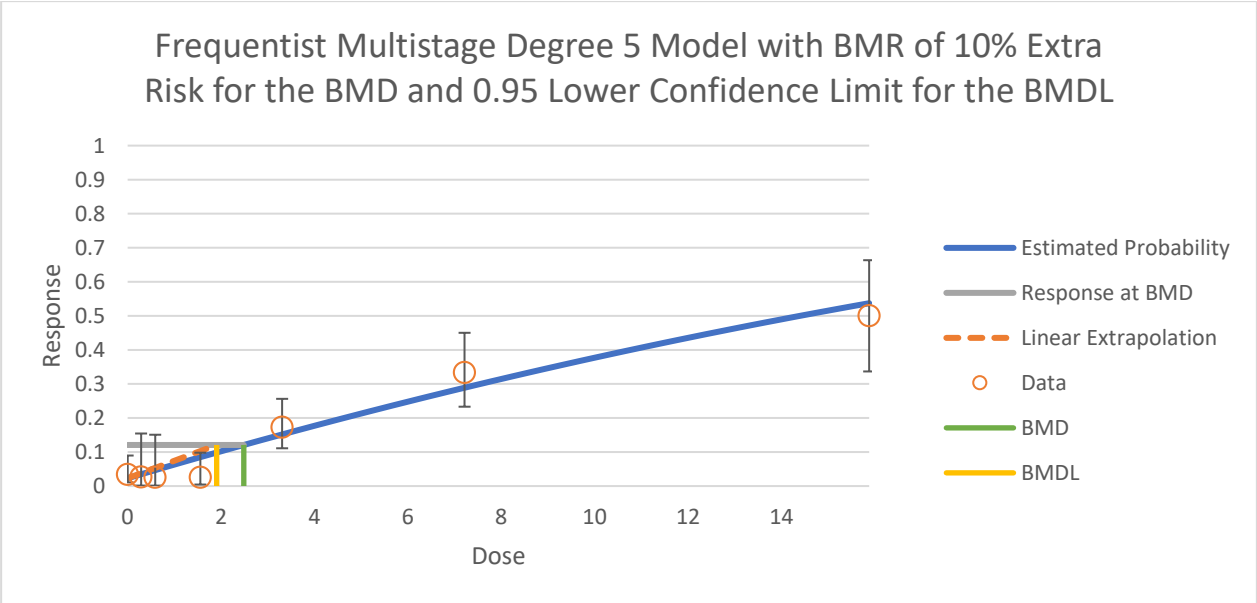
b1	0.04150191
b2	0.000349048
b3	Bounded
b4	Bounded
b5	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023005714	2.714674275	4	118	0.7892386
0.288	0.034641725	1.316385551	1	38	-0.28066
0.59	0.046753838	1.823399667	1	39	-0.62455
1.557	0.084915738	6.623427572	2	78	-1.877985
3.308	0.151582456	17.58356491	20	116	0.625629
7.214	0.288823285	22.52821624	26	78	0.8673622
15.877	0.537073972	20.40881092	19	38	-0.45834

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274014	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 5 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 4 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.486596527
BMDL	1.905923074
BMDU	3.638738218
AIC	343.8772904
P-value	0.201231563
D.O.F.	4
Chi^2	5.97223281
Slope Factor	0.052468015

Model Parameters	
# of Parameters	5
Variable	Estimate
g	0.023005909

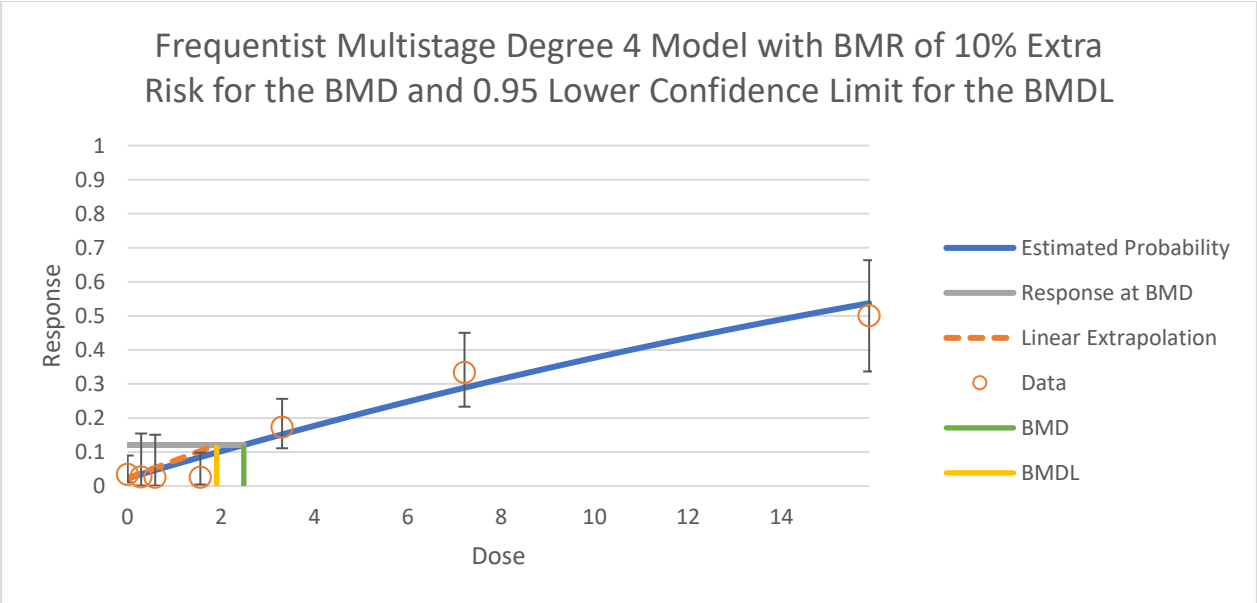
b1	0.041504008
b2	0.000348817
b3	Bounded
b4	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023005909	2.714697291	4	118	0.7892212
0.288	0.034642483	1.316414337	1	38	-0.280683
0.59	0.046755131	1.823450117	1	39	-0.62458
1.557	0.084918397	6.623634991	2	78	-1.878043
3.308	0.151586368	17.58401867	20	116	0.6255049
7.214	0.288825636	22.5283996	26	78	0.8673143
15.877	0.53706251	20.40837539	19	38	-0.458198

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.1627401	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 4 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 3 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.486614508
BMDL	1.905949622
BMDU	3.638763895
AIC	343.8772904
P-value	0.201236119
D.O.F.	4
Chi^2	5.97217237
Slope Factor	0.052467284

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.02300703

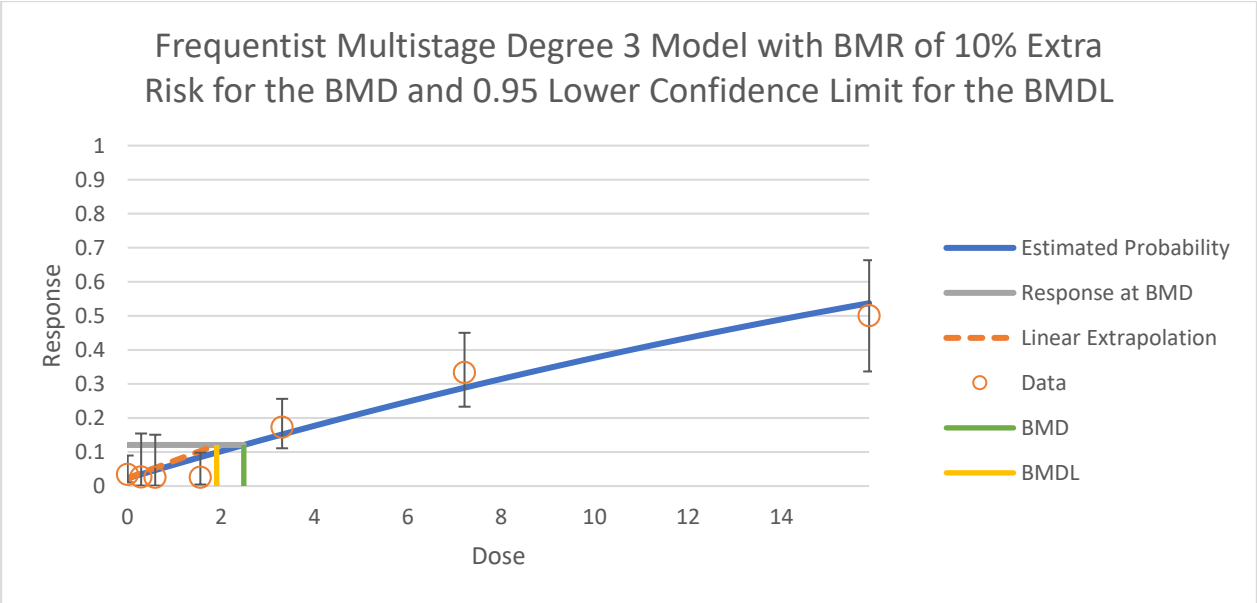
b1	0.041503652
b2	0.000348833
b3	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.02300703	2.714829553	4	118	0.7891212
0.288	0.034643492	1.316452715	1	38	-0.280713
0.59	0.04675603	1.823485177	1	39	-0.624601
1.557	0.084918976	6.623680146	2	78	-1.878055
3.308	0.151586493	17.58403316	20	116	0.6255009
7.214	0.288825224	22.52836747	26	78	0.8673227
15.877	0.537062309	20.40836773	19	38	-0.458195

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 3 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 2 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.486620186
BMDL	1.905940218
BMDU	3.638772204
AIC	343.8772904
P-value	0.201235814
D.O.F.	4
Chi^2	5.97217641
Slope Factor	0.052467543

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.023007074

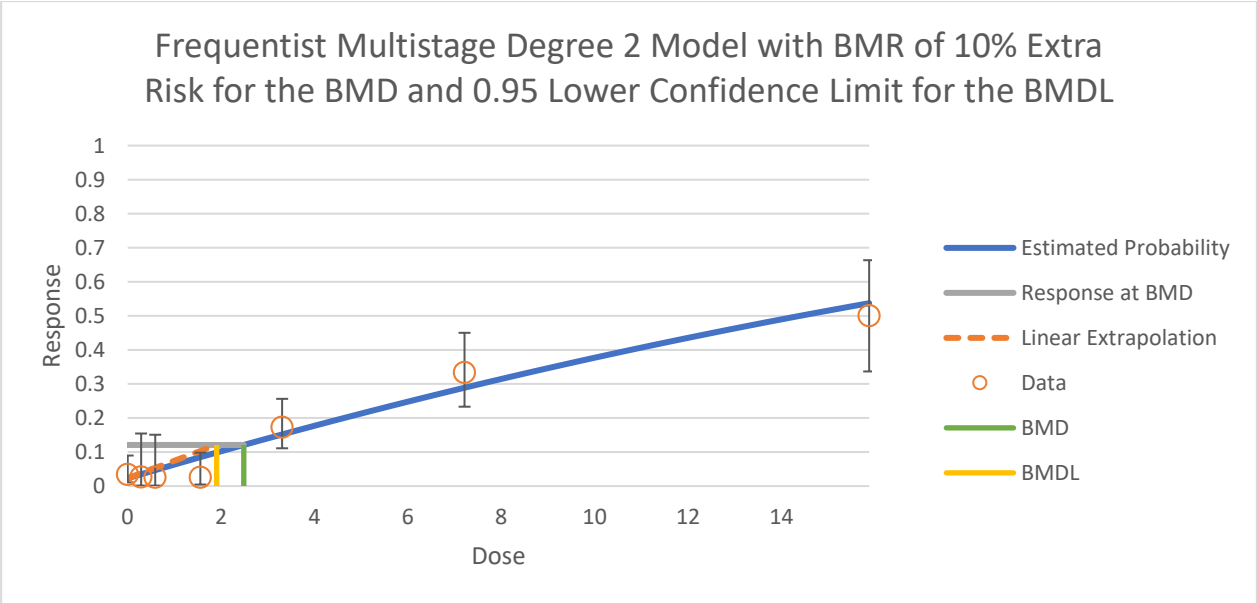
b1	0.041503509
b2	0.000348852

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023007074	2.714834783	4	118	0.7891173
0.288	0.034643498	1.316452921	1	38	-0.280713
0.59	0.046755999	1.823483964	1	39	-0.6246
1.557	0.084918856	6.623670775	2	78	-1.878053
3.308	0.151586308	17.58401173	20	116	0.6255068
7.214	0.288825236	22.52836841	26	78	0.8673225
15.877	0.537063533	20.40841427	19	38	-0.458211

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 2 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #1

User Input

Info	
Model	frequentist Multistage degree 1 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.363516583
BMDL	1.899269331
BMDU	3.025504832
AIC	341.9596887
P-value	0.312328616
D.O.F.	5
Chi^2	5.937696467
Slope Factor	0.052651827

Model Parameters	
# of Parameters	2
Variable	Estimate
g	0.022370269

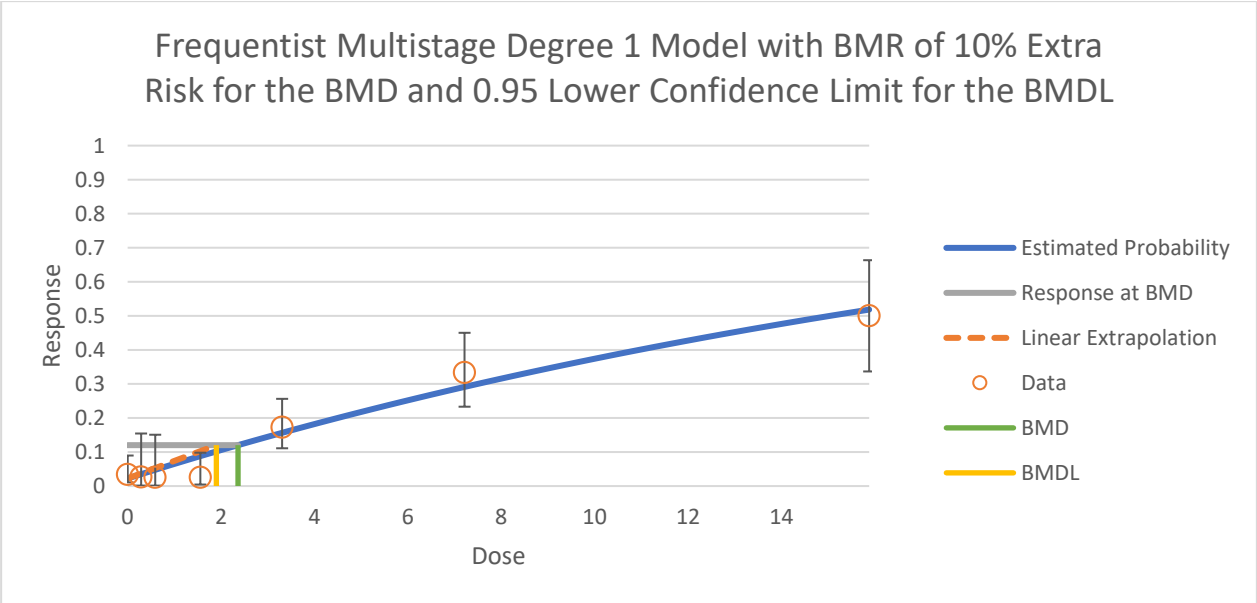
b1	0.04457786

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.022370269	2.639691715	4	118	0.8467857
0.288	0.034841268	1.323968196	1	38	-0.286592
0.59	0.04774766	1.862158738	1	39	-0.647445
1.557	0.087924044	6.858075436	2	78	-1.94244
3.308	0.156409289	18.14347747	20	116	0.4745414
7.214	0.291219197	22.71509738	26	78	0.8186707
15.877	0.518277458	19.6945434	19	38	-0.22549

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9798444	2	7.24513846	5	0.2030381
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 1 Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Weibull Restricted Option Set #1

User Input

Info	
Model	frequentist Weibull v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.76894297
BMDL	1.968361922
BMDU	3.806444731
AIC	343.1162362
P-value	0.234428638
D.O.F.	4
Chi^2	5.560892121

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.024782327
a	1.163539658

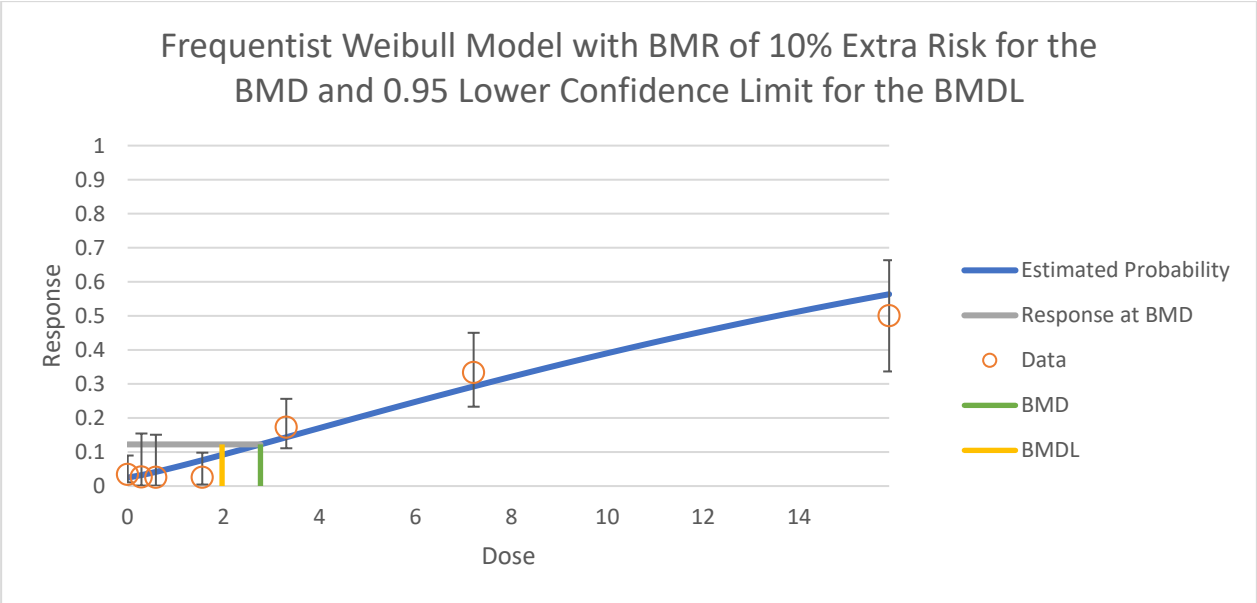
b	0.032212764

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.024782327	2.924314567	4	118	0.6369751
0.288	0.032135399	1.221145167	1	38	-0.203417
0.59	0.041637238	1.623852284	1	39	-0.500085
1.557	0.0759751	5.926057762	2	78	-1.677768
3.308	0.143312493	16.6242492	20	116	0.8945161
7.214	0.292577921	22.82107782	26	78	0.7911749
15.877	0.56348596	21.41246648	19	38	-0.789094

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.5581181	3	6.40168598	4	0.1710913
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Weibull Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Logistic Unrestricted Option Set #1

User Input

Info	
Model	frequentist Logistic v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

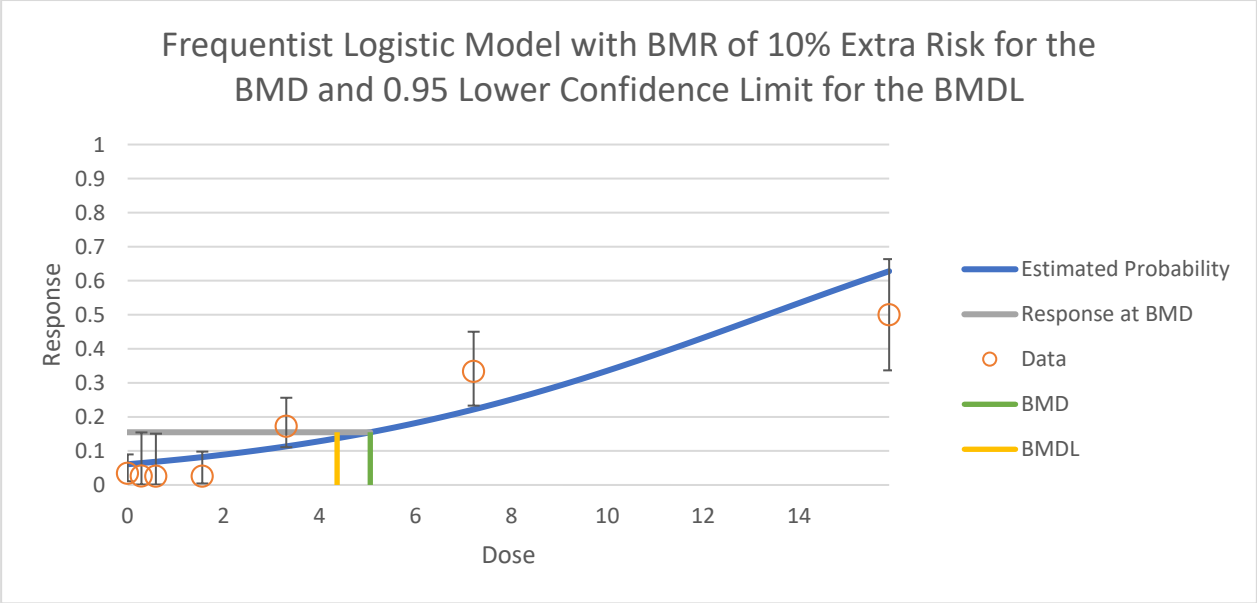
Model Results

Benchmark Dose	
BMD	5.058685936
BMDL	4.367083692
BMDU	5.914337424
AIC	354.6898843
P-value	0.001829067
D.O.F.	5
Chi^2	19.11567129

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-2.735664173
b	0.205253099

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.060901408	7.186366168	4	118	-1.22655
0.288	0.064371273	2.446108365	1	38	-0.955897
0.59	0.068206914	2.660069638	1	39	-1.054436
1.557	0.081954322	6.392437152	2	78	-1.813177
3.308	0.113378447	13.15189983	20	116	2.0054263
7.214	0.221841284	17.30362015	26	78	2.3699322
15.877	0.62788154	23.85949852	19	38	-1.630873

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-175.3449421	2	19.975334	5	0.0012631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Log-Probit Unrestricted Option Set #1

User Input

Info	
Model	frequentist Log-Probit v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.86660661
BMDL	2.076722859
BMDU	3.751295643
AIC	340.5993346
P-value	0.489725364
D.O.F.	4
Chi^2	3.422722793

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026517297
a	-2.13287123

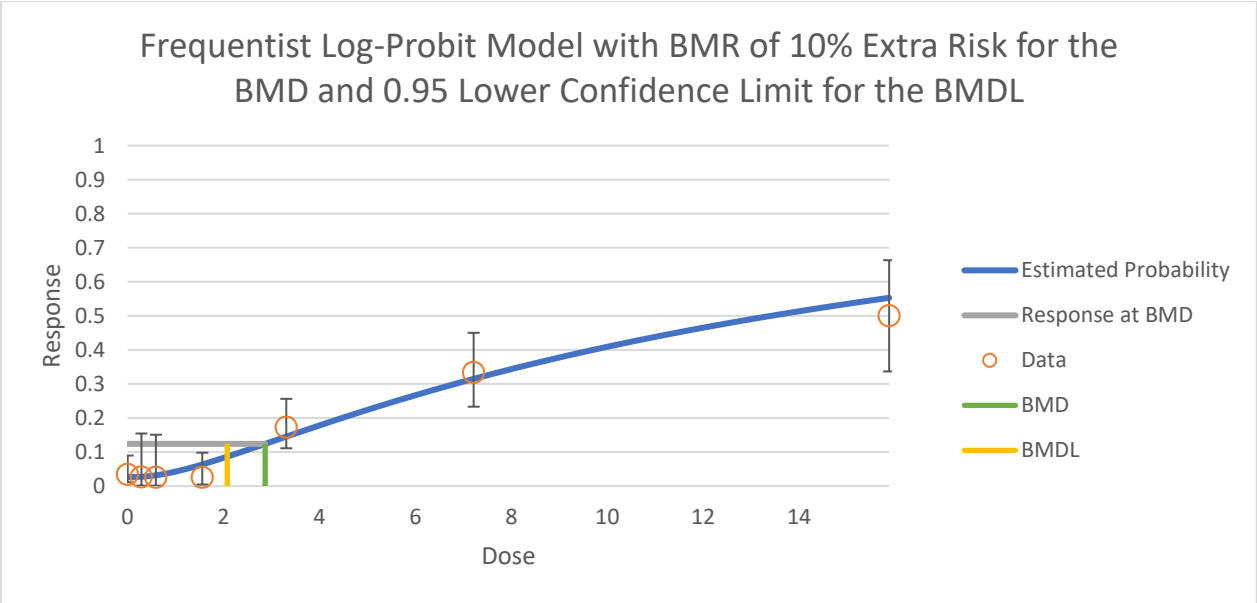
b	0.808371712

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026517297	3.129040989	4	118	0.4990315
0.288	0.027342086	1.038999277	1	38	-0.038794
0.59	0.031621006	1.233219217	1	39	-0.213413
1.557	0.063463485	4.95015185	2	78	-1.370165
3.308	0.145137671	16.83596989	20	116	0.8340142
7.214	0.314812971	24.55541177	26	78	0.352181
15.877	0.552869854	21.00905447	19	38	-0.655498

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.2996673	3	3.88478433	4	0.4218231
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Probit Model with BMR of 10% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Probit Unrestricted Option Set #1

User Input

Info	
Model	frequentist Probit v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.1
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

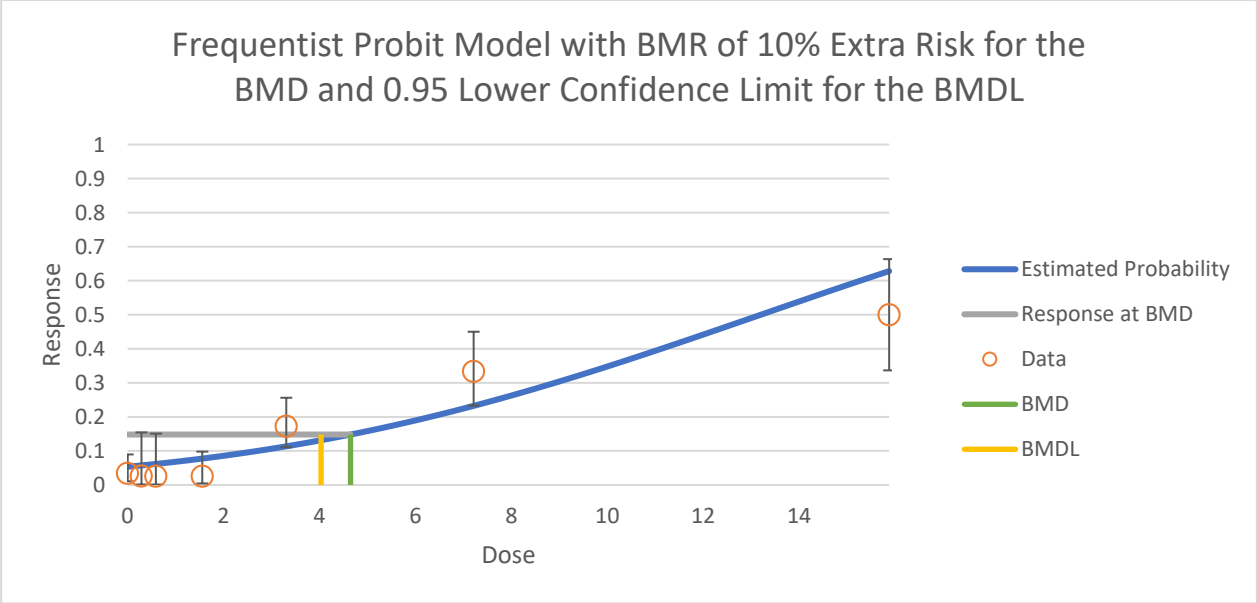
Model Results

Benchmark Dose	
BMD	4.647259053
BMDL	4.032688105
BMDU	5.426292466
AIC	351.7787603
P-value	0.00551691
D.O.F.	5
Chi^2	16.51532838

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-1.612083166
b	0.122130719

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.053471922	6.309686765	4	118	-0.94511
0.288	0.057408173	2.181510574	1	38	-0.823943
0.59	0.061777003	2.409303112	1	39	-0.937358
1.557	0.07752392	6.046865756	2	78	-1.713468
3.308	0.113509256	13.16707368	20	116	1.999977
7.214	0.232379754	18.12562085	26	78	2.111041
15.877	0.628160859	23.87011266	19	38	-1.634686

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-173.8893802	2	17.0642101	5	0.0043796
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Dichotomous Hill Restricted Option Set #2

User Input

Info	
Model	frequentist Dichotomous Hill v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	2.154583008
BMDL	1.371798319
BMDU	3.084334791
AIC	341.0130828
P-value	0.543012368
D.O.F.	3
Chi^2	2.144251591

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.026931831
v	0.464956094

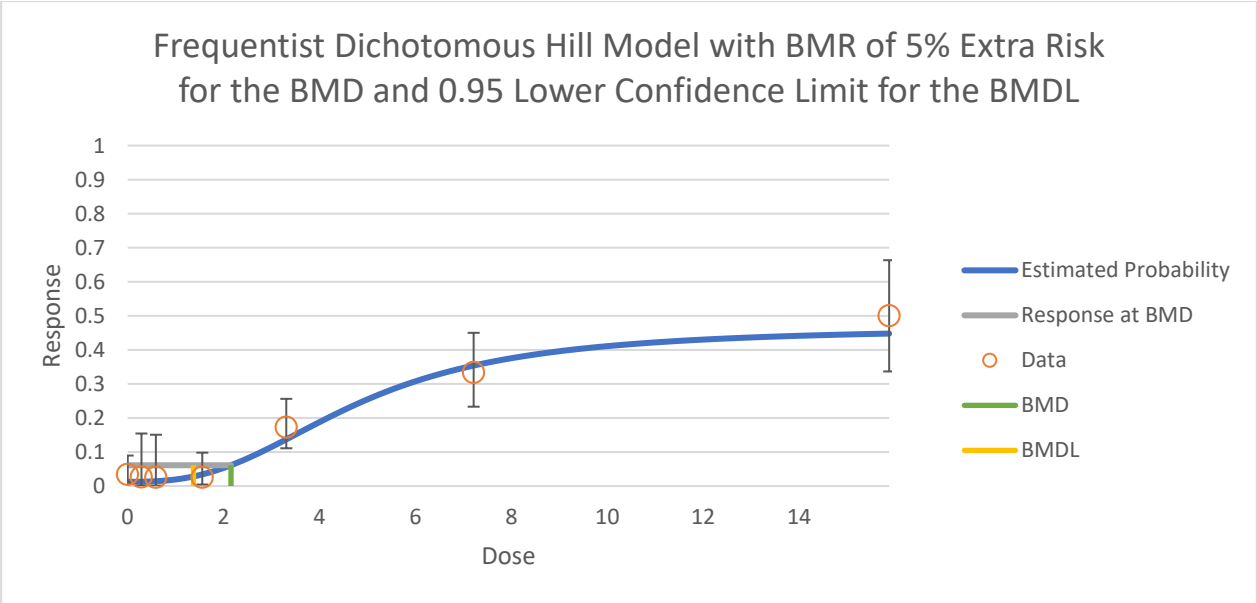
a	-4.173671276
b	2.680470372

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026931831	3.177956049	4	118	0.4674654
0.288	0.027179364	1.032815821	1	38	-0.032738
0.59	0.028618796	1.116133039	1	39	-0.111533
1.557	0.048659005	3.795402426	2	78	-0.944854
3.308	0.151576209	17.58284019	20	116	0.6258272
7.214	0.368313633	28.72846338	26	78	-0.640488
15.877	0.462273207	17.56638185	19	38	0.4664569

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.5065414	4	2.29853253	3	0.5128021
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Dichotomous Hill Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Gamma Restricted Option Set #2

User Input

Info	
Model	frequentist Gamma v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.582715775
BMDL	0.971771591
BMDU	2.442031184
AIC	342.8320964
P-value	0.250243569
D.O.F.	4
Chi^2	5.382597968

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025340723
a	1.266036419

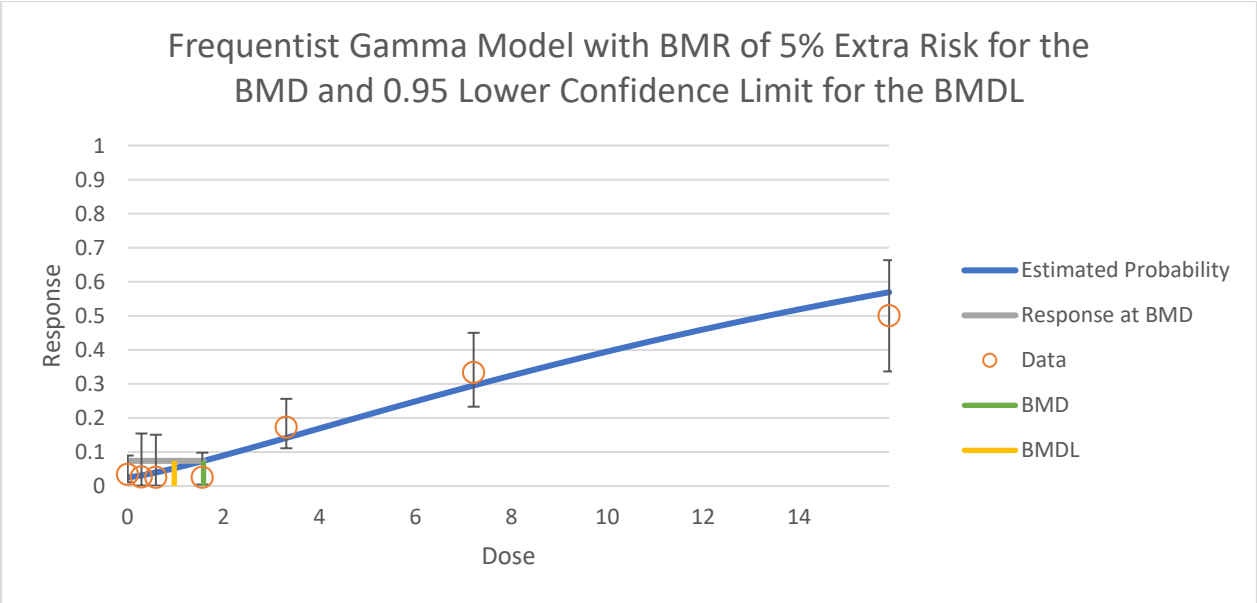
b	0.06914903

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025340723	2.990205322	4	118	0.5915019
0.288	0.031262822	1.187987232	1	38	-0.175234
0.59	0.039853432	1.554283847	1	39	-0.453731
1.557	0.073120153	5.703371911	2	78	-1.610719
3.308	0.141452731	16.40851678	20	116	0.9568791
7.214	0.295290251	23.0326396	26	78	0.7365349
15.877	0.569270404	21.63227537	19	38	-0.862339

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.4160482	3	6.11754616	4	0.1905401
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Gamma Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Log-Logistic Restricted Option Set #2

User Input

Info	
Model	frequentist Log-Logistic v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.648722866
BMDL	0.996590726
BMDU	2.442779798
AIC	341.8764519
P-value	0.342049645
D.O.F.	4
Chi^2	4.504200966

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025226573
a	-3.637879998

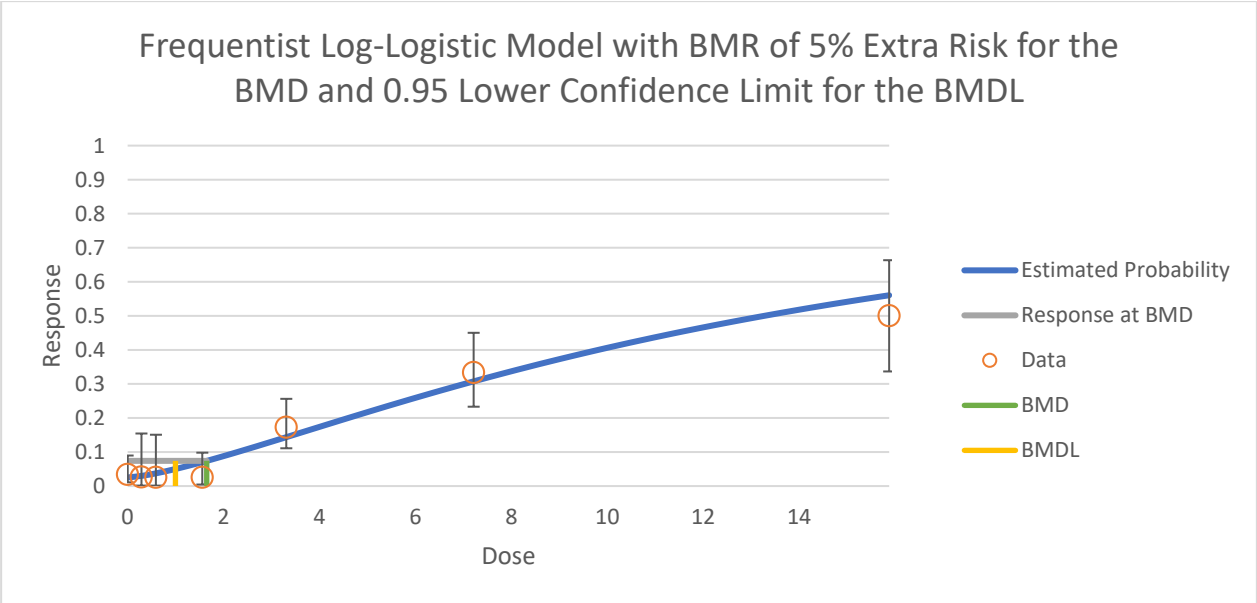
b	1.386879354

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025226573	2.976735581	4	118	0.6007114
0.288	0.029768152	1.131189784	1	38	-0.125226
0.59	0.037408893	1.458946837	1	39	-0.387277
1.557	0.070418153	5.492615964	2	78	-1.545672
3.308	0.14362057	16.65998614	20	116	0.8842556
7.214	0.307511701	23.98591268	26	78	0.49419
15.877	0.560384939	21.29462768	19	38	-0.749965

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.938226	3	5.16190163	4	0.2710851
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Logistic Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 6 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.223300145
BMDL	0.927602958
BMDU	1.981406541
AIC	343.8772904
P-value	0.201235611
D.O.F.	4
Chi^2	5.972179109
Slope Factor	0.053902372

Model Parameters	
# of Parameters	7
Variable	Estimate
g	0.023007039

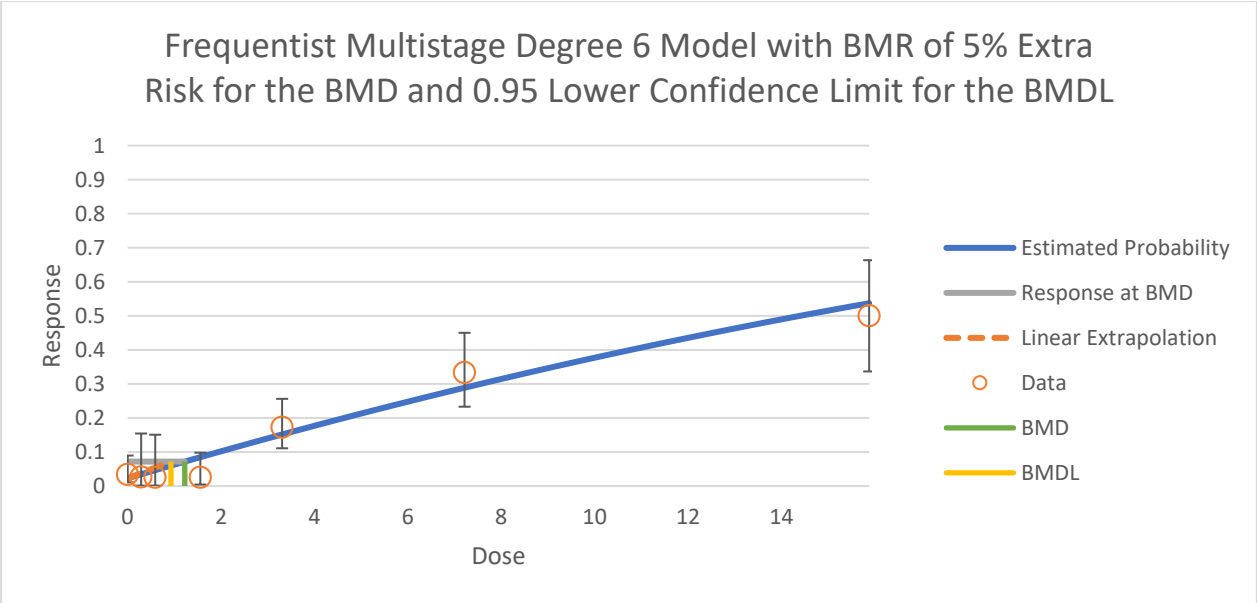
b1	0.041503508
b2	0.000348852
b3	Bounded
b4	Bounded
b5	Bounded
b6	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023007039	2.714830612	4	118	0.7891204
0.288	0.034643463	1.316451584	1	38	-0.280712
0.59	0.046755964	1.823482599	1	39	-0.624599
1.557	0.084918822	6.623668095	2	78	-1.878052
3.308	0.151586275	17.58400788	20	116	0.6255078
7.214	0.288825206	22.52836606	26	78	0.8673231
15.877	0.537063511	20.40841342	19	38	-0.45821

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 6 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 5 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.223339418
BMDL	0.927610407
BMDU	1.981422209
AIC	343.8772904
P-value	0.201221767
D.O.F.	4
Chi^2	5.972362782
Slope Factor	0.053901939

Model Parameters	
# of Parameters	6
Variable	Estimate
g	0.023005714

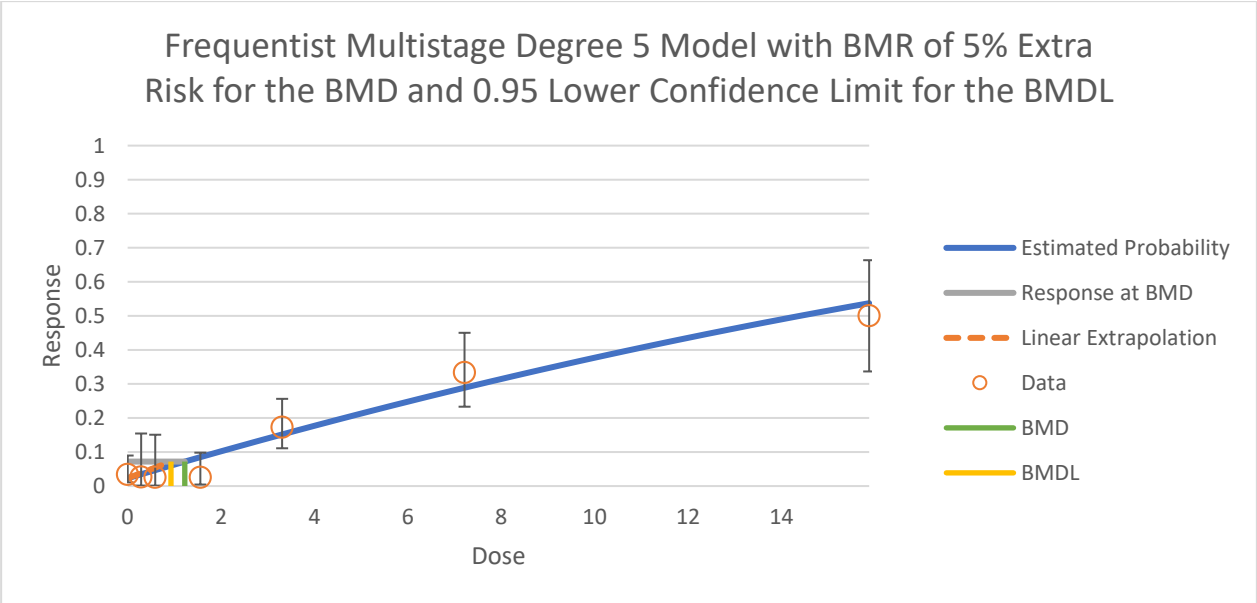
b1	0.04150191
b2	0.000349048
b3	Bounded
b4	Bounded
b5	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023005714	2.714674275	4	118	0.7892386
0.288	0.034641725	1.316385551	1	38	-0.28066
0.59	0.046753838	1.823399667	1	39	-0.62455
1.557	0.084915738	6.623427572	2	78	-1.877985
3.308	0.151582456	17.58356491	20	116	0.625629
7.214	0.288823285	22.52821624	26	78	0.8673622
15.877	0.537073972	20.40881092	19	38	-0.45834

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274014	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 5 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 4 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.223286896
BMDL	0.927606949
BMDU	1.981381089
AIC	343.8772904
P-value	0.201231563
D.O.F.	4
Chi^2	5.97223281
Slope Factor	0.05390214

Model Parameters	
# of Parameters	5
Variable	Estimate
g	0.023005909

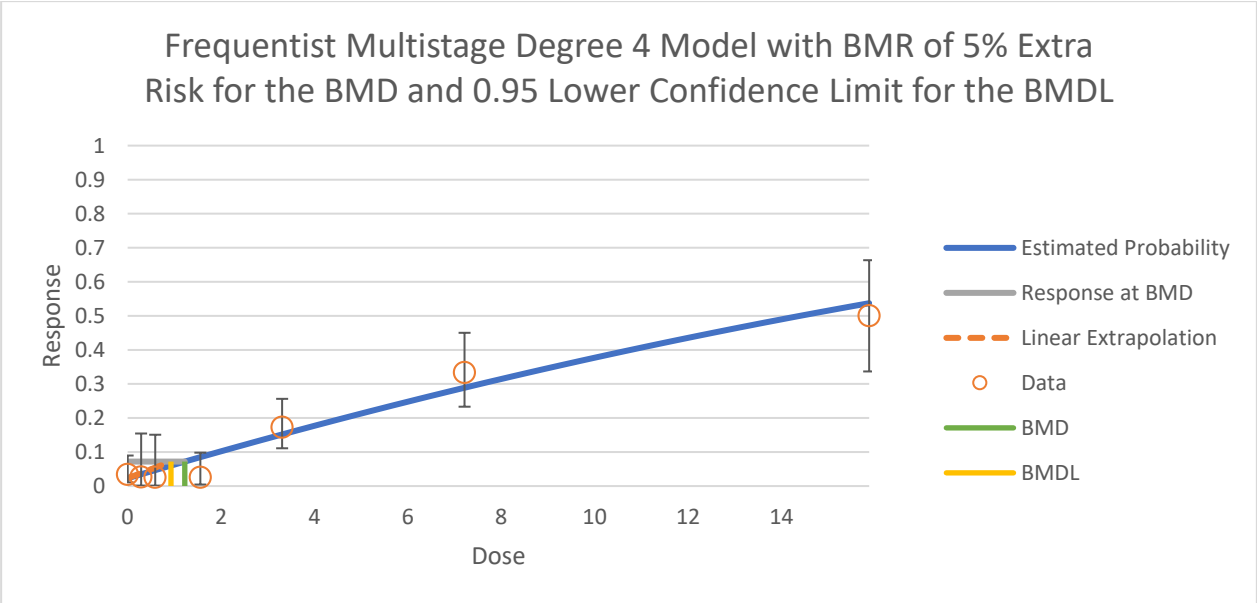
b1	0.041504008
b2	0.000348817
b3	Bounded
b4	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023005909	2.714697291	4	118	0.7892212
0.288	0.034642483	1.316414337	1	38	-0.280683
0.59	0.046755131	1.823450117	1	39	-0.62458
1.557	0.084918397	6.623634991	2	78	-1.878043
3.308	0.151586368	17.58401867	20	116	0.6255049
7.214	0.288825636	22.5283996	26	78	0.8673143
15.877	0.53706251	20.40837539	19	38	-0.458198

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.1627401	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 4 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 3 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.223296832
BMDL	0.927607994
BMDU	1.981428757
AIC	343.8772904
P-value	0.201236119
D.O.F.	4
Chi^2	5.97217237
Slope Factor	0.05390208

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.02300703

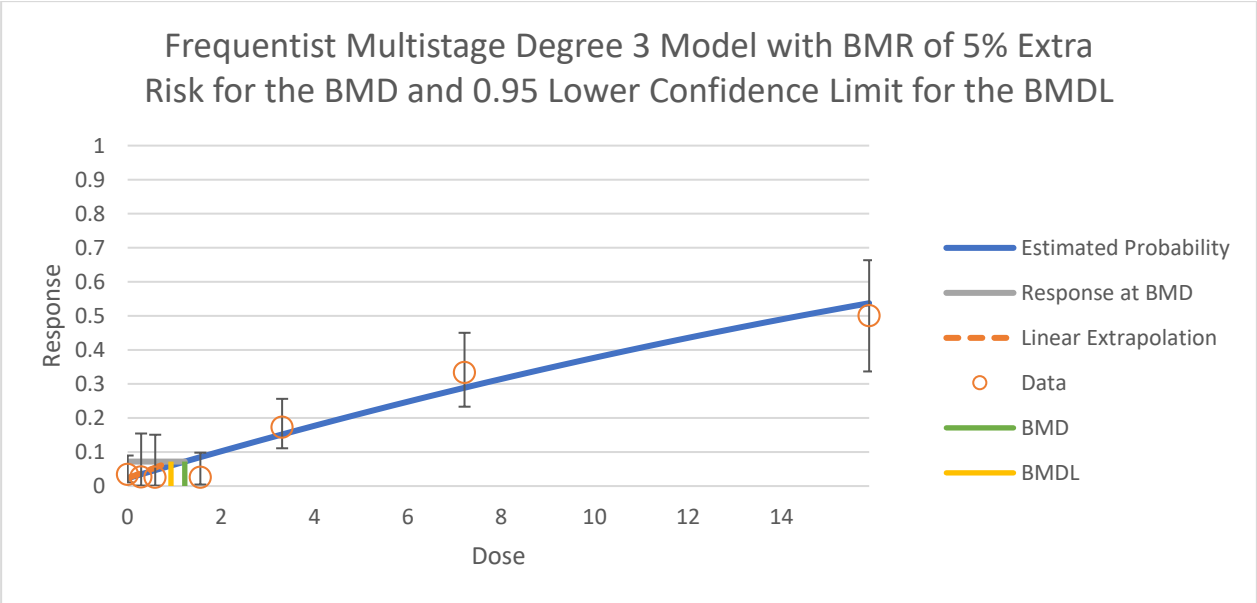
b1	0.041503652
b2	0.000348833
b3	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.02300703	2.714829553	4	118	0.7891212
0.288	0.034643492	1.316452715	1	38	-0.280713
0.59	0.04675603	1.823485177	1	39	-0.624601
1.557	0.084918976	6.623680146	2	78	-1.878055
3.308	0.151586493	17.58403316	20	116	0.6255009
7.214	0.288825224	22.52836747	26	78	0.8673227
15.877	0.537062309	20.40836773	19	38	-0.458195

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 3 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 2 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.223300145
BMDL	0.927589222
BMDU	1.981435858
AIC	343.8772904
P-value	0.201235814
D.O.F.	4
Chi^2	5.97217641
Slope Factor	0.053903171

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.023007074

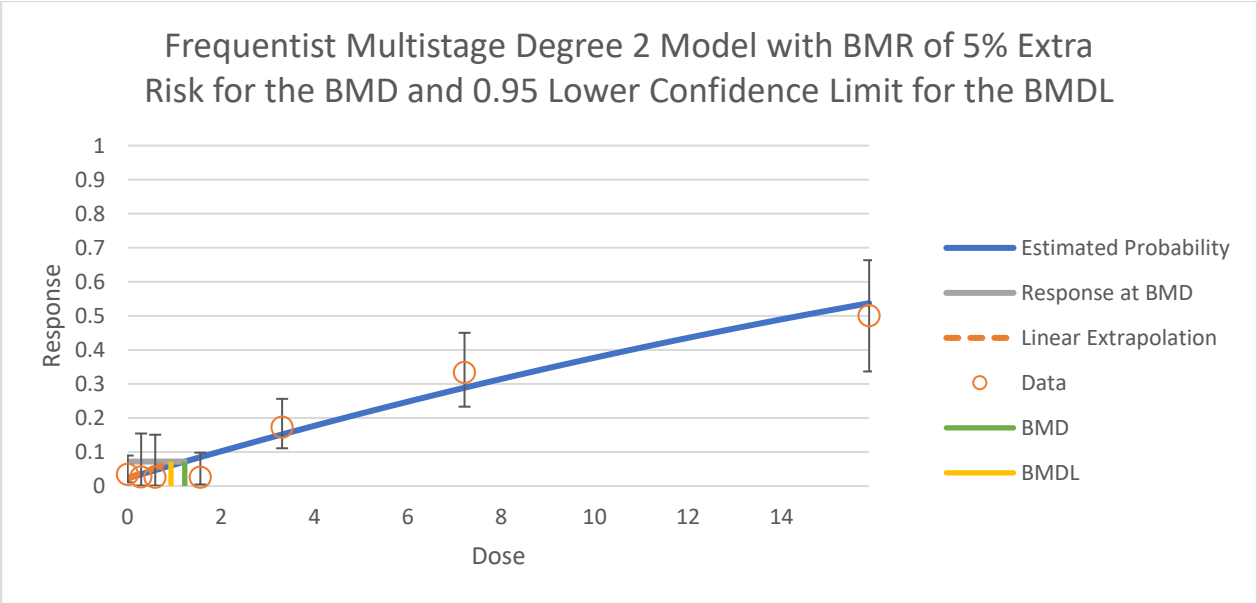
b1	0.041503509
b2	0.000348852

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023007074	2.714834783	4	118	0.7891173
0.288	0.034643498	1.316452921	1	38	-0.280713
0.59	0.046755999	1.823483964	1	39	-0.6246
1.557	0.084918856	6.623670775	2	78	-1.878053
3.308	0.151586308	17.58401173	20	116	0.6255068
7.214	0.288825236	22.52836841	26	78	0.8673225
15.877	0.537063533	20.40841427	19	38	-0.458211

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 2 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #2

User Input

Info	
Model	frequentist Multistage degree 1 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.150645138
BMDL	0.92466283
BMDU	1.472895095
AIC	341.9596887
P-value	0.312328616
D.O.F.	5
Chi^2	5.937696467
Slope Factor	0.054073764

Model Parameters	
# of Parameters	2
Variable	Estimate
g	0.022370269

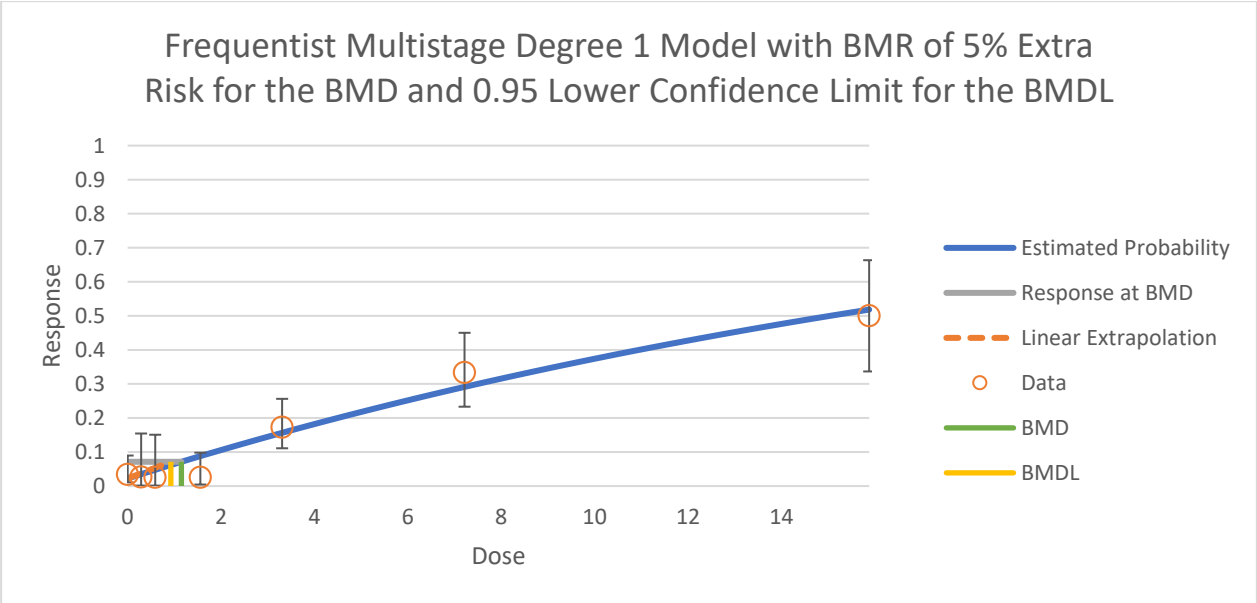
b1	0.04457786

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.022370269	2.639691715	4	118	0.8467857
0.288	0.034841268	1.323968196	1	38	-0.286592
0.59	0.04774766	1.862158738	1	39	-0.647445
1.557	0.087924044	6.858075436	2	78	-1.94244
3.308	0.156409289	18.14347747	20	116	0.4745414
7.214	0.291219197	22.71509738	26	78	0.8186707
15.877	0.518277458	19.6945434	19	38	-0.22549

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9798444	2	7.24513846	5	0.2030381
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 1 Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Weibull Restricted Option Set #2

User Input

Info	
Model	frequentist Weibull v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.491544431
BMDL	0.958414088
BMDU	2.30523634
AIC	343.1162362
P-value	0.234428638
D.O.F.	4
Chi^2	5.560892121

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.024782327
a	1.163539658

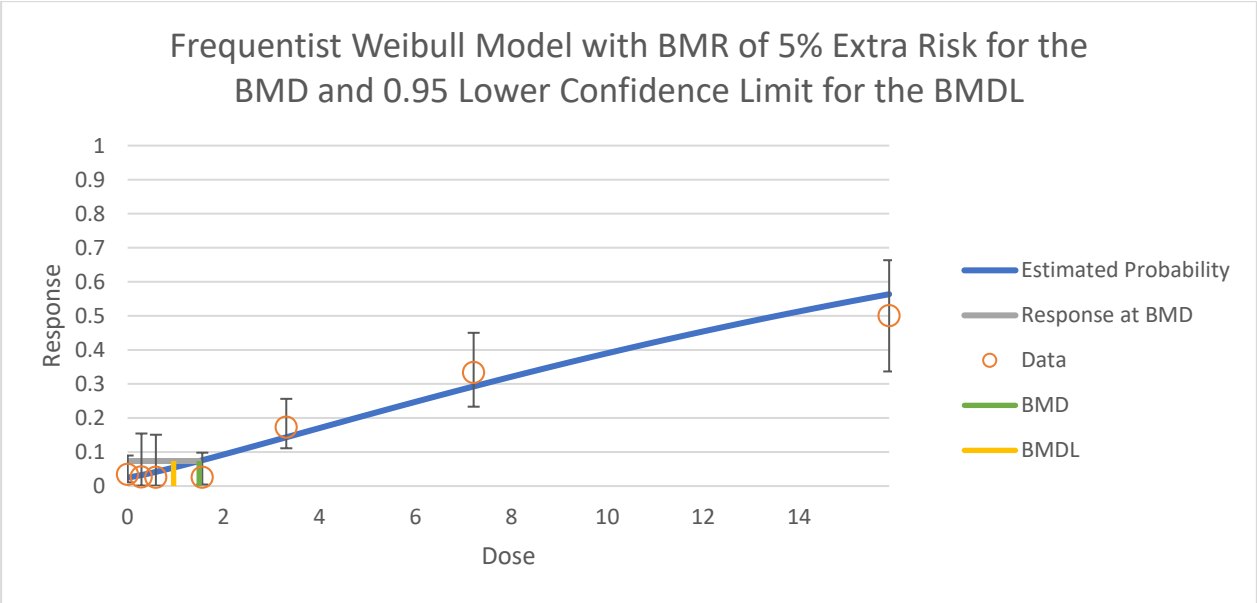
b	0.032212764

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.024782327	2.924314567	4	118	0.6369751
0.288	0.032135399	1.221145167	1	38	-0.203417
0.59	0.041637238	1.623852284	1	39	-0.500085
1.557	0.0759751	5.926057762	2	78	-1.677768
3.308	0.143312493	16.6242492	20	116	0.8945161
7.214	0.292577921	22.82107782	26	78	0.7911749
15.877	0.56348596	21.41246648	19	38	-0.789094

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.5581181	3	6.40168598	4	0.1710913
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Weibull Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Logistic Unrestricted Option Set #2

User Input

Info	
Model	frequentist Logistic v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

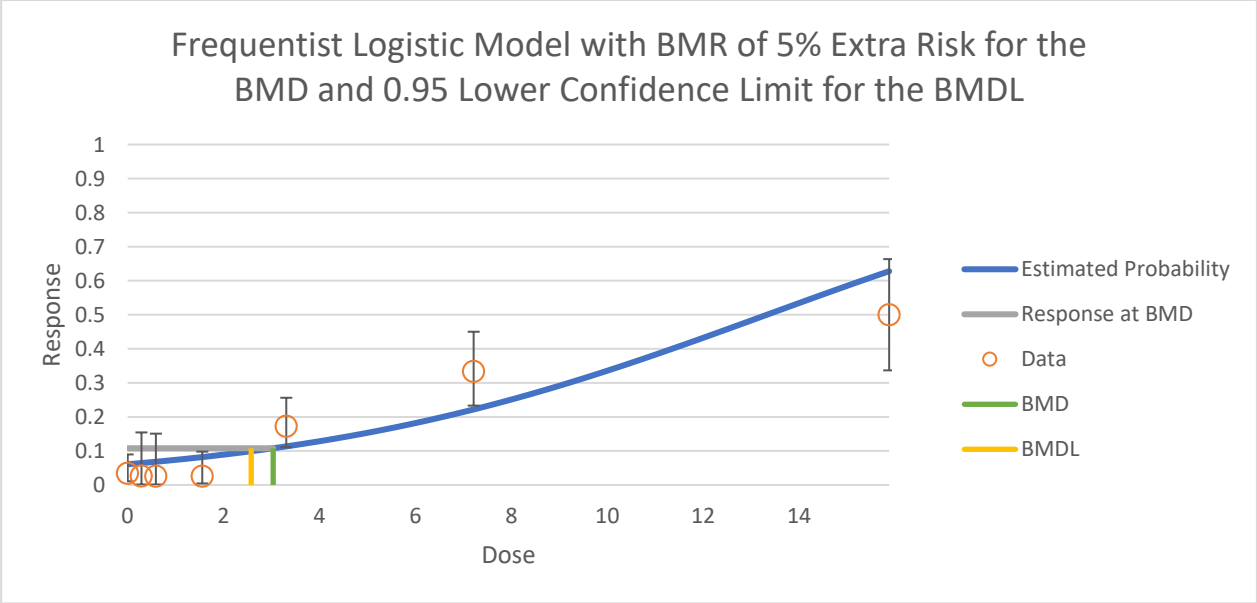
Model Results

Benchmark Dose	
BMD	3.03448346
BMDL	2.576382999
BMDU	3.586710407
AIC	354.6898843
P-value	0.001829067
D.O.F.	5
Chi^2	19.11567129

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-2.735664173
b	0.205253099

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.060901408	7.186366168	4	118	-1.22655
0.288	0.064371273	2.446108365	1	38	-0.955897
0.59	0.068206914	2.660069638	1	39	-1.054436
1.557	0.081954322	6.392437152	2	78	-1.813177
3.308	0.113378447	13.15189983	20	116	2.0054263
7.214	0.221841284	17.30362015	26	78	2.3699322
15.877	0.62788154	23.85949852	19	38	-1.630873

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-175.3449421	2	19.975334	5	0.0012631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Log-Probit Unrestricted Option Set #2

User Input

Info	
Model	frequentist Log-Probit v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.828881273
BMDL	1.168978259
BMDU	2.582599793
AIC	340.5993346
P-value	0.489725364
D.O.F.	4
Chi^2	3.422722793

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026517297
a	-2.13287123

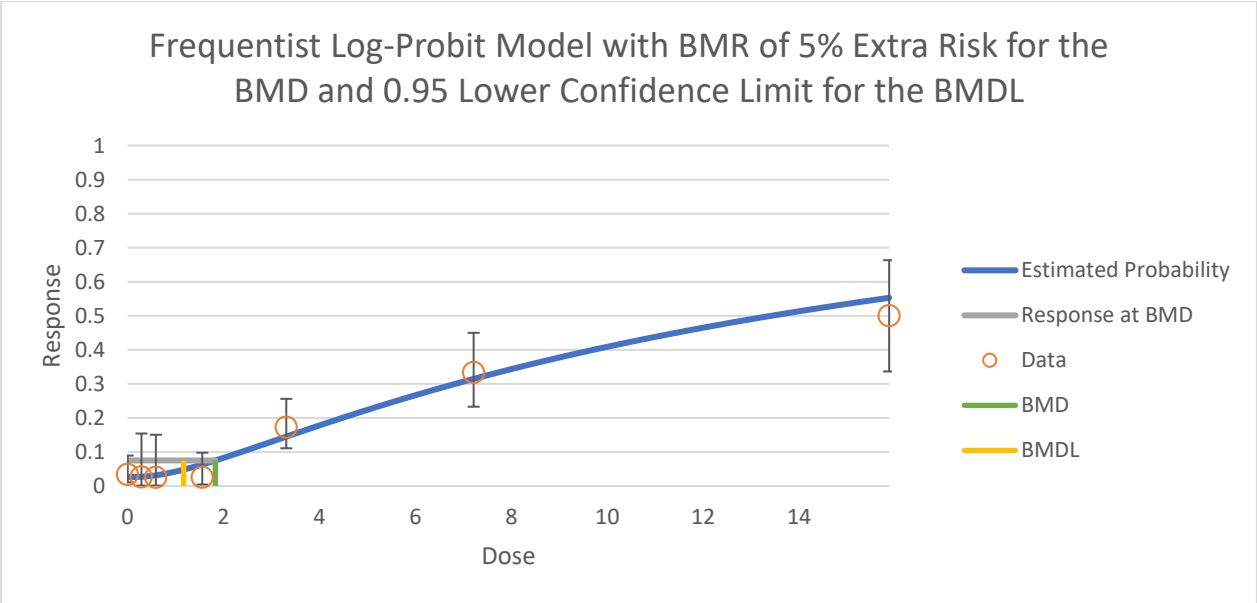
b	0.808371712

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026517297	3.129040989	4	118	0.4990315
0.288	0.027342086	1.038999277	1	38	-0.038794
0.59	0.031621006	1.233219217	1	39	-0.213413
1.557	0.063463485	4.95015185	2	78	-1.370165
3.308	0.145137671	16.83596989	20	116	0.8340142
7.214	0.314812971	24.55541177	26	78	0.352181
15.877	0.552869854	21.00905447	19	38	-0.655498

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.2996673	3	3.88478433	4	0.4218231
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Probit Model with BMR of 5% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Probit Unrestricted Option Set #2

User Input

Info	
Model	frequentist Probit v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.05
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

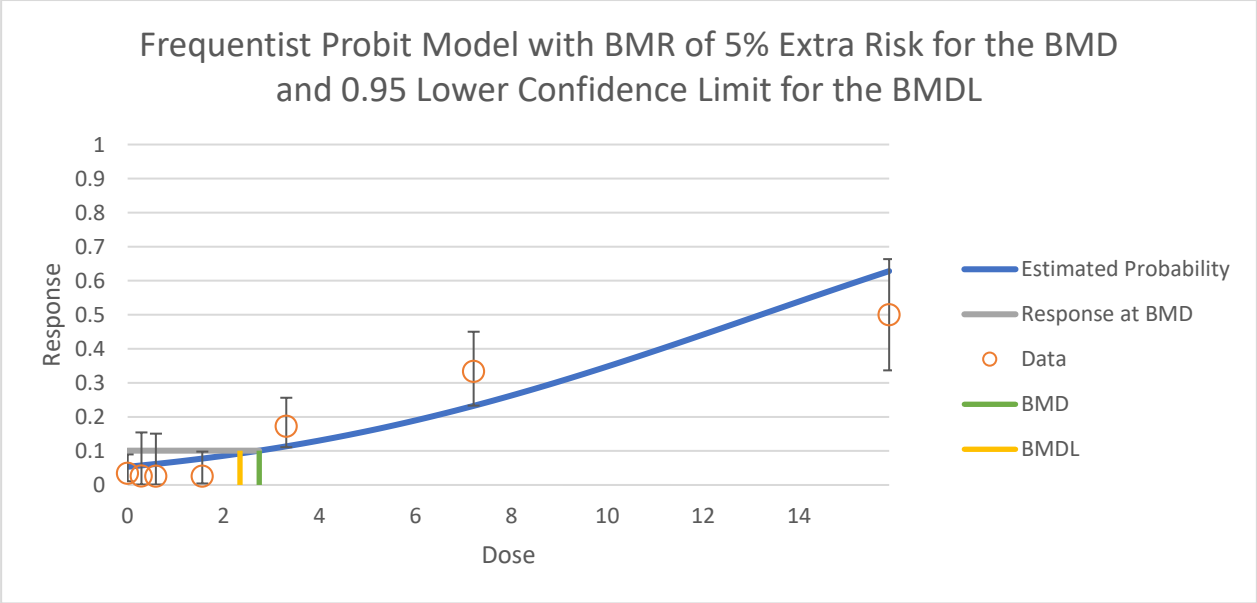
Model Results

Benchmark Dose	
BMD	2.743513824
BMDL	2.342233822
BMDU	3.230586778
AIC	351.7787603
P-value	0.00551691
D.O.F.	5
Chi^2	16.51532838

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-1.612083166
b	0.122130719

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.053471922	6.309686765	4	118	-0.94511
0.288	0.057408173	2.181510574	1	38	-0.823943
0.59	0.061777003	2.409303112	1	39	-0.937358
1.557	0.07752392	6.046865756	2	78	-1.713468
3.308	0.113509256	13.16707368	20	116	1.999977
7.214	0.232379754	18.12562085	26	78	2.111041
15.877	0.628160859	23.87011266	19	38	-1.634686

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-173.8893802	2	17.0642101	5	0.0043796
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Dichotomous Hill Restricted Option Set #3

User Input

Info	
Model	frequentist Dichotomous Hill v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	1.142059485
BMDL	0.41619005
BMDU	2.669021244
AIC	341.0130828
P-value	0.543012368
D.O.F.	3
Chi^2	2.144251591

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.026931831
v	0.464956094

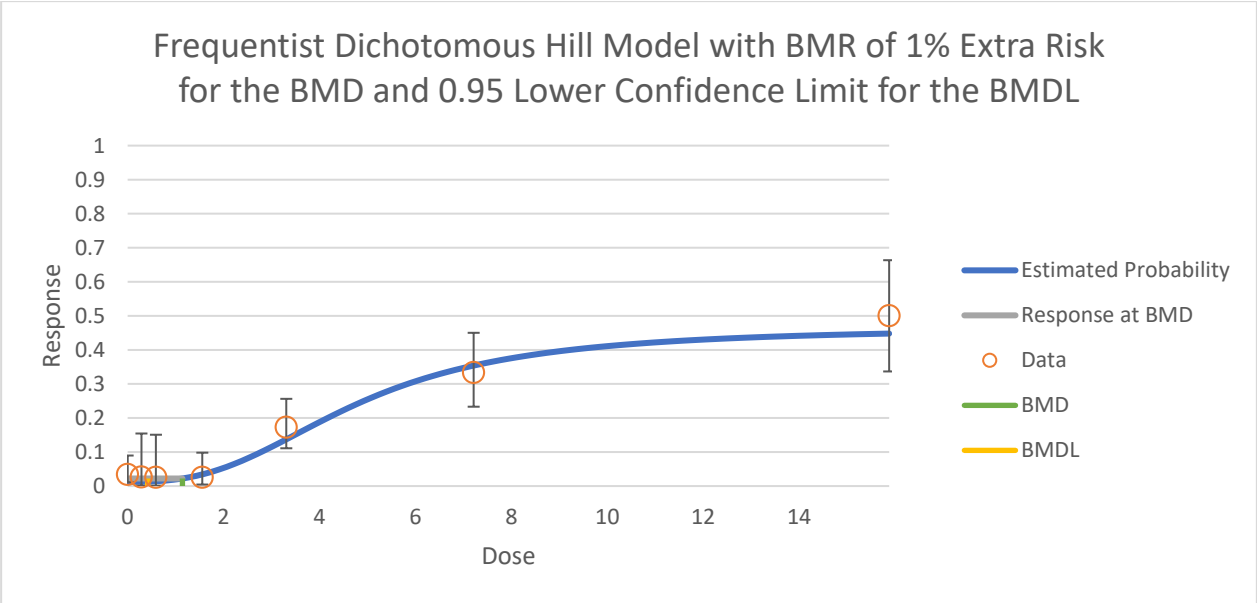
a	-4.173671276
b	2.680470372

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026931831	3.177956049	4	118	0.4674654
0.288	0.027179364	1.032815821	1	38	-0.032738
0.59	0.028618796	1.116133039	1	39	-0.111533
1.557	0.048659005	3.795402426	2	78	-0.944854
3.308	0.151576209	17.58284019	20	116	0.6258272
7.214	0.368313633	28.72846338	26	78	-0.640488
15.877	0.462273207	17.56638185	19	38	0.4664569

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-166.5065414	4	2.29853253	3	0.5128021
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Dichotomous Hill Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Gamma Restricted Option Set #3

User Input

Info	
Model	frequentist Gamma v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.42870653
BMDL	0.190429589
BMDU	0.926667851
AIC	342.8320964
P-value	0.250243569
D.O.F.	4
Chi^2	5.382597968

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025340723
a	1.266036419

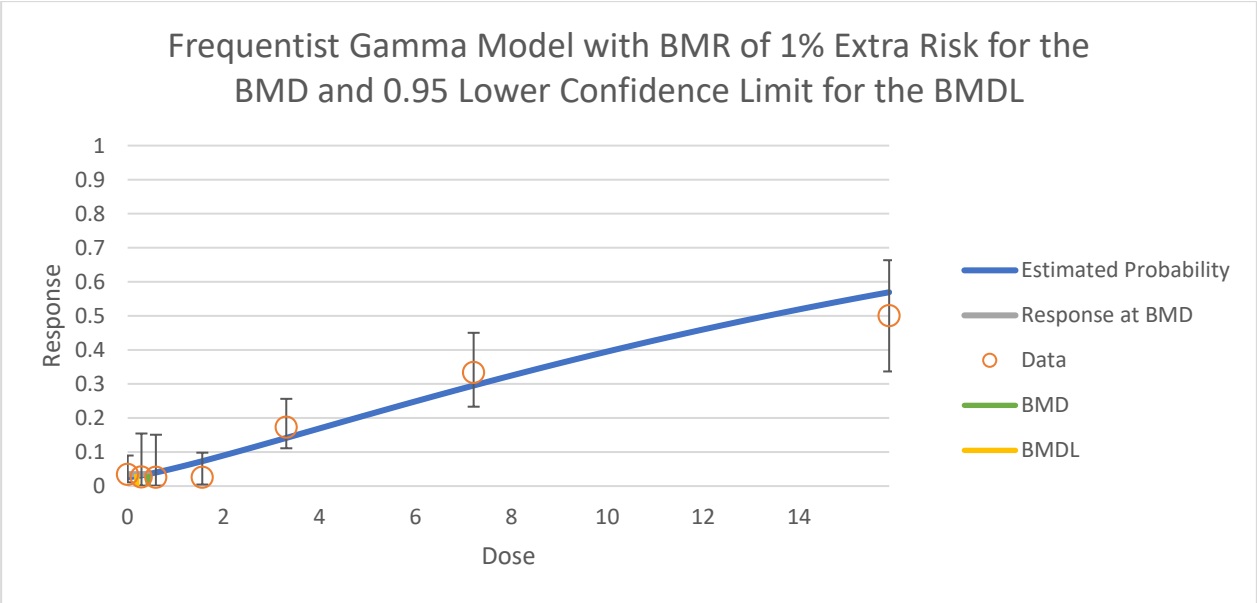
b	0.06914903

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025340723	2.990205322	4	118	0.5915019
0.288	0.031262822	1.187987232	1	38	-0.175234
0.59	0.039853432	1.554283847	1	39	-0.453731
1.557	0.073120153	5.703371911	2	78	-1.610719
3.308	0.141452731	16.40851678	20	116	0.9568791
7.214	0.295290251	23.0326396	26	78	0.7365349
15.877	0.569270404	21.63227537	19	38	-0.862339

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.4160482	3	6.11754616	4	0.1905401
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Gamma Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Log-Logistic Restricted Option Set #3

User Input

Info	
Model	frequentist Log-Logistic v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.501470079
BMDL	0.206226911
BMDU	0.9551493
AIC	341.8764519
P-value	0.342049645
D.O.F.	4
Chi^2	4.504200966

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.025226573
a	-3.637879998

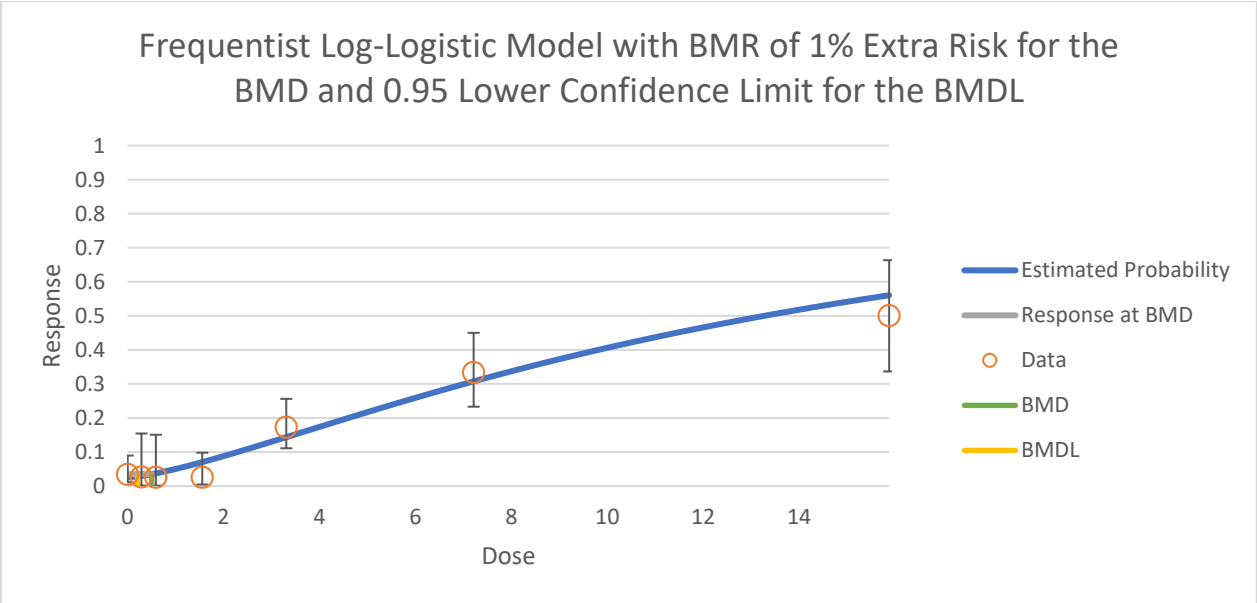
b	1.386879354

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.025226573	2.976735581	4	118	0.6007114
0.288	0.029768152	1.131189784	1	38	-0.125226
0.59	0.037408893	1.458946837	1	39	-0.387277
1.557	0.070418153	5.492615964	2	78	-1.545672
3.308	0.14362057	16.65998614	20	116	0.8842556
7.214	0.307511701	23.98591268	26	78	0.49419
15.877	0.560384939	21.29462768	19	38	-0.749965

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.938226	3	5.16190163	4	0.2710851
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Logistic Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 6 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.241665232
BMDL	0.181778202
BMDU	0.441656999
AIC	343.8772904
P-value	0.201235611
D.O.F.	4
Chi^2	5.972179109
Slope Factor	0.055012097

Model Parameters	
# of Parameters	7
Variable	Estimate
g	0.023007039

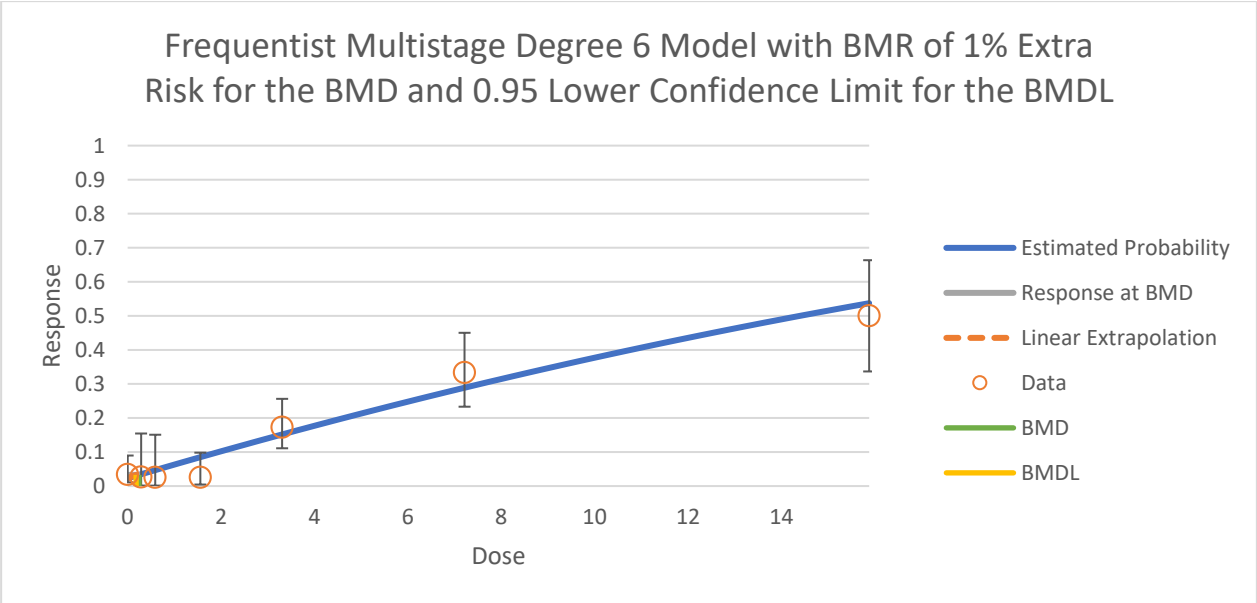
b1	0.041503508
b2	0.000348852
b3	Bounded
b4	Bounded
b5	Bounded
b6	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023007039	2.714830612	4	118	0.7891204
0.288	0.034643463	1.316451584	1	38	-0.280712
0.59	0.046755964	1.823482599	1	39	-0.624599
1.557	0.084918822	6.623668095	2	78	-1.878052
3.308	0.151586275	17.58400788	20	116	0.6255078
7.214	0.288825206	22.52836606	26	78	0.8673231
15.877	0.537063511	20.40841342	19	38	-0.45821

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 6 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 5 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.241674222
BMDL	0.181776147
BMDU	0.441662311
AIC	343.8772904
P-value	0.201221767
D.O.F.	4
Chi^2	5.972362782
Slope Factor	0.055012719

Model Parameters	
# of Parameters	6
Variable	Estimate
g	0.023005714

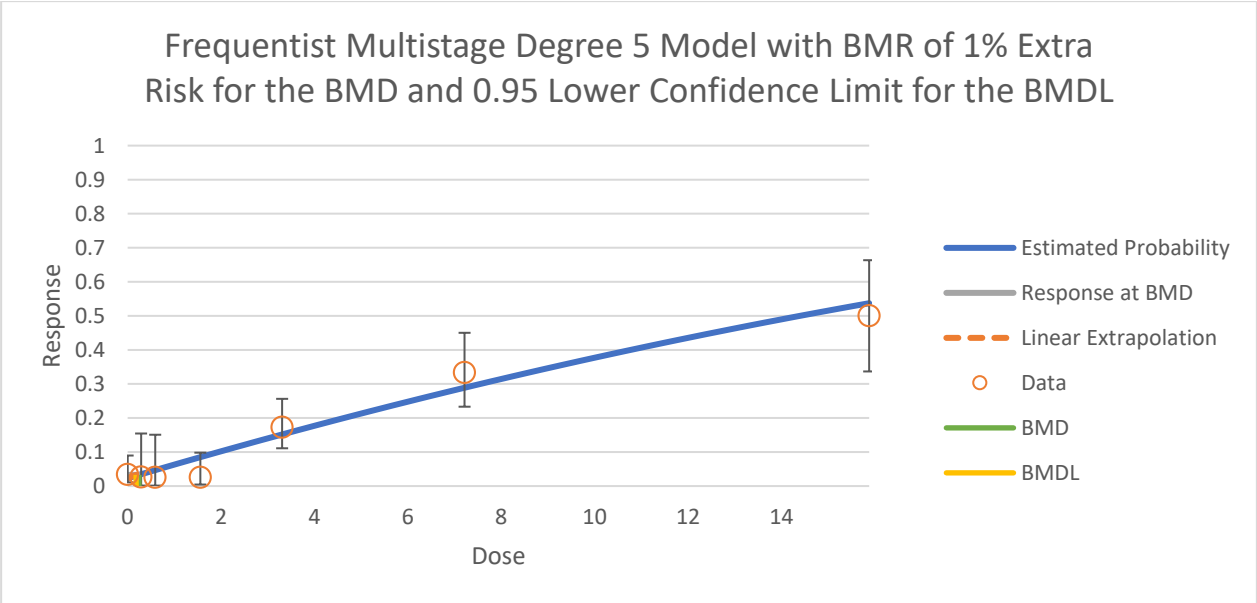
b1	0.04150191
b2	0.000349048
b3	Bounded
b4	Bounded
b5	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023005714	2.714674275	4	118	0.7892386
0.288	0.034641725	1.316385551	1	38	-0.28066
0.59	0.046753838	1.823399667	1	39	-0.62455
1.557	0.084915738	6.623427572	2	78	-1.877985
3.308	0.151582456	17.58356491	20	116	0.625629
7.214	0.288823285	22.52821624	26	78	0.8673622
15.877	0.537073972	20.40881092	19	38	-0.45834

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274014	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 5 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 4 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.241662393
BMDL	0.181774623
BMDU	0.441667542
AIC	343.8772904
P-value	0.201231563
D.O.F.	4
Chi^2	5.97223281
Slope Factor	0.05501318

Model Parameters	
# of Parameters	5
Variable	Estimate
g	0.023005909

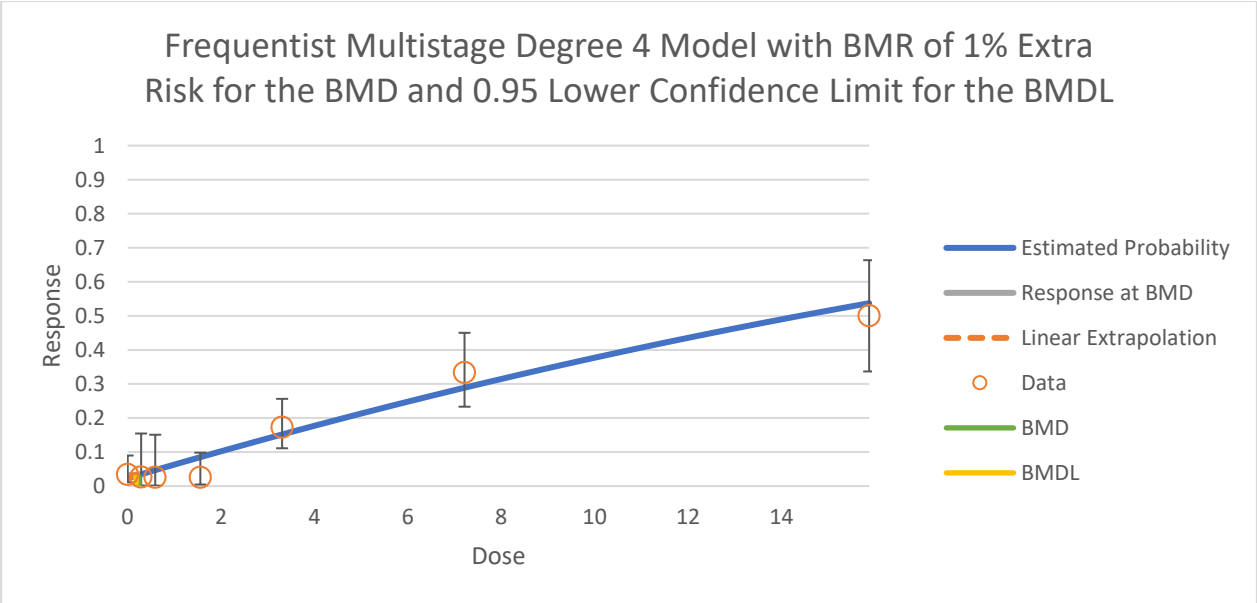
b1	0.041504008
b2	0.000348817
b3	Bounded
b4	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023005909	2.714697291	4	118	0.7892212
0.288	0.034642483	1.316414337	1	38	-0.280683
0.59	0.046755131	1.823450117	1	39	-0.62458
1.557	0.084918397	6.623634991	2	78	-1.878043
3.308	0.151586368	17.58401867	20	116	0.6255049
7.214	0.288825636	22.5283996	26	78	0.8673143
15.877	0.53706251	20.40837539	19	38	-0.458198

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.1627401	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 4 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 3 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.241664759
BMDL	0.181771494
BMDU	0.441664392
AIC	343.8772904
P-value	0.201236119
D.O.F.	4
Chi^2	5.97217237
Slope Factor	0.055014127

Model Parameters	
# of Parameters	4
Variable	Estimate
g	0.02300703

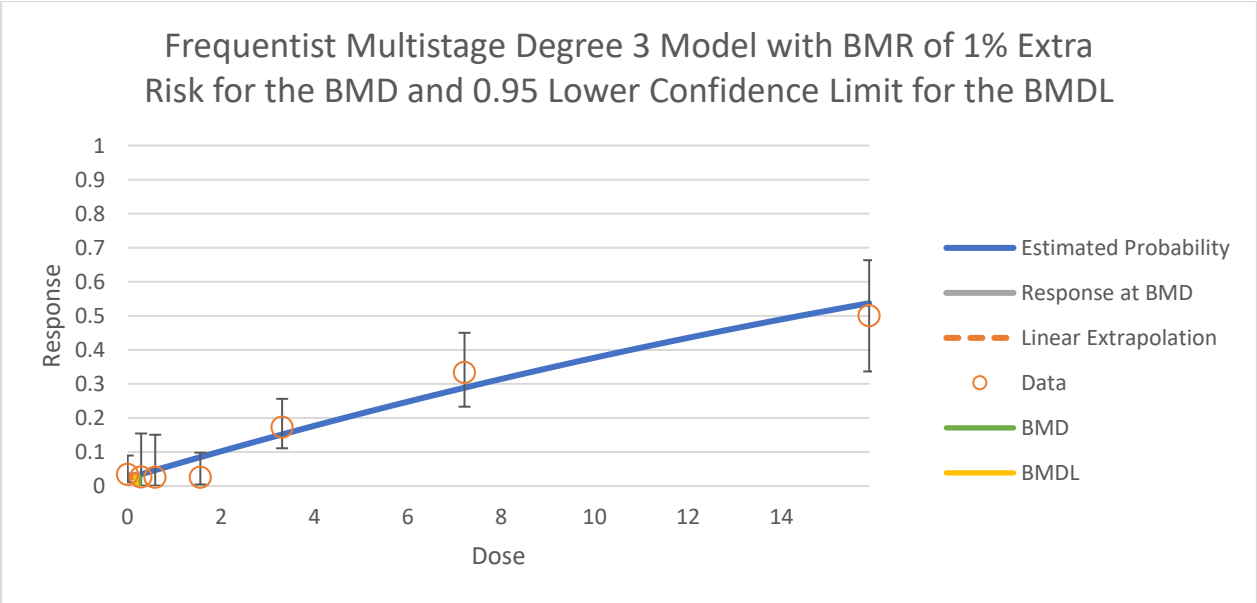
b1	0.041503652
b2	0.000348833
b3	Bounded

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.02300703	2.714829553	4	118	0.7891212
0.288	0.034643492	1.316452715	1	38	-0.280713
0.59	0.04675603	1.823485177	1	39	-0.624601
1.557	0.084918976	6.623680146	2	78	-1.878055
3.308	0.151586493	17.58403316	20	116	0.6255009
7.214	0.288825224	22.52836747	26	78	0.8673227
15.877	0.537062309	20.40836773	19	38	-0.458195

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 3 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 2 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.241665232
BMDL	0.181771731
BMDU	0.441665257
AIC	343.8772904
P-value	0.201235814
D.O.F.	4
Chi^2	5.97217641
Slope Factor	0.055014055

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.023007074

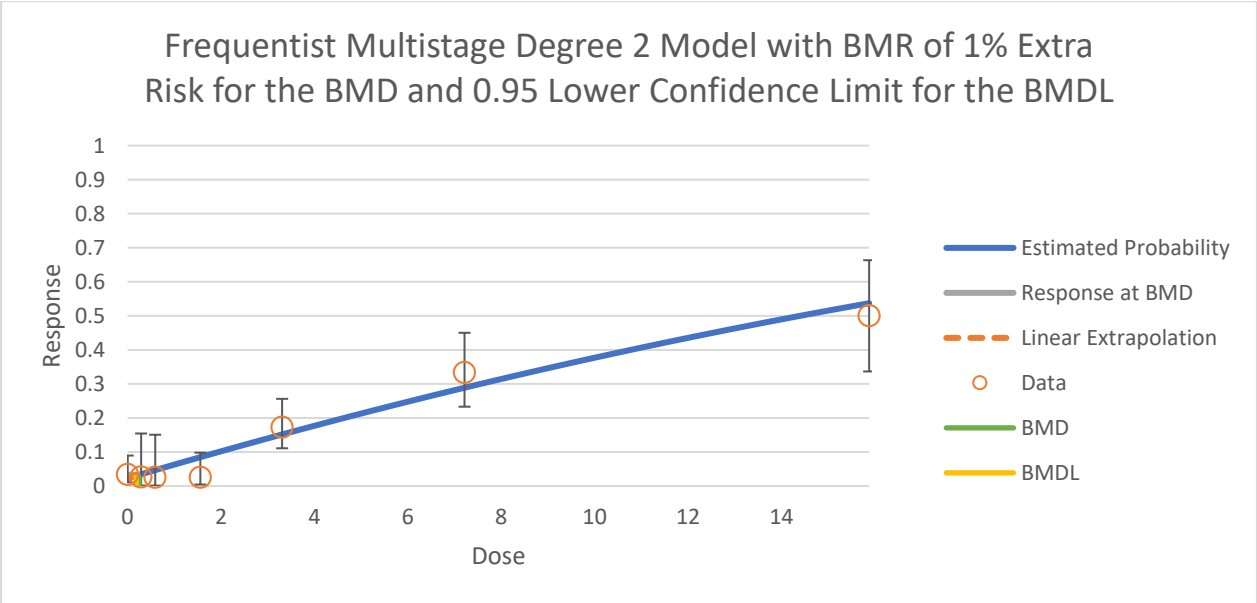
b1	0.041503509
b2	0.000348852

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.023007074	2.714834783	4	118	0.7891173
0.288	0.034643498	1.316452921	1	38	-0.280713
0.59	0.046755999	1.823483964	1	39	-0.6246
1.557	0.084918856	6.623670775	2	78	-1.878053
3.308	0.151586308	17.58401173	20	116	0.6255068
7.214	0.288825236	22.52836841	26	78	0.8673225
15.877	0.537063533	20.40841427	19	38	-0.458211

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9386452	3	7.16274009	4	0.127534
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 2 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Multistage Restricted Option Set #3

User Input

Info	
Model	frequentist Multistage degree 1 v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.225455797
BMDL	0.181170282
BMDU	0.288600062
AIC	341.9596887
P-value	0.312328616
D.O.F.	5
Chi^2	5.937696467
Slope Factor	0.055196691

Model Parameters	
# of Parameters	2
Variable	Estimate
g	0.022370269

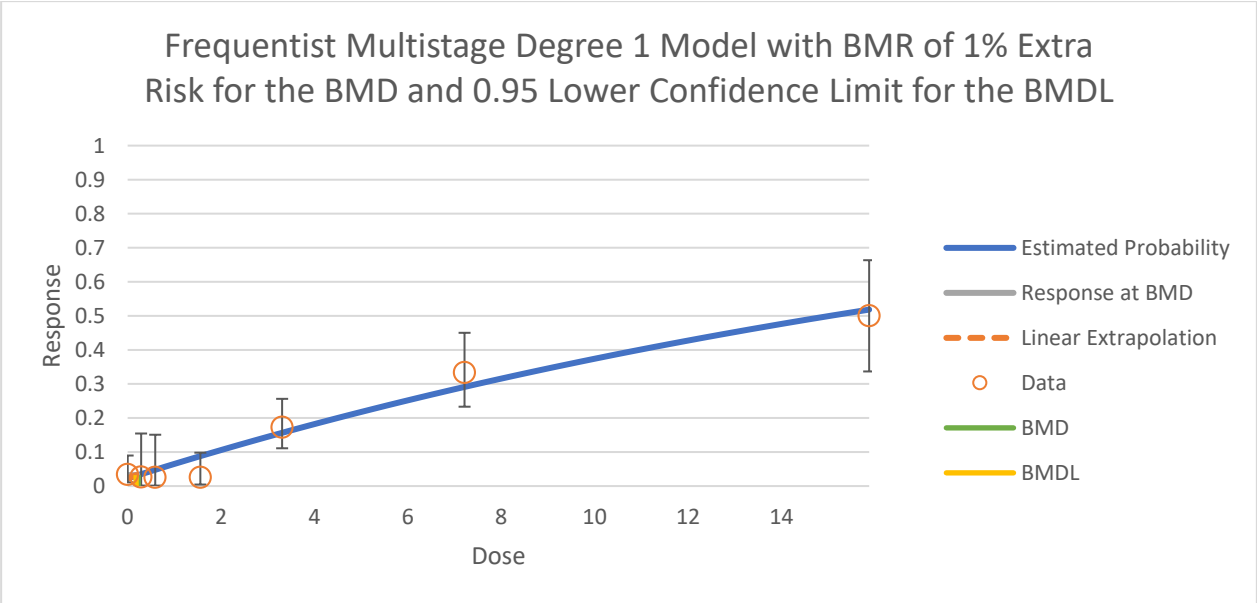
b1	0.04457786

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.022370269	2.639691715	4	118	0.8467857
0.288	0.034841268	1.323968196	1	38	-0.286592
0.59	0.04774766	1.862158738	1	39	-0.647445
1.557	0.087924044	6.858075436	2	78	-1.94244
3.308	0.156409289	18.14347747	20	116	0.4745414
7.214	0.291219197	22.71509738	26	78	0.8186707
15.877	0.518277458	19.6945434	19	38	-0.22549

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.9798444	2	7.24513846	5	0.2030381
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Multistage Degree 1 Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Linear Extrapolation
Data
BMD
BMDL

Frequentist Weibull Restricted Option Set #3

User Input

Info	
Model	frequentist Weibull v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.367494839
BMDL	0.187762449
BMDU	0.759561908
AIC	343.1162362
P-value	0.234428638
D.O.F.	4
Chi^2	5.560892121

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.024782327
a	1.163539658

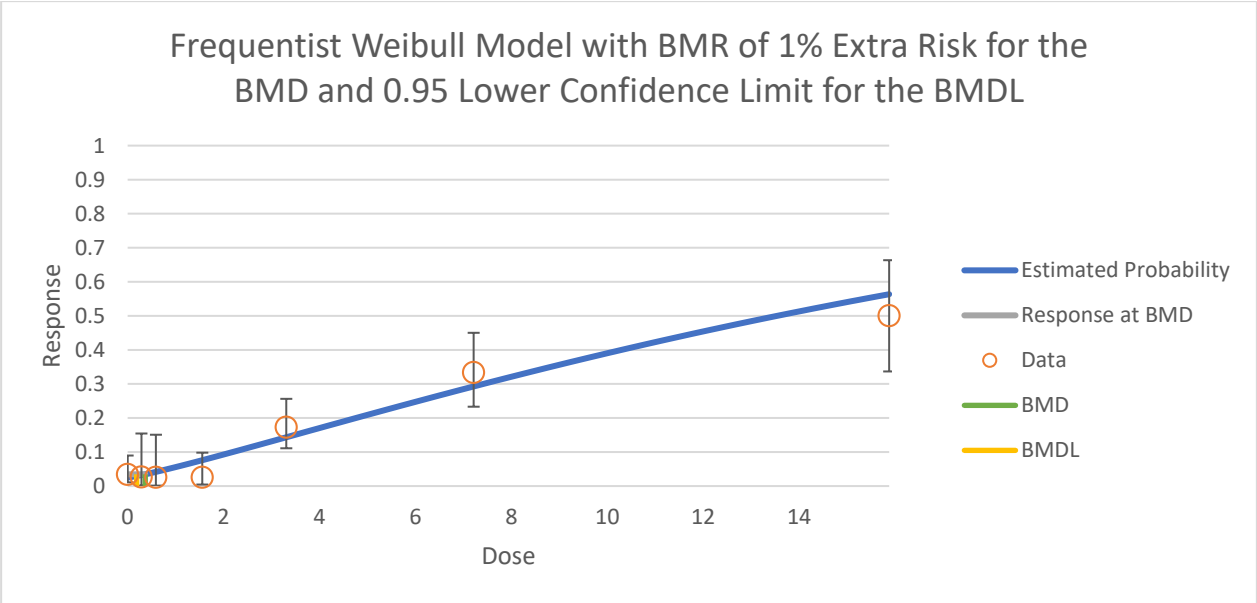
b	0.032212764

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.024782327	2.924314567	4	118	0.6369751
0.288	0.032135399	1.221145167	1	38	-0.203417
0.59	0.041637238	1.623852284	1	39	-0.500085
1.557	0.0759751	5.926057762	2	78	-1.677768
3.308	0.143312493	16.6242492	20	116	0.8945161
7.214	0.292577921	22.82107782	26	78	0.7911749
15.877	0.56348596	21.41246648	19	38	-0.789094

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-168.5581181	3	6.40168598	4	0.1710913
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Weibull Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Logistic Unrestricted Option Set #3

User Input

Info	
Model	frequentist Logistic v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

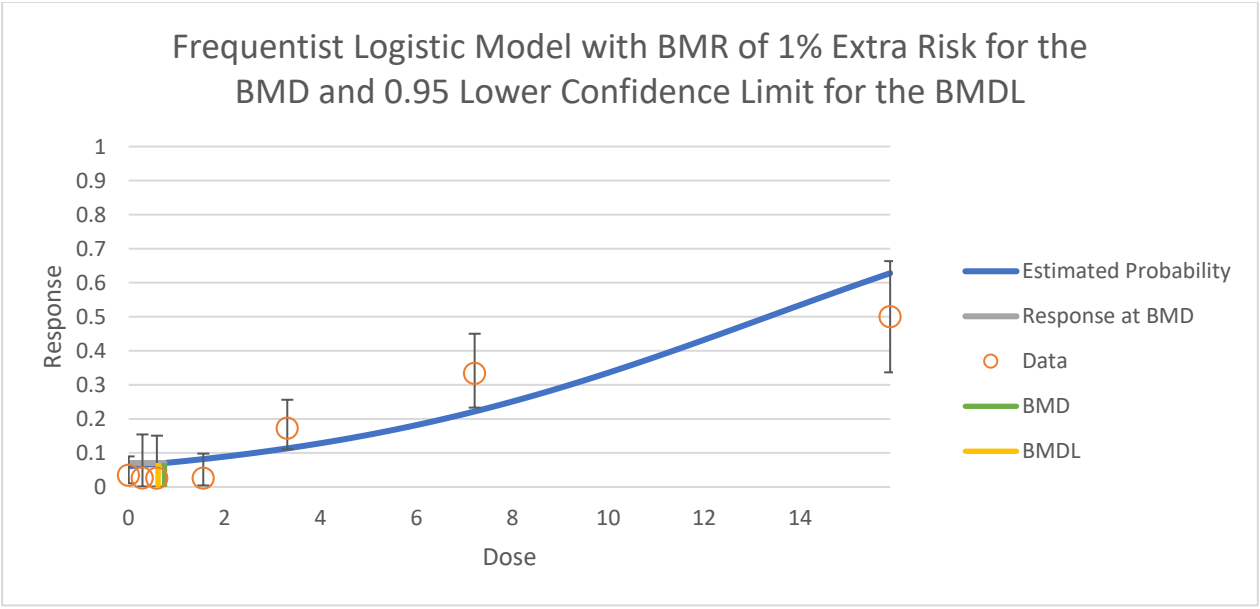
Model Results

Benchmark Dose	
BMD	0.747650781
BMDL	0.614932035
BMDU	0.91683865
AIC	354.6898843
P-value	0.001829067
D.O.F.	5
Chi^2	19.11567129

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-2.735664173
b	0.205253099

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.060901408	7.186366168	4	118	-1.22655
0.288	0.064371273	2.446108365	1	38	-0.955897
0.59	0.068206914	2.660069638	1	39	-1.054436
1.557	0.081954322	6.392437152	2	78	-1.813177
3.308	0.113378447	13.15189983	20	116	2.0054263
7.214	0.221841284	17.30362015	26	78	2.3699322
15.877	0.62788154	23.85949852	19	38	-1.630873

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-175.3449421	2	19.975334	5	0.0012631
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001



Frequentist Log-Probit Unrestricted Option Set #3

User Input

Info	
Model	frequentist Log-Probit v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

Model Results

Benchmark Dose	
BMD	0.787146273
BMDL	0.38531337
BMDU	1.31487106
AIC	340.5993346
P-value	0.489725364
D.O.F.	4
Chi^2	3.422722793

Model Parameters	
# of Parameters	3
Variable	Estimate
g	0.026517297
a	-2.13287123

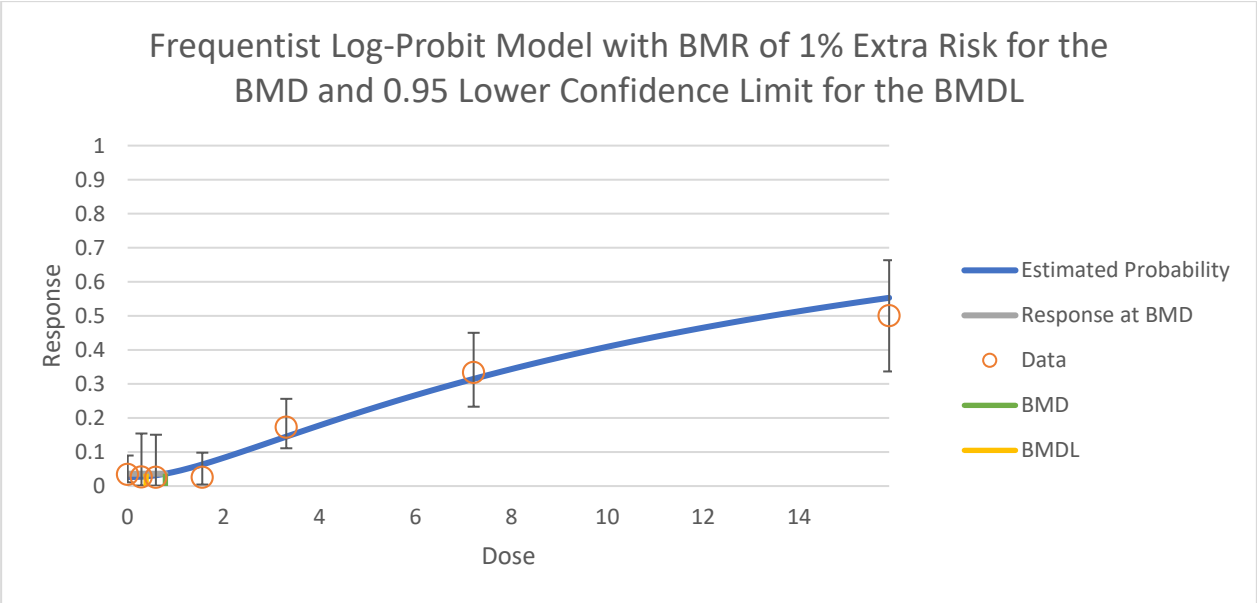
b	0.808371712

Goodness of Fit

Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.026517297	3.129040989	4	118	0.4990315
0.288	0.027342086	1.038999277	1	38	-0.038794
0.59	0.031621006	1.233219217	1	39	-0.213413
1.557	0.063463485	4.95015185	2	78	-1.370165
3.308	0.145137671	16.83596989	20	116	0.8340142
7.214	0.314812971	24.55541177	26	78	0.352181
15.877	0.552869854	21.00905447	19	38	-0.655498

Analysis of Deviance

Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-167.2996673	3	3.88478433	4	0.4218231
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001


Frequentist Log-Probit Model with BMR of 1% Extra Risk for the BMD and 0.95 Lower Confidence Limit for the BMDL
Response
Dose
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
Estimated Probability
Response at BMD
Data
BMD
BMDL

Frequentist Probit Unrestricted Option Set #3

User Input

Info	
Model	frequentist Probit v1.1
Dataset Name	Mortality_AUCBid
User notes	median internal dose metric

Model Options	
Risk Type	Extra Risk
BMR	0.01
Confidence Level	0.95
Background	Estimated

Model Data	
Dependent Variable	internal dose
Independent Variable	Incidence
Total # of Observations	7

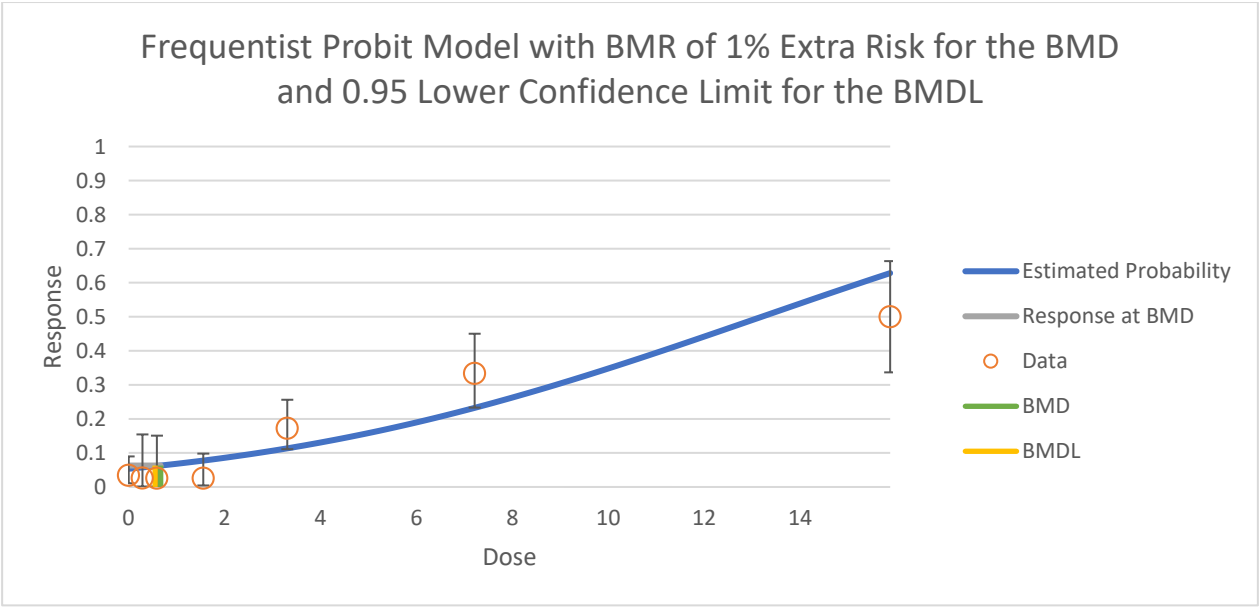
Model Results

Benchmark Dose	
BMD	0.667382677
BMDL	0.551827286
BMDU	0.815996581
AIC	351.7787603
P-value	0.00551691
D.O.F.	5
Chi^2	16.51532838

Model Parameters	
# of Parameters	2
Variable	Estimate
a	-1.612083166
b	0.122130719

Goodness of Fit					
Dose	Estimated Probability	Expected	Observed	Size	Scaled Residual
0	0.053471922	6.309686765	4	118	-0.94511
0.288	0.057408173	2.181510574	1	38	-0.823943
0.59	0.061777003	2.409303112	1	39	-0.937358
1.557	0.07752392	6.046865756	2	78	-1.713468
3.308	0.113509256	13.16707368	20	116	1.999977
7.214	0.232379754	18.12562085	26	78	2.111041
15.877	0.628160859	23.87011266	19	38	-1.634686

Analysis of Deviance					
Model	Log Likelihood	# of Parameters	Deviance	Test d.f.	P Value
Full Model	-165.3572751	7	-	-	-
Fitted Model	-173.8893802	2	17.0642101	5	0.0043796
Reduced Model	-208.6386135	1	86.5626766	6	<0.0001

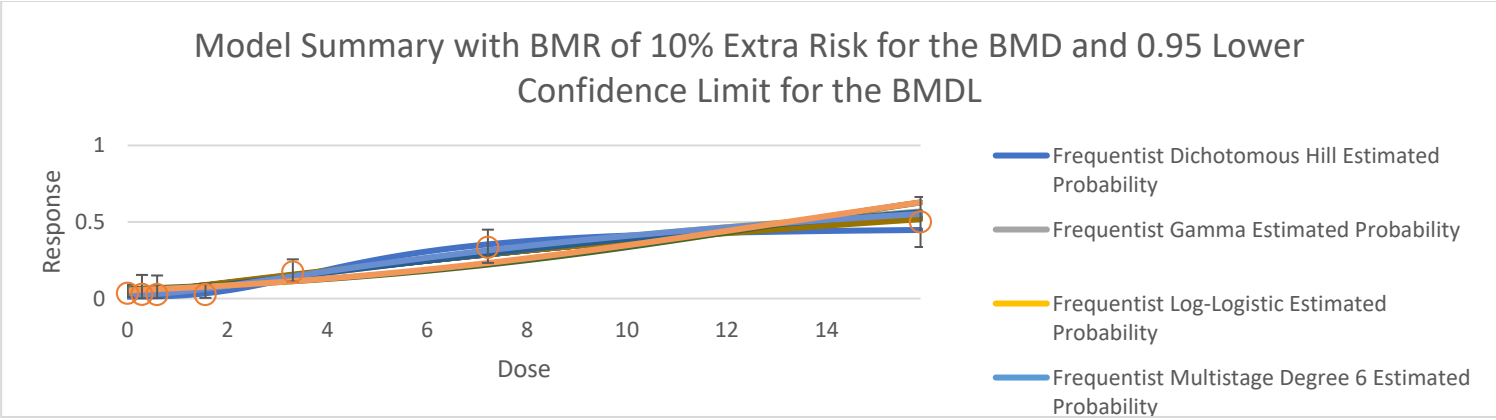


Summary of Results

Option set #1 (Hover for details)											
Model	Analysis Type	Restriction	RiskType	BMD	BMDL	BMDU	P Value	AIC	Unnormalized Log Posterior Probability	BMDS Recommendation	BMDS Recommendation Notes
Dichotomous Hill	frequentist	Restricted	Extra Risk	2.927326	2.260302	3.6810597	0.5430124	341.0130828	-	Viable - Alternate	
Gamma	frequentist	Restricted	Extra Risk	2.841249	1.996309	3.8626022	0.2502436	342.8320964	-	Viable - Alternate	
Log-Logistic	frequentist	Restricted	Extra Risk	2.825753	1.995725	3.7894996	0.3420496	341.8764519	-	Viable - Alternate	
Multistage Degree 6	frequentist	Restricted	Extra Risk	2.48662	1.90592	3.638772	0.2012356	343.8772904	-	Viable - Alternate	
Multistage Degree 5	frequentist	Restricted	Extra Risk	2.486684	1.905931	3.6387664	0.2012218	343.8772904	-	Viable - Alternate	
Multistage Degree 4	frequentist	Restricted	Extra Risk	2.486597	1.905923	3.6387382	0.2012316	343.8772904	-	Viable - Alternate	
Multistage Degree 3	frequentist	Restricted	Extra Risk	2.486615	1.90595	3.6387639	0.2012361	343.8772904	-	Viable - Alternate	
Multistage Degree 2	frequentist	Restricted	Extra Risk	2.48662	1.90594	3.6387722	0.2012358	343.8772904	-	Viable - Alternate	
Multistage Degree 1	frequentist	Restricted	Extra Risk	2.363517	1.899269	3.0255048	0.3123286	341.9596887	-	Viable - Alternate	
Weibull	frequentist	Restricted	Extra Risk	2.768943	1.968362	3.8064447	0.2344286	343.1162362	-	Viable - Alternate	
Logistic	frequentist	Unrestricted	Extra Risk	5.058686	4.367084	5.9143374	0.0018291	354.6898843	-	Questionable	Goodness of fit p-value < 0.1 |Residual for

											Dose Group Near BMD| > 2
Log-Probit*	**frequentist**	**Unrestricted**	**Extra Risk**	**2.866607**	**2.076723**	**3.751295 6**	**0.489725 4**	**340.599334 6**	**-**	**Viable - Recommended**	**Lowest AIC**
Probit	frequentist	Unrestricted	Extra Risk	4.647259	4.032688	5.426292 5	0.005516 9	351.778760 3	-	Questionable	Goodness of fit p-value < 0.1

*Selected model in bold; scaled residuals for selected model for doses 0, 0.288, 0.59, 1.557, 3.308, 7.214, 15.877 were 0.467465388907822, -3.27382486077664E-02, -0.111532891156813, -0.944854175074002, 0.625827194847241, -0.640488267898211, 0.466456869280912 [units], respectively.

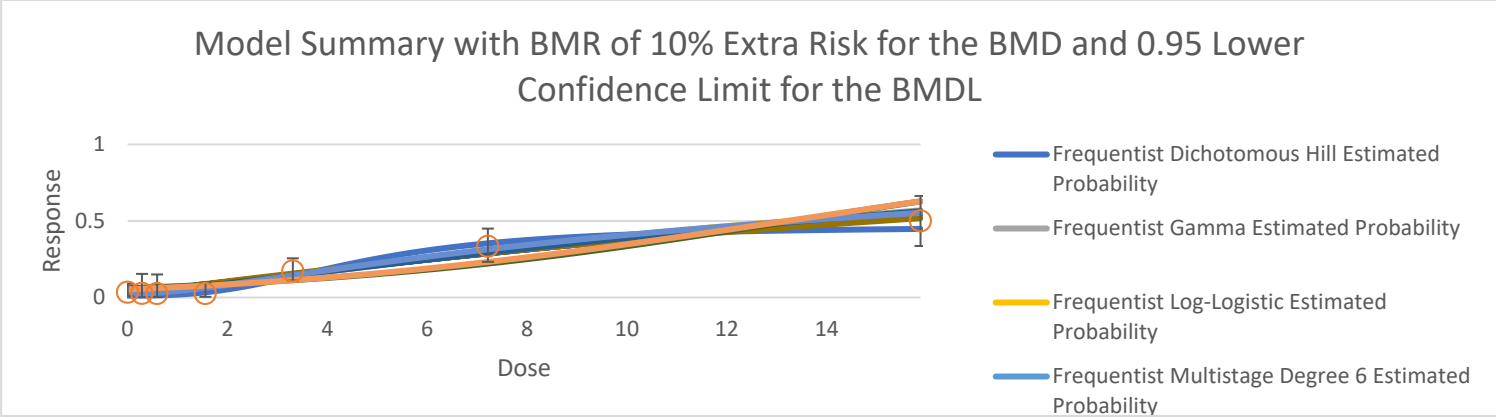


Option Set #2 (Hover for details)

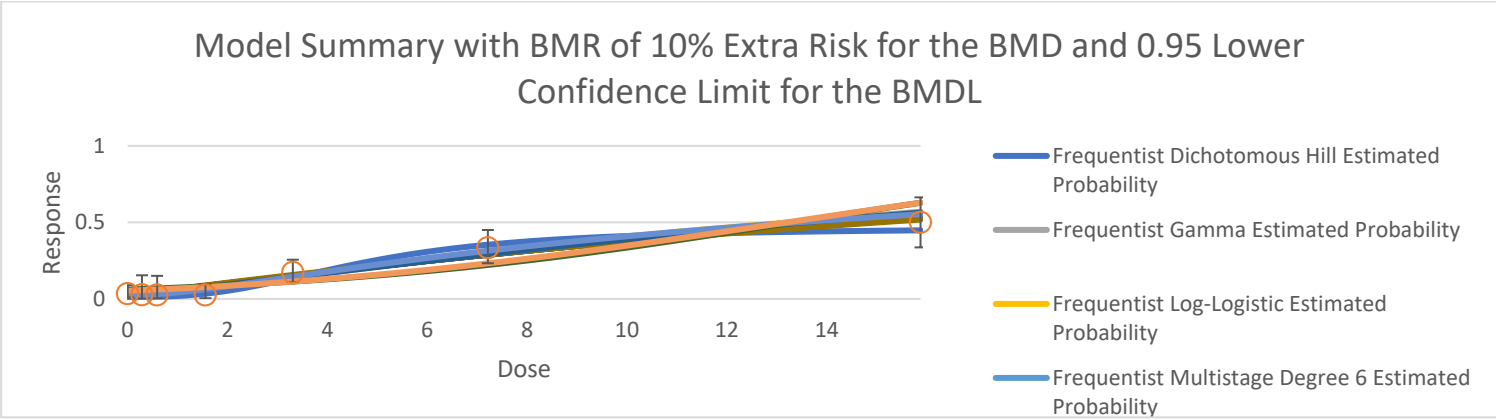
Model	Analysis Type	Restriction	RiskType	BMD	BMDL	BMDU	P Value	AIC	Unnormalized Log Posterior Probability	BMDS Recommendation	BMDS Recommendation Notes
Dichotomous Hill	frequentist	Restricted	Extra Risk	2.154583	1.371798	3.084334 8	0.543012 4	341.013082 8	-	Viable - Alternate	

Gamma	frequentist	Restricted	Extra Risk	1.582716	0.971772	2.4420312	0.2502436	342.8320964	-	Viable - Alternate	
Log-Logistic	frequentist	Restricted	Extra Risk	1.648723	0.996591	2.4427798	0.3420496	341.8764519	-	Viable - Alternate	
Multistage Degree 6	frequentist	Restricted	Extra Risk	1.2233	0.927603	1.9814065	0.2012356	343.8772904	-	Viable - Alternate	
Multistage Degree 5	frequentist	Restricted	Extra Risk	1.223339	0.92761	1.9814222	0.2012218	343.8772904	-	Viable - Alternate	
Multistage Degree 4	frequentist	Restricted	Extra Risk	1.223287	0.927607	1.9813811	0.2012316	343.8772904	-	Viable - Alternate	
Multistage Degree 3	frequentist	Restricted	Extra Risk	1.223297	0.927608	1.9814288	0.2012361	343.8772904	-	Viable - Alternate	
Multistage Degree 2	frequentist	Restricted	Extra Risk	1.2233	0.927589	1.9814359	0.2012358	343.8772904	-	Viable - Alternate	
Multistage Degree 1	frequentist	Restricted	Extra Risk	1.150645	0.924663	1.4728951	0.3123286	341.9596887	-	Viable - Alternate	
Weibull	frequentist	Restricted	Extra Risk	1.491544	0.958414	2.3052363	0.2344286	343.1162362	-	Viable - Alternate	
Logistic	frequentist	Unrestricted	Extra Risk	3.034483	2.576383	3.5867104	0.0018291	354.6898843	-	Questionable	Goodness of fit p-value < 0.1 |Residual for Dose Group Near BMD| > 2
Log-Probit*	**frequentist**	**Unrestricted**	**Extra Risk**	**1.828881**	**1.168978**	**2.5825998**	**0.4897254**	**340.5993346**	**-**	**Viable - Recommended**	**Lowest AIC**
Probit	frequentist	Unrestricted	Extra Risk	2.743514	2.342234	3.2305868	0.0055169	351.7787603	-	Questionable	Goodness of fit p-value < 0.1

*Selected model in bold; scaled residuals for selected model for doses 0, 0.288, 0.59, 1.557, 3.308, 7.214, 15.877 were 0.467465388907822, -3.27382486077664E-02, -0.111532891156813, -0.944854175074002, 0.625827194847241, -0.640488267898211, 0.466456869280912 [units], respectively.



Option Set #3 (Hover for details)											
Model	Analysis Type	Restriction	RiskType	BMD	BMDL	BMDU	P Value	AIC	Unnormalized Log Posterior Probability	BMDS Recommendation	BMDS Recommendation Notes
Dichotomous Hill	frequentist	Restricted	Extra Risk	1.142059	0.41619	2.669021	0.543012	341.0130828	-	Viable - Alternate	
Gamma	frequentist	Restricted	Extra Risk	0.428707	0.19043	0.926667	0.250243	342.8320964	-	Viable - Alternate	
Log-Logistic	frequentist	Restricted	Extra Risk	0.50147	0.206227	0.955149	0.342049	341.8764519	-	Viable - Alternate	
Multistage Degree 6	frequentist	Restricted	Extra Risk	0.241665	0.181778	0.441657	0.201235	343.8772904	-	Viable - Alternate	
Multistage Degree 5	frequentist	Restricted	Extra Risk	0.241674	0.181776	0.441662	0.201221	343.8772904	-	Viable - Alternate	
Multistage Degree 4	frequentist	Restricted	Extra Risk	0.241662	0.181775	0.441667	0.201231	343.8772904	-	Viable - Alternate	
Multistage Degree 3	frequentist	Restricted	Extra Risk	0.241665	0.181771	0.441664	0.201236	343.8772904	-	Viable - Alternate	

Multistage Degree 2	frequentist	Restricted	Extra Risk	0.241665	0.181772	0.4416653	0.2012358	343.8772904	-	Viable - Alternate	
Multistage Degree 1	frequentist	Restricted	Extra Risk	0.225456	0.18117	0.2886001	0.3123286	341.9596887	-	Viable - Alternate	
Weibull	frequentist	Restricted	Extra Risk	0.367495	0.187762	0.7595619	0.2344286	343.1162362	-	Viable - Alternate	
Logistic	frequentist	Unrestricted	Extra Risk	0.747651	0.614932	0.9168387	0.0018291	354.6898843	-	Questionable	Goodness of fit p-value < 0.1
Log-Probit*	**frequentist**	**Unrestricted**	**Extra Risk**	**0.787146**	**0.385313**	**1.3148711**	**0.4897254**	**340.5993346**	**-**	**Viable - Recommended**	**Lowest AIC**
Probit	frequentist	Unrestricted	Extra Risk	0.667383	0.551827	0.8159966	0.0055169	351.7787603	-	Questionable	Goodness of fit p-value < 0.1

*Selected model in bold; scaled residuals for selected model for doses 0, 0.288, 0.59, 1.557, 3.308, 7.214, 15.877 were 0.467465388907822, -3.27382486077664E-02, -0.111532891156813, -0.944854175074002, 0.625827194847241, -0.640488267898211, 0.466456869280912 [units], respectively.