

Homework 4

Denis Ostroushko

Problem 1

(1)

Call:

```
glm(formula = seiz ~ log(age) + log_base + treat, family = poisson(),
     data = seiz_total)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-6.0834	-2.0602	-0.4096	1.3963	8.1997

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.02151	0.40354	-2.531	0.0114 *
log(age)	0.58778	0.10992	5.347	8.93e-08 ***
log_base	1.22522	0.03252	37.672	< 2e-16 ***
treat	-0.01759	0.04818	-0.365	0.7150

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for poisson family taken to be 1)

Null deviance: 2122.73 on 58 degrees of freedom
Residual deviance: 556.39 on 55 degrees of freedom
AIC: 847.66

Number of Fisher Scoring iterations: 5

```
Call:
glm(formula = seiz ~ log(age) + log_base + treat, family = quasipoisson(),
     data = seiz_total)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-6.0834	-2.0602	-0.4096	1.3963	8.1997

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-1.02151	1.34172	-0.761	0.450
log(age)	0.58778	0.36548	1.608	0.114
log_base	1.22522	0.10813	11.330	5.27e-16 ***
treat	-0.01759	0.16019	-0.110	0.913

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for quasipoisson family taken to be 11.05488)

Null deviance: 2122.73 on 58 degrees of freedom
 Residual deviance: 556.39 on 55 degrees of freedom
 AIC: NA

Number of Fisher Scoring iterations: 5

(Intercept)	log(age)	log_base	treat
0.162843551	0.012083084	0.001057737	0.002321266

(Intercept)	log(age)	log_base	treat
1.80021599	0.13357705	0.01169316	0.02566131

(Intercept)	log(age)	log_base	treat
11.05488	11.05488	11.05488	11.05488

(2)

(3)

Bias = average of bootstrap - fitted coefficient

(Intercept)	log(age)	log_base	treat
-1.02151177	0.58777978	1.22521697	-0.01759081

	intercept_b	log_age_b	log_base_b	treat_b
1	0.08124596	0.01437261	-0.0581612	-0.06440782

(4)

Log (Age)

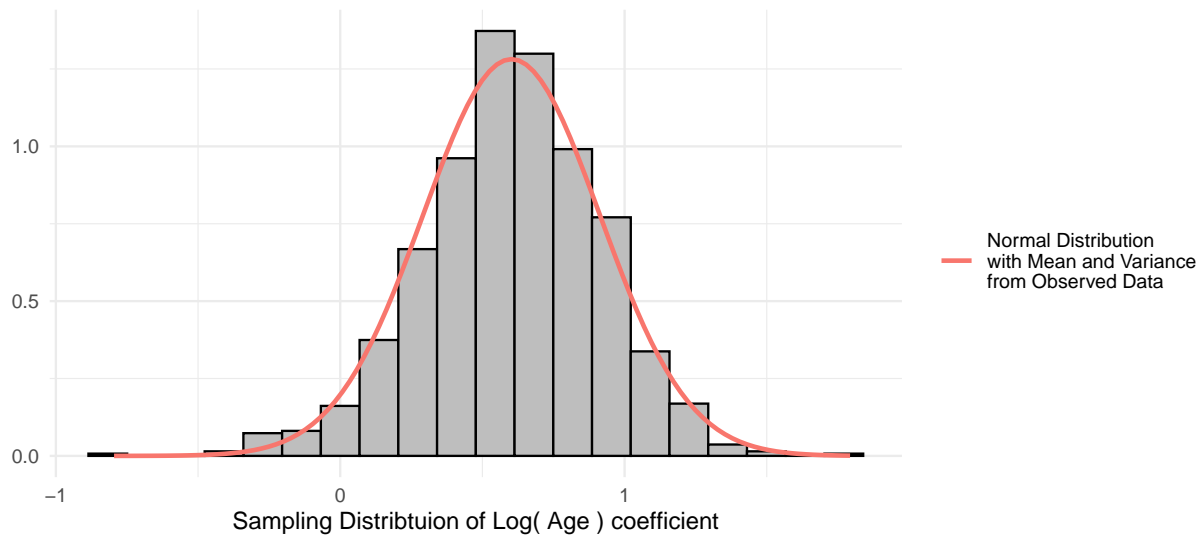


Figure 1: Sampling Distribution of Log(Age) regression coefficient

1. Normal Approximation Method

2.5%	97.5%
-0.03523	1.21079

2. Percentile Method

2.5%	97.5%
-0.05769824	1.17303312

3. Comparison with Quasipoisson

2.5 %	97.5 %
-0.1307821	1.3032966

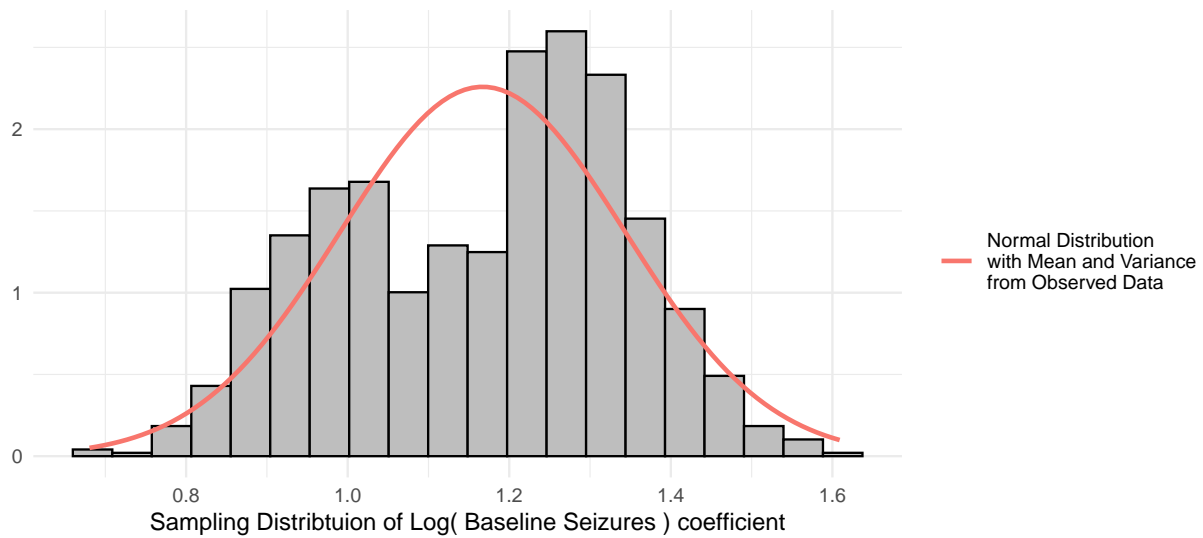


Figure 2: Sampling Distribution of Log(Baseline Seizures) regression coefficient

Log (Baseline Seizures)

1. Normal Approximation Method

2.5% 97.5%
0.87170 1.57873

2. Percentile Method

2.5% 97.5%
0.8430312 1.4575380

3. Comparison with Quasipoisson

2.5 % 97.5 %
1.015432 1.439530

Treatment

1. Normal Approximation Method

2.5% 97.5%
-0.43061 0.39543

2. Percentile Method

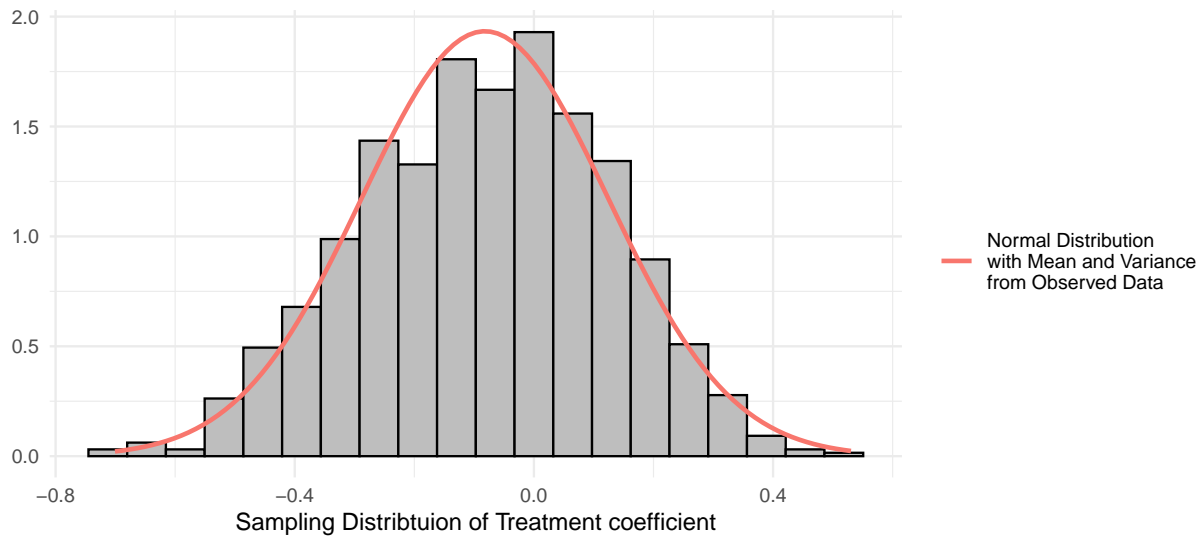


Figure 3: Sampling Distribution of Treatment regression coefficient

2.5%	97.5%
-0.4859459	0.2945001

3. Comparison with Quasipoisson

2.5 %	97.5 %
-0.3318274	0.2970761

(5)

Comparison with simpler additive model

Log (Age)

1. Normal Approximation Method

2.5%	97.5%
-3.50179	0.72757

2. Percentile Method

2.5%	97.5%
-3.6516936	0.3983661

3. Comparison with Quasipoisson

Table 1: Comparison of fitted and bootstrapped model parameters

Model Terms	Poisson Fitted Values		Quasipoisson Fitted Values		Bootsrapp Model with Interaction		Boostrapp Simple Model	
	Beta	SE	Beta	SE	Avg. Beta	SE	Avg. Beta	SE
Log(Age)	-1.39	0.56	-1.39	1.79	-1.51	1.06	0.60	0.31
Log(Baseline Seizures)	-2.44	0.82	-2.44	2.62	-2.60	1.91	1.17	0.18
Treatment	-8.29	2.77	-8.29	8.83	-6.52	7.43	-0.08	0.21
Log(Age):Log(Baseline Seizures)	1.01	0.24	1.01	0.78	1.06	0.57	NA	NA
Log(Age):Treatment	2.05	0.84	2.05	2.69	1.61	2.18	NA	NA
Log(Baseline Seizures):Treatment	3.53	1.21	3.53	3.84	2.84	3.54	NA	NA
Log(Age):Log(Baseline Seizures):Treatment	-0.87	0.37	-0.87	1.18	-0.71	1.05	NA	NA

2.5 % 97.5 %
-4.812707 2.196485

Log (Baseline Seizures)

1. Normal Approximation Method

2.5% 97.5%
-6.26578 1.39504

2. Percentile Method C.I.

2.5% 97.5%
-6.3355195 0.9243775

3. Comparison with Quasipoisson

2.5 % 97.5 %
-7.471634 2.791414

Treatment

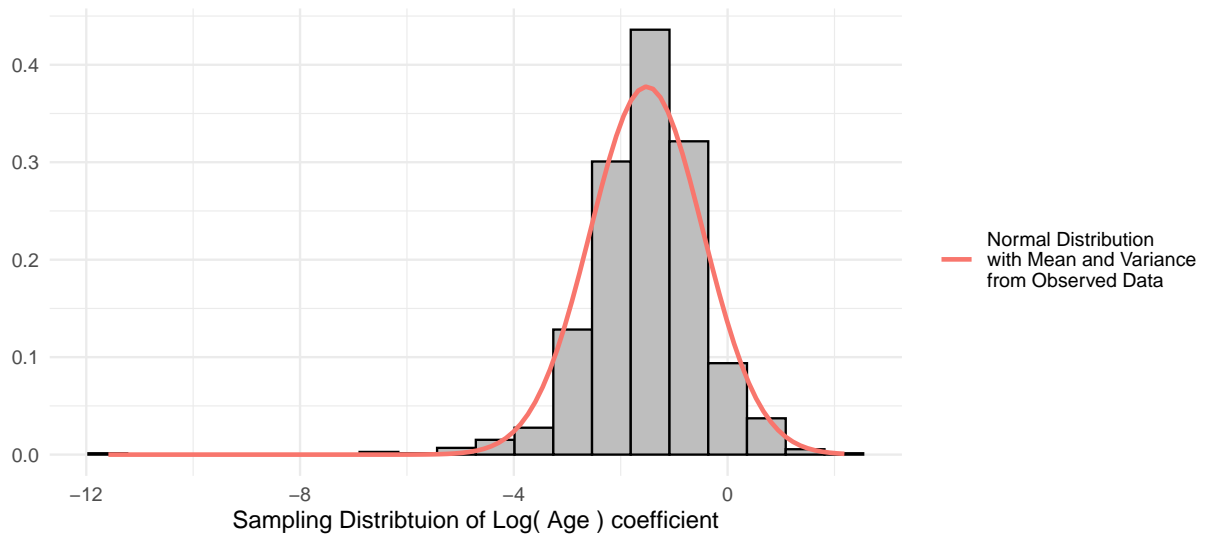


Figure 4: Sampling Distribution of Log(Age) regression coefficient from a model with interaction terms

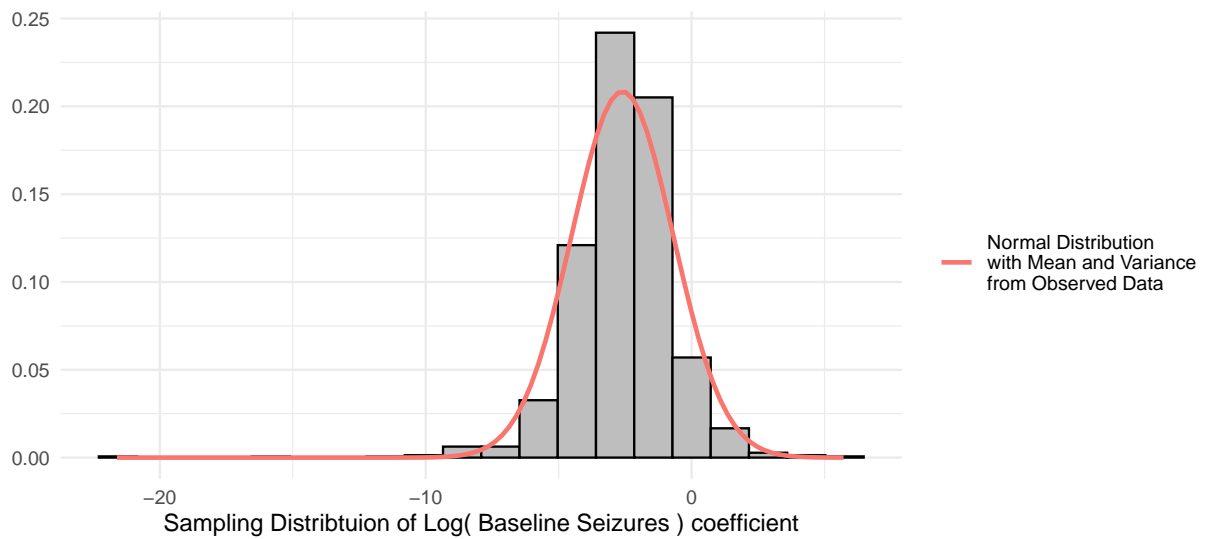


Figure 5: Sampling Distribution of Log(Base) regression coefficient from a model with interaction terms

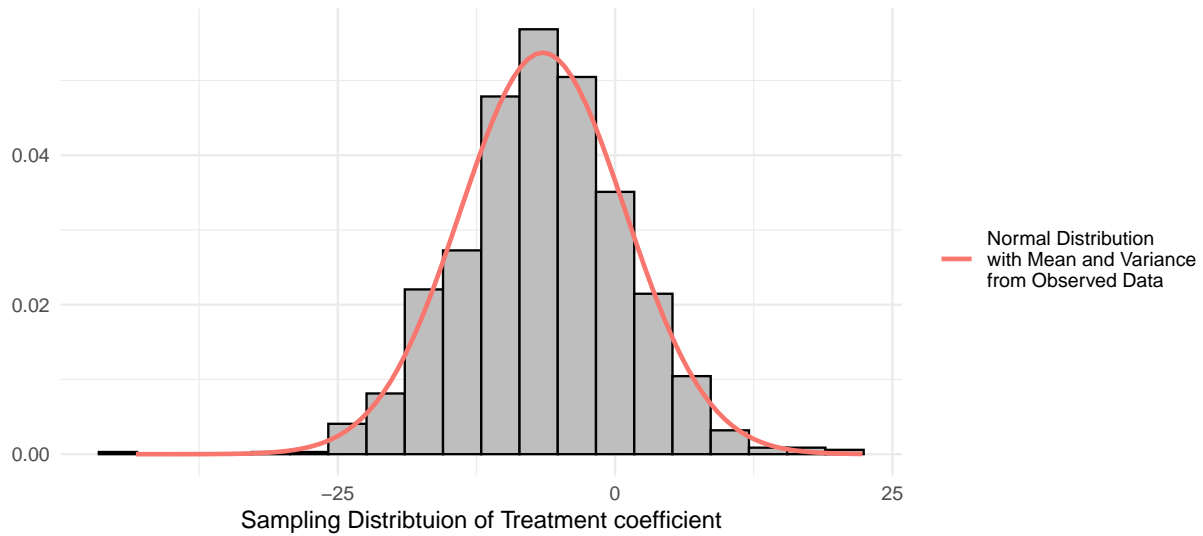


Figure 6: Sampling Distribution of Treatment regression coefficient from a model with interaction terms

1. Normal Approximation Method

2.5%	97.5%
-23.15413	6.57482

2. Percentile Method C.I.

2.5%	97.5%
-20.789025	7.623422

3. Comparison with Quasipoisson

2.5 %	97.5 %
-25.221737	9.446769

Log(Age) - Log(Baseline Seizures) Interaction Term

1. Normal Approximation Method

2.5%	97.5%
-0.13849	2.15159

2. Percentile Method C.I.

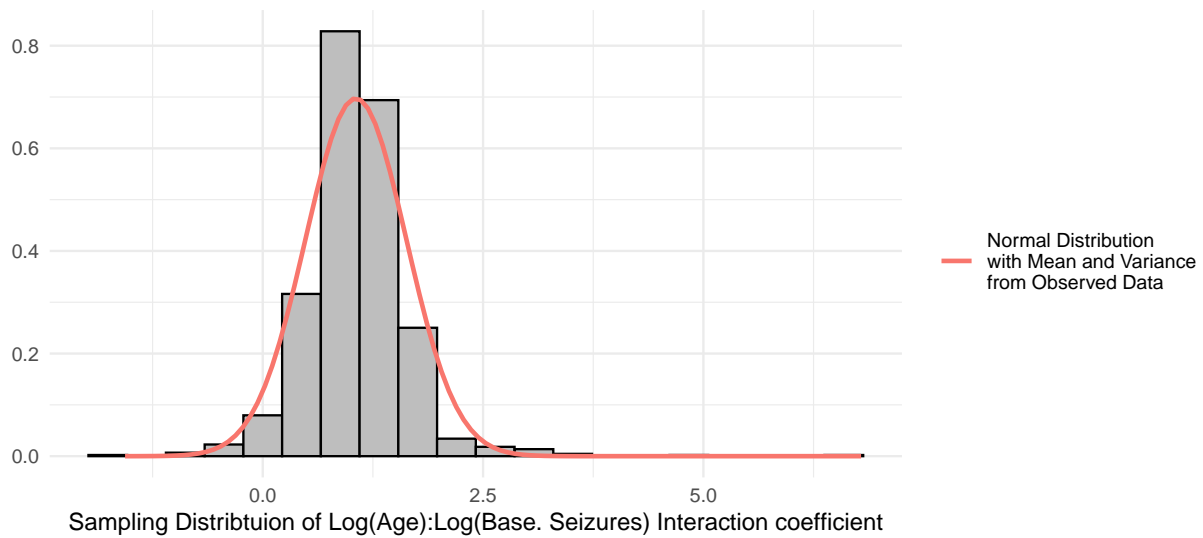


Figure 7: Sampling Distribution of respective interactive term regression coefficient

2.5%	97.5%
-0.02432662	2.13075935

3. Comparison with Quasipoisson

2.5 %	97.5 %
-0.5424838	2.5149233

Treatment - Log(Age) Interaction Term

1. Normal Approximation Method

2.5%	97.5%
-2.32255	6.42360

2. Percentile Method C.I.

2.5%	97.5%
-2.567275	5.855594

3. Comparison with Quasipoisson

2.5 %	97.5 %
-3.354097	7.201258

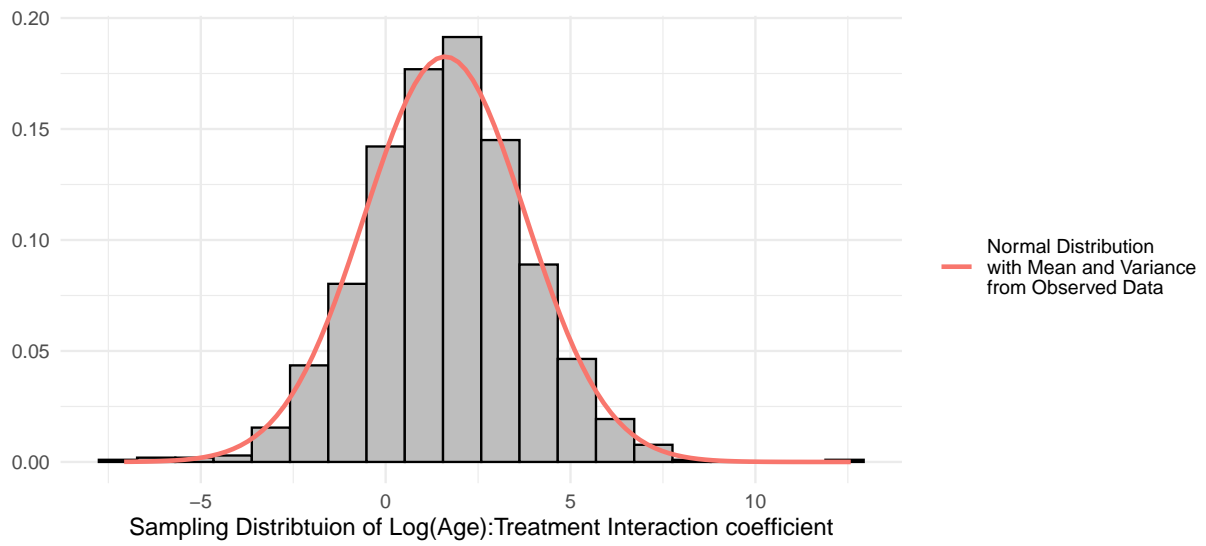


Figure 8: Sampling Distribution of respective interactive term regression coefficient

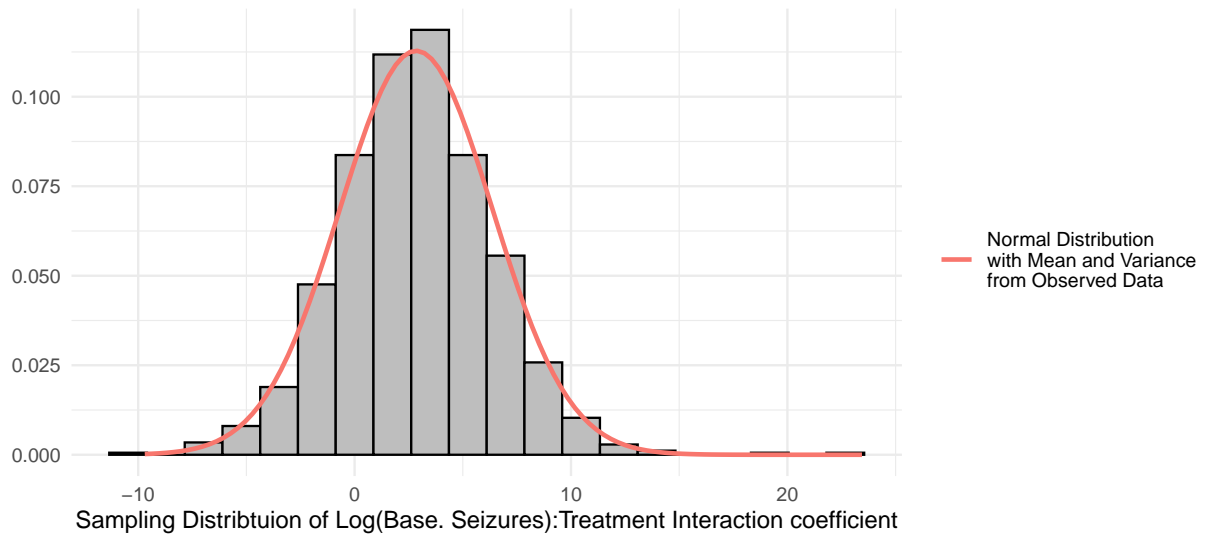


Figure 9: Sampling Distribution of respective interactive term regression coefficient

Treatment - Log(Baseline Seizures) Interaction Term

1. Normal Approximation Method

2.5%	97.5%
-3.54853	10.60684

2. Percentile Method C.I.

2.5%	97.5%
-3.794025	9.650747

3. Comparison with Quasipoisson

2.5 %	97.5 %
-4.164202	10.921238

Three-variable Interaction Term



Figure 10: Sampling Distribution of a three-variable interaction term regression coefficient

1. Normal Approximation Method

2.5%	97.5%
-2.98021	1.23762

2. Percentile Method C.I.

2.5%	97.5%
-2.773731	1.300454

3. Comparison with Quasipoisson

2.5 %	97.5 %
-3.142550	1.496276

Problem 2