Biostat 234: Lab 5

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Question 0
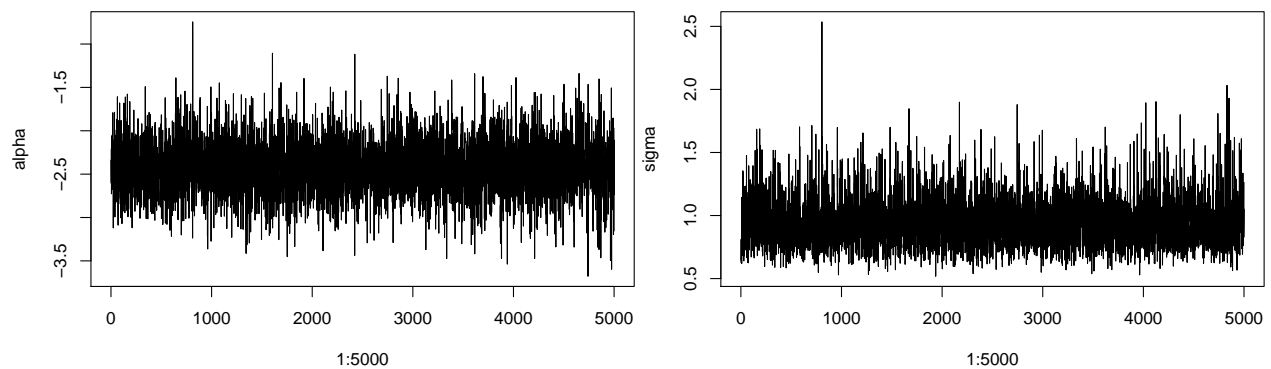
Convergence for both α and σ is now good as seen in the time-series plot.

Question 1

Compared to the first model, α intercept term is removed, and the intercept term now gets soaked into `beta` random effects term. Accordingly, the posterior for `beta` is different for two models. Other than `beta` and σ, posterior inference for other parameters is more or less the same, as seen in the tables below.

Question 2

`d0` is the single parameter we are most interested, as it represents the effect of previous history of cardiovascular disease (CVD) on mortality. The posterior inference for this particular remains more or less the same between the two models. Posterior means of odds ratio are all greater than 1 across 9 studies, and their corresponding 95% credible interval also do not contain one except for Study 7, suggesting that people with prior heart disease fares worse afters visiting the ER, which is consistent with what we would expect in medicine.

Question 3

```
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
```

Table 1: Summary statistics for posterior distribution (Model 2)

	mean	sd	2.5%	97.5%	P > 0
OR[1]	3.20	0.97	1.70	5.44	1
OR[2]	3.58	0.52	2.64	4.70	1
OR[3]	3.45	0.28	2.95	4.01	1
OR[4]	1.94	0.58	1.03	3.28	1
OR[5]	3.29	1.24	1.46	6.29	1
OR[6]	1.78	0.48	1.01	2.89	1
OR[7]	1.33	0.23	0.93	1.83	1
OR[8]	2.56	0.80	1.36	4.43	1
OR[9]	5.61	0.95	4.01	7.72	1
alpha	-2.41	0.32	-3.04	-1.80	0
d0	0.95	0.25	0.43	1.42	1
deviance	118.59	5.91	109.04	132.24	1
pie0[1]	0.04	0.01	0.03	0.06	1
pie0[2]	0.01	0.00	0.01	0.01	1
pie0[3]	0.02	0.00	0.02	0.02	1
pie0[4]	0.20	0.03	0.15	0.26	1
pie0[5]	0.14	0.02	0.10	0.19	1
pie0[6]	0.10	0.01	0.08	0.13	1
pie0[7]	0.06	0.01	0.05	0.07	1
pie0[8]	0.08	0.01	0.05	0.10	1
pie0[9]	0.02	0.00	0.02	0.02	1
pie1[1]	0.12	0.02	0.08	0.17	1
pie1[2]	0.04	0.00	0.03	0.05	1
pie1[3]	0.07	0.00	0.06	0.08	1
pie1[4]	0.32	0.06	0.22	0.44	1
pie1[5]	0.33	0.07	0.20	0.48	1
pie1[6]	0.17	0.03	0.11	0.23	1
pie1[7]	0.08	0.01	0.06	0.10	1
pie1[8]	0.17	0.04	0.11	0.25	1
pie1[9]	0.10	0.01	0.08	0.12	1
sigma	0.93	0.20	0.64	1.42	1
tau	0.70	0.15	0.48	1.06	1

Table 2: Summary statistics for posterior distribution (Model 1)

	mean	sd	2.5%	97.5%	P > 0
OR[1]	3.21	0.96	1.72	5.45	1.00
OR[2]	3.56	0.53	2.61	4.66	1.00
OR[3]	3.46	0.28	2.93	4.05	1.00
OR[4]	1.97	0.57	1.05	3.28	1.00
OR[5]	3.34	1.27	1.51	6.36	1.00
OR[6]	1.81	0.50	1.04	2.95	1.00
OR[7]	1.33	0.23	0.92	1.84	1.00
OR[8]	2.56	0.77	1.37	4.35	1.00
OR[9]	5.61	0.98	3.95	7.72	1.00
alpha	-2.44	1.71	-5.85	0.28	0.12
d0	0.95	0.25	0.46	1.43	1.00
deviance	118.42	5.77	109.05	131.50	1.00
pie0[1]	0.04	0.01	0.03	0.06	1.00
pie0[2]	0.01	0.00	0.01	0.01	1.00
pie0[3]	0.02	0.00	0.02	0.02	1.00
pie0[4]	0.20	0.03	0.16	0.25	1.00
pie0[5]	0.14	0.02	0.10	0.19	1.00
pie0[6]	0.10	0.01	0.08	0.13	1.00
pie0[7]	0.06	0.01	0.05	0.07	1.00
pie0[8]	0.08	0.01	0.05	0.10	1.00
pie0[9]	0.02	0.00	0.01	0.02	1.00
pie1[1]	0.12	0.02	0.08	0.17	1.00
pie1[2]	0.04	0.00	0.03	0.05	1.00
pie1[3]	0.07	0.00	0.06	0.08	1.00
pie1[4]	0.33	0.06	0.22	0.44	1.00
pie1[5]	0.34	0.07	0.20	0.49	1.00
pie1[6]	0.17	0.03	0.11	0.24	1.00
pie1[7]	0.08	0.01	0.06	0.10	1.00
pie1[8]	0.17	0.03	0.11	0.25	1.00
pie1[9]	0.10	0.01	0.08	0.12	1.00
sigma	1.50	0.78	0.68	3.29	1.00
tau	0.68	0.14	0.47	1.03	1.00

```
## Graph information:
##    Observed stochastic nodes: 16
##    Unobserved stochastic nodes: 20
##    Total graph size: 147
##
## Initializing model
##
## Compiling model graph
##    Resolving undeclared variables
##    Allocating nodes
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##    Total graph size: 147
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Table 3: Sensitivity analysis for d0

mean	sd	2.5%	97.5%	P > 0
0.924	0.269	0.376	1.449	0.999
0.901	0.271	0.351	1.432	0.998
0.906	0.274	0.351	1.446	0.998
0.988	0.268	0.447	1.501	0.999
0.920	0.267	0.380	1.431	1.000
1.002	0.269	0.451	1.509	0.999
1.052	0.262	0.517	1.563	1.000
0.956	0.269	0.413	1.485	0.999
0.843	0.261	0.332	1.363	0.998

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Study 7 and 9 have the most influence with omitting Study 7 increasing the OR and omitting Study 9 decreasing the OR. The final conclusion does not change, as 95% credible interval for all the analyses omitting a single study is greater than zero.

Question 4

Looking at empirical OR's, it apperas that Study 7 and 9 have the lowest and highest OR, respectively, out of all studies, and hence infl the meta-analysis the most, consistent with what we observed.