

The data in the file `rct_data.csv` includes the results of 22 randomized clinical trials conducted at 22 different hospitals in the USA. In each of the 22 trials, a varying number of patients (column "Number treated" in the file) was randomly allocated to the treatment group (beta-blocker), or to a placebo group (column Number untreated). In both groups, the number of myocardial infarction (MI) in 2 years follow up was recorded (columns MI cases in treated and MI cases in untreated).

The goal of the analysis is to estimate the odds ratio for MI in the treated versus untreated groups. The investigators believe there is heterogeneity in the results due to the locations of the hospitals and would like to also identify the hospitals with the largest and the smallest odds ratios for MI in treated versus untreated patients.

Analyze the data using a pooled model in which the results from the hospitals are supposed to be generated from the same distribution. Use logistic regression to describe the odds ratio. Be complete and state the prior distributions

Using a pooled model where all 22 hospitals' data was generated from the same prior binomial distribution with an average of 0 and standard deviation of 0.01, the average OR is 0.7715 (95% Credible Interval: 0.6993, 0.8475).

Analyze the data using both a hierarchical and independent logistic regression model in which each hospital has its own odds ratios. Rank hospitals based on odds ratios for MI from smallest to largest.

Hospital	Hierarchical Model		Independent Model	
	OR	Rank	OR	Rank
1	0.7958	14	1.0482	17
2	0.6294	5	0.4565	1
3	0.7068	7	0.5707	6
4	0.7785	10	0.7808	11
5	0.9554	20	1.0586	18
6	0.7077	8	0.5387	2
7	0.6245	4	0.5988	7
8	0.8958	18	0.923	15
9	0.7000	6	0.6635	8
10	0.7174	9	0.7149	9
11	0.7936	13	0.8071	13
12	0.9488	19	0.9574	16
13	0.6112	2	0.5407	3
14	1.1574	22	1.3248	20
15	0.7922	12	0.7303	10
16	0.8896	17	0.8734	14
17	1.0012	21	1.1754	19
18	0.8692	16	1.3906	21
19	0.7802	11	1.6596	22
20	0.8371	15	0.801	12
21	0.6122	3	0.5539	5
22	0.5886	1	0.5423	4

Compare the estimate of the overall odds ratios for MI in treated versus untreated patients that you derived from the three analyses.

The fixed effects model gave an OR estimate of 0.7715. The hierarchical and independent models gave OR estimates between 0.45 and 1.66, which are around the 0.7715 estimate. The rankings from the hierarchical and independent models are very similar.

Which hospital has the smallest odds for MI in treated versus untreated patients?

Using the hierarchical model, hospital 22 has the smallest OR of 0.5886. Using the independent model hospital 2 has the smallest OR of 0.4565.

Predict the odds ratio for MI in a new trial.

Using the hierarchical model, the OR for myocardial infarction in a new trial is 0.7804 (95% Credible Interval: 0.3151, 1.9147).

Predict the odds ratio for MI in a new trial conducted at hospital 1.

Using the hierarchical model, the OR for myocardial infarction in a new trial at Hospital 1 is 0.7974 (95% Credible Interval: 0.2520, 2.5415).