Simulating Cluster-Level Counts from Multinomial Models

Suzanne Dufault

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1 Set-Up

	Seek Care				**Do Not Seek Care**			
	Infected with DENV	Infected with OFI	Not Infected	*Total*	Infected with DENV	Infected with OFI	Not Infected	*Total*
Vaccinated	A	B	C	N_1	D	E	F	N_2
Not Vaccinated	G	H	I	N_3	J	K	L	N_4

Table 1: Stratification of population based on intervention status, infection, and health care-seeking behavior. Adapted from Figure 1 of Jackson & Nelson (2013).

Hence, A represents the number of test-positive individuals in the treatment arm. We denote the observed number of these individuals in cluster j as A_j. Previously, we were using the historic data and setting A_j^* (the number of test-positive individuals in the intervention arm *after* the intervention) deterministically such that:

$$A_j^* = A_j \times \lambda$$

2 Description

We propose drawing case and OFI (*e.g.* A, B, G, H) counts from multinomial distributions. **Cases** are drawn from the multinomial distribution parameterized by n sampled cases (n = 200, 400, 600, 800, 1000), with distribution among the clusters according to:

$$p_{Dj}^* = \frac{X \times \lambda p_{D_j} + (1 - X) \times p_{D_j}}{\sum_{j \in J} \left(X \times \lambda p_{D_j} + (1 - X) \times p_{D_j} \right)}$$

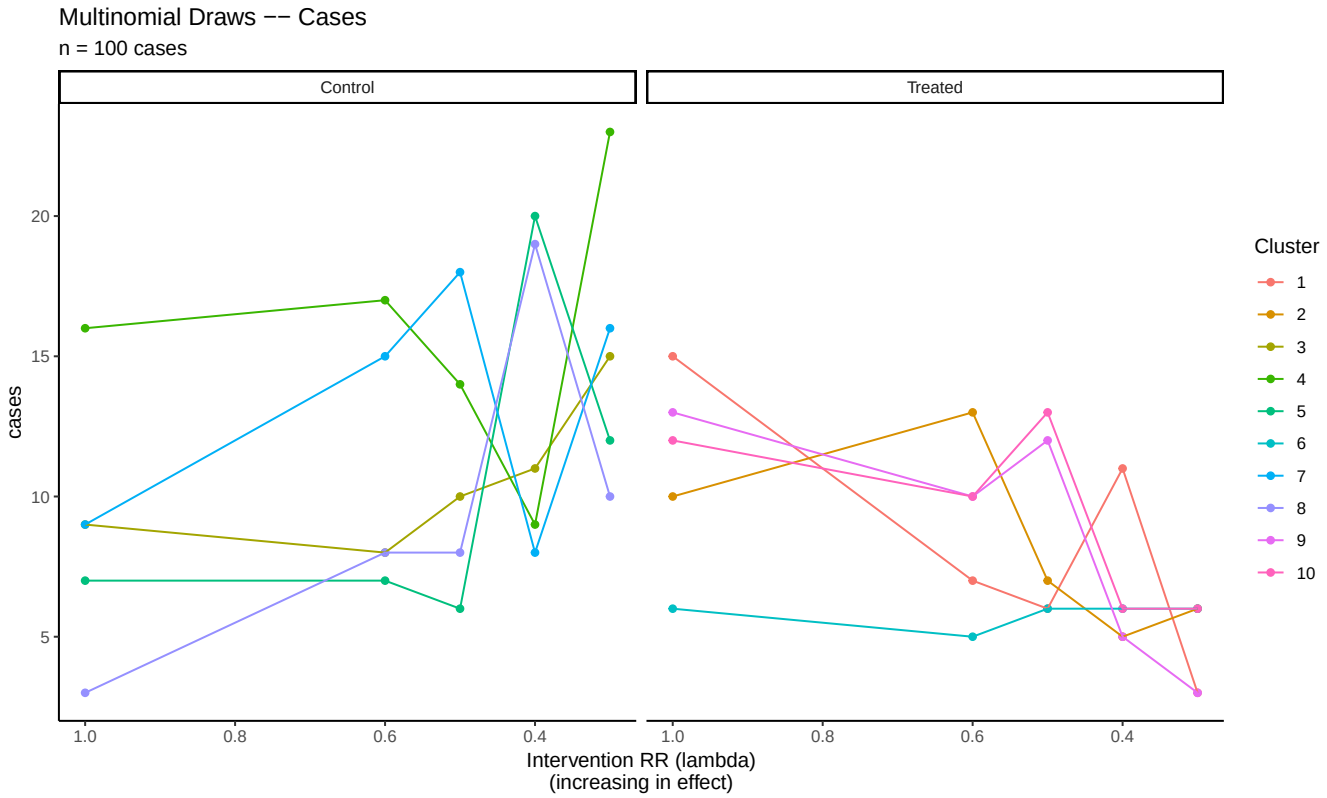
where $X = 0, 1$ according to treatment status and p_{D_j} is the observed proportion of cases in cluster j.

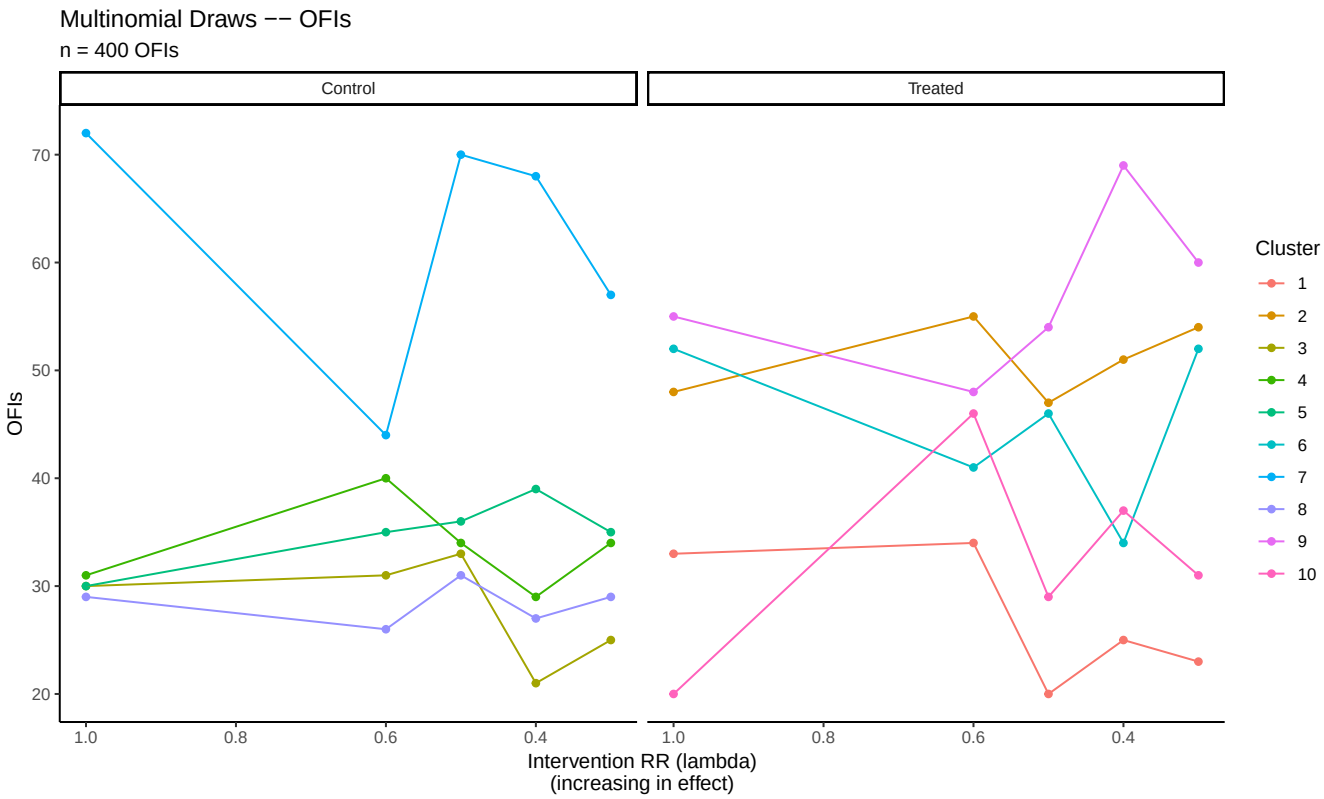
OFIs are drawn from the multinomial distribution parameterized by $4 \times n$ sampled cases, with distribution among the clusters according to the observed distribution (i.e. intervention does not affect OFI counts).

3 Hypothetical 10 Cluster Example

Cluster	Cases	OFI	Period	tx	pD	pD.bar
1	52	138	1	1	0.086	0.079
2	74	212	1	1	0.123	0.121
3	54	125	1	0	0.090	0.072
4	72	145	1	0	0.120	0.083
5	46	165	1	0	0.076	0.095
6	42	194	1	1	0.070	0.111
7	70	250	1	0	0.116	0.143
8	50	131	1	0	0.083	0.075
9	73	229	1	1	0.121	0.131
10	69	156	1	1	0.115	0.089

Table 2: Hypothetical table of observed case and OFI counts and proportions




Multinomial Draws −− OFIs
n = 400 OFIs
Control
Treated
OFIs
70
60
50
40
30
20
1.0
0.8
0.6
0.4
Intervention RR (lambda)
(increasing in effect)
Cluster
1
2
3
4
5
6
7
8
9
10