

Preliminary findings in analysis of  
Kathariou's msmnts of bacterial colonization  
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To investigate whether colonization rates vary by farm company, flocks were taken as sampling units in the initial analysis of the experiment. If any of the 5 (or 6) birds in flock  $i$  from company  $j$  was colonized by any of the species of bacteria and the colonization was detected by any of the 2 (or 3) samples taken on the bird, the response is coded  $y_{i(j)} = 1$  and is coded  $y_{i(j)} = 0$  otherwise:

$$y_{i(j)} = \begin{cases} 1 & \text{flock } i \text{ in co. } j \text{ colonized} \\ 0 & \text{no colonization detected in flock } i \text{ in co. } j \end{cases}$$

Birds were counted as having bacteria of interest if they were not coded as species=4.

The probability of colonization for observation  $y_{ij}$  is denoted  $p_{ij}$ . There were 30 flocks from each of two companies. The number and proportion of flocks colonized within each company are given in the table below:

The SAS System  
The FREQ Procedure

1

Table of colonies by FarmCo

colonies	FarmCo		
Frequency			
Col Pct	1	2	Total
0	4	5	9
13.33	16.67		
1	26	25	51
86.67	83.33		
Total	30	30	60

These two flock colonization rates, 87% for company 1 and 83% for company 2, are not significantly different.

A more naive (and less defensible) approach is to ignore flock effects, so that birds, rather than flocks, are taken as the experimental units. Under this approach, the individual bird colonizations are modelled as a Bernoulli sequence. The table below breaks down infected birds by company.

The SAS System  
The FREQ Procedure

1

Table of infected by FarmCo

infected	FarmCo		
Frequency			
Col Pct	1	2	Total
0	60	41	101
	40.00	27.15	
1	90	110	200
	60.00	72.85	
Total	150	151	301

Statistics for Table of infected by FarmCo

Statistic	DF	Value	Prob
Chi-Square	1	5.5710	0.0183
Likelihood Ratio Chi-Square	1	5.5957	0.0180
Continuity Adj. Chi-Square	1	5.0097	0.0252
Mantel-Haenszel Chi-Square	1	5.5525	0.0185

Fisher's Exact Test

Cell (1,1) Frequency (F)	60
Left-sided Pr <= F	0.9936
Right-sided Pr >= F	0.0125
Table Probability (P)	0.0061
Two-sided Pr <= P	0.0206

The infection rates for individual birds among the two companies differ significantly ( $p < 0.05$ ). The rate for company 1 is 60% and the rate for company 2 is 73% for a difference of 13%. A 95% confidence interval (assuming the appropriateness of the model) for the difference is (0.016, 0.241), so that very small differences between the companies infection rates are plausible, even if 0 isn't.