

P5.2 Statistics for Medicine

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1 Evaluating odds and risks

Frequencies

	logHE4	logCA125	logCA19-9	logCEA	AgePatient		Histology	
						Classical		
1	3.58	4.25	3.33	0.22	84	Binomial Test	benign	
2	3.42	5.45	4.84	0.24	21	Multinomial Test	benign	
3	5.68	4.72	3.2	0.92	64	Contingency Tables	malignant	
4	4.14	3.96	3.54	1.76	58	Log-Linear Regression	malignant	
5	3.57	3.03	-0.04	1.03	74	Bayesian	benign	
6	3.7	4.11	3.44	0.58	40	Binomial Test	benign	
7	7.17	7.58	2.45	0.44	51	A/B Test	malignant	
8	3.57	2.48	1.46	0.1	21	Multinomial Test	benign	
9	3.97	3.64	2.3	0.14	27	Contingency Tables	benign	
10	4.11	4.03	4.73	0.82	75	Log-Linear Regression	benign	
						post	malignant	

Frequencies

Histology	Menopause		Total
	ante	post	
benign	106	65	171
malignant	12	27	39
Total	118	92	210

Table: Menopausal status is a predictor, or a confounder, of malignancy in ovarian cancer?

Odds Ratio

Histology	Menopause		Total
	ante	post	
benign	106	65	171
malignant	12	27	39
Total	118	92	210

Example (Odds Ratio)

Explore the output of the Odds Ratio (2×2 only) checkbox in the Statistics menu of the contingency table of Histology (Rows) versus Menopause (Columns).

Bayes Theorem

$$P(\text{malignant}|\text{ante}) = \frac{P(\text{ante}|\text{malignant}) \cdot P(\text{malignant})}{P(\text{ante})}$$

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	ante	post	
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- prevalence
- sensitivity and specificity
- predictive values
- ...

<https://ictpmmp.weebly.com/lecture-notes.html>

professor Luigi Rigon

the Bayes factor: JASP core business!

- Alice has a balanced urn with 5 winning black balls and 5 white balls ($p = 0.5$)
- Bob has a tricky urn with 6 winning black balls and 4 white balls ($p = 0.6$).

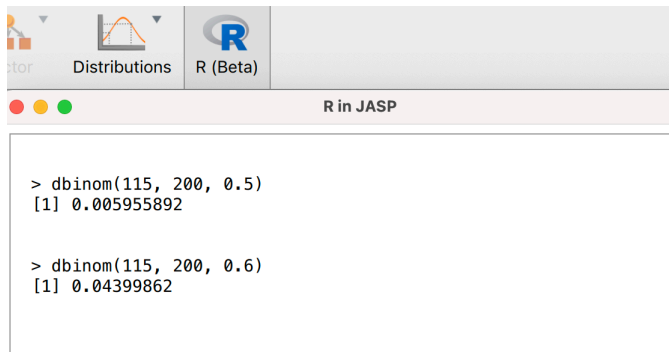
(binomial scheme, extractions with replacement)

we observe 115 successes over 200 draws, but without knowing if they are generated from Alice's or Bob's urn.

the Bayes factor: JASP core business!

$$P(X = 115 | Alice) = \binom{200}{115} \cdot 0.5^{115} \cdot 0.5^{200-115} \approx 0.006$$

$$P(X = 115 | Bob) = \binom{200}{115} \cdot 0.6^{115} \cdot 0.4^{200-115} \approx 0.044$$



The screenshot shows the R in JASP interface. The top bar contains icons for 'Distributions' and 'R (Beta)'. Below the bar is a terminal window with the following R code and output:

```
> dbinom(115, 200, 0.5)
[1] 0.005955892

> dbinom(115, 200, 0.6)
[1] 0.04399862
```

the Bayes factor: JASP core business!

$$\frac{P(X = 115 | Bob)}{P(X = 115 | Alice)} \approx \frac{.044}{.006} \approx 7.4$$

it is much more likely that the balls have been drawn by Bob's urn: about seven times higher

the Bayes factor:

$$\frac{P(D|M_1)}{P(D|M_2)} = \frac{P(M_1|D)}{P(M_2|D)} \cdot \frac{P(M_2)}{P(M_1)}$$