P5.2 Statistics for Medicine

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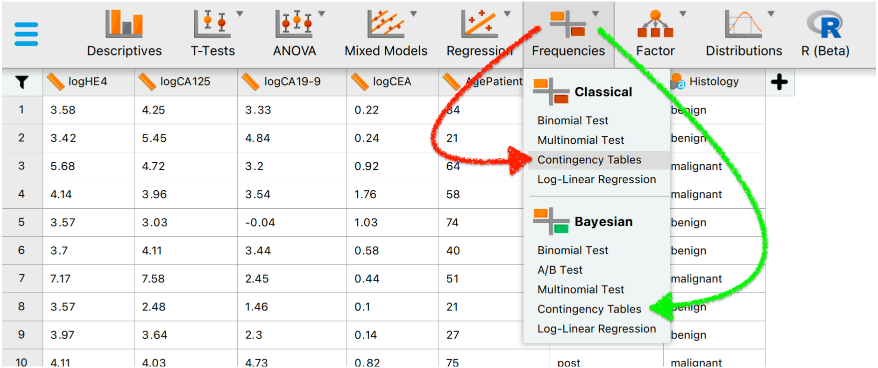
ICTP The Abdus Salam International Centre for Theoretical Physics

IAEA

1. Evaluating odds and risks

Frequencies



Frequencies

	Menopause		
Histology	ante	post	Total
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 ante	Menopause post	Total
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

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

	Menopause		
Histology	ante	post	Total
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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!

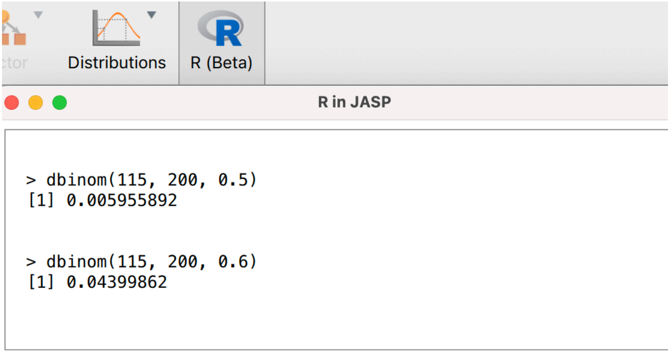
- Alice has a balanced urn with 5 winning black balls and 5 white balls ($p = 0.5$)
- Bob has a tricky urn with 6 winning black balls and 4 white balls ($p = 0.6$).

(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 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 drawned by Bob's urn: about seven times higher

the **Bayes factor**:

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