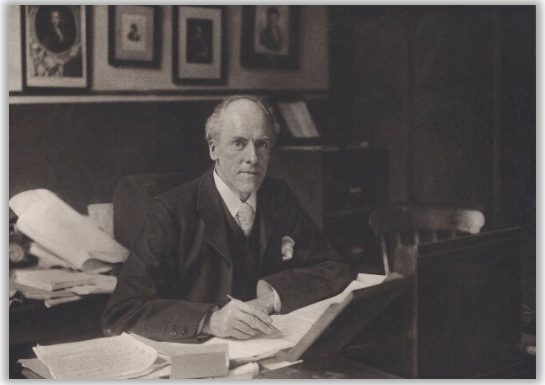
Early Meta-Analyses

Karl Pearson‘s Typhoid Fever Inoculation „Meta-Analysis“ (1904)

- Five Datasets on the typhoid fever immunity immunity in individuals with and without inoculation
- None were randomized (RCTs weren’t invented!)
- Pearson calculated tetrachoric correlations for each studies and their probable error, then took the arithmetic mean
- He concluded that effects differed strongly from each other (today, we would call this “heterogeneity”), and that the data did not show clear benefits of inoculations



Pearson’s 1904 Analysis

Dataset	Correlation (Immunity-Inoculation)	Probable Error
Hospital Staff	0.373	0.021
Ladysmith Garrison	0.445	0.017
Methuen	0.191	0.026
Regiments	0.021	0.033
Army in India	0.100	0.013
Mean	**0.226**	.

(Senn, 2023, ch. 8; Shannon, 2016)

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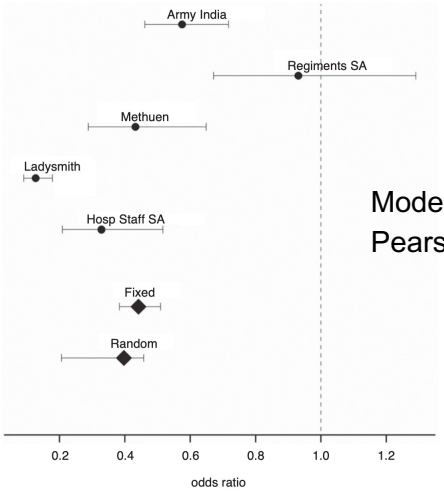

Modern Meta-Analysis of Pearson’s Data

Pearson’s 1904 Analysis

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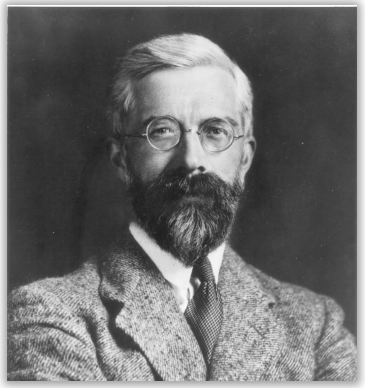
Early Meta-Analyses



R. A. Fisher's Method to Combine *P*-Values

- Included in the famous work Statistical Methods For Research Workers (1925)
- Can be used to combine the *P*-values of multiple independent analyses (that used the same test)
- Combined significance can be determined using the χ^2 distribution:

$$\chi^2_{2k} \sim -2\sum_{i=1}^{k}\log(p_i)$$

- Idea lives on in a "modern" meta-analysis method ("*P*-curve"), which can be used to control for questionable research practices