

# Meta-analysis: the method of systematic review

- Very difficult. It requires very sophisticated manner of statistical thinking. You must pay substantial effort to learn. In this lecture, just a overview is given.
- The recommendable textbook (in Japanese) “メタアナリシス入門:エビデンスの統合を目指す統計手法” (Introduction to meta-analysis: the statistical technique to integrate various evidences), written by Dr. Toshiro Tango, Asakura-Shoten Pub., 2002.



# Definition and history

- What “meta” means?
  - Something occurring later, more comprehensive, and is often used to name a new but related discipline designated to deal critically with the original one. (Egger et al., 1997)
- A statistical analysis to integrate the results of various previous studies.
- The trials to integrate or summarize the previously conducted studies are not new.
  - Sir Wright (1896) developed a new vaccine against typhoid fever and tested the effectiveness of the same vaccine in several different groups.
  - Karl Pearson (1904) re-evaluated the effectiveness of that vaccine ever used.



## Karl Pearson’s calculation

➤ Data: <http://minato.sip21c.org/Pearson1.txt>

StudyName	RecovV	DiedV	TotalV	RecovNV	DiedNV	TotalNV
HospitalSA	30	2	32	63	12	75
GarrisonLadysmith	27	8	35	1160	329	1489
SpecialRegimenSA	63	9	72	61	21	82
SpecialHospitalSA	1088	86	1174	4453	538	4991
MilitaryHospitalSA	701	63	764	2864	510	3374
IndianArmy	73	11	84	1052	423	1475

- Calculate the tetrachoric correlation coefficients for each study (cf. <http://www.personality-project.org/r/psych/R/tetrachor.R> [File] -> [Load script file] -> select all and submit)
- $tetrachoric(matrix(c(30,2,63,12),2,2))$  gives 0.307
- Taking mean of 6 studies by  $mean(c(0.307,-0.010,0.300,0.119,0.194,0.248))$  gives 0.193  
Pearson concluded “The effects is too small to recommend the vaccine”.



## Using Odds Ratios for meta-analysis

- Each result can also be evaluated using odds ratio. For example,  $(30/2)/(63/12)$  gives 2.86. It means vaccination raised the viability 2.86 times at the first study. Using  $fisher.test(matrix(c(30,2,63,12),2,2))$ , the odds ratio is 2.83.
- [Statistical analysis], [Metaanalysis and metaregression], [Metaanalysis and metaregression for proportions]
- Estimated combined odds ratio is 1.77 in fixed effect model and 1.79 in random effect model (both statistically significant at 5% level). “No heterogeneity” is not rejected ( $p=0.235$ ).
- Forest plot is very convenient to see.

