The University of Hong Kong
School of Public Health

CMED 6020 Advanced Statistical Methods I
TUTORIAL 3 – Meta analysis

Fish consumption and depression

It has been proposed that dietary factors can be associated with risk of depression. Studies have investigated the association between fish consumption and risk of depression, but the issue is still controversial. A systematic review and meta-analysis of observational study may help to gather the best evidence for the association.

After a systematic review, 16 studies were found suitable for obtaining a pooled estimated effect of high fish consumption. Some of these studies provided sex or country-specific estimates. The data was saved in 'fishconsumption.csv' (extracted from Li et al., JECH, 2016), with the following variables:

Variable	Data label	Remark
study	Last name of the first author	
year	Year of the study	
country	Study location	Multiple study sites in some study
sex	Sex of the study participants	Some studies carried out stratified and/or combined analysis
rr	Adjusted relative risk of depress for participants with high fish consumption	
rr.lb	95% lower bound of *rr*	
rr.ub	95% upper bound of *rr*	

1. Read the dataset into R and study the dataset.

2. Fit a fixed effects model to estimate overall effect and the associated 95% CI of high fish consumption. (Use the combined estimates for study with both combined and sex-specific estimates)

Variable	***RR***	***95% CI****
High fish consumption		

*CI: confidence interval

3. Try to reproduce the above results using inverse variance weighting method.

$$(\hat{\theta} = \sum_i w_i Y_i / \sum_i w_i,\ \mathrm{var}(\hat{\theta}) = 1/\sum_i w_i)$$

4. Assess the heterogeneity between studies. Do you think a fixed effects model is appropriate?

5. Fit a random effects model to estimate overall effect and the associated 95% CI of high fish consumption.

Variable	***RR***	***95% CI****
High fish consumption		

*CI: confidence interval

6. Produce a forest plot of the relative risks based on your final model.

7. Assess if there is evidence of publication bias.

8. Suppose we like to test if there is heterogeneity due to difference in sex and study year. Perform a meta-regression on sex. (hint: in *rma* function, include moderator in yi = *effect ~ moderator*)

   Meta-regression model:

   $Y_i = \theta + \theta_i + \beta I(i \in J) + \varepsilon_i$ (binary moderator)

   $Y_i = \theta + \theta_i + \beta x_i + \varepsilon_i$ (continuous moderator)

   (e.g. J is the set of studies with certain characteristics)

9. Suppose after the quality assessment, it was found that Smith et al. 2014 and Colangelo et al 2009 have relatively lower quality. Would that affect the overall estimates qualitatively?

10. Carry a leave-one-out sensitivity analysis to assess the impact of study heterogeneity on the overall estimate. (hint: R function: leave1out())

    Leave-one-out method: for K data points, remove data point 1, 2, …, K to perform K analyses to assess impact of individual data.

11. Draw a conclusion for the meta analysis based on the above results.

12. Carry out a trim and fill sensitivity analysis for publication bias. (hint: R function: trimfill()). Suppose the study by Albanese et al. was not included?

Example of a trim and fill analysis (Kleikers, Sci Rep, 2015)