

META-ANALYSIS

Markus Jokela

markus.jokela@helsinki.fi

The results of single studies can be fickle, and the same result may not hold when the same study design is repeated in other samples. This has long been recognised in epidemiology, at least, and the recent waves of “replicability crisis” have brought the issue attention in psychology as well.

Meta-analysis attempts to evaluate the totality of evidence for and against specific hypotheses by pooling information from several different studies. More specifically, individual-participant meta-analysis uses raw (instead of published) data from separate studies and can thus mitigate problems of publication bias and spurious findings in small samples.

References

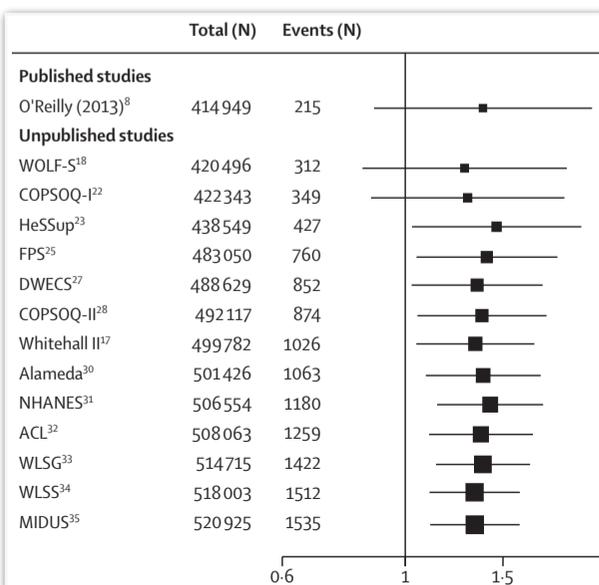
172. Kivimäki M, Jokela M, ..., Virtanen M. Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603 838 individuals. *Lancet*. 2015;386(10005):1739-1746. doi:10.1016/S0140-6736(15)60295-1.
154. Virtanen M, Jokela M, ..., Kivimäki M. Long working hours and alcohol use: systematic review and meta-analysis of published studies and unpublished individual participant data. *BMJ*. 2015;350:g7772.
129. Jokela M, Hamer M, Singh-Manoux A, Batty GD, Kivimäki M. Association of metabolically healthy obesity with depressive symptoms: pooled analysis of eight studies. *Mol Psychiatry*. 2014;19(8):910-914. doi:10.1038/mp.2013.162.
166. Hakulinen C, Elovainio M, Batty GD, Virtanen M, Kivimäki M, Jokela M. Personality and alcohol consumption: Pooled analysis of 72,949 adults from eight cohort studies. *Drug Alcohol Depend*. 2015;151:110-114. doi:10.1016/j.drugalcdep.2015.03.008.
155. Hakulinen C, Hintsanen M, Munafò MR, Virtanen M, Kivimäki M, Batty GD, Jokela M. Personality and smoking: individual-participant meta-analysis of nine cohort studies. *Addiction*. 2015;110(11):1844-1852. doi:10.1111/add.13079.
144. Hakulinen C, Elovainio M, Pulkki-Råback L, Virtanen M, Kivimäki M, Jokela M. Personality and depressive symptoms: Individual-participant meta-analysis of 10 cohort studies. *Depress Anxiety*. 2015;32(7):461-470. doi:10.1002/da.22376.
118. Jokela M, Elovainio M, Nyberg ST, Tabák AG, Hintsanen T, Batty GD, Kivimäki M. Personality and risk of diabetes in adults: pooled analysis of 5 cohort studies. *Health Psychol*. 2014;33(12):1618-1621. doi:10.1037/hea0000003.
111. Jokela M, Hintsanen M, Hakulinen C, Batty GD, Nabi H, Singh-Manoux A, Kivimäki M. Association of personality with the development and persistence of obesity: a meta-analysis based on individual-participant data. *Obes Rev*. 2013;14(4):315-323. doi:10.1111/obr.12007.
103. Jokela M, Batty GD, Nyberg ST, Virtanen M, Nabi H, Singh-Manoux A, Kivimäki M. Personality and all-cause mortality: individual-participant meta-analysis of 3,947 deaths in 76,150 adults. *Am J Epidemiol*. 2013;178(5):667-675. doi:10.1093/aje/kwt170.

1. Individual-participant meta-analysis

Traditional meta-analysis pools information from published studies to integrate all available evidence. Their conclusions can be heavily influenced by publication bias—the tendency of researchers and journals to favor positive over negative findings.

Individual-participant meta-analysis pools together several datasets instead of published reports. The same analysis is then applied across all the studies. These data can then be added on to previously published studies.

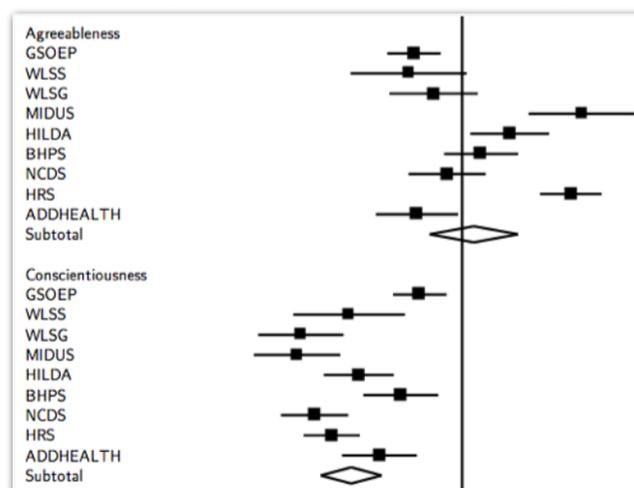
We have used this approach in several studies of personality, psychosocial factors, and health. For example, with 1 published study and 13 unpublished studies, we showed a robust association between long working hours (55 hours or more) and 30% increased risk of stroke. The estimate became more and more precise as more datasets were added to the analysis:



2. Heterogeneity across studies

Individual-participant meta-analysis makes you appreciate how much variation there often is across results from single studies—even with large sample sizes.

For example, the association between agreeableness and obesity was positive in some cohort studies but negative in others, with a null pooled association. Conscientiousness, by contrast, was consistently associated with lower obesity risk:



Heterogeneity across samples can make one doubt whether even the pooled association is true or not. Widely fluctuating findings are also easily left unpublished—known as the file drawer problem.



3. More precise and reliable effect size estimates

Even when the individual-participant meta-analyses only establish associations that are well-known already before, the effect size estimates are often quite different from those based on published studies. For example, in our individual-participant meta-analysis the pooled effect size for low conscientiousness and higher mortality risk was only one-third of that estimated in an earlier meta-analysis of published studies (HR=0.88 vs. HR=0.64 per 1SD).