Recalibration as an approach to context in statistical meta-analyses

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Background

- Using evidence from meta-analyses for local decision-making is hampered by the lack of explicit connection between the contexts in which interventions were evaluated and the context in which the evidence is to be applied.

- New methods are needed to address the question, 'is there any evidence that the intervention will work differently in an area like mine?'

- The CEPHI project sought to develop and test four methods for synthesizing evidence that better accounted for context than standard statistical meta-analysis approaches.

- This presentation: Recalibration of the contribution of studies to the pooled effect size so that the most relevant studies contribute more than less relevant studies

Handling Complexity in Evidence from systematic reviews and meta-analyses of Public Health Interventions (CEPHI project)

Recalibration process

Using a co-produced logic model as an anchor, identify relevant characteristics

Extract the contextual characteristics of each study

Add in characteristics of a Local Authority (LA), gleaned from secondary data sources (in this case mainly, Census data)

Harmonise the data (create rules for categorising data)

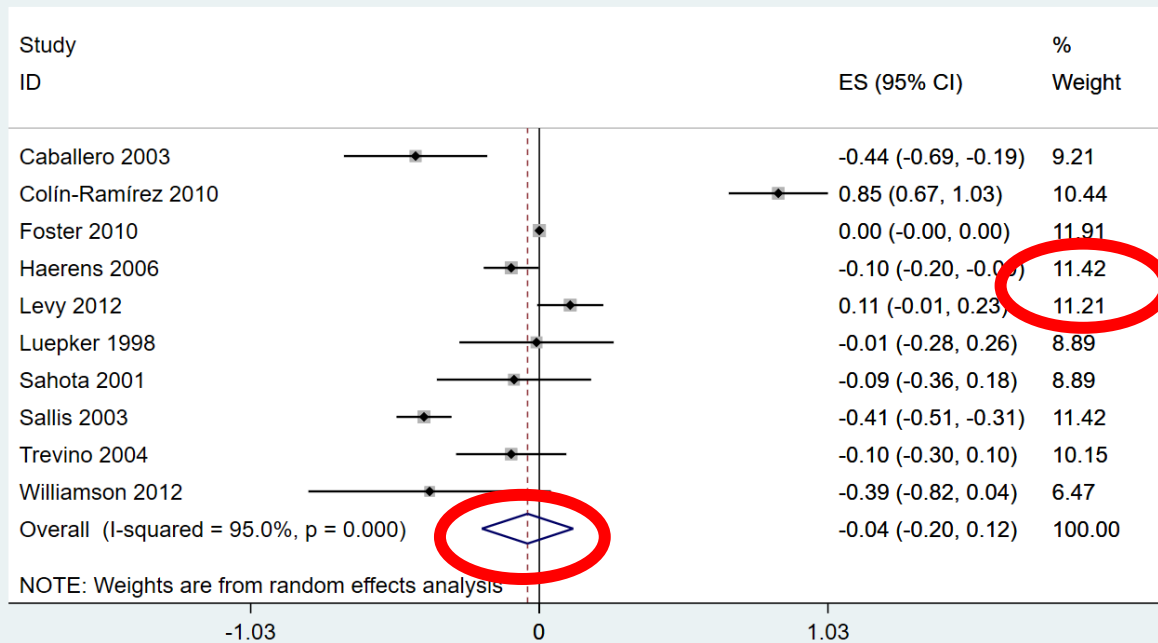Create dissimilarity matrix based on multiple factors – focus on similarity to context to LA

Create weight that includes the usual inverse of the variance (and tau2) plus a similarity coefficient
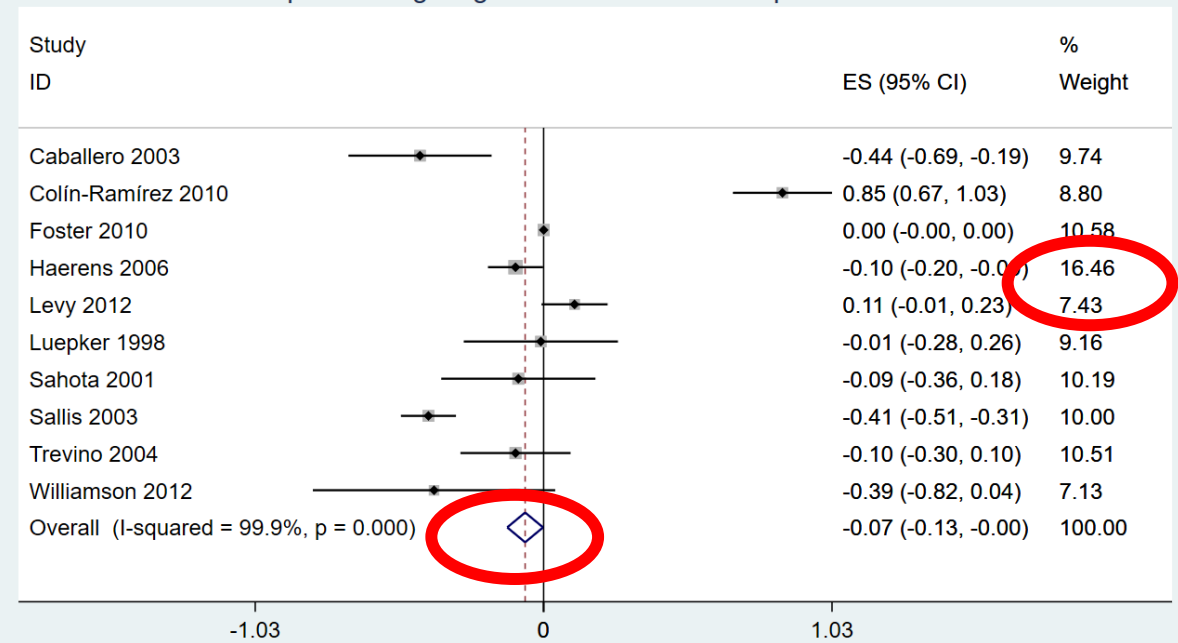
Results: Giving more weight to relevant studies can change interpretation – e.g., studies more similar to Liverpool had higher effect sizes, and upweighting these suggests small but significant intervention impact.

Before   and   after

Random Effects Model on Fat intake

Study ID	ES (95% CI)	% Weight
Caballero 2003	-0.44 (-0.69, -0.19)	9.21
Colín-Ramírez 2010	0.85 (0.67, 1.03)	10.44
Foster 2010	0.00 (-0.00, 0.00)	11.91
Haerens 2006	-0.10 (-0.20, -0.0)	11.42
Levy 2012	0.11 (-0.01, 0.23)	11.21
Luepker 1998	-0.01 (-0.28, 0.26)	8.89
Sahota 2001	-0.09 (-0.36, 0.18)	8.89
Sallis 2003	-0.41 (-0.51, -0.31)	11.42
Trevino 2004	-0.10 (-0.30, 0.10)	10.15
Williamson 2012	-0.39 (-0.82, 0.04)	6.47
Overall (I-squared = 95.0%, p = 0.000)	-0.04 (-0.20, 0.12)	100.00

NOTE: Weights are from random effects analysis

-1.03   0   1.03

Upward weighting of trials similar to Liverpool context

Study ID	ES (95% CI)	% Weight
Caballero 2003	-0.44 (-0.69, -0.19)	9.74
Colín-Ramírez 2010	0.85 (0.67, 1.03)	8.80
Foster 2010	0.00 (-0.00, 0.00)	10.58
Haerens 2006	-0.10 (-0.20, -0.0)	16.46
Levy 2012	0.11 (-0.01, 0.23)	7.43
Luepker 1998	-0.01 (-0.28, 0.26)	9.16
Sahota 2001	-0.09 (-0.36, 0.18)	10.19
Sallis 2003	-0.41 (-0.51, -0.31)	10.00
Trevino 2004	-0.10 (-0.30, 0.10)	10.51
Williamson 2012	-0.39 (-0.82, 0.04)	7.13
Overall (I-squared = 99.9%, p = 0.000)	-0.07 (-0.13, -0.00)	100.00

-1.03   0   1.03

Recalibration — further interpretation

The decision-maker's question: *"Is there any evidence that the intervention would work differently in an area like mine (Liverpool)?"*

Evidence that when we upweight studies more similar and downweight studies less similar, we might be more confident in seeing an impact in Liverpool

<u>Caveats:</u> weighting doesn't lead to a 'perfect' match; different factors contribute equally to the weight; what components should we include in the weight?

<u>Advantages:</u> Interpretation for decision-making **alongside** usual approach; emphasises contextual factors that are relevant

Discussion

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- The original meta-analysis found that the intervention was not effective in reducing fat intake.

- In the recalibration analyses, because contextually relevant studies showed greater effects, the recalibrated pooled effect sizes indicated a larger effect with a narrower confidence interval in three Local Authorities, but the interpretation remained unchanged in a fourth.

- The findings held under both fixed effect and random effects specifications.

- Recalibration may give a contextually-nuanced estimate for a given local context.