Background

Although meta-analysis methods are now commonplace in systematic reviews of clinical interventions, their application in public health contexts is less extensive. This is partly due, at least, to the heterogeneous nature of public health evidence bases which often include studies with different designs and using inconsistent definitions of outcomes and interventions.

**Aims**

- To review the methods currently used in synthesis of public health evidence.
- To demonstrate the availability of more sophisticated approaches to overcome some of the problems inherent in evidence synthesis for public health evaluations.

**Methods**

A systematic review of NICE public health appraisals published between 2006 and 2012 was performed to assess the methods used for synthesis of the effectiveness evidence.

The ability of new developments in evidence synthesis methodology to address the challenges and opportunities present in a public health context is demonstrated through the following:

a) Pairwise meta-analysis.
b) Meta-regression using both individual participant data (IPD) and aggregate or summary level data.
c) Network meta-analysis (NMA).

The effectiveness of home safety interventions to promote safety practices in households with children, for example, increase uptake of a stair gate(s) were evaluated in a Cochrane systematic review using pairwise meta-analysis (see Figure 1a). Meta-regression using both IPD and summary data examined the effect of interventions by child age, gender, and social variables. The Cochrane review strategies were then reclassified into more homogenous intervention groups (see Figure 1b) and re-evaluated using NMA.

**Results**

Nine (23%) of the 39 NICE appraisals included in the review performed pairwise meta-analyses as part of the effectiveness review with one of these also including a network meta-analysis. Of the remainder, 29 (74.4 %) presented narrative summaries of the evidence only, and 1(2.6 %) appraisal did not present any review of effectiveness and cost-effectiveness evidence. Heterogeneity of outcomes and interventions were the main reasons given for not pooling the data.

Exploration of the synthesis methods shows that: i) pairwise meta-analyses can be extended to incorporate individual participant data (where it is available), ii) NMA can be used to extend the pairwise meta-analyses by enabling simultaneous comparison of all evaluated interventions including comparisons not treated in primary studies (results for the stair gate example (Figure 1b) are presented in Table 1), and iii) both pairwise meta-analyses and NMA can be adjusted for both subject and summary-level covariates. All these can contribute to ensuring the analysis answers directly the policy relevant questions.

**Discussion**

**Key Findings**

Quantitative synthesis is not carried out in systematic reviews for the majority of PH evaluations. When quantitative synthesis is done it tends to use the simplest methods, e.g. a fixed or random effects meta-analysis comparing two groups, which potentially limits the scope of the analysis.

**What this adds to what is known?**

Demonstrates application of recent developments in evidence synthesis methodology that offer the opportunity for a more realistic modelling of public health evidence and thus answer the relevant policy questions.

**What is the implication, what should change now?**

Researchers working on PH evaluations should consider expanding their toolbox and using more sophisticated methods many of which have recently been developed, motivated and applied in pharmaceutical evaluations.

**Conclusions**

More sophisticated methods in evidence synthesis should be considered to make evaluations in public health more useful for decision makers.

**Table 1: Estimated Odds Ratios (95% credible intervals) from the NMA model (below diagonal line) or Odds ratios (95% confidence intervals) from the pairwise meta-analysis model (above diagonal line) for uptake of a fitted stair gate(s).** The NMA model also provided estimates of the probability that each intervention is the most effective (Prob. Best).

**REFERENCES**

5. Hubbard S, A Sutton, D Kendrick, and Y Young, F Achana, and N Cooper, Network Meta-analyses to evaluate the effectiveness of interventions to prevent falls injuries in children under 5, 2012, WHO.

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**Figure 1: Network diagrams indicating how intervention groups were defined and the number of studies available for the a) pairwise meta-analysis and b) network meta-analysis.**