

## How might improvements to maternal mental wellbeing reduce inequalities in child health in the UK? A simulation of hypothetical interventions using a causal mediation method

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### Background:

Early years' services, such as the Family Nurse Partnership (FNP), aim to improve maternal mental health (MMH) to support child health and development. We examined how inequalities in child mental health (CMH) might change if interventions to improve MMH were scaled-up nationally, using data from the UK Millennium Cohort (18000 children born 2000-02).

### Methods:

Exposure: Maternal education in infancy. Mediator: MMH (Kessler Psychological Distress Scale at 3yrs). Outcome: CMH using the Strengths and Difficulties Questionnaire at 5yrs. Predicted probabilities for poor CMH were estimated in marginal structural models, accounting for confounding with

inverse-probability-treatment-weights ( $n = 14451$ ). Prevalence ratios (PRs) captured relative HIs in CMH. Intervention scenarios were simulated by re-estimating predicted probabilities after modifying MMH by given amounts reflecting effect size (ES), in eligible groups (for targeted interventions), using random sampling (if uptake  $[U] < 100\%$ ). Survey weights and multiple imputation addressed sample design, attrition, item missingness.

### Results:

10% children had poor CMH, with a 2-fold difference in low v high education groups (PR 2.33 [1.94-2.72]). Simulations informed by meta-analyses of trials had limited benefit: a proportionate universal intervention combining a universal intervention (ES: 0.2SD, U: 75%), a targeted intervention in FNP eligible mothers  $< 25$  years (ES: 0.3SD, U: 66%), and an intensive intervention in mothers previously treated for depression (ES: 0.7SD, U: 66%) produced a prevalence of 9.2% and PR 2.36 (0.96-2.76). An optimistic scenario produced modest reductions in prevalence in CMH (to 8.5%) with PR 1.63 (1.34-1.91).

### Conclusions:

If achievable, levelling-up MMH could produce a substantial reduction in HIs. However, scale-up of existing interventions carries limited potential, even when targeting high-risk groups. These results require replication in other contexts and using alternative MMH measures.