Vaccine 33 (2015) 2862–2880

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Review

# Parental reminder, recall and educational interventions to improve early childhood immunisation uptake: A systematic review and meta-analysis

Hannah Harvey[a,*], Nadja Reissland[a], James Mason[b]

[a] Department of Psychology, Durham University, Durham DH1 3LE, UK
[b] Durham University School of Medicine, Pharmacy and Health, Wolfson Research Institute, Stockton-On-Tees TS17 6BH, UK

ARTICLE INFO

*Article history:*
Received 16 January 2015
Received in revised form 21 April 2015
Accepted 23 April 2015
Available online 2 May 2015

*Keywords:*
Vaccination
Early childhood
Intervention
Recall and reminder
Education
Uptake

ABSTRACT

Vaccination is one of the most effective ways of reducing childhood mortality. Despite global uptake of childhood vaccinations increasing, rates remain sub-optimal, meaning that vaccine-preventable diseases still pose a public health risk. A range of interventions to promote vaccine uptake have been developed, although this range has not specifically been reviewed in early childhood. We conducted a systematic review and meta-analysis of parental interventions to improve early childhood (0–5 years) vaccine uptake. Twenty-eight controlled studies contributed to six separate meta-analyses evaluating aspects of parental reminders and education. All interventions were to some extent effective, although findings were generally heterogeneous and random effects models were estimated.

Receiving both postal and telephone reminders was the most effective reminder-based intervention (RD = 0.1132; 95% CI = 0.033–0.193). Sub-group analyses suggested that educational interventions were more effective in low- and middle-income countries (RD = 0.13; 95% CI = 0.05–0.22) and when conducted through discussion (RD = 0.12; 95% CI = 0.02–0.21). Current evidence most supports the use of postal reminders as part of the standard management of childhood immunisations. Parents at high risk of non-compliance may benefit from recall strategies and/or discussion-based forums, however further research is needed to assess the appropriateness of these strategies.



## 1. Introduction

The reduction in global mortality associated with vaccinations is second only to the introduction of safe drinking water [1]. According to the World Health Organisation, childhood vaccinations prevent an estimated 2–3 million deaths per year. Yet despite global increases in childhood vaccine uptake, rates remain sub-optimal (<95%), with vaccine-preventable diseases still posing a public health risk [2]. Neither is this risk limited to low- and middle-income countries (LMICs). Factors such as poor access to healthcare, indigenous or ethnic status, a large family size and low educational achievement are associated with pockets of low coverage in high-income countries (HICs) [3].

Maintaining reductions in mortality from vaccine-preventable disease relies upon continued immunisation uptake that, during childhood, is reliant on parental decision-making and subsequent attendance at vaccine clinics [4]. However, several factors may act as barriers to childhood immunisation. Factors include parental concerns about vaccine safety, a lack of knowledge about the recommended schedule, pain caused by the injections, distrust of the medical community and difficulty accessing clinics [5]. Therefore, it is important to understand the effectiveness of interventions implemented by primary care settings that are designed to improve childhood immunisation. Interventions to increase childhood immunisation have been targeted at a variety of groups, including healthcare providers, healthcare practices and parents [6]. This review will focus on the effectiveness of interventions targeted at parents. Many strategies have been trialled, including financial incentives [7] and home vaccination [8]. However, as the majority of trials have addressed (a) the lack of schedule awareness using parental reminder systems and/or (b) knowledge about the safety and efficacy of vaccines through educational leaflets or discussion-groups, these interventions will be the primary focus of this review. Systems designed to remind parents that their child was due (reminder) or overdue (recall) their immunisations have been linked to a 1.5 times increase in uptake [9]. The effects of parental education are less clear,

* Corresponding author. Tel.: +44 0191 334 3251.
*E-mail addresses:* hannah.harvey@durham.ac.uk (H. Harvey), n.n.reissland@durham.ac.uk (N. Reissland), j.m.mason@durham.ac.uk (J. Mason).

http://dx.doi.org/10.1016/j.vaccine.2015.04.085

with evidence presented both for [10,11] and against [3] their utility.

Previous reviews have focussed on the efficacy of intervention strategies in isolation and not all have made specific recommendations regarding childhood immunisations. Today, primary health care services are under increasing pressure to meet immunisation expectations at both an organisational and patient level [12]. In order to facilitate physician judgements about interventions to increase childhood immunisation, and to increase the efficacy of intervention implementation and policy updates, a review comparing the effectiveness of multiple interventions to be compared is timely. Therefore, a systematic review and meta-analysis was conducted to evaluate available evidence on parental interventions to improve childhood (birth to 5 years) vaccine uptake.

## 2. Material and methods

### 2.1. Literature search

A systematic literature search of five databases (MEDLINE, EMBASE, EMBAR, CINAHL and PsychINFO) was conducted in February 2014 using the OVID and EBSCOhost search platforms (with adaptation of terms for EBSCOhost). Search terms were predefined to allow a comprehensive search strategy that included text fields within records and Medical Subject Headings (MeSH terms). Terms related to immunisation, immunisation uptake, infants and young children and intervention study design. The OVID search strategy is reported in Table 1. This search was conducted as part of a wider review of barriers and facilitators of childhood immunisation and so included both qualitative and quantitative data. The present review refers only to quantitative intervention studies.

### 2.2. Study selection

Database search results were combined and duplicates were removed. Studies were screened for eligibility by the primary author, with uncertain citations discussed with J.M. Full-text reports were gained for all eligible studies. The reference lists of included studies were additionally searched for any relevant articles. A sample of studies was independently assessed for eligibility by J.M. to corroborate study selection. Any disagreements were resolved by discussion. Studies were eligible for inclusion in the systematic review if they reported interventions aimed at parents of children (≤5 years-old) due or overdue one or more routine immunisations, recommended to be administered by WHO, with outcomes that measured child immunisation uptake. Because of variations in the reporting of immunisation uptake [3] outcomes that addressed the uptake of individual or a combination of recommended vaccines were included. Studies without a control group and studies that did not provide outcome data in terms of the number of children completely immunised or up-to-date for their age were excluded from the meta-analysis. Interventions that met these criteria but for which only one study was found were also excluded from pooled analyses.

**Table 1**
OVID search strategy.

| Search no. | Search terms (number of records found) |
|---|---|
| 1 | Vaccination/or vaccin*.mp. (504,709) |
| 2 | Vaccines, Combined (Roberts et al.) (15,179) |
| 3 | Immunisation, Secondary/or Immunisation Schedule/or immuniz*.mp. or immunis*.mp. (259,183) |
| 4 | Child, Preschool/(1,015,179) |
| 5 | infant*.mp. or exp Infant/(1,419,667) |
| 6 | Intervention Studies/or intervention*.mp. (1,272,614) |
| 7 | Observational Study/or observational.mp. (186,994) |
| 8 | randomised controlled trials as topic/or epidemiologic research design/or cross-over studies/(302,583) |
| 9 | comparative study/or evaluation studies/or meta-analysis/(2,466,746) |
| 10 | Qualitative Research/or qualitative.mp. (253,593) |
| 11 | Attitude to Health/or attitude*.mp. (586,720) |
| 12 | Decision Making/or decision*.mp. (611,254) |
| 13 | uptake.mp. (506,659) |
| 14 | 1 or 2 or 3 (629,636) |
| 15 | 4 or 5 (1,921,801) |
| 16 | 6 or 7 or 8 or 9 or 10 (4,175,191) |
| 17 | 11 or 12 or 13 (1,636,383) |
| 18 | 14 and 15 and 16 and 17 (1432) |

*Note.* Databases searched <dates>: EBM Reviews – Cochrane Database of Systematic Reviews <2005 to December 2013>, EBM Reviews – ACP Journal Club <1991 to January 2014>, EBM Reviews – Database of Abstracts of Reviews of Effects <1st Quarter 2014>, EBM Reviews – Cochrane Central Register of Controlled Trials <January 2014>, EBM Reviews – Cochrane Methodology Register <3rd Quarter 2012>, EBM Reviews – Health Technology Assessment <1st Quarter 2014>, EBM Reviews – NHS Economic Evaluation Database <1st Quarter 2014>, Embase <1996 to 2014 Week 06>, Ovid MEDLINE(R) <1946 to January Week 5 2014>.

### 2.3. Data extraction and assessment of methodological quality

Study characteristics were recorded using a pre-defined data extraction sheet. Information was extracted on (a) study design, (b) country of study, (c) intervention (including type, population, setting, details and sample sizes), (d) outcomes (including the number of children completely immunised for their age, received at least one dose of the studies vaccine(s), or were vaccinated on-time), (e) study findings and (f) eligibility for inclusion within meta-analyses.

### 2.4. Risk of bias in individual studies

Risk of bias was performed by the primary author using the Cochrane Collaboration Risk of Bias Tool [13]. Studies were assessed as being at a high, low or unclear risk of six attributes: sequence allocation, allocation concealment, blinding, incomplete outcome data, selective reporting, and other sources of bias. Studies were assessed as 'unclear' when an attribute (e.g., blinding) was not or insufficient evidence to support a judgement was provided. Evidence of quality across studies was determined by the proportion of studies given each judgement for each methodological attribute assessed in the tool. Although assessment of study quality is reported here it was not used to weigh review findings.

### 2.5. Data analysis

Studies that were eligible for inclusion in the meta-analysis were grouped according to intervention type. Separate meta-analyses were conducted for each intervention type. Studies examining multiple interventions could contribute to several analyses. Where trials had a cluster randomised design, reported intra-cluster correlation coefficient (ICC) were sought. If ICCs were not reported, unadjusted values were included in the meta-analyses, accepting that this might overestimate the weight of these studies in the analysis. Risk difference values and 95% confidence intervals were used to calculate both individual and pooled effect sizes for the effect of each intervention on complete childhood immunisation uptake. Potential differences between studies were explored by sub-group analyses including where possible, the effect of the country of study income, time, frequency and method of intervention delivery and focus of intervention content.

Heterogeneity was assessed using Cochrane's $Q$ statistic, with $p < .10$ denoting heterogeneity. Inconsistency across studies was measured using the $I^2$ statistic, with a value greater than 40% presenting evidence of moderate heterogeneity and signalling the need to use a random effects model [13]. Where heterogeneity was not reduced by sub-group analyses, variability in study method