Provider Based Interventions

Provider reminder/recall

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Brink 1989) **Citation:** Provider Reminders Changing Information Format to Increase Infant Immunisations **Aim of study:** This study describes a provider reminder system designed for used with a low-income urban population with low-immunisation rates at one year of age. **Study design:** Before and after study **Internal validity score:** - **Applicability:** C	**Source population/s:** United States. **Eligible population:** Children with low immunisation rates aged less than one year. The authors have not provided any information on settings, eligibility criteria of the participants. and also how the participants were selected for the study. **Selected population:** Pre and post intervention cohorts born in the same months of consecutive years were used to give an uncontaminated pre-test cohort and to minimise bias due to time of year born and seasonal illness. Healthy infants in low-income families born in eight consecutive months in each of the pre and post years were included to obtain 200 infants in each cohort. **Excluded population/s:** NR **Setting:** NR **Vaccines:**	**Method of allocation:** NA **Intervention/s description:** The intervention includes provider reminder system. The intervention was implemented in two stages: an information session for the healthcare providers, and an immunisation reminder system. This system aided the provider by giving current immunisation information without the necessity of a chart search. The reminder system consisted of a database that tracked all children and their primary care visits and an immunisation information label specific to the infant. Each immunisation label contained a specific patients name, birth date, medical record number, and dates of previous immunisations. These labels were applied to each clinic note prior to infant visits during the first year of life. The immunisation labels were introduced in the clinic after orientation sessions for	**Primary Outcomes:** Immunisation status of the children for immunisation series of 3 doses of DPT/OPV. **Secondary outcomes:** Not relevant to the review. **Follow-up periods:** 1. 2, and 3 dose of DPT/OPV. **Method of analysis:** NR	**Primary outcomes:** For the first and second immunisation series of DPT/OPV, the cumulative proportion of children unimmunised 10 days after the recommended day was similar for both cohorts. However for the third immunisation, at 190 days after birth, the post intervention cohort had significantly fewer infants remaining unimmunised (p=0.036); 66% of the post intervention cohort remained unimmunised compared with 75.4% of the pre-intervention cohort. (CI not reported) **Secondary outcomes:** Not relevant to the review. **Attrition details:** DPT/OPV- 1dose 1 lost to follow-up in the post test group DPT/OPV - 2 dose 2 lost to follow-up in the post group DPT/OPV – 3 dose	**Limitations identified by author:** NR **Limitations identified by review team:** Not reported eligibility criteria of the participants. Not reported settings of the study. Not reported Confidence Interval for the results. Intention to treat analysis not used. **Evidence gaps and/or recommendations for future research:** Well designed studies should be conducted in this topic area

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	DPT, OPV	providers. **Control/comparison/s description:** NA **Sample sizes:** **Total n=** 200 **Intervention n=**NA **Control n=**NA **Baseline comparisons:** The post and pre intervention cohorts were similar with respect to sex, number of siblings, single –parent families, ethnicity, and initial trimester of prenatal care. The post intervention cohort did include more mothers who were under 20 years of age when their babies were born (x2= 10.87, p<0.01). The number of visits the infants made at which they could receive an immunisation was similar in both cohorts; 22.3% of visits for the preintervention cohort and 21.9% for the post-intervention cohort. **Study sufficiently powered?** Yes. A study population of 200 infants in each cohort (pre and post test) was necessary to detect a 10% increase at the		8 lost to follow-up in the post test group and 5 lost to follow-up in the pre test group.	**Source of funding:** NR

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		alpha =0.01 level, and a power of (b=0.05). Hence a sample of 200 infants was included in the study.			

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(Chappel & Fernandes 1996) **Aim of study:** To evaluate the effect of a computer-based reminder system to increase uptake of neonatal BCG vaccination. **Study design:** Interrupted time series **Internal validity score:** - **External validity score:** A	**Source population/s:** Health professionals, working in the UK. **Eligible population:** Health professionals working in obstetrics in Milton Keynes. **Selected population:** Health professionals (midwives) required to undertake and document antenatal assessment care and health professionals (midwives) working within a postnatal ward. **Excluded population/s:** NR **Setting:** Milton Keynes, UK. Approximately 5.4 of the population (according to 1991 census) were from non-white ethnic groups.	**Method of allocation:** NR, place of employment. **Intervention/s description:** Introduction of a computer generated reminder system. Midwives working in the antenatal clinic recorded the potential for women belonging to a higher risk group (how defined? Or not further described?), which was then entered into a computer in the obstetric department that generated a reminder to staff to check a baby's need for vaccination on the post natal ward. If they were missed on the post natal ward they were then offered an appointment to return to the ward. The computer was introduced in June 1991. **Control/comparison/s description:** No comparison	**Primary Outcomes** Proportion of those at higher risk vaccinated **Secondary outcomes** NR **Follow-up periods:** Three, annually prior to the intervention and two, annually post intervention. **Method of analysis:** NR	**Primary outcomes:** Proportion of those at higher risk vaccinated in years prior to intervention 1988 23.9% 1989 18.3% 1990 19.3% **1991 intervention (June)** Proportion of those at higher risk vaccinated in years post intervention 1992 52.6% 1993 77.5% The observed increase in vaccination rates was supported by an increase in the number of vials of BCG vaccine dispensed from the pharmacy, i.e. the increase not a matter of simply better reporting. There is no indication as to whether this increase was significant or not (p-values not reported). **Secondary outcomes:**	**Limitations identified by author:** Documentation on health professional using the computer system was not clearly reported. **Limitations identified by review team**: Staff training surrounding the introduction of the computer is not reported. I suspect, although could be wrong, that pre-intervention outcomes were actually assessed retrospectively (ie using old vaccination data)? In which case there could be

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		Sample sizes: **Total n=** NR **Intervention n=** NR **Control n=** NR **Baseline comparisons:** NR **Study sufficiently powered?:** NR		NR **Attrition details:** NR	measurement/recording biases being introduced in that similar protocols to identify who is 'at-risk' might not have been in use? **Evidence gaps and/or recommendations for future research:** Studies exploring broader populations and settings **Source of funding:** NR

Assessment feedback for vaccination

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Fried et al. 2004) **Citation:** Practice based education to improve delivery systems for prevention in primary care: randomised trial **Aim of study:** To examine the effectiveness of an intervention that combined continuing medical education with process improvement methods in improving the up-take of immunisations. **Study design:** Cluster RCT **Internal validity score:** - **Applicability:**	**Source population/s:** USA **Eligible population:** Healthcare workers at practices in two regions of North Carolina. **Selected population:** Healthcare professionals working at practices in two regions of North Carolina located near practice assistance teams at the University of North Carolina at Chapel Hill and the Charlotte Area Health Education Centre that had sufficient newborns enrolled each month to achieve sample size requirements; not part of an academic institution or a publicly funded health centre; and, in the region near the University of North Carolina, annual Medicaid billing in excess of $50 000 (£27 000; 40 000). The recruitment team was unaware of a practice's treatment allocation until after consent to participate was signed by all doctors in each practice. **Excluded population/s:** NR **Setting:**	**Method of allocation:** Computerised random generator was used to assign the practices to either intervention or control. **Intervention/s description:** The intervention comprised practice based continuing medical education (CME) and process improvement methods to support the implementation of 'office systems' for delivery of preventive care. The intervention was based on the plan-do-study-act (PDSA) cycle of process improvement as an organising framework. It included four steps: reviewing data to identify less than desired performance of preventive services; identifying evidence based changes that could improve performance; testing changes; and monitoring and adjusting new processes for delivery of care. In the first step, practices formed an improvement team of clerical, nursing, and physician staff members and discussed the results of chart abstractions.	**Primary Outcomes:** The proportion of children aged 24-30 months who received age appropriate immunisations in the intervention clinic compared to control clinics. A complete immunisation schedule comprised four injections of diphtheria-pertussis-tetanus vaccine; three oral polio vaccines; one measles, mumps, and rubella immunisation; three Haemophilus influenzae type B vaccines; and three hepatitis B vaccines by 24 months of age. **Secondary outcomes:** Not relevant to the review. **Follow-up periods:** Follow up of intervention practices was planned for 15-18 months after the 12 month intervention. **Method of analysis:**	**Primary outcomes:** The proportion of children aged 24-30 months who received age appropriate immunisations in the intervention clinic compared to control clinics was reported as being the same (no values reported). **Secondary outcomes:** Not relevant to the review. **Attrition details:** NA	**Limitations identified by author:** The authors have reported that they selected practices that provided care for relatively large numbers of children in order to be able to detect an intervention effect. Small paediatric practices and most family practices were excluded and hence this may limit the generalisability of the study to multi-physician settings. **Limitations identified by review team:** Not reported method used for determination of sample size. Not reported method used for concealment of allocation.

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B	Private paediatric and family practices in two areas of North Carolina, USA. **Vaccines:** Diphtheria-pertussis-tetanus vaccine; oral polio vaccines; measles, mumps, and rubella immunisation; Haemophilus influenzae type B vaccines; and hepatitis B vaccines.	In the second step, project staff provided education about preventive care and effective delivery strategies for preventives services (for example, developing a preventive services summary, establishing a tracking or recall system). Practices selected performance improvement goals and identified strategies that might improve care. We provided an organised set of tools (for example, preventive services flow sheets) to test the changes that were made, and project staff helped practices to customise these tools. During the third step, project staff helped practices use repeated PDSA cycles in small samples of patients to understand how to adapt new approaches to current office routines. In the fourth step, changes that had the desired effect on the process of preventive care after testing were spread throughout the practice by training staff in new roles. Two teams consisting of a trained nurse and doctor helped to carry out the intervention. These teams met with practices monthly over a year,	Descriptive statistics. Intention to treat analysis conducted.		Not reported blind assessment of primary outcome. Not reported values for change in immunisation rates in the results. **Evidence gaps and/or recommendations for future research:** Studies exploring broader populations and settings **Source of funding:** US Agency for Healthcare Research and Quality ,US Bureau of Maternal and Child Health, the North Carolina Division of Medical assistance , the North Carolina Health Education Centres, and the Robert Wood Johnson Foundation Generalist Faculty

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		using a defined curriculum. During the subsequent year, we checked in on each practice by telephone every two to three months to discuss problems with the logistical aspects of implementation, and to offer advice and support to overcome them. **Control/comparison/s description:** Control group practices received feedback at baseline and annually for two years without comparison with other practices. The intervention was evaluated using data from medical records, using repeated, random samples of 30 charts of children between 24 and 30 months of age in each practice, and from surveys of doctors and office staff administered at baseline and at the end of the study period. Patients who had been seen at least three times and for whom there was no evidence of having transferred out of the practice were eligible. Abstractors were not informed of the study arm to which each practice was			Scholars Program.

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		assigned. **Sample sizes:** **Total n=** 44 **Intervention n=**22 **Control n=**22 **Baseline comparisons:** The intervention and control practices were comparable in baseline rates of preventive services and practice characteristics. Control practices were twice as likely to be physician owned. **Study sufficiently powered?** NR			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Morrow, Gooding, & Clark 1995) **Citation:** Improving physicians' preventive health care behaviour through peer review and financial incentives **Aim of study:** To assess improvement of	**Source population/s:** USA **Eligible population:** The participants were physicians working in practices contracted by the US Healthcare an Independent practice association-health maintenance organisation (IPA-HMO) in the north-eastern United States from four states (Pennsylvania, New Jersey, New York and Connecticut). **Selected population:** A total of 418 practices were	**Method of allocation:** NR **Intervention/s description:** The intervention comprised of peer review and provision of financial incentives to the physicians. Primary care physicians who participate in the (IPA-HMO) were reimbursed on a capitation basis, as opposed to a fee for service. However, in this situation there is an incentive to reduce services to individual patients. To reward appropriate services by	**Primary Outcomes:** Uptake of MMR and Hib Audits were done by college graduates who were trained for 5 weeks and tested by the US Healthcare before they were sent in to the field. The central computer in Bluebell, Pennsylvania randomly selected 50 patients from each practice. The results of the audits were collected from a four state area (Pennsylvania, New	**Primary outcomes:** The audits of Haemophilus B immunisation had a very small sample size for 3 full years; hence the authors have not included these results in the analysis. The MMR vaccination after 3 years increased from 78% (95% CI, 73.9 to 82.1) to 96 % (95% CI, 93.4 to 97.6) ($p<0.05$). **Secondary outcomes:** Not relevant to the review.	**Limitations identified by author:** NR **Limitations identified by review team:** Not reported the selection process of the practices. Not provided the exact number of participants (physicians) in the study

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preventive healthcare behaviours by physicians in an independent practice association – health maintenance organisation. **Study design:** Before and after study **Internal validity score:** **-** **Applicability:** C	selected for conducting audits. Only those practices that underwent audits for 3 separate years were included in the analysis. The authors have not provided the exact number of participants (physicians) included in the study. **Excluded population/s:** Practices that were not in the four states (Pennsylvania, New Jersey, New York and Connecticut). **Setting:** US Healthcare an Independent practice association-health maintenance organisation (IPA-HMO) in the north-eastern United States. **Vaccines:** MMR, Haemophilus B in children in children 2-5 years of age.	physicians to its members, US Healthcare combined the system of peer review of specific preventive healthcare services with the reimbursement rates of the individual practices; a good score increases reimbursement. During this period the reimbursement levels for participating physicians varied based on utilisation of services (e.g. hospital days, speciality costs, and emergency costs) and quality elements (e.g. chart audits. Member surveys, transfer rates out of an office, and philosophy of managed health care). Each of the four elements were given a number value and the score earned in this evaluation determined the amount of capitation and the dollar amount and frequency of distribution of additional funds paid to the primary physician. **Control/comparison/s description:** NA **Sample sizes:** **Total n= 418 practices** **Intervention n=NA** **Control n= NA** **Baseline comparisons:**	Jersey, New York and Connecticut). **Secondary outcomes:** Not relevant to the review. **Follow-up periods:** 3 years. **Method of analysis:** NR	**Attrition details:** NR	Not reported method used of calculation of sample size. **Evidence gaps and/or recommendations for future research:** The study aimed to assess the behaviour change in physicians but the outcomes used in the study assess the effectiveness of the programme, not the change in behaviour. Hence study aiming to evaluate causes for behaviour change would require a study designed for that purpose**.** **Source of funding:** NR

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		NR **Study sufficiently powered?** NR			

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(Sinn, Morrow, & Finch 1999) **Citation:** Improving Immunisation Rates In Private Paediatric Practices Trough Physician Leadership **Aim of study:** To determine whether a physician-led quality improvement initiative can improve immunisation rates in participating private practices. **Study design:** Before and after	**Source population/s:** USA **Eligible population:** Physicians of children aged 9-30 months. **Selected population:** Physicians of children aged 9-30 months in 10 of the largest paediatric practices in the region. **Excluded population/s:** NR **Setting:** Ten private pediatric practices in Norfolk and Virginia Beach, US, area and affiliated with the children's hospital. All 10 practices participated in the intervention. **Vaccines:**	**Method of allocation:** NR **Intervention/s description:** The intervention, 'The Physician Leadership Model', comprised several different tactics for changing physician behavior, including an opinion leader, academic detailing, goal setting with feedback, peer review, and peer influence. To encourage change in immunisation practices, a well respected local physician functioned as an opinion leader by convening the task force and encouraging the adoption of practice innovations. The physician facilitator provided academic highlighted specific practice innovations for	**Primary Outcomes:** The proportion of infants who were up-to-date on recommended immunisations at age 3, 12, and 24 months. **Secondary outcomes:** Not relevant to this review. **Follow-up periods:** The study commenced in June 1996 and follow-up was un December 1997. **Method of analysis:** Analysis of variance	**Primary outcomes:** The proportion of infants who were up-to-date on recommended immunisations at age 3 months was 75.5% baseline versus 88.9% (post intervention); at 12 months was 72.9% baseline versus 84.6% (post intervention), and at 24 months was 50.9% baseline versus 69.7% (post intervention) all P<0.001). **Secondary outcomes:** Not relevant to this review. **Attrition details:** NR	**Limitations identified by author:** Lack of control group. Intervention was labour intensive. **Limitations identified by review team:** No information relating to the physicians is reported. No baseline characteristics between the groups compared. No power

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study **Internal validity score:** **-** **Applicability:** C	DTP, OPV, MMR	producing higher immunisation rates. The process enabled participants to set goals for coverage levels, adopt innovations to reach those and monitor progress by reviewing assessment data. Motivation to adopt innovations was enhanced by an implicit peer review process in which physicians challenge themselves to become the top performers and by a peer influence process in which physicians learned of innovations adopted by other practices. Trained assessors from the academic medical centre conducted standardised assessments in the participating practices. The practices received reports providing practice immunization rates and diagnostic data (eg, use of opportunities for simultaneous administration). At the same time, the physician leader invited practices to send a representative to the first task force meeting. The physician leader reviewed several key points from the Standards for Pediatric Immunisation Practices regarding screening, contraindications, simultaneous administration,			calculation. **Evidence gaps and/or recommendations for future research:** Studies exploring broader populations and settings **Source of funding:** Virginia Department of Health

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		record keeping, tracking systems, and practice assessments. The group then reviewed the blinded assessment data, identified problems, and discussed ways to improve immunisation rates. Participants reconvened every 6 months to examine new assessment data, review their immunisation practices, and consider changes. After the initial meeting, the task force met 3 more times. The second and third meetings followed a format similar to that of the first meeting. During the second meeting, physician participants expressed several concerns. First, some physicians were concerned that the standard assessment methods produced biased results by including patients in the sample that should be considered inactive. To address this concern, the technical team consulted with the participating physicians to generate alternative assessment criteria that might better delineate active patients. Second, some physicians expressed a desire to see individual patient histories to adequately interpret the practice			

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		immunisation rates. To meet this need, the technical team developed practice reports that profiled individual patients who were behind schedule. During the third meeting, immunisation rates of practices were presented using the standard CDC criteria and the proposed alternative criteria. The study was evaluated using data on children aged 9-30 months in paediatric practices. Records were systematically selected for all children who were active patients. Assessments were conducted every 6 months, and a new cohort of children aged 24 to 30 months was included each round. A patient was deemed active unless documentation indicated the patient had moved or gone elsewhere for care, or had never received an immunisation from the practice. A total of 7269 records were assessed (mean 182 per practice assessment). **Control/comparison/s description:** Before and after study			

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		Sample sizes: **Total n=** NR **Intervention n=** NR **Control n=** NR **Baseline comparisons:** NR **Study sufficiently powered?** NR			

Provider based education

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Ahmed, Hicks, & Stanwell-Smith 1992) **Citation:** Policy and practice- an audit of neonatal BCG immunisation in Avon **Aim of study:** To explore the effect of practice revision on a district's neonatal BCG immunisation uptake **Study design:** Before and after study **Internal validity score:** (-) **Applicability:**	**Source population/s:** Health professionals from the UK. **Eligible population:** Junior paediatricians, GPs and Health Visitors. **Selected population:** Junior paediatrician's working in Bristol and Weston Health District, GPs and Health Visitors in Avon. Exact numbers of participants not specified. **Excluded population/s:** NR **Setting:** Avon, UK. No further information provided about this area or population.	**Method of allocation:** Based on place of employment i.e. Bristol and Weston Health District and GPs working in Avon. **Intervention/s description:** The educational intervention comprised three components. 1. All junior paediatricians to receive a copy of Avon's neonatal BCG policy at the start of their appointment. 2. Regular training sessions provided for health visitors 3. Monthly infection newsletter sent to all GPs in Avon. Further details of the intervention are not provided. For example, it is not reported who delivered the intervention (such as training to health visitors) or over what time span. **Control/comparison/s description:** Before and after study, no control group **Sample sizes:** **Total n=** NR **Intervention n=** NR	**Primary Outcomes:** Pre and post figures are reported for the number of babies for whom BCG vaccination was indicated and given. **Secondary outcomes:** Pre and post figures are reported for the number of babies for whom BCG was not indicated and received it. **Follow-up periods:** Surveys pre (conducted between March and May 1988) and post intervention (18 months after the first survey in December 1989. It is not indicated how long after the educational intervention the post evaluation took place. **Method of analysis:** Descriptive statistics.	**Primary outcomes:** The number of babies for whom BCG was indicated and who received it increased from 13% (pre-intervention) to 80% (post intervention). This was statistically significant X^2 1 d.f. = 17.81; p<0.0001 **Secondary outcomes:** The number of babies for whom BCG was not indicated and who received it decreased from 2/344 (pre-intervention) to 0/604(post intervention). **Attrition details:** 77% response rate to second survey.	**Limitations identified by author:** Response rate to first survey unknown. Although 359 surveys were returned from the first survey the denominator is unknown and therefore not possible to calculate a response rate. A sensitivity analysis was preformed comparing the findings of the first survey with centrally held BCG vaccination records. This showed 11 BCG vaccinations were administered to babies who would have been part of the first survey. Even after the results were adjusted for this difference the results remained statistically significant, X^2 1 d.f. = 8.017; p < 0.005 **Limitations identified by review team**: Lack of information about those receiving

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A		**Control n=** NR **Baseline comparisons:** NR **Study sufficiently powered?:** NR			the interventions. Lack of demographic information about the setting. Lack of information provided about the source and eligible population. Lack of detailed information provided on the intervention itself. **Evidence gaps and/or recommendations for future research:** Well designed studies should be conducted in this topic area **Source of funding:** NR

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Smith et al. 1999) **Citation:** A Preschool Immunization Project To Enhance Immunization Levels, The Public-Private Relationship, And Continuity Of Care **Aim of study:** To determine whether implementing a program aimed at providing a variety of incentives to physicians who provide immunisations to preschool-aged children would help to improve immunisation rates. **Study design:** Before and after study	**Source population/s:** US **Eligible population:** Physicians enrolled in the Special Childhood Immunisation Initiative. **Selected population:** Physicians who responded to a letter mailed to physicians enrolled in either Access to Care or Healthy Moms/ Healthy kids Programs, who had 25% or greater medically indigent clients in their practices and were willing to comply with the project. **Excluded population/s:** NR **Setting:** Suburban Cook County, US. **Vaccines:** DTP, OPV, MMR Up-to-date was assessed as 4th DTP by 15 months 3rd OPV by 12-18 months 1st MMR by 12-15 months	**Method of allocation:** Before and after study **Intervention/s description:** The intervention comprised: free vaccines, problem resolution, and support regarding Medicaid billing and physician education. The physician education consisted of updates concerning local epidemiology of vaccine preventable illnesses, tips on reducing billing and supply errors and delays, flip chart booklets listing contradictions by condition or symptom, a newsletter, and a provider education binder with the Centre for Disease Control and Prevention's, Guidelines for Immunisations', techniques for administering immunisations to infants and information on reporting adverse events. **Control/comparison/s description:** Before and after study **Sample sizes:** **Total n=** 19 physicians/ 14 practices **Intervention n=** NR **Control n=** NR	**Primary Outcomes:** Percentage of infants up-to-date for immunisations for age **Secondary outcomes:** Process evaluation of physicians acceptance of the programme. **Follow-up periods:** Precise follow-up not reported. **Method of analysis:** Descriptive statistics (Frequencies, percentages, and means).	**Primary outcomes:** Compared to baseline significantly more infants were up-to-date for age following the intervention (45.5% versus 70.3%) ($p < 0.00001$). **Secondary outcomes:** All of the physicians (19/19) viewed the project as an effective means to improve immunization services to low income children. 79% (15/19) reported using posters and other educational materials 74% 14/19 thought that reminder postcards were a helpful tool however only 42% reported using them. 68% thought the MMWR recommendations were useful 79% thought the ACIP Standards were useful 58% thought the agency produced newsletter was useful. **Attrition details:**	**Limitations identified by author:** Lack of control group Increase may be due to the wider public health agenda, outbreaks, or media campaigns. The study examined practices from two time points. **Limitations identified by review team:** The method used to evaluate is not clear. The method used to select charts to review is not described in sufficient detail. The follow-up period is not reported. The change may

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Internal validity score: - **Applicability:** C		The project was evaluated using charts selected from participating physicians' offices using 'proportional random sampling', no further details are given on this. The baseline group comprised infants born between January 1988 and December 1990 and the post intervention group comprised infants born between January 1991 and October 1994 and focused on the time when the infant was 0-3 years of age. **Baseline n=** 310 infants (aged 0-3 years) **Post intervention n=** 310 infants (aged 0-3 years during the project**)** **Baseline comparisons:** Between two groups of infants compared (baseline versus post intervention) no differences were found related to race or gender. Demographically they were reported to be similar. A greater number of families in the baseline group (38%) were insured privately compared to the post intervention sample (18%); no p value or CI is reported for this comparison. The precise length of time between the		NR	be due to factors outside the study. No demographic details provided of the population in which the study is set. **Evidence gaps and/or recommendations for future research:** Studies exploring broader populations and settings **Source of funding:** 1994 Joyce Foundation Special Project Grant

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		intervention and post assessment is not reported. **Study sufficiently powered?** NR			

Provider Incentives

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Fairbrother et al. 1999) **Citation:** The Impact of Physician Bonuses, Enhanced Fees, and Feedback on Childhood Immunization Coverage Rates **Aim of study:** To examine the effects on immunisation coverage of 3 incentives for physicians--a cash bonus for practice-wide increases, enhanced fee for service, and feedback compared to no intervention. **Study design:** RCT **Internal validity score:** **+**	**Source population/s:** New York, USA **Eligible population:** 176 paediatricians and family practice physicians whose primary service delivery sites were in the targeted neighbourhoods and who had submitted 2500 or more Medicaid claims for children in 1992. **Selected population:** 83 paediatricians and family practice physicians whose primary service delivery sites were in the targeted neighbourhoods and who had submitted 2500 or more Medicaid claims for children in 1992, who provided immunisations and could be located. **Excluded population/s:** Paediatricians and family practice physicians who no longer practiced in the targeted neighbourhoods, worked in hospital based practices, were retired, were on disability, no longer accepted Medicaid, or shared a practice with another eligible physician. **Setting:** Nine neighbourhoods in New York with the highest rate of poverty and	**Method of allocation:** Reported as random allocation but not described. **Intervention/s description:** There were 4 groups. 1. Feedback only 2. Feedback plus bonus 3. Enhanced fee for service and feedback 4. Control Physicians in each of the 3 intervention groups received feedback on their immunisation performance at the time of data collection and, in more detail, in a letter mailed to each physician approximately 4 weeks later along with any applicable financial award. Feedback included up-to-date coverage rates for immunisations, coverage by patient age groups, missed opportunities to immunise, comparisons with peers' performance, and hypothetical coverage rates calculated as if no opportunities had been missed and/or one timelier visit had been scheduled for vaccines due.	**Primary Outcomes:** Up-to-date immunisation status **Secondary outcomes:** Number of physicians qualifying for bonuses after 8/12. **Follow-up periods:** 4 and 8 months **Method of analysis:** Descriptive statistics and X^2 analysis.	**Primary outcomes:** The percentage of children whose charts showed them to be up to date for DTP/Hib, OPV, and MMR improved significantly (P<0.01) within the bonus group, relative to the control group (43.9% versus 38.0%), within 4 months after the intervention was initiated, and the upward trend continued from time 2 to time 3 (P =0.058). At eight months follow-up, the percentage of children whose charts showed them to be up to date for these vaccines had increased by 25.3 percentage points, from 29.1% to 54.4% (P < 0.01). No significant changes over time, relative to the control group, were observed in any other group in the study. **Secondary outcomes:** Two thirds of the physicians in the bonus group had improved enough to earn a bonus (i.e., they had improved by 20 percentage points or reached 80% up-to-date coverage). Only 2 of the physicians in the enhanced fee-for service group and 2 of	**Limitations identified by author:** Increases may be due to better documentation and history taking rather than the interventions. Time may not have been long enough to see change. The sample of physicians was small. **Limitations identified by review team:** Method of randomisation not described. Small sample size. Numbers randomised to each group not clearly reported. **Evidence gaps and/or recommendations**

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Applicability: C	proportions of Medicaid enrolled children. **Vaccines:** DTP, Hib, OPV and MMR	Physicians assigned to the bonus and feedback group were eligible to receive financial bonuses based on patients' up-to date coverage for DTP and Hib, OPV, and MMR. Bonuses were comprised: $1000 for a 20% improvement from baseline, $2500 for a 40% improvement from baseline, and $5000 for reaching 80% coverage irrespective of baseline performance level. Physicians assigned to the enhanced fee for service and feedback group received $5 for each vaccine they administered within 30 days of its coming due. A fee of $15 was awarded for each visit at which more than 1 vaccine was due, and all due vaccines were administered. Physicians in the control group received feedback on their performance with respect to blood lead and tuberculosis screenings, as well as the monitoring of anaemia. This feedback included overall up-to-date screening rates, rates by patient age groups, and comparisons with peers' performance.		the physicians in the feedback-only group improved as much. Precise numbers not provided. **Attrition details:** 1 physician dropped out of the study after the first data point, it is not clear to which group they were randomised or whether they are included in the results.	**for future research:** Studies exploring broader populations and settings **Source of funding:** Centres for Disease Control and Prevention with the New York Department of Health

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		Control/comparison/s description: see above **Sample sizes:** **Total n=** 60 **Intervention groups n=** 15 per group **Control n=**1 per group **Baseline comparisons:** The characteristics of the practices from which sample children were drawn did not vary significantly across groups of the study. On average, participating physicians had 324 preschool-aged children in their active patient populations. 83% of physicians had hospital admitting privileges 55% were board certified 57% participated in 1 or more managed care plans 52% had been designated Medicaid preferred providers The characteristics of the children sampled did not differ across groups of the study. 93% were overwhelmingly enrolled in Medicaid On average, they were 17 months old at the time of their			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		last visit and had almost 6 total visits over the 7.5 months they had been followed up by the participating physician. Immunisation performance, did vary significantly at baseline. Although no intervention group differed from the control group, the enhanced fee-for-service group appeared different from the other intervention groups. Children in the enhanced fee-for-service group were more likely to be up to date for DTP/Hib, OPV, and MMR at baseline (46.2%) than were children in the bonus group (29.1%, P<.01) or those in the feedback- only group (31.4%, P<.05). **Study sufficiently powered?** NR			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Fairbrother et al. 2001) **Citation:** Impact Of Financial Incentives on Documented Immunisation Rates in the Inner City:	**Source population/s:** New York, USA **Eligible population:** Paediatricians and family practice physicians whose primary service delivery sites were in the targeted neighbourhoods. **Selected population:** 62 paediatricians and family	**Method of allocation:** Reported as random allocation but not described. **Intervention/s description:** There were 3 groups. 1. Feedback plus bonus 2. Feedback plus enhanced fee for	**Primary Outcomes:** Up-to-date immunisation status. **Secondary outcomes:** NR **Follow-up periods:** 3 monthly internals from baseline to 12 months	**Primary outcomes:** The percentage of children whose charts showed them to be up to date for DTP/Hib, OPV, and MMR improved significantly (P<0.01) within the bonus and feedback group, relative to the control group (54.5% versus 40.2%), within 8 months after the intervention was	**Limitations identified by author:** Time may not have been long enough to see change. The sample of physicians was small.

Results of a Randomised Controlled Trial **Aim of study:** To examine the effects on immunisation coverage of 2 incentives for physicians—feedback and a cash bonus for practice-wide increases, enhanced fee for service compared to no intervention. **Study design:** RCT **Internal validity score:** - **Applicability:** C	practice physicians whose primary service delivery sites were in the targeted neighbourhoods who provided immunisations and could be located. **Excluded population/s:** Paediatricians and family practice physicians who no longer practiced in the targeted neighbourhoods, worked in hospital based practices, were retired, were on disability, no longer accepted Medicaid, or shared a practice with another eligible physician. **Setting:** Nine neighbourhoods in New York with the highest rate of poverty and proportions of Medicaid enrolled children. **Vaccines:** DTP, Hib, OPV and MMR	service 3. Control Physicians in each of the two intervention groups received feedback on their immunisation performance at the time of data collection and, in more detail, in a letter mailed to each physician approximately 4 weeks later along with any applicable financial award. Feedback included up-to-date coverage rates for immunisations, coverage by patient age groups, missed opportunities to immunise, comparisons with peers' performance, and hypothetical coverage rates calculated as if no opportunities had been missed and/or one timelier visit had been scheduled for vaccines due. Physicians assigned to the bonus and feedback group were eligible to receive financial bonuses based on patients' up-to date coverage for DTP and Hib, OPV, and MMR. Bonuses were comprised: $1000 for a 20% improvement from baseline, $2500 for a 40% improvement from baseline, and $5000 for reaching 80% coverage irrespective of baseline	**Method of analysis:** Descriptive statistics and *liner and logistic regression*	initiated, and the upward trend continued from time 3 to time 4 (P =0.05). At 12 months the enhanced fee for service was significantly more up-to-date than the control group (58.2% versus 42.8%; P<0.01). At 12 months follow-up, the percentage of children whose charts showed them to be up to date for these vaccines had increased from 49.7% to 55.6% in the bonus and feedback group. **Secondary outcomes:** NR **Attrition details:** 7 dropped out: 2 from the bonus group, 2 from the EFF group and 3 from the control group.	**Limitations identified by review team:** Method of randomisation not described. Small sample size. Numbers randomised to each group not clearly reported. Sources of immunisation data may not be reliable. **Evidence gaps and/or recommendations for future research:** Studies exploring broader populations and settings **Source of funding:** Centres for Disease Control and Prevention with the New York Department of Health

		performance level. Physicians assigned to the enhanced fee for service and feedback group received $5 for each vaccine they administered within 30 days of its coming due. A fee of $15 was awarded for each visit at which more than 1 vaccine was due, and all due vaccines were administered. Physicians in the control group received feedback on their performance with respect to blood lead and tuberculosis screenings, as well as the monitoring of anemia. This feedback included overall up-to-date screening rates, rates by patient age groups, and comparisons with peers' performance. **Control/comparison/s description:** see above **Sample sizes:** **Total n=** 62 **Intervention groups** Feedback plus bonus = 26 Feedback plus enhanced fee for service n= 14 Control n= 24 **Baseline comparisons:** 50 children were sampled from each physician's office at			

		each time point. Physicians were asked permission to take names of 15 randomly selected children from whose charts were reviewed. Immunisation rates were sourced from physicians, home visits and additional providers listed on the immunisation card. The characteristics of the practices from which sample children were drawn did not vary significantly across groups of the study, (the number of preschool children enrolled in their practices, percentage who were board certified, participated in at least 1 Medicaid managed care plan, children did not differ significantly in terms of age, percentage with Medicaid or the mean number of visits in four months). **Study sufficiently powered?** NR			

Multi component provider based

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Gill & Scott 1998) **Citation:** Improving the uptake of selective neonatal BCG immunisation **Aim of study:** Evaluation of Bolton neonatal BCG policy **Study design:** Interrupted time series **Internal validity score:** - **Applicability:** A	**Source population/s:** Health professionals, working in the UK. **Eligible population:** Midwives and health visitors. **Selected population:** Midwives working within antenatal clinics and maternity units as well as health visitors in Bolton, UK. **Excluded population/s:** NR **Setting:** Bolton, north west England, 8% of this population from the Indian subcontinent. No other population demographics available.	**Method of allocation:** NR **Intervention/s description:** Bolton local neonatal BCG policy comprised: 1. Shifting the responsibility of vaccination from community medical officers to midwives and health visitors. 2. Regular training sessions provided for midwives and health visitors to identify and give BCG to neonates from defined groups [not further described?] (covering the vaccine, administration of BCG, contraindications, anaphylaxis, and paediatric resuscitation). Participants received a certificate of attendance and copy of the revised neonatal policy for Bolton. There is no further information on who delivered the training sessions except that they were regular. **Control/comparison/s description:** Number of eligible infants	**Primary Outcomes:** Number of eligible infants receiving BCG vaccine. **Secondary outcomes:** NR **Follow-up periods:** Annually in 1993 (pre intervention), 1994, 1995 and 1996 (all post intervention). The time between the intervention and first evaluation is not reported, nor is the time period for each year when the annual data was collected. **Method of analysis:** NR	**Primary outcomes:** The number eligible infants receiving BCG vaccine in the first 3 months of life increased from 6% (pre intervention) to 88% (1994), 90% (1995) and 89% (1996). No significance testing pre v post intervention is reported. The number of infants for whom BCG was indicated remained relatively constant (22%, 22%, 23%, and 17%) over the period of this study, suggesting that it was not simply an improvement in identifying babies and infants that lead to the increase in the number of vaccinations. **Secondary outcomes:** NR **Attrition details:** NA	**Limitations identified by author:** NR **Limitations identified by review team**: No clear time point when the intervention was delivered. The time lapse from intervention to first survey is not reported. **Evidence gaps and/or recommendations for future research:** Studies exploring broader populations and settings **Source of funding:** NR

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		receiving BCG vaccine prior to intervention. **Sample sizes:** **Total n=** NR **Intervention n=** NR **Control n=** NR **Baseline comparisons:** NR **Study sufficiently powered?** NR			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Harper et al. 1997) **Citation:** A clinic system to improve preschool vaccinations in a low socio-economic status population **Aim of study:** To determine if a clinic system to assess and vaccinate preschool-age children at every clinic visit can	**Source population/s:** USA **Eligible population:** Appointment personnel, medical assistants, nurse practitioners and physicians working at 2 clinics in St. Paul. **Selected population:** Appointment personnel, medical assistants, and physicians working at 2 clinics in St. Paul from October 1993 to October 1994, one a community health centre clinic staffed by board-certified family physicians and nurse practitioners. The clinics were located in areas of	**Method of allocation:** NR **Intervention/s description:** The intervention comprised a clinic-wide system to identify and vaccinate children at all clinic visits. The intervention clinic was a family practice residency training site. 1. Appointment personnel instructed parents to bring their child's vaccination card to the next appointment. 2. Medical assistants asked the parents for the vaccination card at all visits, assessed the child's vaccination status, and	**Primary Outcomes:** Percentage of children in each cohort who were up-to-date for a primary vaccine series (4DTP: 3OPV:1 MMR) at age 24 months and at the end of the study. **Secondary outcomes:** Not relevant to the review. **Follow-up periods:** 24 months and at end of study period. **Method of analysis:** Descriptive statistics.	**Primary outcomes:** The intervention clinic improved from 42.1% pre intervention to 56% post intervention (x2=5.24, p=0.02). The comparison clinic improved from 56.9% to 58.5% between the preintervention and post intervention periods, respectively (x2=0.06, p=0.81). At the end of the study periods, the percentage of children up-to-date for vaccinations in the intervention group improved from 49.1% preintervention to 63.3% post intervention (x2=5.52, p=0.02).	**Limitations identified by author:** NR **Limitations identified by review team:** Not reported method used for determination of sample size. The comparison clinic had higher pre study immunisation rates, however no comparison was made between end point data between

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
improve vaccination rates. **Study design:** NRCT **Internal validity score:** **-** **Applicability:** C	low socio-economic status. **Excluded population/s:** NR **Setting:** Two urban clinics in St Paul, Minneapolis, USA. **Vaccines:** DTP, oral polio virus vaccine, MMR.	educate the parents about the next vaccine date. The assistants documented this information on a specially stamped section of the visit record. 3. The physician ordered needed vaccinations, made arrangements for vaccinations at a later date, or arranged to obtain old medical records. 4. Performance feedback was provided for each group on a regular basis. Personnel underwent a training session during one of their meetings. **Control/comparison/s description:** The comparison clinic was a community health centre clinic staffed by board-certified family physicians and nurse practitioners. The intervention was evaluated using the immunisation data for all children aged 24-35 months at each clinic with a least one visit to the clinic in the last 12 months obtained from the billing system, there were no exclusions.		During the same time, the comparison clinic had little change from 61.5% pre intervention to 66.2% post intervention (x2= 0.57, p=0.45). **Secondary outcomes:** Not relevant to the review. **Attrition details:** NR	groups. **Evidence gaps and/or recommendations for future research:** Well designed studies should be conducted in this topic area **Source of funding:** Ramsey Foundation, St.Paul.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		Data for 280 children from the intervention clinic and 239 children in the comparison clinic was abstracted. **Sample sizes:** **Total n=** 519 **Intervention n=**280 **Control n=**239 **Baseline comparisons:** The intervention clinic had more children receiving Medicaid, ($p<0.001$), and had family practice residents compared with board certified family physicians at the comparison clinic. **Study sufficiently powered?** NR			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Harper & Murray 1994) **Citation:** An organisational strategy to improve adolescent measles-mumps-rubella vaccination in a low socioeconomic	**Source population/s:** USA **Eligible population:** The populations visiting two urban clinics. **Selected population:** Adolescents aged 11-18 years at two urban family practice clinics serving low socioeconomic populations. One clinic was a family practice residency training clinic and	**Method of allocation:** NR Clinics were selected because of connections to the investigator and willingness to participate. **Intervention/s description:** The intervention clinic has a system that screened and attempted to vaccinate with MMR all eligible adolescents regardless of the reason for	**Primary Outcomes** The mean percentage of MMR vaccines given in the intervention and comparison clinics pre versus post intervention. The mean percentage of adolescents up-to-date in the intervention and comparison clinics pre versus post intervention.	**Primary outcomes:** <u>Comparison clinic</u> The mean percentage of immunisations given decreased from 16.4% to 10.3% (Student's t= -1.13; P=0.28) Mean percentage up-to date changed very little, 27.5% pre to 26.1% post intervention (Student's t= -0.26; P = 0.80).	**Limitations identified by author:** Highlight that younger providers are likely to be more prevention orientated; however the comparison clinic also had recent family practice graduates who were likely to also be prevention minded. The potential for

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
population **Aim of study:** To determine whether a clinic organisational strategy can improve MMR vaccination rates in adolescents by reducing missed opportunities. **Study design:** CBA **Internal validity score: -** **Applicability: C**	the other a community clinic staffed by board certified family physicians and nurse practitioners. **Excluded population/s:** Adolescent visits at the comparison clinic that were from an adolescent runaway shelter. **Setting:** St Paul, Minneapolis, US. Both clinics served a predominantly white, low socioeconomic population.	their appointment. Nurses screened, obtained consent and advised the physician to order the MMR vaccination at conclusion of the visit. Staff training was limited to one session. **Control/comparison/s description:** There was no system to facilitate MMR vaccination of adolescents although providers were aware of the department of health recommendations. **Sample sizes:** **Total n=** **Intervention n=** pre intervention visits 733/ post intervention 737 **Control n=** pre intervention visits 599/ post intervention 812 **Baseline comparisons:** The treatment and comparison clinics were similar. Treatment versus companion White 90% versus 87% Female 59% versus 55% Insurance med assistance 28 % versus 26% % of total adolescents 15%	**Secondary outcomes** NR **Follow-up periods:** The intervention period lasted 9 months and data was collected for this period. **Method of analysis:** Descriptive statistics, students t test.	<u>Intervention clinic</u> The mean percentage of immunisations given increased from 7.8% to 17.4 (Student's t= 3.02; P=0.0087) Mean percentage up-to date increased from 17.2% to 38.6% (Student's t= 8.33; P<0.0001). **Secondary outcomes:** NR **Attrition details:** NR	vaccinations given elsewhere to have been included. **Limitations identified by review team**: The comparison clinic had a different fee structure in that their was also a sliding scale fee in addition to fee for service, which may have meant less people took up the vaccination. **Evidence gaps and/or recommendations for future research:** Well designed studies should be conducted in this topic area **Source of funding:** Supported in part with a grant form the US department of health and Human Services.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		versus 20% No adolescents visits per month 86 versus 82 **Study sufficiently powered?** NR			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Minkovitz et al. 2001) **Citation:** Effectiveness of a Practice-Based Intervention to Increase Vaccination Rates and Reduce Missed Opportunities **Aim of study:** To determine whether provider prompting at acute care visits in an urban hospital-based outpatient clinic can increase vaccination rates and decrease missed opportunities. **Study design:**	**Source population/s:** US **Eligible population:** Triage nurses, acute care teams, clinicians, and staff working in the study clinic. Evaluated using data from 642 infants at baseline who were 3 years or younger as of March 1, 1998, and were assigned to receive care at the Harriet Lane Pediatric Clinic (HLPC), The Johns Hopkins Hospital, Baltimore, Md. The MCO also provided a postintervention list of 930 enrollees who were 3 years or younger as of June 30, 1999, and were assigned to receive care at HLPC. Baseline and postintervention lists were manually examined and compared to identify duplicate entries within and between the lists. **Selected population:** Triage nurses, acute care teams, clinicians, and staff working in the study clinic. Evaluated using data	**Method of allocation:** Before and after study **Intervention/s description:** The intervention took place between May 1998 and July 1999. Triage nurses generated computerised printouts of each child's vaccination record and prominently attached them to the encounter form during each acute care visit. The acute care team was instructed to review the vaccination history during the visit and offer age-appropriate vaccinations as appropriate. The acute care team were educated monthly regarding this policy and the need to assess vaccination status at each visit. During these sessions, clinicians and staff received chocolate bars labeled "Immunize On Time, Every Time" to reinforce compliance. In addition, clinic	**Primary Outcomes** % up-to-date for 4:3:1 and 4:3:1:3:3 by 24 months. Missed opportunities **Secondary outcomes** NR **Follow-up periods:** Immediately post intervention (June 30, 1999) **Method of analysis:** Proportions were compared using χ^2 analyses, and means were compared using analysis of variance. Comparisons were made between baseline and post intervention groups for 2 groups of children: those aged 10 to 23 months and those aged 24 months and older.	**Primary outcomes:** For children aged 24 months and older and continuously enrolled in the MCO and the clinic, there was an increase in 4:3:1:3:3 vaccination rates from 70% to 87% (P< 0.01). For children aged 24 months and older and continuously enrolled in the MCO and the clinic, there was an increase in 4:3:1 vaccination rates from 77% to 89% (P< 0.05). For children aged 24 months and older and continuously enrolled in the MCO and the clinic, missed opportunities decreased from 65% to 31% (P< 0.05). Among children aged 24 months and older, the proportion completing a visit within the first 2 months of life was higher in the postintervention than in the baseline group. However, there was no difference in	**Limitations identified by author:** Generalisability of the study may be limited. The study design does not enable to determine causal relationships. Small sample size **Limitations identified by review team**: Small sample size Follow-up may not have been long enough to detect a difference between groups. No power calculation

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
Before and after study **Internal validity score:** **-** **Applicability:** C	on infants identified by the MCO as receiving primary care at the outpatient hospital-based clinic, who had a documented visit to the institution, who were assigned to HLPC and whose medical records were available. **Excluded population/s:** Children with duplicate listings in the MCO enrollment file, those without a documented visit to the institution, not assigned to HLPC but assigned to an alternate source of care within the institution, and those for whom medical records were unable to be located. **Setting:** Urban hospital-based paediatric clinic (Baltimore, US) in which acute care was provided by a team of residents, medical students, nurse practitioners, and preceptors, including general paediatric fellows and faculty. The residents and students providing acute care rotated on a monthly basis. Patients receiving care at the clinic were predominantly low-income children who qualified for mandatory Medicaid managed care and were enrolled in 1 of several health plans. **Vaccines:** 4:3:1- 4 DTP, 3OPV, 1MMR 4:3:1:3:3 - 4DTP, 3OPV, 1MMR, 3	vaccination rates were reviewed with staff and providers at several monthly staff meetings and at quarterly preceptor meetings. **Control/comparison/s description:** Before and after study **Sample sizes:** **Total n=** 1163 **Intervention n=** 642 **Control n=** 521 **Baseline comparisons:** The baseline and post intervention samples were similar with regard to gender, race, number of siblings, and birth weight. However, the groups differed regarding age, with the post intervention group having a greater proportion of infants aged 12-23 months than the baseline group (P <0.001) **Study sufficiently powered?** NR	The post intervention sample was identified as the total sample and the subset of children continuously enrolled.	UTD rates for the first DTP at 3 months between the baseline (79.3%) and postintervention (80.7%) groups (*P*>.05). For children aged 10 to 23 months, only missed opportunities were significantly changed in the total post intervention group, with a decrease from 60% at baseline to 42% post intervention (P <0.05). **Secondary outcomes:** NR **Attrition details:** NR	No demographic details of the study setting to determine applicability to the UK The number of staff and precisely who this was directed at is not clear **Evidence gaps and/or recommendations for future research:** Well designed studies should be conducted in this topic area **Source of funding:** Pew Charitable Trusts

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
	Hib, 3 Hep B				

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Murphy et al. 1996) **Citation:** Impact Of A Collaborative Immunisation Programme in an Inner City Practice **Aim of study:** To describe the impact of a collaborative immunisation programme, between inner city practice and the Eastern Health Board (EHB). **Study design:** Before and after study **Internal validity score:** ++ **Applicability:**	**Source population/s:** Dublin, Ireland **Eligible population:** **The p**ractice nurse and three medical partners at an inner Dublin practice. **Selected population:** The practice nurse and three medical partners at an inner Dublin practice. **Excluded population/s:** NA **Setting:** One Dublin inner city practice with three partners located in an area with a deprived socio-economic profile. **Vaccines:** DPT, DT, Oral polio, Hib, MMR	**Method of allocation:** NR **Intervention/s description:** The intervention comprised of a collaborative immunisation programme which included: 1. Development of an immunisation list from practice records. 2. Cross-checking the list with Eastern Health Board (EHB) records. 3. A three month period of opportunistic immunisations and postal reminders to the remaining non-vaccinated children. 4. Monthly written feedback provided to all practice staff for uptake figures. Since telephone ownership was less than 10%, a postal strategy was adopted. Notebooks for recording opportunistic on-going immunisations were distributed within the practice from July 1994. The immunisation list was updated	**Primary Outcomes:** Proportion of participants who had completed DTP, DT, Hib and MMR vaccines, compared for the group on before the postal reminders had been sent to after the postal reminder campaign. **Secondary outcomes:** NR **Follow-up periods:** The study ran from July 1994 to February 1995. There was 3 months between the postal reminders and follow-up. **Method of analysis:** Descriptive statistics, chi square test.	**Primary outcomes:** <u>In those aged > 6 months</u> Uptake of DPT rose 44% before the postal reminders had been sent to, to 57% after the programme ($p<0.0005$). Uptake of DT decreased from 17% before the postal reminders had been sent to, to 13% after the programme (NS). Uptake of Hib rose 18% before the postal reminders had been sent to 50% after the programme ($p<0.0005$). <u>In those aged > 15 months</u> Uptake of MMR rose 67% before the postal reminders had been sent to 75% after the programme ($p<0.0005$). **Secondary outcomes:** NR **Attrition details:** There were no loss-to-follow-ups.	**Limitations identified by author:** NR **Limitations identified by review team:** No sample size calculation reported. Baseline characteristics of participants not reported. CI not reported **Evidence gaps and/or recommendations for future research:** Studies exploring broader populations and settings **Source of funding:** NR

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
B		on a weekly basis. On the 15th of November 1994, the names of all children, apparently requiring further immunisations were collated. A standardised letter was sent to the parents of all these children. A total of 279 letters were sent during the postal campaign. The letter advised the parents to either update the records if the child had in fact completed the immunisation course or to make an appointment with the practice nurse or doctor to complete the course. These letters were sent in three batches, of approximately 100 each, over a three week period beginning on the 16th November. The intervention was evaluated using immunisation data on 342 children identified in July 1994 who were registered at the practice and 464 children registered at the practice by end of the programme in February 1995.This increase was due to a number of factors, newly registered patients, more children reaching 6 months of age and further eligible children being identified			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		during opportunistic surgery visits. **Control/comparison/s description:** NA **Sample sizes:** **Total n=** 464 **Intervention n=**NA **Control n=**NA **Baseline comparisons:** NR **Study sufficiently powered?** NR			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Szilagyi et al. 1996) **Citation:** Reducing missed opportunities for immunizations **Aim of study:** To measure the effectiveness of (1) changing practice policies to incorporate the new national standard to screen and	**Source population/s:** USA **Eligible population:** Children attending a Paediatric Continuity Clinic in a teaching hospital (Clinic) in Rochester New York, and a large NHC serving predominantly urban children in Rochester New York, USA. **Selected population:** Children aged 0-2 years attending a Paediatric Continuity Clinic in a teaching hospital (Clinic) in Rochester New York, and a large NHC serving predominantly urban	**Method of allocation:** For the clinic group the method of randomisation is not reported. At the NHC participants were randomised and allocated to 1 of 4 groups suing a 2X2 factorial design, so that each intervention had a study group and control group. **Intervention/s description:** The study included two interventions: No missed opportunities (NMO) and Vaccination without legal guardian's signature.	**Primary Outcomes:** Immunisation rates and missed opportunity rates at the end of the study. **Secondary outcomes:** Not relevant to the review. **Follow-up periods:** The clinic trial lasted 9 months at the Clinic (October 1, 1991-June 30, 1992) and 18 months at the NHC (May 1, 1992-October 31, 1993). **Method of analysis:**	**Primary outcomes:** Among the 'clinic' children, 68% of those who received the no missed opportunities intervention compared to 65% in the control group (no intervention) were up-to date with their immunisations; among the Neighbourhood Health Centre children, 60% of those who received the no missed opportunities intervention compared to 62% in the control group were up-to-date with their immunisations (p=0.5)(CI not reported).	**Limitations identified by author:** Since Clinic and NHC staff was aware of the study and were able to identify study patients by the marked charts, there was the possibility of a Hawthorne effect producing a study bias. A potential design limitation involved randomising within practices, which forced office staff to

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
vaccinate eligible children at all office visits and (2) eliminating legal guardian signature requirements. **Study design:** RCT **Internal validity score:** **-** **Applicability:** B	children in Rochester New York, USA. Prior to the study, both sites had low immunisation levels and high rates of missed opportunities. **Excluded population/s:** Patients who had transferred out of either practice were excluded from the study. 72 NHC patients who had made no visits or telephone calls during the entire NHC period and 127 Clinic patients who had made no visits during the entire Clinic study period or the subsequent 2 years were excluded from the study. There were no significant differences in the proportion of patients excluded between study and control groups within each site. **Setting:** A Paediatric Continuity Clinic in a teaching hospital (Clinic) in Rochester New York, and a large NHC serving predominantly urban children in Rochester New York, USA. **Vaccines:** DTP, OPV, MMR Hib	*Intervention 1 : NMO* The NMO intervention was available at both the Clinic and the NHC. The intervention included the following: medical charts of patients were marked with a conspicuous black dot to indicate that they were assigned to the NMO group; staff nurses were instructed to screen these medical charts for immunisation status at all visit types, including acute illnesses, follow-up and nurse only visits; and if a vaccination was due , a brightly coloured immunisation reminder card was to be attached by the triage nurse to the front of the medical chart indicating that a vaccination was due and listing the valid contraindications to immunisations . Providers were required to complete the card whether or not a vaccination was administered; providers were instructed to list the reasons for not vaccinating the patient (e.g. fever, acute illness, insufficient time). *Intervention 2: Vaccination*	Descriptive Statistics.	**Secondary outcomes:** Not relevant to the review. **Attrition details:** NR	treat two groups of patients differently, and perhaps reduced the likelihood of nurses screening for vaccination status of study patients. **Limitations identified by review team:** Not reported method of randomisation and allocation concealment of the participants. No blind assessment of the primary outcome. Not reported attrition details in the study. Confidence Interval not reported in the review. Intention to treat analysis not used. **Evidence gaps and/or recommendations for future research:** Well designed studies

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		without legal guardian's signature. This intervention was performed at the NHC only. For study patients a single consent form was developed, to be signed once by a legal guardian prior to the administration of any vaccines. Subsequent vaccinations were administered without additional written consent, as long as the provider met the duty-to-warn requirements by providing the Vaccine Information Pamphlets, answering any questions and determining whether valid vaccine contraindications existed. **Control/comparison/s description:** The comparison group received the no missed opportunities intervention only. **Sample sizes:** **For Intervention 1 (NMO)** **Total n=** 868 **Intervention n=**430 **Control n=**448 **For Intervention 2**			should be conducted in this topic area **Source of funding:** New York State Department of Health in Albany.= and the Strong's Children's Research Centre, Rochester.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		(Vaccination without legal guardians signature at each visit) **Total n=** 911 **Intervention n=**473 **Control n=** 438 **Baseline comparisons:** At the start of the study, there were no differences between study and control groups on race, ethnicity, insurance status, sex, average age, and baseline immunisation rates. There were also no significant baseline differences between study and control groups for the vaccination without legal guardian's signature intervention at the NHC. At the start of the study, the mean age for clinic patients was 13 months and for NHC patients, 7 months. Fifty-three percent of clinic patients and 52% of NHC patient's were male. Seventy percent of clinic patients were African American and 6% were Hispanic. Insurance coverage for clinic patients included Medicaid (85%), health maintenance organisations (10%), and commercial coverage (4%) 56% of the pre-school age children at the			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
		NHC were African American, 3% were Hispanic, and 94% had Medicaid coverage. **Study sufficiently powered?** Yes. The study was designed to be able to detect differences between proportions of less than 10%by use of a sample size of at least 500 in the study and control groups.			

Continuity of Care

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes
(Gill et al. 2002) **Citation:** Does Continuity Between Prenatal and Well-child Care Improve Childhood Immunisations? **Aim of study:** T**o** determine whether continuity from prenatal to paediatric care is associated with higher immunisation rates for low-income children in Delaware. **Study design:** Retrospective cohort study **Internal validity score:** + **Applicability:** C	**Source population/s:** United States. The participants were mother-child pair from lower socio-economic status. **Eligible population:** Mother-child pairs identified from four health care clinics in Newcastle County, Delaware. **Selected population:** Women who were aged 18 or older and whose babies were born during the period July 1, 1997, to August 31, 1999, and had one of the four study clinics as the regular source of prenatal care for that pregnancy and who agreed to participate. The majority of the mothers were of Hispanic ethnicity and had Medicaid insurance. **Excluded population/s:** Those 18 years of age and not having one of the four study clinics as the regular source of prenatal care for that pregnancy. **Setting:** Four health care clinics in Newcastle County, Delaware, USA.	**Method of allocation:** NR **Intervention/s description:** The intervention comprised the mother-infant pairs as having either provider continuity (same provider for prenatal and pediatric care), or clinic continuity (same clinic but different provider), or no continuity (different clinic). **Control/comparison/s description:** No continuity*, different clinic. .* **Sample sizes:** **Total n=** 187 **Intervention:** (provider continuity) n= 44 (clinic continuity) n= 77 **Control n=66** **Baseline comparisons:** NR **Study sufficiently powered?** NR	**Primary Outcomes** Completion of immunisations (3 DPT/ 2 polio/ 3 Hib/ 2 Hep B) by 7 months of age and by 12 months of age. **Secondary outcomes** NR **Follow-up periods:** 7 months and 12 months of age. **Method of analysis:** Descriptive Statistics	**Primary outcomes:** Provider continuity was found to be associated with a significantly higher likelihood of having all immunisations completed by 7 months, compared with both no continuity (OR=4.85, 95% CI=2.07–11.36) and clinic continuity (OR=3.08, 95% CI=1.35–7.03). At 12 months, provider continuity was associated with a higher likelihood of completed immunisations in bivariate analysis when compared to both no continuity (OR=9.14, 95% CI=1.11–75.46) and clinic continuity (OR=8.38, 95% CI=1.03–68.30). **Secondary outcomes:** NR **Attrition details:** NR	**Limitations identified by author:** Study did not have adequate power to detect a difference in immunisation rates at 12 months in multivariate analysis. Unable to contact many women who received prenatal care at the study clinics to determine study eligibility. The results may not be generalizable to other settings, other populations, or other aspects of quality or continuity for children as the subjects were selected from only one county in one state and were primarily low-income, of Hispanic ethnicity, and with Medicaid insurance, and only one aspect of

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	Vaccine: DTP, HIB, Polio.				quality of paediatric care was examined, (ie, immunisation rates) and only one aspect of continuity (continuity from mother to child rather than continuity within one individual). **Limitations identified by review team**: All limitations listed by the authors. **Evidence gaps and/or recommendations for future research:** Well-designed and conducted RCT to be conducted to assess the effectiveness of provider continuity care in improving the immunisation rates for low income children. **Source of funding:** NR

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