Revised Analysis of the evidence

INTRODUCTION:

The analysis presented here provides a synthesis of the evidence contained in the effectiveness review "Review of the evidence of the effectiveness and cost effectiveness of interventions to address differences in the uptake of immunisations (including targeted vaccines) in people younger than 19 years" that has previously been issued for consultation. The analysis also incorporates evidence identified through the consultation process as relevant for inclusion.

Brief summaries of the details of included quantitative studies and corresponding evidence statements are presented by intervention type. For each intervention type relevant qualitative evidence statements are also presented although details of qualitative studies are not included. Further information on all studies (quantitative and qualitative) is available in the Evidence Tables.

The quantitative evidence comprised interventions that were either universal or targeted in nature which are defined as follows[1]:

Universal Interventions: interventions aimed at increasing uptake for age appropriate vaccinations available to all children and young people ('The Green Book', DH [2006]).

Targeted Interventions: interventions that target particular population subgroups of children and young people who are at increased risk of not being fully immunised. At-risk groups would include: children and young people who have missed previous vaccinations (whether as a result of parental intent or otherwise); looked after children; children with physical or learning difficulties; children of teenage or lone parents; children not registered with a general practitioner; younger children from large families; children who are hospitalised; children from low socioeconomic or minority ethnic groups, and vulnerable children, such as those whose families are travellers, asylum seekers or homeless. (DH 2005; Hill et al. 2003; Peckham et al. 1989; Samad et al. 2006).

Targeted vaccines by comparison, are those vaccines that are recommended for specific groups at increased risk of infection with vaccine-preventable disease. Targeted vaccinations for children and young people aged to 19 years in the UK include the bacillus Calmette-Guérin (BCG) and Hepatitis B immunisations that are recommended for, for example, children and young people living in areas with an increased incidence of tuberculosis, and babies born to mothers infected with Hepatitis B ('The Green Book', DH [2006]).

Although the qualitative evidence comprised UK-based studies only, the quantitative evidence included studies from all developed countries, but predominantly from the USA. The evidence has been refined further to only include that which was deemed as applicable to the current UK context (see below)

METHODS:

The following additional inclusion/exclusion criteria were agreed:

1. Those studies comprising interventions not appropriate/transferrable to the UK context were excluded. These include:
    - Where the intervention comprised provision of free vaccines either alone or as part of a health insurance package;
    - Where the intervention comprised immunisation-linked provider payments on a capitation or fee-for-service basis;
    - Where the interventions are delivered in a setting deemed not comparable to the UK context.

2. If universally targeted interventions report baseline coverage levels of <70% (with the exception of coverage for MMR vaccine), these studies have been excluded. Also excluded were those where only post-intervention levels were presented and the control (no-intervention) levels are <70%. If studies report baseline levels for a number of vaccines or age groups and at least one is >70%, these studies have been included.

[1] Oliver et al., (2008): *Health promotion, inequalities and young people's health. A systematic review of research.* EPPI-Centre report no. 1611, October 2008

3. Those studies aiming to increase uptake of HPV vaccine were excluded.

RESULTS:

A total of 23 quantitative studies were excluded as a result of applying the additional inclusion/exclusion criteria (see Appendix 1).

The evidence for the included 94 studies has been presented according to intervention, then by whether the intervention is delivered on a universal or targeted level, then by age group and/or vaccine where appropriate. Evidence Statements pertaining to each section for both the quantitative and the relevant qualitative evidence have been derived and presented at the beginning of each section.

A study typically appears in only one section, although there is just one exception: the study by Morgan and Evans, (1998) assesses two distinct interventions for increasing uptake of universal vaccines in children not-up-to date with either the primary vaccine series (DTP, OPV, Hib) or the first MMR dose: a targeted reminder recall intervention and an intervention in which a child's immunisation status is provided to the child's health visitor. Consequently, this study is presented both within Section 1 (reminder recall interventions) and Section 7 (Provision of child vaccination information to service providers). Furthermore, as the study reported uptake outcomes for both the primary series and MMR, the study is also presented within Section 11 (interventions specific for increasing uptake of MMR);

Targeted versus Universal interventions:

Of the 94 included quantitative studies, 67 (71%) describe interventions targeted towards specific population sub-groups who were identified at risk of low vaccination uptake (e.g. children not up to date with the vaccination schedule, Black and Minority Ethnic (BME) groups, low socio-economic status (SES) families etc) (see Table 1) whilst 27 (29%) describe universal interventions that were aimed at increasing immunisation uptake across the wider population (see Table 2). Only 15 (16%) of the studies were from the UK, the majority of which (13) described targeted interventions (see Figure 1).

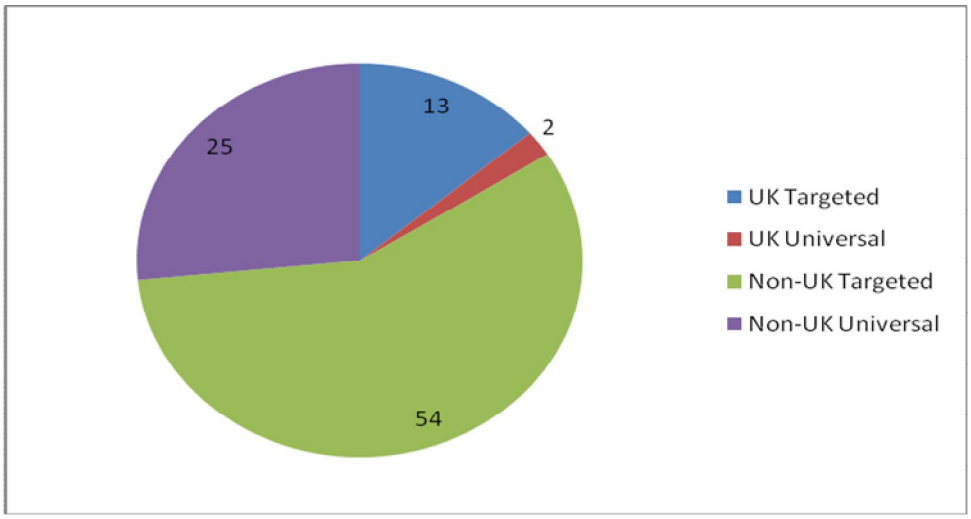

Figure 1: Illustration of the proportion of UK and non-UK targeted and universal interventions.

Reducing differences in immunisation uptake:

Just one of the included studies reported on the differential uptake of immunisations across population subgroups. In a recent study from the USA, Morita and colleagues (2008) found that the differential uptake of universal Hepatitis B vaccination in high school pupils across different ethnic groups reduced with the introduction of legislation requiring vaccination for school entry (see Section 5 'Interventions in school (or day-care) settings).

Table 1: Included studies by targeted population and Intervention type.

Targeted Population[2]		Interventions/studies
Children not up-to-date with their vaccinations		**Recipient reminder/recall interventions:** Morgan and Evans, 1998[2]; Kempe et al., 2001; Lieu et al., 1998; Vivier et al., 2000[2]; Alto et al., 1994; Gore et al., 1998. Szilagyi et al., 2006 **Home Visiting:** Bond, Nolan and Lester, 1998 **Interventions in school (or day-care) settings:** Ferson et al., 1995; **Provider-based interventions** Morgan & Evans, 1998[2] **Opportunistic Vaccinations:** Szilagyi, et al, 1996; Riley et al., 1991[2] Conway, 1999[2] Ressler et al., 2008[2] **Multicomponent interventions**: Barnes et al., 1999; Rosenberg, et al., 1995; Crittenden & Rao 1994; **Interventions specific for increasing uptake of MMR** Morgan & Evans 1998[2]; Mason & Donnelly 2000; Lieu et al., 1997;
BME Groups:	Infants of teen BME mothers	**Recipient reminder/recall interventions:** O'Sullivan and Jacobsen, 1992 **Multicomponent interventions:** Wilcox, et al., 2001 Fitzpatrick, et al., 1997;
	Infants of BME families	**Home Visiting:** Norr et al., 2003 **Multicomponent interventions:** Wood, et al., 1998[2] El-Mohandes et al., 2003[2] McPhee, et al., 2003 Kitzman et al., 1997
Low SES families		**Recipient reminder/recall interventions:** Vivier et al., 2000[2] Szilagyi et al., 2006[2] Abramson et al., 1995 Irigoyen et al., 2000 Stehr-Green et al., 1993 **Home Visiting:** Goldstein et al., 1999. Taylor et al., 1997 **Client or family incentives (or disincentives):** Kerpelman et al., 2000;

[2] In some studies the targeted population has more than one at-risk characteristic (for example, the study by Vivier et al., [2000] targets children enrolled in Medicaid who were not up-to-date with their vaccinations).

	Minkovitz et al., 1999; Stille et al., 2001. **Provider based interventions:** Brink, 1989 Margolis et al., 2004 Gill et al., 1992; **Opportunistic Vaccinations:** Harper et al., 1997; Minkovitz et al, 2001; **Multicomponent interventions:** Browngoehl, et al., 1997; Hoekstra et al., 1999; Johnson, et al., 1993; 2000 Wood, et al., 1998 El-Mohandes et al., 2003; Findley, et al., 2004; Hambidge et al., 2004; Szilagyi, et al., 2002 Murphy, et al, 1996; **Interventions specific for increasing uptake of MMR** Harper & Murray, 1994;
Infants of teen mothers *See also: Infants of teen BME mothers*	**Home visiting:** Koniak et al., 2002; 2003; Taylor et al., 1997[2]
Infants of illicit drug users	**Home visiting:** Bartu et al., 2006
Homeless youth	**Multicomponent interventions** Steele & O'Keefe, 2001
Infants at-risk of tuberculosis infection[3]	**Provider based interventions:** Gill & Scott, 1998; Tseng et al., 1997; Ahmed et al., 1992; Wroe et al., 2007. Chappel & Fernandes, 1996
Looked after children	**Provider-based interventions** Ashton-Key and Jorge, 2003
Infants at risk of Hepatitis B infection	**Interventions for increasing uptake of neonatal hep B** Riley et al., 1993 Stroffolini & Pasquini, 1990; Henning, et al., 1992 Larcher et al., 2001; Lam & McLaws, 1998
Adolescents in prisons and youth offender institutions	**Opportunistic Vaccinations:** Hutchinson et al., 2004
Hospitalised children	**Opportunistic Vaccinations:** Rodewald et al., 1996 Bell et al., 1997; Riley et al., 1991 Skull et al., 1999; Conway, 1999; Szilagyi et al., 1997; Muehleisen et al., 2007 Ressler et al., 2008

[3] In the UK, a selective neonatal BCG immunisation programme targets infants born to parents from high-prevalence countries (DH, 2006).

Table 2: Included universal studies by Intervention type.

Universal interventions	
Recipient reminder/recall interventions:	**Aged <2 years:** Freed et al., 1999; Franzini et al., 2000; Alemi et al., 1996
Client or family incentives (or disincentives):	Lawrence et al., 2004
Interventions in school (or day-care) settings:	**Policies requiring vaccinations for school/day care entry:** Averhoff et al., 2004; Kolasa et al., 2003; Shah et al., 2001; Morita, Ramirez and Trick, 2008; Wilson et al., 2005; Yusuf et al., 1999 **Education programmes:** Skinner et al., 2000.
Provider-based interventions	**Change in provider practice:** Sinn, Morrow & Finch, 1999.
Opportunistic Vaccinations	**Schools:** Guay et al., 2003;
National Immunisation Programmes	Bond et al., 2002; Australian Government Department of Health and Aging, 2004 KPMG, 2000 NCIRS, 1999a, 1999b, 1999c, 1999d 1999e Paunio et al., 1991
Multicomponent interventions	Johnston et al., 2006; Rodewald, et a., 1999 Hellerstedt, et al., 1999
Interventions specific for increasing uptake of MMR	Lamden, unpublished Jackson, 2007

Contents

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
1. Recipient reminder/recall systems Interventions that incorporate reminder/recall systems typically consist of written reminders (letters, postcards), telephone reminders (personal or automated) or a combination of both. In England, some child health departments/GPs have in place a reminder system calling children for vaccination.						
Targeted interventions: **Not up-to-date with vaccination schedule:**						
Children aged <2 years: **Evidence Statement 1:** There is mixed evidence from 3 RCT's (one from the UK and two from the USA) as to the effectiveness of reminder/recall interventions targeting children aged <2 years who are not up-to-date with the recommended vaccination schedule (including DTP, OPV, Hib, Hep B and MMR vaccinations). One RCT (Grade++; N=451) from the UK found no significant difference in the proportion of infants up-to-date with primary immunisations or MMR between those who received a mailed reminder to the child's parents and a no-contact control (Morgan & Evans, 1998). A second study (RCT-; N=603) found mixed results depending on the age of the child: reminder postcards plus telephone follow up significantly improved up-to-date coverage in children aged 12 months compared with a no contact control group, but not in children aged 7 or 19 months (Kempe et al., 2001). Finally, a third study (RCT-; N=867) found that automated telephone messages or letters either alone or together improved vaccination uptake compared with an historical no contact control (Lieu et al., 1998). In the UK study chidren aged <2years who were behind in their vaccinations were identified from the Child Health System (Morgan & Evans, 1998). Two studies were from the USA (Lieu et al., 1998; Kempe et al., 2001), one of which examined vaccination recall in an urban paediatric teaching clinic, so applicability to UK GP settings from these studies might be limited (Kempe et al., 2001). No demographic details on population recipients were reported for any of the three studies.						
Morgan & Evans 1998; Country: UK	RCT ++ Sample: N=451	1) A non-directive phone call to the child's health visitor in which the child's immunisation status was confirmed. Although follow-up was anticipated, it was not specifically requested. 2) Mailed reminder to the child's parents Vaccine/s: DTP, OPV, Hib, MMR	No contact	Targeted	Children not up-to-date with their vaccinations. Ages: To 21 months	No significant difference between the intervention and control groups in the proportion completing the primary course or MMR immunisation at post-assessment.
Kempe et al.,	RCT +	Reminder postcards plus telephone	No contact.	Targeted	Children not	Significantly more children in the

[4] Is cited variably by the studies as either age of study enrolment, or age at which vaccination status is assessed.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
2001; Country: USA	Sample: N=603	follow-up (up to 4 attempts made) Vaccine/s: DTP, OPV, Hib ,Hep B, MMR			up-to-date with their vaccinations. Ages: To 17 months	intervention group who were aged 12 months were brought up-to-date through receiving vaccinations compared with control 2 months after recall (25% v 10%; p=0.005). However, there was no significant difference between intervention and control in the proportion of children aged 7 or 19 months who were brought up-to-date through vaccinations (7 months: 6% v 7%; p=0.86; 19 months: 6% v 4%; p=0.71). For each age group, a greater proportion of children were brought up-to-date through 'acquisition of historical data' (not further described) than through receipt of vaccinations. Although there was a trend toward higher composite (i.e. historical review +vaccinations) up-to-date rates in the 12 month old children, the difference was not significant. No difference was seen in the children aged 7 or 19 months.
Lieu et al., 1998; Country: USA	RCT – Sample: N=867	1) An automated telephone message; 2) A letter 3) An automated telephone message followed by a letter 1 week later; 4) A letter followed by an automated telephone message 1 week later. Vaccine/s: DTP, OPV, Hib, Hep B, MMR	No contact (historical comparison)	Targeted	Children not up-to-date with their vaccinations. Ages: To 20 months	The letter followed by the phone message significantly improved vaccination rates compared both with the letter alone and the phone alone. There was no significant difference in proportion of children fully immunised between immunisation groups. All interventions improved uptake compared with control.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Children aged 2 to 7 years: **Evidence Statement 2:** There is mixed evidence from 3 RCTs (2 Grade +, 1 Grade -) from the USA as to the effectiveness of reminder/recall interventions targeting children aged 2 to 7 years who are not up-to-date with the recommended vaccination schedule (including DTP, polio, Hib, Hep B and MMR). Two RCT's (both Grade +) assessed telephone and mailed reminders either alone or together (mailed reminder followed by telephone reminder if the family failed to schedule an appointment) and found that children in the intervention groups were significantly more likely to be immunised or brought up-to-date compared with no intervention (Vivier et al., 2000 [N=321]; Alto et al., 1994; [N=464]). However, the third study (RCT-; N=243) found that mailed reminders comprising 'persuasive messages' to encourage parents to have their children immunised was not effective compared with no-contact (Gore et al., 1998) All 3 studies were conducted in the USA, one (Vivier et al, 2000) involved children enrolled in Medicaid (i.e. from low income families) and was conducted through a primary care clinic delivered in a hospital, possibly limiting applicability to UK GP settings.						
Vivier et al., 2000 Country: USA	RCT + Sample: N=264	1) telephone reminder; 2) a mailed reminder; 3) mailed reminder followed by a telephone reminder if the family failed to schedule an appointment. Vaccine/s: DTP, polio, Hib, MMR, or Hepatitis B	No intervention	Targeted	Children enrolled in Medicaid and who were not up-to-date with their vaccinations. Ages: Younger than 6	Children in the intervention groups were significantly more likely to receive an immunisation compared with control. There was no significant difference between the three intervention groups in the percentage of children immunised after10 wks.
Alto et al., 1994; Country: USA	RCT + Sample: N=464	Post-card reminder, with phone follow-up if required. Vaccine/s: DTP, OPV, MMR and Hib	No contact.	Targeted	Children not up-to-date with their vaccinations. Ages: Younger than 7	Significantly more infants receiving intervention were up-to-date with immunisations (MMR or fully immunised) compared with control.
Gore, et al.,1998.	RCT –	One of three mailed messages based on: fear-arousal; motherhood arousal; rational argument.	No contact.	Targeted	Children not up-to-date with their vaccinations.	No child received late vaccinations.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: N=243	Vaccine/s: Immunisation schedule			Ages: To 4 years	
Adolescents: **Evidence Statement 3:** There is conflicting evidence from one RCT (Grade ++; N=3006) from the USA that compared review of medical records plus delivery of automated reminder phone calls to families of young people aged 11-14 years behind on vaccinations with usual care (not further described). Although the intervention significantly improved Hepatitis B vaccination uptake there was a non-significant increase in uptake of the tetanus-diphtheria booster uptake, compared to controls. This study was conducted in the USA in urban practices with high rates of child poverty (Szilagyi, 2006).						
Szilagyi et al., 2006; Country: USA	RCT ++ Sample: N=3006	Intervention comprised: review and monitoring of medical records to identify and update phone numbers; database tracking for missing vaccinations; an autodialer reminder system. Vaccine/s: Hepatitis B Tetanus- diphtheria booster	Usual care (not further defined)	Targeted	Young people behind on vaccinations. Practices in a city with high rates of child poverty. Ages: 11-14 years	Although significantly more young people received Hepatitis B vaccination with intervention compared with control (62% with intervention v 57.8% with control; P=0.02), there was no significant effect on uptake of the tetanus-diphtheria booster (52% with intervention vs. 49.9% with control; P=0.27). Outcomes reported as proportions vaccinated at follow up: intervention versus control.
Infants of teen BME mothers: **Evidence Statement 4:** There is evidence from one RCT (Grade -; N=243) from the USA to suggest that a baby clinic for black adolescent first time mothers focusing on immunisations coupled with reminder calls and letters after missed appointments were effective, but not significantly, at increasing the number of children vaccinated. As the intervention was hospital based applicability to the UK primary care setting may be limited.						
O'Sullivan & Jacobsen, 1992; Country: USA	RCT - Sample: 243	Routine care plus teen baby clinic. Programme focused on up-to-date immunisations. Reminder phone calls and letters after missed appointments. Vaccine/s: Not specified	Routine care which included regular hospital based well baby clinics	Targeted	Black adolescent 1st time mothers who delivered at study hospital	Fully immunised at 18months: Intervention = 33% (37/113) Control = 18% (20/111) p<0.2

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Infants of low SES families: **Evidence Statement 5:** There is mixed evidence from three RCT's, all from the USA, as to the effectiveness at increasing immunisation uptake of reminder/recall interventions targeting families of low socio-economic status. One RCT (Grade++; N=601) found that reminder postcards in advance of appointments with follow-up postcards and phone calls if the appointment is missed significantly increased the number of infants up-to-date with immunisations compared with families that only received a single reminder postcard if they failed to keep the appointment (Abramson, et al., 1995). The second RCT (Grade +; N=1273) found that although postcard and telephone reminders in advance of an appointment significantly increased vaccination coverage in infants who were not up-to-date at baseline compared with families who didn't receive a reminder, there was no significant difference in overall vaccination coverage rates between reminder and control groups (Irigoyen et al., 2000). Finally, one RCT (Grade -; N=222) found that although more children of families who received a computer generated phone message in advance of an appointment were vaccinated within 1 month of being due compared with families who didn't receive a reminder, the difference was not significant (Stehr-Green et al., 1993).						
Abramson, et al., 1995; Country: USA	RCT++ Sample: N=601	Reminder postcards in advance of appointment plus follow-up postcard & phone call if appointment missed. Vaccine/s: DTP, OPV, Hib ,Hep B	Single reminder postcard to families who failed to keep appointment	Targeted	Families of lower socio-economic status Ages: To 6 months	Significantly more infants up-to-date with immunisations receiving intervention (91%) compared with control (72%).
Irigoyen et al., 2000. Country: USA	RCT + Sample: N=1273	Reminders issued via either: 1) Postcards mailed a week in advance of the appointment; or 2) telephone call the evening before or 3) postcard plus telephone call Vaccine/s: DTP, OPV, MMR	No reminder.	Targeted	Clinic provided care predominantly to a low-income community. Ages: To 18 months	There was no significant difference in vaccination coverage rates between reminder and control groups (average coverage 84.1%; X^2=2.66; P=0.45). For those who were not up-to-date at baseline, postcard and telephone reminders increased their vaccination coverage threefold compared with control (OR 2.9; 95% CI 1.1 to 8.0). Baseline not reported
Stehr-Green et al., 1993;	RCT-	Computer generated phone message in advance of appointment.	No contact	Targeted	Clinic provided care predominantly to poor,	More children in the intervention group were vaccinated within 1 month of being due compared with control, although the difference was not significant.

<table>
<tr><th>Study/
Country</th><th>Design/
Grade/
Sample</th><th>Intervention
Vaccine/s</th><th>Control</th><th>Targeted/
Universal</th><th>Targeted
Population
and Age[4]</th><th>Result</th></tr>
<tr><td>

Country:
USA</td><td>

Sample:
N=222</td><td>

Vaccine/s:
DTP, OPV, MMR</td><td></td><td></td><td>minority
populations.

Ages:
<2 years</td><td>
Baseline levels:
Not applicable. Only children who were due to receive a vaccination were included in the study.</td></tr>
<tr><td colspan="7">Universal interventions:</td></tr>
<tr><td colspan="7">Children aged <2 years:

Evidence Statement 6:
There is mixed evidence from 3 studies from the USA: 2 RCTs (both Grade -) and 1 nRCT (Grade +) as to the effectiveness of universal reminder/recall interventions for children aged <2 years. Two studies and found that compared with children who received no contact, reminders comprising either mailed postcards or computer-generated telephone messages in advance of appointments increased uptake of DTP (Franzini et al 2000; RCT-; N=1,138) and DTP, OPV, Hib, and MMR (Alemi et al., 1996; n-RCT+; N=213). Conversely, one RCT found that letters comprising either a health message or a message reminding parents that vaccination is compulsory under state law had no significant impact on vaccine coverage at 7months compared with a control group that received no reminder/recall letters (Freed et al., 1999; RCT -; N=1351).</td></tr>
<tr><td>Freed, et al., 1999

Country:
USA</td><td>RCT –

Sample:
1351</td><td>Parents received either:
1) a letter with a health message,
2) a letter with a message alerting parents that state law requires their children to be immunised according to the recommended schedule not just at school entry.

Vaccines:
DTP, OPV, MMR, Hib and Hep B</td><td>No mailings</td><td>Universal</td><td>All babies born to North Carolina residents.

Age:
To 7 months</td><td>There were no significant differences in immunisation rates at seven months between groups. Immunisation rates for the 3DTP:2OPV:0MMR:2Hib series were: 78% with health message versus 80% with law message and 78% with control.

Baseline not reported</td></tr>
<tr><td>Franzini, et al., 2000.

Country:
USA</td><td>RCT –

Sample:
N=1138</td><td>Postcard reminder OR computer-generated phone message in advance of appointment

Vaccine/s:
DTP.</td><td>No contact.</td><td>Universal</td><td>Children attending a private paediatric practice.

Ages:
<12 months</td><td>More children who received reminder messages received vaccinations at their next scheduled visit compared with control.

<table><tr><td></td><td>Number in study</td><td>Number receiving vaccination</td></tr><tr><td>Mail reminder</td><td>395</td><td>315</td></tr></table></td></tr>
</table>

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
						Auto-dialer: 314 / 270 Control: 429 / 273 **Baseline levels:** Not applicable. Only children eligible for a vaccination at their next visit were included in the study.
Alemi, et al., 1996. Country: USA	N-RCT + Sample: N=213	Computer generated phone reminder in advance of appointment plus follow-up computer call if appointment missed. Vaccine/s: DTP, OPV, Hib, MMR	No contact.	Universal	No further details. Ages: <6 months	Significantly more infants received vaccines on time with intervention compared with control. This pattern was observed for all vaccines combined and individual vaccines Baseline not reported
2. Home visiting Home visiting interventions consist of a healthcare professional or trained community support worker visiting parents in their home to discuss immunisation. These visits can be one off for children who are late for immunisations and may involve home immunisation of the child or they may be part of a wider health programme where regular visits to the family are made. Current practice in England is for Health visitors to have contact with children regularly (5 times) in first 9 months of life. The next scheduled check up with a health visitor is at age 2. Not all of these visits will take place in the child's home.						
Targeted interventions **Not up-to-date with vaccination schedule:** **Evidence Statement 7:** There is evidence from one RCT (Grade ++; N=169) from Australia that a home vaccination service for children who were behind on the recommended immunisation schedule (DTP/OPV/Hib or MMR) significantly improved vaccination coverage compared with children who did not receive a home-based vaccination service (Bond, Nolan & Lester, 1998).						
Bond, Nolan & Lester, 1998;	RCT ++	The intervention comprised making contact with the intervention group by letter, then by telephone to verify vaccination status, to organise an appointment, and to administer a pre-vaccination health check to ensure that	No home vaccination service	Targeted	Children 90days late (age 9 months) for 3rd DTP/OPV/Hib or 120 days	DTP/OPV/Hib or MMR Intervention = 46/81 (57%) Control = 24/88 (27%) RR = 2.08 (1.4-3.1) p<0.001 DTP/OPV/Hib

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Australia	Sample: N=169	the child could be vaccinated at home. A nurse administered vaccination in the child's home at a time convenient to the parents. Siblings were also vaccinated if they were due for vaccination. Vaccine/s: DTP/OPV/Hib, MMR			late (age 16 months) for MMR Age: 9-16 months	Intervention = 18/32 (56.3%) Control = 12/35 (33.3%) RR = 1.69 (0.97-2.9) p<0.057 MMR Intervention = 28/49 (57.1%) Control = 1 2/52(23.1%) RR = 2.48 (1.43-4.3) p<0.001
Infants of low SES families **Evidence Statement 8:** There is evidence from one BA study (Grade +; N=1075) from the USA that a community-based outreach programme comprising home visits to a large public housing development to identify children and pregnant women significantly improved children's vaccination coverage in this population (Goldstein et al., 1999). There is evidence from one RCT+ from the USA that a community-based outreach programme comprising 7 home visits during the infant's first 15 months together with advice and support for mothers is as effective at ensuring age-appropriate immunisations if delivered on a one-to-one basis or a group basis (Taylor et al., 1997; RCT+; N=220]). ***See also Evidence Statement 45***						
Goldstein, et al., 1999 Country: USA	BA + Sample: 1075	Community-based outreach programme comprising home visits to identify children and pregnant women and recording of child's immunisation status (either from home records or contact with clinic). Vaccines: DTP, OPV, MMR, Hib.	N/A	Targeted	Children living in a large public housing development Age: To 6 years.	After three years, more children were up-to-date at their final assessment, than at their initial assessment: 50% versus 37% (p<0.001).
Taylor, et al., 1997;	RCT +	Both groups received health supervision visits at 4, 5, 6, 8, 10, 12 and 15 months of age that comprised a study nurse practitioner leading discussion on a predetermined curriculum of topics,	GWCC v IWCC	Targeted	'High Risk' infants Mothers who were; single,	At 12 months: 3DTP/DT, 2OPV/IPV, 3 Hep B and 3 Hib GWCC = 67% IWCC = 73% p=0.35

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: 220	focused on age appropriate child rearing issues and a brief physical either before or after each session. Groups received supervision either as: 1. Group Well Child Care (GWCC) 2. Individual Well Child Care (IWCC) Vaccine/s: DTP/DT, OPV/IPV, Hib, Hep B			education less than high school, Medicaid, Under 20, Previous substance misuse, history of abuse as child	3DTP/DT, 2OPV/IPV GWCC = 84.5% IWCC = 87% p=0.61 17 lost to follow-up
Infants of BME families **Evidence Statement 9:** There is evidence from one RCT (Grade -; N=588) from the USA that found that a community outreach programme (the REACH-Futures programme) for pregnant BME women centred on home visits (an average of 5 in the first 12 months) from trained bilingual community health advocates supplemented with three accompanied visits from nurses did increase vaccination rates (significance not reported) in infants at 12 months compared with women who did not receive the REACH-Futures programme (Norr et al., 2003).						
Norr et al., 2003;	RCT –	REACH-Futures Programme (Resources, Education and Care in the home) which comprised home visits (once a month or more often if necessary commencing 2 weeks after discharge) by a team of trained bilingual community residents led by a nurse. The nurse accompanied the community advocate at 1, 6, and 12 month visits and conducted an infant health and development screening. After 2 months, if mother and infant were doing well telephone calls were substituted for alternate monthly visits. The average participant received around 5 home visits and seven contacts over the first 12 months.	No REACH-Futures Programme	Targeted	Pregnant African-American or Mexican-American women attending 2 prenatal clinics	At 12 months % up-to date with imms: 76.4% intervention v 74.6% control (reported by mother or medical records) 83.2% intervention v 79.3% in control up-to-date reported by mother 61.4% intervention V 48.6% control up-to-date as documented in medical records Mexican American more likely to be immunised. No diff in intervention and control for African Americans. Mexican Americans control group had higher immunisation rate.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: N=588	Vaccine/s: Not specified				
Infants of teen mothers **Evidence Statement 10:** There is evidence from one RCT from the USA reported in two papers (Grade + and -; n=102) to suggest that an intervention targeting pregnant adolescents which incorporated intensive home visitation (approximately 17 prenatal and postnatal visits) from pregnancy to 1 year post partum significantly improved vaccination uptake to 12 months of age compared with a control group that received 1-2 visits. Although evaluation of the programme at 24 months post partum found that the intervention group were less likely than the control group to be up-to-date with immunisations, >40% of participants had been lost to follow-up by 24 months, limiting the reliability of this finding (Koniak-Griffin et al., 2002 & 2003).						
Koniak-Griffin et al., 2002; Koniak-Griffin et al., 2003; Country: USA	RCT + RCT - Sample: N=102	Early Intervention Programme (EIP) – intensive home visitation (approximately 17 prenatal and postnatal visits) by public health nurses (PHN's) from pregnancy to 1yr post partum. Each visit lasting 1–1/2 to 2 hours comprised nursing case management, individualized life planning and counselling, health education, social support, and referrals for family planning, child care, and mental health services. The EIP group also received four preparation-for-motherhood classes focusing on behaviours to promote health during pregnancy, parent-child communication, and the transition to motherhood. Vaccine/s: DTP, Polio	One or two prenatal home visits by the PHNs, with a focus on assessment and counselling related to prenatal health care, self-care, childbirth preparation, future educational plans, and well-baby care. PHNs provided general information about child care, postpartum recovery, maternal and infant nutrition, home safety, and family planning**.**	Targeted	Pregnant adolescents planning to keep the baby. Age: To 2 years.	At 12 months of age significantly more children in the intervention group were adequately immunised (96% versus 86%). At 24 months of age, 77% of intervention versus 87% of control were adequately immunised. However, it should be noted that 43 (42.2%) infants were lost to follow-up by 24 months.

<table>
<tr><th>Study/ Country</th><th>Design/ Grade/ Sample</th><th>Intervention Vaccine/s</th><th>Control</th><th>Targeted/ Universal</th><th>Targeted Population and Age[4]</th><th>Result</th></tr>
<tr><td colspan="7">Infants of illicit drug users

Evidence Statement 11:
There is evidence from one RCT (Grade ++; n=152) from Australia to suggest that regular home visitation up to 6 months postpartum by midwives to new mothers who are illicit drug users did not significantly increase age appropriate vaccination rates of newborns at 2, 4 or 6 months compared with a control group who received telephone contact at 2 months and a home visit at 6 months. However, vaccination rates at 2 and 4 months were higher (although not significantly) in the intervention group compared with control (Bartu et al., 2006).</td></tr>
<tr><td>Bartu et al., 2006;

Country: Australia</td><td>RCT ++

Sample: N=152</td><td>Home visitation by midwives weeks 1, 2 and 4 then monthly until 6m post partum including discussion of immunisations

Vaccine/s: Not specified</td><td>Telephone contact at 2m and home visit at 6m</td><td>Targeted</td><td>Illicit drug users recruited at Antenatal Chemical Dependency clinic</td><td>No significant differences between 2 groups at 2 (p=0.757), 4 (0.477) or 6 (0.283) months
<table>
<tr><td>Age</td><td>Int.</td><td>Control</td><td>P-value</td></tr>
<tr><td>2 mths</td><td>87%</td><td>78%</td><td>0.757</td></tr>
<tr><td>4 mths</td><td>82%</td><td>70%</td><td>0.477</td></tr>
<tr><td>6 mths</td><td>14%</td><td>20%</td><td>0.283</td></tr>
</table></td></tr>
</table>

3. Provision of health information/education for families/communities

Information on the UK childhood vaccination schedule is in the Child Health Record and leaflets have been produced by The Department of Health on individual vaccines (e.g. Hib booster) and age targeted vaccine schedules (e.g. up to 13months, pre-school vaccinations).

Qualitative evidence:

Evidence Statement: 12:
Conceptions of the severity of vaccine-preventable diseases:
There is evidence from a focus group study with 66 parents (Hilton, 2007) (Quality +) and an interview study with 22 parents (Tickner, Leman, & Woodcock, 2007) (Quality ++) that many parents lack knowledge about immunisations and vaccine-preventable diseases, their incidence in the UK and their severity.

There is evidence from 20 surveys of mothers of children under 3 years of age (n=15,000) carried out over a 10 year period from 1991-2001 (Quality +) that the perceived severity of different vaccine-preventable diseases has changed over time with the perceived severity of some diseases having declined (polio, pertussis, and diphtheria), increased (meningitis C) remained stable (tetanus and mumps), or varied (rubella, Hib and measles) (Yarwood, 2005).

There is conflicting evidence as to the relationship between how severe vaccine-preventable diseases are perceived to be by parents and the likelihood of their children

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

having completed their immunisations. A postal survey of 80 parents (Lewendon, 2002) (Quality -) suggested that parents of children with incomplete immunisations were less likely to see childhood diseases as severe. Conversely, an interview study with 759 parents (Gill & Sutton, 1993) (Quality -), found that there were few differences in the beliefs of parents who had and had not had their children immunised regarding incidence and severity of vaccine-preventable diseases.

There is evidence from two qualitative studies with parents living in inner city settings to suggest that vaccine preventable childhood diseases are perceived as severe or serious:

- One interview and focus group study with 21 Somali, Pakistani and Afro-Caribbean mothers (Condon, 2002) (Quality +) found that the severity and incidence of childhood diseases was perceived as high.
- Likewise, a survey of orthodox Jewish parents (n=67) in London found that most parents perceived vaccine-preventable diseases such as measles as very serious or serious (Cuninghame et al., 1994).

However, three studies found there are mixed views on how serious different vaccine-preventable diseases are perceived to be:

- One recent interview study undertaken in October-November 2006 with mothers of children aged less than 3 years (N= 1016) found that Meningitis was perceived as being the most severe disease, while mumps, measles and rubella were seen as the least severe (Smith et al., 2007; Quality ++)
- One questionnaire study with 68 parents in an inner-city setting (Smailbegovic, Laing, & Bedford, 2003) (Quality +) found that meningitis was perceived to be the most serious disease, with pertussis, diphtheria and measles perceived as serious or very serious and rubella perceived as mild.
- One interview study with 13 parents in an inner-city setting (Sporton & Francis, 2001) (Quality -) found that diphtheria, tetanus and polio are perceived as serious, whilst measles, mumps and rubella are perceived as mild.

There is evidence from one focus group study (Henderson, Millett, & Thorogood, 2008) with 25 orthodox Jewish mothers and 10 local health care workers from an orthodox Jewish community in North East London found that the separation of the community from outside influence led to feelings of safety and a lack of need for the BCG vaccination, a situation that local health care providers occasionally supported, although this was not done consistently.

Evidence Statement: 13:
Mis-conceptions about the safety of vaccines:
There is evidence from one study comprising 20 surveys of mothers of children under 3 years of age carried out over 10 years (n=15,000) (Yarwood et al., 2005) (Quality +) that most mothers (>90%) trust in the safety of immunisations. However, there is evidence from five studies that some mothers and parents considered the risks of vaccines greater than the risks of acquiring a vaccine-preventable disease) (Samad, 2006) (Quality ++); (Simpson, Lenton, & Randall, 1995) (Quality -); (Smailbegovic, 2003) (Quality +); (Rogers, 1994) (Quality -); and (Sporton & Francis 2001) (Quality -).

There is evidence to suggest a range of perceived risks of immunisation may influence some parental decisions to delay or avoid immunisations for their children, as suggested by a postal questionnaire with 87 parents (Simpson, 1995) (Quality -), a nationally representative interview survey with 18,488 mothers (Samad, 2006) (Quality ++), a postal survey of 80 parents (Lewendon & Maconachie, 2002) (Quality -;). A fear of vaccines being contraindicated for existing medical conditions such as eczema is indicated by some parents (proportion not stated) in an interview study with 759 parents (Sutton et al., 1993) (Quality -); or concerns about combined antigens putting too much stress on a baby's immune system, are identified by three studies (Hilton, 2006 ;N= 72 parents) (Quality +) (Tickner, 2007; N=22) (Quality ++) (Lewendon, 2002; N=80)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

(Quality -).

There is evidence from one survey (n=not reported) that found that one in three parents of 0-2 year old children worry about the effect of multiple vaccines and too many vaccinations on the child. One in three parents had some concern over the immunisation process, with the principle concerns around a lack of information and worries about the effect on the child, but also concern about the way health professionals carry out the immunisation appointments (a perceived lack of empathy, concern and time in particular) (BMRB Social Research, 2008; Quality -).

There is evidence from an interview study with 10 orthodox-Jewish mothers (Loewenthal, 1996) (Quality –) that mothers' fears of bad reactions to vaccines were a reason for low uptake. A multi-method study with 21 Somali, Pakistani and Afro-Caribbean mothers (Condon, 2002) (Quality +) indicated that none of the mothers knew anyone who had suffered an adverse reaction to immunisation and all were positive about immunisation.

A study which included focus group with health professionals (Loewenthal, 1996) (Quality –) found that health professionals thought that parents' fears of side effects were a reason for low uptake and that in close-knit communities negative stories about immunisation were perpetuated.

Some studies indicated that parents making the decision to immunise their children weigh up of the risks and benefits of immunisation as they perceive them, as illustrated in a postal questionnaire with 87 parents (Simpson, 1995) (Quality -), an interview study with 13 parents in an inner-city setting (Sporton et al., 2001) (Quality -), a questionnaire study with 68 parents in an inner-city setting (Smailbegovic, 2003) (Quality +), an interview study with 19 mothers and 10 health professionals (Rogers, 1994) (Quality -). However, the decision making-process is complicated and different parents in different studies raised differing perceptions of risks and benefits.

Evidence Statement: 14:
Information sources:
Evidence from 20 surveys carried out over 10 years involving 15,000 mothers (Yarwood et al., 2005) (Quality +) suggests that the majority of parents discuss immunisation with a health professional prior to uptake. However, the same study and an interview study with 759 parents (Sutton et al., 1993) (Quality -) found that a substantial minority did not. There is also evidence from two studies to suggest that some health professionals would like more time to discuss immunisation with parents and that some health professionals worried about 'overloading' parents with information particularly if it might cause otherwise compliant parents not to immunise their children (Redsell et al., unpublished; n= 22 health visitors)(Quality +) (Alderson et al., 1997) n=58 health professionals (Quality +).

There is evidence from five studies which suggest that parents find health professionals, NHS literature, friends and the media (including television and the internet) to be important sources of information on immunisation. (Bedford, 2006 [n=859 parents; Quality +]; Macdonald, et al., 2004 [n=278; Quality +], Lewendon, 2002; [n=80; Quality -]; BMRB Social Research, 2008; [n= not reported; Quality -]; Sutton, 1993; [n=759 parents; Quality -]).

Evidence Statement: 15:
Satisfaction with information sources:
There is evidence from two UK postal surveys that found that although the majority (70%) were satisfied with information on immunization, parents of fully immunised children

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
were more likely to be satisfied with available information than parents whose children were unimmunised or only partially immunized (Bedford, 2006; N= 859 parents of 18-24 month old children; [Quality +] and Lewendon, 2002; N=40 parents; [Quality -]). However, there is also evidence from one study from Scotland that found that an investigation of parents' beliefs indicated dissatisfaction with the information provided by NHS leaflets and professionals (MacDonald et al., 2004) (Quality +). There is evidence from an interview study with 13 parents in an inner-city setting who had chosen not to immunise their children (Sporton et al., 2001) (Quality -) and a questionnaire study with 68 parents in an inner-city setting with children with incomplete immunisation (Smailbegovic, 2003) (Quality +) to suggest that some parents mistrusted the information provided (proportion not stated in the first study, 28% in the second study), because they perceived that the information exaggerated the efficacy of vaccines and did not adequately acknowledge the potential side effects of vaccines. A postal questionnaire including 278 parents in Scotland (MacDonald et al., 2004) (Quality +) found that parents of children with incomplete immunisations were more likely to rely on information from the media (including the internet) and friends and were less likely to have discussed immunisation with a health professional, compared with parents with completely immunised children. Similar results were found by a postal survey of 80 parents (40 who had completely immunised children and 40 who had partially or unimmunised children) (Lewendon et al., 2002) (Quality -). A postal questionnaire study of 859 parents reported that there were mixed views on the preferred timing of information (e.g. either before the baby's birth, at the first health visitor's call or at the 6-8 week check) (Bedford, 2006; Quality +). **Evidence Statement: 16:** **Tailoring of information for population sub-groups:** Three studies (Condon 2002; Redsell, et al., 2008; Loewenthal & Bradley 1996) indicated a need to tailor immunisation information for particular groups. There is evidence from a multi-method study with 21 Somali, Pakistani and Afro-Caribbean mothers (Condon, 2002) (Quality +) and an interview study with 22 health visitors (Redsell et al., unpublished) (Quality +) that there are concerns about the accessibility of immunisation literature (whether translated or not), particularly for migrants with low literacy levels. Concerns were also raised by Afro-Caribbean mothers in one study (Condon, 2002) (Quality +) who were dissatisfied with the lack of ethnic minority representations in literature on immunisation. Two studies, one interview study with orthodox-Jewish mothers (n=10) in London (Loewenthal, 1996) and another focus group study with 25 orthodox Jewish mothers and 10 local health care workers from an orthodox Jewish community in North East London found that the research participants were quite 'cut off' from the media as a source of information and instead relied on sources of information within their social networks.						

<table>
<tr><th>Study/ Country</th><th>Design/ Grade/ Sample</th><th>Intervention Vaccine/s</th><th>Control</th><th>Targeted/ Universal</th><th>Targeted Population and Age[4]</th><th>Result</th></tr>
<tr><td colspan="7">Evidence Statement: 17:
There is a lack of quantitative evidence on the effectiveness of interventions that have focused solely on the provision of information for parents and carers on childhood vaccines or vaccine-preventable diseases on increasing immunisation uptake. However, many multicomponent interventions comprised, in part, provision of information either in printed materials or as part of a more interactive educational exercise. There is also some evidence on the provision of information regarding MMR specifically (see sections 10 and 11).</td></tr>
<tr><td colspan="7"><h2>4. Client or family incentives (or disincentives)</h2>Client or family incentives involved interventions where payments of financial benefits were linked to immunisation and schemes were parents were provided with personalised card tracking immunisations. Currently there are no such incentives in England.</td></tr>
<tr><td colspan="7">Targeted interventions:
Infants of low SES families:</td></tr>
<tr><td colspan="7">Evidence Statement: 18:
There is mixed evidence from 3 studies from the USA as to the effectiveness of client/family incentives (or disincentives) at increasing uptake of immunisations in children of low income families. One RCT (Grade +; Kerpelman et al., 2000) found that linking receipt of benefit payments to proof of up-to-date immunisation status significantly increased immunisation rates compared with families who were encouraged to immunise their children but were not told about the sanction or were penalised for failing to immunise them. Conversely, two studies (RCT-; Minkovitz et al., 1999; and nRCT+; Stille et al., 2001) found no improvement in vaccination uptake when linked to incentives (welfare benefits or a personalised calendar).</td></tr>
<tr><td>Kerpelman, et al., 2000</td><td>RCT +</td><td>Parents were required to provide proof of up-to-date immunisations when applying or reapplying for AFDC benefits. If the family did not present such proof without good cause, such as having religious objections or known allergic reactions, benefits normally provided for the non-immunised child could be lost.</td><td>Families were encouraged to immunise their preschool children, however they were neither told about the sanction nor penalised for failure to immunise them.</td><td>Targeted</td><td>Families who received benefits (Aid to Families with Dependent Children (AFDC))</td><td>From baseline, immunisation rates were higher for intervention group children for all immunisations in each year. Differences after the project's first year are statistically significant for all immunisations ($p<0.05$), with the lone exception of Hib in the second year.
<table>
<tr><td></td><td></td><td>Int %</td><td>Control %</td></tr>
<tr><td rowspan="2">DTP</td><td>Baseline</td><td>61.2</td><td>60.1</td></tr>
<tr><td>1996</td><td>70.5</td><td>64.3</td></tr>
<tr><td rowspan="2">Polio</td><td>Baseline</td><td>68.1</td><td>68.1</td></tr>
<tr><td>1996</td><td>87.5</td><td>80.5</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Study/
Country</th><th>Design/
Grade/
Sample</th><th>Intervention
Vaccine/s</th><th>Control</th><th>Targeted/
Universal</th><th>Targeted
Population
and Age[4]</th><th>Result</th></tr>
<tr><td>Country:
USA</td><td>Sample :
2500
families
N=4150
children</td><td>Vaccine/s:
DTP, OPV, MMR, Hib and Hepatitis B.</td><td></td><td></td><td>Ages:
To 6 years.</td><td>
<table>
<tr><td>MMR</td><td>Baseline</td><td>79.3</td><td>77.6</td></tr>
<tr><td></td><td>1996</td><td>88.0</td><td>81.95</td></tr>
<tr><td>Hib</td><td>Baseline</td><td>16.5</td><td>13.0</td></tr>
<tr><td></td><td>1996</td><td>23.9</td><td>17.1</td></tr>
<tr><td>Hep B</td><td>Baseline</td><td>1.9</td><td>1.7</td></tr>
<tr><td></td><td>1996</td><td>23.6</td><td>16.2</td></tr>
</table>
</td></tr>
<tr><td>Minkovitz, et al., 1999

Country:
USA</td><td>RCT –

Sample :
2246</td><td>A behaviour-based strategy designed to promote parental responsibility, accountability, and self-sufficiency. Welfare recipients were subject to a $25 monthly penalty for failure to verify that their preschool-aged children received preventive health care services, including vaccinations. Noncompliant families were sent an official notice before penalties were imposed. The disallowances were not necessarily for the study child, since disallowances were tracked by family, not by individual child.

Vaccine/s:
DTP, OPV, MMR,</td><td>Welfare recipients in the control group were not subject to the penalty.</td><td>Targeted</td><td>Families receiving Aid to Families With Dependent Children (AFDC)

Ages:
3-24 months</td><td>No significant difference in the percentage of children up-to-date with intervention compared with control for DTP polio or MMR
<table>
<tr><td>DTP</td><td>Int.</td><td>Control</td></tr>
<tr><td>Baseline</td><td>53.5%</td><td>assume 53.5</td></tr>
<tr><td>Yr 1</td><td>54.6</td><td>55.4</td></tr>
<tr><td>Yr 2</td><td>55.6</td><td>59.4</td></tr>
</table>
<table>
<tr><td>Polio</td><td>Int.</td><td>Control</td></tr>
<tr><td>Baseline</td><td>64.3</td><td>Assume 64.3</td></tr>
<tr><td>Yr 1</td><td>64</td><td>65.8</td></tr>
<tr><td>Yr 2</td><td>66.7</td><td>67.2</td></tr>
</table>
<table>
<tr><td>MMR</td><td>Int.</td><td>Control</td></tr>
<tr><td>Baseline</td><td>66.4</td><td>Assume 66.4</td></tr>
<tr><td>Yr 1</td><td>66</td><td>67.4</td></tr>
<tr><td>Yr 2</td><td>69.2</td><td>69.9</td></tr>
</table>
</td></tr>
</table>

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Stille, et al., 2001; Country: USA	nRCT + Sample: 315	Intervention comprised two components: 1) an interactive graphic card given to parents that enabled parents to place stickers for each immunisation received and a space for parents to add their child's picture. The reverse had information about timing, safety, and contraindications. 2) The second component of the intervention comprised an explanation about the card to the infant's provider and answering any questions and took two to three minutes. Vaccines DTP, OPV, Hib, Hepatitis B.	Standard information	Targeted	The sites provided care to more than 90% of uninsured and Medicaid eligible infants in Hartford. Age: 7 months	There was no difference between groups for the proportion of infant receiving age-appropriate immunisations at 7 months (58.3% intervention versus 57.9% control (p=0.93)). There was no difference between groups for the proportion of infants receiving one dose of DTP by three months of age (85.3% intervention versus 88.1% control (p=0.47).
Universal interventions:						
Evidence Statement: 19: There is evidence from one Case-Control study (Grade+) from Australia that found that children were significantly more likely to be immunised if parents were aware of, and had applied for, two national government funded immunisation-linked incentive schemes-the Maternity Immunisation Allowance (MIA) and the Child Care Benefit (CCB) (Lawrence et al., 2004).					
Lawrence et al., 2004	Case control +	A federal law that requires parents to provide evidence that their child is age-appropriately immunized or that they have an approved medical or philosophical exemption in order to receive two government-funded payments, a maternity immunisation allowance (MIA) and the child care benefit (CCB). Cases were defined as those children who were incompletely immunised for age, according to the	Controls were defined as children who were fully immunised and were randomly selected from among the 85% of the birth cohort who were recorded on the ACIR as fully immunised for age.	Universal		Parent knowledgeable about the MIA (Cases 53% *v* Controls 74%; p<0.001) Parent knowledgeable about CCB (Cases 15% *v* Controls 25%; p = 0.006) Had applied for and received MIA (Cases 19% *v* Controls 70%; p <0.001) Had applied for and received CCB: (Cases 27% *v* Controls 42%; p <0.001)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Australia	Sample: N=779	Australian Childhood Immunisation Register (ACIR). Vaccine/s: Universal according to Australian Immunisation Schedule			Age: 28-31 months.	In multivariate analysis, not being MIA knowledgeable was associated with incomplete immunisation OR 3.34 [95% CI 2.28 to 4.91] as was not being CCB knowledgeable OR 2.08 [1.30 to 3.34]

5. Interventions in school (or day-care) settings

Vaccination programmes classified as school (or day care) based are diverse ranging from legislative interventions, such as those that exist in the USA, requiring children to show proof of vaccination status for entry to school; routine checking of immunisation status by school nurses; actual delivery of vaccinations in the school setting (see Opportunistic vaccinations in section 8), and educational initiatives seeking to inform studies on vaccine preventable diseases.

Currently in England there are no legal requirements for vaccination before entry into day care or school. Some PCTs currently deliver vaccination programmes in school settings (e.g. HPV and the school leaver booster).

Checking vaccination status on school/day care entry:

Qualitative evidence:

Evidence Statement: 20:
There is evidence from an interview study with head teachers (n=31), school nurses (n= 12) and parents (of 1411 children) in inner-city London (Bedford et al., 1992) (Quality +) that the majority of head teachers stated they would be in favour of asking about immunisation status on school entry, and would be prepared to recommend that parents have their children fully immunised before school entry.

Evidence Statement: 21:
There is evidence from 1 RCT- that active follow-up of pre-school aged children who were not up-to-date with their vaccinations (MMR and the DTP booster), comprising letters to parents or carers encouraging immunisation followed by a phone reminder by the school nurse if they failed to be immunised 1-2 months later, is effective at increasing uptake of immunisations compared with reminder letters alone. However, the study was of poor quality with around 30% of children lost to follow up (Ferson et al., 1995).

Ferson, et al., 1995;	RCT -	Active intervention: As per control intervention plus follow-up phone call 1-2 months later by school nurse. If they had not been immunised, the nurse provided further information and encouragement to get	Passive intervention: Carers were sent a letter from the school encouraging immunisation plus a Department of Health	Targeted	Children not up-to-date with the MMR vaccine at 12-15 months or the booster for	The authors report that 20/54 (37%) children were immunised after the passive intervention and 35/49 (71%) were fully immunised after the active intervention (p=0.001).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Australia	Sample: 239	the immunisation done. Vaccines: Diphtheria, tetanus. Polio and MMR	leaflet in the appropriate language.		DTP before school entry. Age: Pre-school children.	However, the results presented aren't by ITT and a total of 72/239 (30.1%) of children randomised were lost to follow-up and a further 64/239 (26.7%) excluded as they were up-to-date at the time of the intervention.
Policies requiring vaccinations for school/day care entry: ***Qualitative evidence:*** **Evidence Statement: 22:** There is evidence from a multi-method study (focus groups and interviews) with Pakistani, Somali and Afro-Caribbean mothers (n=21) from Bristol (Condon 2002) (Quality +) and an interview study with 31 head teachers (n=31), school nurses (n= 12) and parents (of 1411 children) in inner-city London (Bedford, et al., 1992) (Quality +) that some parents, particularly those of children who were not fully immunised (Bedford, et al., 1992), supported immunisation as a requirement for school entry. Likewise, there is evidence from an interview study with 58 health professionals (including GP's, health visitors and practice nurses) (Alderson et al., 1997) (Quality +) that found that some (not further quantified) are in favour of immunisation as a requirement for school entry.						
Evidence Statement: 23: There is evidence from five studies from the USA (BA+, 1 BA-, 1 Cohort++, 1 Cohort- and 1 Cross Sectional Study ++), that policies requiring vaccinations for school or day care entry is effective, to varying degrees, at increasing immunisation coverage: the first reported a significant increase in MMR and Hep B vaccination coverage post legislation in US Grade 5 & 6 students (Averhoff et al., 2004; BA+; N=1072); the second found that although immunisation coverage for DTP, OPV, MMR, Hib and Hep B in children attending day care increased from enrolment to follow-up at 60 days, the increase was not significant (Kolasa et al., 2003; BA -; N=2847); two studies (Morita et al., 2008; Cohort ++; N= 106451.and Wilson et al., 2005; Cohort -; N=2230) found an increase in Hep B coverage post legislation in secondary school aged children, however no increase in coverage was observed for other vaccinations in one study (Wilson et al 2005); and finally, one cross-sectional study (++) found that in states with day care entry requirements, significantly more children had received 3 or more Hepatitis B vaccine doses compared with states without an entry requirement (Yusuf et al., 1999) There is evidence from one Cohort study (Grade ++) from the USA that a policy requiring Hepatitis B vaccination for school entry is effective at reducing differences in coverage between different ethnic groups (Morita et al., 2008; Cohort ++; N=106,541). There is evidence from one study (BA-) from Australia that legislation requiring schools to ask that 'School Immunisation Certificates (SIC's)' be provided as evidence of prior immunisation at the time of enrolment, did not increase the number of students providing the certificate, although in those that did provide SIC's, the proportion of those that were completely immunised significantly increased (Shah et al., 2001; BA-; N=1570).						
Averhoff et	BA+	California legislative bill that required	Grades 8-15 who	Universal	Young people	Vaccination coverage was significantly

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
al., 2004; Also reported in (Centers for Disease Control and Prevention, 2000) } and (Centers for Disease Control and Prevention (CDC), 2001) Country: USA	Sample: N=1072	students entering 7th grade to have received 3 doses of Hep B and 2 doses of MMR Vaccine/s: MMR and Hep B	completed Grade 7 before legislation was enforced		in grades 5 and 6 (UK equivalent grades 6+7) who legislation would effect at study school	greater in post-intervention cohort compared both with pre intervention cohort (61.7% (100/162) v 13.2% (27/205);p<0.001) and control (27% (58/212); p<0.0001).
Kolasa et al., 2003;	BA –	State law requiring licensed child care centres to document that each enrolled child is up-to-date for vaccinations	NA	Universal	Children enrolled in childcare <=59 months old	There were no statistically significant differences for any vaccine 60 days after enrolment compared to at enrolment <u>Children aged 19-35 months</u> Enrolment v 60 dayslater *DTP, Polio, MMR & Hib* 241 (72%) v 252 (75%); P<0.38 *Hep B (3 doses)* 288 (86%); no change *Varicella* 72% v 73%

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: N=2847	Vaccine/s: DTP, Polio, MMR, Hib, Hep B				<u>Children aged 36-59 months</u> Enrolment v 60 days later *DTP, Polio, MMR & Hib* 1006 (71%) v 1029 (73%); p<0.240 *Hep B (3 doses)* 82% v 83% *Varicella* 62% v 63%
Shah et al., 2001 Country: Australia	BA- N=1570	Legislation requiring schools to request a School Immunisation Certificate (SIC) before starting school in NSW (came into effect in 1994). Vaccine/s: DTP, Polio, MMR	N/A	Universal	The sample area is among the most socioeconomically disadvantaged in NSW, 48% of residents are born overseas and 63% speak a language other than English Age: Primary school entry age	Proportion providing evidence of immunisation was 82.9% in 1994 compared to 81.6% in 1998 (p=0.5) Of those presenting SIC those completely immunised increased from 56.7% in 1994 to 80.2% in 1998 (p<0.001)
Morita, Ramirez & Trick, 2008;	Cohort++	Law (came in 1997) requiring students to complete Hep B series before Oct 15th of 5th grade. Threat of exclusion if can't provide documentation of completed or initiated series	Cohorts completing grade 12 in 2000-2003	Universal	Young people enrolled in 12th grade of school in 2004 and 2005	On entry to 5th grade first mandate cohort had significantly higher coverage levels than final premandate cohort – 38.3% v 4.3% (diff 34% CI 33.5%-34.3%) p<0.001 On entry to 9th grade first mandate cohort had significantly higher coverage levels than final premandate cohort – 85% v 37.4% (CI

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample N=106541	Vaccine/s: Hep B				47.4-47.8%) p<0.001 **Completion of HBV series by Ethnic group:** Before implementation of the school-entry vaccination requirement, black and Hispanic students were less likely than white students to have completed HBV by the 5th and 9th grades. For the pre-mandate cohorts, the differences in coverage levels between white and black students were increasing. However, for both post-mandate cohorts, the differences in coverage levels between white, black and Hispanic students decreased: in the first postmandate cohort, Hispanic students were almost as likely as white students to have completed HBV by 5th and 9th grades.
Wilson et al., 2005; Country: USA	Cohort – Sample: N=2230	A middle school entry law requiring hep B vaccinations for school entry Vaccine/s Hep B, Tetanus & Diphtheria, MMR	Schools with different immunisation laws and policies	Universal	Young people grade 9-12 in 11 middle schools in Kansas and Missouri	Young people in grade 9 in schools with an immunisation-linked entry requirement had higher Hepatitis B rates (72.8%) that in those schools without (18.6%) (p<0.01) There were no statistically significant differences between schools or grades for MMR and Td coverage.
Yusuf et al., 1999; Country:	Cross-sectional study ++ Sample: N=32,43	Schools with a requirement for 3 or more doses of Hep B vaccination for day care entry Vaccine/s:	States with no day care entry requirement for Hep B	Universal	Children aged 19-35 months in 78 geographic regions	In states with day care entry requirements, significantly more children had received 3 or more Hepatitis B vaccine doses compared with states without an entry requirement (with: 86.7% [85.7-87.7% versus without: 83% [82.4 - 83.6%]; p<0.01)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
USA	3	Hep B				
Education programmes:						
Evidence Statement: 24: There is evidence from one cluster RCT (Grade +; N=135) from Australia, that a school-based Hepatitis B education programme for adolescents comprising posters, reminder stickers, parent homework assignments and standard information brochures did not increase uptake of Hepatitis B vaccine compared with schools that received standard information brochures alone (Skinner et al., 2000).						
Skinner et al., 2000 Country: Australia	Cluster RCT + Sample: N=135 schools	Hep B education promotion kit developed and delivered to Yr 7 including parent homework assignment, posters, reminder stickers in addition to standard state information brochures and (presumably) Hep B vaccination at school. Vaccine/s: Hep B	Standard state information brochures alone	Universal	Yr 7 pupils	School based programme did not increase Hep B vaccination uptake compared to control. Intervention schools had lower (not significant) vaccine uptake at all 3 doses of hep B compared to control schools Baseline not reported

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

6. Provider-based interventions

Provider based interventions include education and training around vaccinations such as the universal vaccination schedule and targeted vaccinations such as Hepatitis B and BCG, reminders to GP's about children overdue for immunisations and service redesign.

Provider education and training

Qualitative evidence:

Evidence Statement: 25:
Poor knowledge of the benefits and risks of vaccines
There is evidence from a questionnaire study with 174 health professionals in Liverpool (Reid, 1989) (Quality -) and a postal questionnaire including 116 health visitors and practice nurses in Scotland (Henderson et al., 2004) (Quality +) suggest that there are mixed views from health professionals about what constitutes contraindications to some vaccines.

There is evidence from one questionnaire study (Gordon et al, 2007) (Quality -) of health professionals (n=120) (midwives, nurses, allied professionals and doctors) from an acute hospital in England that found that less than 50% could accurately identify which babies should receive a neonatal BCG vaccine.

There is qualitative evidence from one recent survey (n= not reported) of GPs (31% response rate), health visitors (63%) and practice nurses (63%) that found a third of health professionals who stated concerns regarding immunisation reported their main concern was that babies were given too many immunisations. Similar concerns were also reported in a postal questionnaire of 116 health visitors and practice nurses in Scotland (Macdonald, et al., 2004) (Quality +) that found that several health professionals (number not stated) are concerned about the ability of infants' immune systems to cope with vaccines. Other concerns raised by health professionals include difficulties with the practicalities of administering the number of vaccinations in the current schedule, the complexity of and changes to the schedule, as well as difficulties with keeping up-to-date. (BMRB Social Research, 2008; Quality -).

There is evidence from one questionnaire study (Reid 1989) that found that health professionals (health visitors, school nurses and clinical medical officers) judged that different vaccines offered different levels of protection with measles and pertussis vaccines given lower scores than others. It also found that more health professionals thought it very important to prevent diphtheria, polio, tetanus, and whooping cough, but less thought measles prevention to be very important.

Evidence Statement: 26:
Health professionals views on immunisation education and training:
There is qualitative evidence from two surveys from the UK that found that most health professionals (including health visitors and practice nurses) surveyed would like further education or training on immunisation. (Reid 1989; N=174; Quality -) (MacDonald et al., 2004; N=116; Quality +). Recent qualitative evidence from one survey (n= not reported) of GPs (31% response rate), health visitors (63%) and practice nurses (63%) found that compared with GPs, health visitors and practice nurses were more likely to be aware of both immunization training (89% Health Visitors v 94% of Practice Nurses v 49% of GPs) and their local immunization coordinator (89% Health Visitors v 94% of

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Practice Nurses v 49% of GPs). The study also found that Health Visitors and Practice Nurses were more likely to have attended 1-2 sessions of immunization training in the preceding 2 years, compared with GPs (69% of Health Visitors, 72% of Practice Nurses; 64% of GPs; P not stated) (BMRB Social Research, 2008; Quality -) **Evidence Statement: 27:** **Information sources for health professionals:** There is evidence from two surveys that found that Department of Health publications (including the 'Green Book' and CMO letters or updates) and NHS information and publications are important and frequently used sources of information for GPs, health visitors and practice nurses (BMRB Social Research, 2008; Quality -) (Henderson et al., 2004; Quality +). One study also reported that in addition to being the source of information most frequently used, Department of Health/NHS information and publications were the most useful source of information reported. The Department of Health website was mentioned most frequently (21% GPs, 46% Health Visitors and 36% Practice Nurses). The NHS Immunisation Information website was the second most commonly mentioned internet site (6% GPs, 23% Health Visitors, and 18% Practice Nurses). GPs continue to be least likely to use the Green Book often (39%) with greater use among Health Visitors, of whom 46% used it often and Practice Nurses with 71% using it often and a quarter (25%) very often (BMRB Social Research, 2008). There is evidence from one recent survey that found that Health professionals' (including GPs, Health Visitors and Practice Nurses) preferred format for the Department of Health publication the 'Green Book' was hard copy (around 30% of each group), with very few preferring an internet-only version (BMRB Social Research, 2008; Quality -). There is evidence from one recent survey that found that other sources of information on immunization included medical and nursing journals, the media (e.g. TV, radio and newspapers), trust and professional body guidelines and the internet. Among Health Visitors and Practice Nurses there appeared to be widespread use of a large variety of sources, with GPs generally using a more restricted range of materials (BMRB Social Research, 2008; Quality -).						
Evidence statement 28: There is evidence from four UK studies (1 ITS + and 3 BA-) that education and training for health professionals (including midwives, health visitors, GP's and paediatricians) in the implementation of targeted neonatal BCG vaccination policies (comprising identification and referral of at-risk neonates; administration of the BCG vaccine and contraindications etc) is effective at increasing the proportion of at-risk neonates that receive timely vaccination (Gill & Scott, 1998 [ITS+]; Tseng et al., 1997 [BA-]; Ahmed et al., 1992 [BA-] and Wroe et al., 2007 [BA-]).						
Gill & Scott, 1998;	ITS +	The introduction of a local neonatal BCG policy that moved the emphasis from medics to midwives and health visitors for BCG vaccination. Training was given to midwives and health visitors on topics such as: identifying neonates from defined groups (not further described); the vaccine; and administration of BCG, contraindications, anaphylaxis, and	N/A	Targeted	Babies at-risk of tuberculosis infection (defined by ethnic group, deprivation or contact with TB)	Introduction of the local neonatal BCG policy increased the proportion of babies for whom BCG was indicated and who received it in the first three months of life from 6% (pre-intervention) to 88% (1994), 90% (1995) and 89% (1996) (post-intervention).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: UK	Sample: NR	paediatric resuscitation Vaccine/s: BCG				
Tseng, et al., 1997 Country: UK	BA –	Encouragement from hospital clinical directors to increase availability of BCG to neonates at risk, training of health visitors to identify and refer eligible infants to designated local clinics, distribution of leaflets about BCG to parents and health professionals; in addition to a policy to identify and vaccinate eligible neonates before discharge from postnatal wards Vaccine/s: BCG	N/A	Targeted	Babies at-risk of tuberculosis infection (defined by ethnic group, deprivation or contact with TB) in London boroughs of Lambeth, Southwark, and Lewisham Age: Newborns	The intervention increased the BCG immunisation rate of eligible infants across the four participating hospitals (no further details) from 9% to 15%, although this change was non-significant, (OR 0.6; 95%CI 0.34 to 1.07). At post-assessment, the rate of immunisation varied from 0% to 37% across the four participating hospitals.
Ahmed et al., 1992; Country: UK	BA – Sample: NR	The educational intervention comprised three components. All junior paediatricians received a copy of Avon's neonatal BCG policy at the start of their appointment, regular training sessions were provided for health visitors and monthly infection newsletters were sent to all GPs in Avon Vaccine/s: BCG	N/A	Targeted	Babies at risk of infection with tuberculosis (defined by ethnic group, deprivation or contact with TB).	The authors found that the proportion of babies eligible to receive BCG who received it increased from 13% (pre-intervention) to 80% (post-intervention) with the neonatal educational campaign. This increase was statistically significant X^2 1 d.f. = 17.81; p<0.0001. 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).
Wroe, et al., 2007	BA –	Risk assessment of all neonates by midwives, referral of all eligible expectant mothers to a BCG clinic,	N/A	Targeted	Babies at-risk of tuberculosis infection;	The neonatal BCG programme increased the proportion of eligible babies offered BCG vaccination from an estimated less

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
		health visitors screening all infants (aged 0-2 years) new to the area and a BCG clinic set up for a day each fortnight in an area deemed to be accessible (not further defined) to the majority of clients. Information leaflets (only in English) were distributed to all eligible parents, information on BCG from other organisations was also available in alternative languages. Training was offered to all midwives, health visitors, and practice nurses on TB and BCG.			Bromley (defined by ethnic group, deprivation or contact with TB); SE London with a large ethnic refugee, homeless and asylum seeking population.	than 20% (number not stated) before the intervention to 384/480 (80%) following the intervention. The 80% post intervention was children who were offered a BCG clinic appointment and received vaccination at that clinic and may not represent all eligible children.
Country : UK	Sample : 480	Vaccine/s: BCG			Ages: Neonates	
Provider reminders						
Evidence statement 29: There is evidence from two studies (1 ITS- and 1 BA-) from the UK and USA that provider reminder systems are effective at both increasing the proportion of at-risk infants who receive BCG vaccination and also the proportion of infants of low income families that receive routine primary vaccinations (DPT/OPV) within the recommended timeframe (Chappel & Fernandes, 1996 [ITS-]; and Brink, 1989 [BA-].						
Chappel & Fernandes, 1996;	ITS –	Computer generated reminder system to highlight babies at high risk of TB.	N/A	Targeted	Babies at high risk of TB (defined by ethnic group, deprivation or contact with TB)	Before intervention the proportion of babies at higher risk of tuberculosis who received the BCG vaccination was 23.9% (1988), 18.3% (1989), and 19.3% (1990). This increased to 52.6% (1992) and 77.5% (1993) following the introduction of the computer system.
Country: UK	Sample: N=NR	Vaccine/s: BCG				No tests of significance or size of effect reported.
Brink, 1989;	BA –	The intervention was an immunisation	Pre and post intervention	Targeted	Healthy infants	For the first and second doses of

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: N=200	reminder system. This comprised a database that tracked all children and their primary care visits and produced an immunisation information label specific to the infant with dates of previous immunisations that was applied to each clinic note prior to visits during the first year of life. The reminder labels were introduced after an information session for providers. Vaccine/s: DTP, OPV	cohorts were infants born in the same month of consecutive years.		in low income families Age: 7 months	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); 34% of the post-intervention cohort immunised compared with 24.6% of the pre-intervention cohort (CI not reported).
Change in provider practice:						
Targeted interventions:						
Low income families: **Evidence statement 30:** There is evidence from one cluster RCT from the USA (Grade -; N=44) that found that a comprehensive 'continuing medical education' programme in which health professionals were encouraged to review their performance and to identify, test and implement new processes (e.g. chart screening) to improve their delivery of preventive care to predominantly low income families did not significantly improve age-appropriate immunisation rates compared to control clinics. However, an important limitation to this study is the likely confounding by a state-wide universal vaccine purchase programme after which the state reported the highest rates of immunisations in the US (Margolis et al., 2004).						
Margolis et al, 2004;	Cluster RCT –	Practice based continuing medical education (CME) in which project staff coached practice staff in reviewing performance and identifying, testing, and implementing new care processes (such as chart screening) to improve delivery of preventive care (including	Feedback at baseline and annually for two years, without comparison to other practices.	Targeted	Practices with a high proportion of children on Medicaid.	The authors found no significant difference in the proportion of children who received age appropriate immunisations between intervention clinics compared to control clinics (not further quantified). However, an important limitation to this

<table>
<tr><th>Study/ Country</th><th>Design/ Grade/ Sample</th><th>Intervention Vaccine/s</th><th>Control</th><th>Targeted/ Universal</th><th>Targeted Population and Age[4]</th><th>Result</th></tr>
<tr><td>Country: USA</td><td>Sample: 44 practices</td><td>immunisations). Intervention group also received feedback on their performance, compared with other practices, every 6 months.

Vaccine/s: DTP, polio, MMR, Hib and Hep B.</td><td></td><td></td><td>Age: Children 24 – 30 months</td><td>study is the likely confounding by a state-wide universal vaccine purchase programme after which the state reported the highest rates of immunisations in the US.</td></tr>
<tr><td colspan="7">Universal interventions:</td></tr>
<tr><td colspan="7">Evidence statement 31:
There is evidence from one BA study from the USA (Grade -) that found that implementation of ‘The Physician Leadership Model’ in which different tactics for changing physician behaviour were employed such as including an opinion leader, academic detailing, and goal setting with feedback, peer review, and peer influence, significantly increased the proportion of infants aged up to 24 months who were up-to-date with the recommended vaccination schedule (DTP, OPV and MMR) (Sinn, Morrow and Finch, 1999).</td></tr>
<tr><td>Sinn, Morrow, & Finch, 1999;

Country: USA</td><td>BA –

Sample: N= NR</td><td>The intervention, ‘The Physician Leadership Model’, comprised several different tactics for changing physician behaviour, including an opinion leader, academic detailing, and goal setting with feedback, peer review, and peer influence.

Vaccine/s: DTP, OPV, MMR</td><td>N/A</td><td>Universal</td><td>Infants to 24 months of age.

Age: Children to 24 months</td><td>The proportion of infants who were up-to-date on recommended immunisations were:
<table><tr><th>Age</th><th>Baseline</th><th>Post intervention</th></tr><tr><td>3 months</td><td>75.5%</td><td>88.9%*</td></tr><tr><td>12 months</td><td>72.9%</td><td>84.6%*</td></tr><tr><td>24 months</td><td>50.9%</td><td>69.7%*</td></tr></table>*p<0.001</td></tr>
</table>

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Provider-Client relationship ***Qualitative evidence:*** **Evidence Statement: 32:** There is evidence from a multi-method study with 21 Somali, Pakistani and Afro-Caribbean mothers that relations between parents and health professionals might vary across different cultures and ethnicities, with Somali mothers in the study putting all their trust in doctors but Afro-Caribbean mothers feeling pressurised into immunisation (Condon, 2002) (Quality +). Meanwhile an interview study with 10 orthodox-Jewish mothers (Loewenthal, 1996) (Quality -) suggested that some mothers felt 'told off' for missing immunisation appointments which discouraged future attendance. An interview study with 22 health visitors indicated that they felt their role was as information providers to assist with informed consent (Redsell et al., unpublished) (Quality +). The same study and an interview study with 19 mothers and ten health professionals (Rogers, 1994) (Quality -) highlighted the importance of parent-health professional discussions about immunisation as a foundation for future interactions around child health.						
Evidence statement 33: There is evidence from one Cohort study from the USA (Grade +) that infants of low-income mothers who have the same provider for both prenatal and paediatric care, are significantly more likely to be up-to-date with the recommended immunisation schedule (DTP, Polio, Hib and Hepatitis B) by 7 and 12 months of age compared with mother-infant pairs that received clinic continuity (ie having the same clinic but different providers) or no continuity (different clinics) (Gill et al., 1992; N=187).						
Gill et al, 2002; Country: USA	Cohort + Sample: N=187	The study identified and compared mother-infant pairs who had either received provider continuity (the same provider for prenatal and paediatric care), or clinic continuity (same clinic but different provider), or no continuity (different clinic). The primary outcome was receipt of immunisations in the first year of life (at least three DPT vaccines, two polio vaccines, three HIB vaccines and two Hepatitis B vaccines). Data were compared when infants were aged 7 months and 12 months. Vaccine/s: DTP, Hib, Polio	N/A	Targeted	Low income mothers over-18 and their babies	Provider continuity was associated with a significantly higher likelihood of having all immunisations completed by 7 months, compared to 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).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Provider incentives ***Qualitative evidence:*** **Evidence Statement: 34:** There is evidence from five qualitative studies to suggest that parents are concerned about provider payments for reaching immunisation targets. Two studies found that provider incentives may lead to parental distrust (Sporton & Francis 2001; Smailbegovic, et al., 2003), particularly for non-acceptors of immunisation (Evans et al., 2001) whilst two studies found that parents either feared or had experience of being removed from GP patient lists (to boost the percentage of immunised patients and thus secure the GP's target payment) (Evans, et al., 2001; Casiday 2006; Casiday 2007). There is also evidence from interviews with 22 health visitors that found that health visitors had concerns about how financial incentives linked to immunisation targets might affect GP practice (Redsell, 2008)(Quality +). Similarly, a postal survey with 206 GPs from Scotland (MacDonald et al., 2004; Quality +) found that the majority (66%) were in favour of stopping payments related to immunisation targets.						
Evidence statement 35: There is a lack of quantitative evidence on the effectiveness of interventions that have focused solely on the provision of provider incentives at increasing immunisation uptake. However, eight studies assessing impact of the Australian multi-component National Immunisation Campaign (including the Immunise Australia 7 point plan) that comprised, in part, provision of immunisation-linked provider incentives found that the campaign resulted in higher practice coverage rates and an increase in age appropriate vaccination coverage (Bond et al., 2002; Australian Government Department of Health and Aging, 2004; KPMG, 2000; NCIRS, 1999a,b,c,d,e) all BA, 2 Grade +, 5 Grade ++).						
7. Provision of child vaccination information to service providers						
Targeted interventions **Evidence Statement: 36:** There is evidence from two studies, both from the UK (RCT++ and BA-) that provision of immunisation status information alone, for children at-risk of being unimmunised or behind on the recommended immunisation schedule is not effective at increasing immunisation uptake. One study (RCT++; N=451) found no significant difference between those who received a non-directive telephone call to their health visitor and those that received no-contact in the proportion of children aged <2 years who were brought up-to-date in their immunisation schedule (primary series or MMR) (Morgan and Evans, 1998). The second study (BA-; N=136) found that provision of a detailed immunisation history for all looked after children registered with an authority to senior social service managers was ineffective at increasing uptake of primary, pre-school and school-leaver's booster vaccinations in these children (Ashton-Key and Jorge, 2003).						
Morgan & Evans 1998;	RCT ++	1) A non-directive phone call to the child's health visitor in which the child's immunisation status was confirmed. Although follow-up was anticipated, it was not specifically requested.	No contact	Targeted	Children not up-to-date with their vaccinations.	No significant difference between the intervention and control groups in the proportion completing the primary course or MMR immunisation at post-assessment.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: UK	Sample: N=451	2) Mailed reminder to the child's parents Vaccine/s: DTP, OPV, Hib, MMR			Ages: To 21 months	
Ashton-Key & Jorge 2003; Country: UK	BA – Sample: N=136	Provision of a detailed immunisation history to social services. This included a record of all immunisations that had been recorded as received and detailed those immunisations that needed to be given to ensure that each child had received all their age appropriate immunisations. This information was provided to the senior social services manager in the unitary authority who had managerial responsibility for looked after children. Vaccine/s: DTP, OPV, Hib, MMR1, MMR2, BCG, school-leavers booster	N/A	Targeted	Looked after children (LAC) Ages: To 18 years.	There were fewer children up-to-date with primary, pre-school and school-leaver's booster vaccinations after full immunisation histories had been provided to social services compared with the previous year (76/136 [55.9%] after *versus* 82/136 [60.3%] before intervention, although the difference was not significant (ARR: 4.4%; 95% CI 7.6% to 16.4%). However, there is the potential for selection bias as the 136 children studied represent just 54% of the total number of LAC registered at the start of the study and were chosen on the basis that they were looked after continuously during the 12 month study period.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
8. Opportunistic vaccinations Opportunistic interventions are centred on offering immunisations to children and young people whenever they come into contact with healthcare providers. For example, this might occur on presentation for routine GP consultations, on admission to hospital or through routine contact with health professionals in other settings such as schools, prisons or juvenile offender institutions. Opportunistic vaccinations are consistent with the recommendations outlined in the Green Book (DH 2006) that "*Every effort should be made to ensure that all children are immunised, even if they are older than the recommended age range; no opportunity to immunise should be missed*".						
GP Clinics: **Evidence Statement: 37:** There is mixed evidence from 2 studies from the USA (1 RCT- and 1nRCT-) as to the effectiveness of GP-based opportunistic vaccination at increasing vaccine uptake. One RCT- (N=911) that focused on marking of notes with vaccine requirements for appointments for 0-2 year olds found no significant difference between the intervention and control arm (Szilagyi et al., 1996). However, one study in which the intervention comprised active identification and vaccination of all children requiring vaccinations at every clinic visit reported significant increases in the percentage of children age-appropriately immunised with intervention compared with no intervention (Harper et al., 1997; nRCT-; N=519) Both studies were carried out in settings likely to be applicable to the UK primary care system.						
Szilagyi, et al, 1996; Country: USA	RCT – Sample: N=911	All visitors aged 0-2 were screened on any visit to a clinic or a neighbourhood health centre and those requiring vaccination had their notes marked prominently. Physicians had to mark the card with reasons if vaccination not given. For study patients a single consent form was 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. Vaccine/s: DTP, OPV, MMR, Hib	Normal care	Targeted	Area with low immunisation rates (not further defined) Ages: 0 – 2 years.	There were no differences between those in the neighbourhood health centre who received vaccinations without legal guardians' signature compared to control. 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).
Harper, et al,	nRCT –	The intervention comprised a clinic-wide	A comparison	Targeted	Low socio-	The intervention significantly improved the

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
1997; Country: USA	Sample: N=519	system to identify and vaccinate children at all clinic visits. The intervention comprised: Appointment personnel instructed parents to bring their child's vaccination card to the next appointment. Medical assistants asked the parents for the vaccination card at all visits, assessed the child's vaccination status, and educated the parents about the next vaccine date. The assistants documented this information on a specially stamped section of the visit record. The physician ordered required vaccinations, made arrangements for vaccinations at a later date, or arranged to obtain old medical records. Performance feedback was provided to each group on a regular basis. Vaccine/s: DTP, OPV, MMR	community health centre clinic staffed by board-certified family physicians and nurse practitioners.		economic status population Pre-school age children	percentage of children up-to-date for vaccinations at age 24 months (pre 42.1% to 56.0% post intervention, χ^2 p=0.02) compared with the comparison clinic (pre 56.9% to 58.5% post-intervention, χ^2=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% pre-intervention to 63.3% post-intervention (χ^2=5.52, p=0.02) however, the comparison clinic had little change from 61.5% pre-intervention to 66.2% post-intervention (χ^2= 0.57, p=0.45).

Hospitals:

Qualitative evidence:

Evidence Statement 38:
There is evidence from a focus group study of 48 parents which found that some (not further quantified) parents felt that opportunistic immunisation of children in accident and emergency departments, or during a hospital admission, was both inappropriate and distressing (Evans *et al.,* 2001).

Evidence Statement: 39:
There is strong evidence from seven studies from the UK (1 BA-; 1 BA+), USA (1 RCT+; 1 BA++; 1 BA+; 1 Cohort -), and Australia (1 BA+), that hospital-based opportunistic

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
immunisation strategies are effective at increasing uptake of recommended vaccinations in children admitted to hospital. One RCT+ (N=1835) from the USA found that fewer children remained under-immunised after discharge if the hospital had either sent a letter to primary care providers notifying of under-immunisation status or had vaccinated before discharge, compared with no intervention, although the difference was not significant (Rodewald et al., 1996). Two before and after studies from the USA found that hospital-based vaccination of children (aged 0-2 years) who were either under-immunised or from predominantly low income families significantly increased the proportion of children age-appropriately immunised (Bell et al., 1997; BA++; N=2006) and reduced the number of missed opportunities for vaccination (Minkovitz et al., 2001; BA +; N=1163). One BA+ (N=866) from Australia found that after introduction of an opportunistic vaccination strategy that comprised training of health professionals and vaccination of under-immunised children, the number of vaccinations provided significantly increased in paediatric wards, but not emergency departments (Skull et al., 1999). Two studies from the UK found that some children were successfully brought up-to-date with the recommended vaccination schedule after hospital-based immunisation (Riley et al., 1991; [BA+ (N=56)]; Conway et al., 1999; [BA- N=1000]) although one study found that some carers refused, preferring to have them done with their primary care provider (Conway et al., 1999). Finally, one Cohort study– (N=1301) from the USA found that the proportion of pre-school aged children up-to-date with the recommended immunisation schedule on admission to the emergency department significantly increased on discharge after hospital-based vaccination. However, by 6 months, there was no significant difference in proportion of children up-to-date compared with that on hospital admission (Szilagyi et al., 1997);						
Rodewald et al., 1996 Country: USA	RCT + Sample: N=1835	1) Children enrolled in emergency department (ED) 2) Informed consent obtained child randomised into a) no intervention b) letter to primary care group c) vaccination if deemed under vaccinated 3) Decision rule determined those likely to be under immunised and those in vaccination group were offered vaccination Vaccine/s: DTP, Polio, MMR, Hib	No intervention or letter sent to primary care	Targeted	Children attending emergency department Age: aged 6-36 months	<u>1month post ED visit – under immunised</u>: No intervention = 31% Letter = 28% (p=0.4) Vaccination = 23% (p=0.2) <u>1year post ED visit – under immunised</u>: No intervention = 28% Letter = 25% (p=0.2) Vaccination = 25% (p=0.2) Baseline not reported **NB: STUDY DATA INCONSISTENT/ UNRELIABLE**
Bell et al., 1997;	BA ++	Daily review of admission of age appropriate children to 6 medical and surgical units. Discussion of child's imms status with primary care provider and if not up-to-date paediatric resident took informed consent and educated about future imms. Consented children	N/A	Targeted	Children admitted to one of 6 medical and surgical wards during study period	1026/2006 (51%) children were eligible for vaccination. A further 44% were up-to-date and a further 5% were not able to be immunised on admission. The % fully vaccinated or up-to-date for age increased from 44% on admission to 70% on discharge (p<0.0001)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: N=2006	were vaccinated free of charge by nurse on day of discharge. Vaccine/s: Not specified			Age: 0-2 years.	674/1026 (66%) of eligible children received at least one vaccination before discharge. 85% of which received multiple immunisations.
Riley et al., 1991 Country: UK	BA+ Sample: N=56	Immunisation history collected from all children admitted to hospital ward during study period and compared to Child Health Information System to identify children not up-to-date. Unless parent refused all catch up immunisations offered on discharge from the review. Parents were given a written record and reminder of when the next vaccines were due. Letters were sent to the child's GP. Vaccine/s: All	N/A	Targeted	Children not up-to-date with vaccinations on admission to children's ward. Age: 5months to 6 years	75% (40/53) of children who were 3 or more months behind on their vaccinations, and for whom there were no valid contraindications, received them on discharge. 45% (24/53) of the children who received vaccinations were brought up-to-date with the recommended schedule.
Skull et al., 1999; Country: Australia	BA + Sample: N=866	1) 5 week training period during which doctors and nurses as to the importance of childhood vaccination & opportunistic vaccination 2) A practical back-up system to ensure adequate vaccines in hospital pharmacy 3) Vaccination section attached to paediatric admissions form Vaccine/s: Not specified	NA	Targeted	All child admissions Age: To 7 years.	Number of opportunistic vaccinations provided: Paediatric Ward Pre-intervention = 0/11 (0%) Post-intervention = 5/8 (62%) RR 2.67 (1.09-6.52) p=0.005 Emergency Department: Pre-intervention = 0/8 (0%) Post-intervention = 1/7 (6%) RR 1.06 (0.94-1.2); p=0.68
Minkovitz et al., 2001;	BA+	Triage nurses generated printouts of each child's vaccination record and prominently attached them to the encounter form for each visit. The acute	N/A	Targeted	Patients receiving care at the clinic were predominantly	Comparisons of all enrolled children aged 24 months and older before and after the intervention found that although there was an increase in both 4:3:1 and 4:3:1:3:3

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: N=1163	care team was instructed to review the vaccination history during the visit and offer age-appropriate vaccinations as appropriate. The 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 labelled "Immunize On Time, Every Time" to reinforce compliance. In addition, clinic vaccination rates were reviewed with staff and providers at several monthly staff meetings and at quarterly preceptor meetings. Vaccine/s: 4:3:1:4 schedule and 4:3:1:3:3 schedule			low-income children who qualified for mandatory Medicaid managed care and were enrolled in 1 of several health plans. Children under 3 years.	completion rates after intervention, the difference was not significant (77% v 81%; 70% v 78%; respectively, significance not reported). However there was a significant reduction in the number of missed opportunities for vaccination with intervention (65% baseline v 45% post-intervention; p<0.01). For children aged 10 to 23 months, only missed opportunities were significantly changed in the post-intervention group with a decrease from 60% at baseline to 42% post intervention (P<0.05). However trends of increased vaccination rates were similar to those for the 24 months and older group.
Conway, 1999; Country: UK	BA – Sample: N=1000	1) Hospital clerk checked medical records 2) Junior doctors offering appropriate vaccinations before discharge 3) Consultants were instructed to reinforce this policy Vaccine/s: DTP, Hib, OPV, MMR	NA	Targeted	Children not up-to-date with vaccinations on admission to Paediatric ward. Age: Mean age 1.5 years.	183/1000 (18.3%) consecutive admissions were found to be behind on the recommended immunisation schedule. 43/183 (23%) were offered catch up immunisations of which 28/43 (65%) accepted, of whom 20 were brought fully up-to-date. 15 carers refused immunisations, 10 preferred to have it done with their GP, 3 felt that their child wasn't well enough; 1 was concerned with vaccine safety and there was no reason recorded for one person.
Szilagyi et	Cohort -	1. Project nurse identifying preschool	NA	Targeted	Pre-school age	ED 1 (Manhattan):

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
al., 1997; Country: USA	Sample: 1301	age children on admission 2. Project nurse interviewing parents regarding their immunisation status and other health questions 3. Offering free immunisations (DTP, Hib, OPV, MMR and Hepatitis B) 4. Follow up involved review of medical records at primary care and emergency department (ED) Vaccine/s: DTP, Hib, Polio, MMR, Hep B			patients from 2 Emergency Departments in New York City.	The percentage of children up-to-date for all immunisations (DTP, OPV, Hib, MMR) increased from 64% to 75% (P<0.001) 1 day after admission. However at 6 mths there was no significant difference 66% (NS compared to at ED visit). ED 2 (Bronx) The percentage of ED patients up-to-date for all immunisations (DTP, OPV, Hib, MMR) increased from 63% to 71% (P< 0.05) 1 day later and then decreased after 6 mths to 54% (P<0.05 compared to at ED visit). NB: DATA REPORTED IS UNRELIABLE.
Hospital initiated reminder/recall:						
Evidence Statement 40: There is evidence from two studies from Australia and Switzerland (1 nRCT- and 1 nRCT+) that delivery of a verbal reminder to parents of children identified on admission to hospital as being not up-to-date with the recommended immunisation schedule with or without a follow-up letter sent to the child's primary care provider, is effective at encouraging vaccination within 30 days compared with children whose parents are not given a reminder (Muehleisen et al., 2007 [nRCT+; N=430]; Ressler et al., 2008 [nRCT-; N=54].).						
Muehleisen et al., 2007;	nRCT +	1) Hospital staff enrolled consecutive children 2) Assessment of immunisation records 3) If not up-to-date, carer advised should take to primary care provider to obtain immunisation, in addition letter sent to physician	No advice to carer	Targeted	Children enrolled in hospital	209 assessed as unimmunised. 8 children lost to follow up. Numbers of catch up immunisations (intervention v control): 1month (27.3% [26/95] v 8.5% [9/106]; p=0.016); 9 months (45.2% [43/95] v 34.9% [37/106]). % immunised (ITT analysis) Control = 105/211 (50%) v Intervention = 116/219 (53%).

<table>
<tr><th>Study/ Country</th><th>Design/ Grade/ Sample</th><th>Intervention Vaccine/s</th><th>Control</th><th>Targeted/ Universal</th><th>Targeted Population and Age[4]</th><th>Result</th></tr>
<tr><td>Country: Switzerland</td><td>Sample: N=430</td><td>Vaccine/s: DTP, Polio, MMR, Hep B, Hib</td><td></td><td></td><td></td><td>9months
Control = 142/211 (67%) v Intervention = 159/219 (73%); NS</td></tr>
<tr><td>Ressler et al., 2008

Country: Australia</td><td>nRCT -

Sample: N =54</td><td>Immunisation history checked on admission and documented in notes. Catch up plans given on an ad hoc basis by nursing staff to children who were overdue (more than 30 days overdue for all age-appropriate immunisations on admission to hospital) on their vaccinations. There were no written policies for provisions of catch-up and plans were usually given as a verbal reminder to parents.

Vaccines: As Australian vaccination schedule</td><td>Children without a catch-up plan.</td><td>Targeted</td><td>Children admitted to study hospital and who were overdue for immunisations.

Age: 2 months-2 years</td><td>54 not up-to-date on clinical indicator form (based on parental record). 13 excluded from analysis (10 documented as up-to-date on ACIR [assumed to be correct] and 3 because no ACIR records available). 21 of 41 remaining had catch-up plan documented.

Children were significantly more likely to be vaccinated within 30 (p=0.005) and 90 (p=0.04) days of admission if they were given a catch-up plan from the ward. Of children not given a catch-up plan, almost half were still overdue at 90 days.

<table>
<tr><th>Length catch-up time after admission</th><th>Catch-up plan N (%)</th><th>No catch-up plan</th></tr>
<tr><td>≤30 days</td><td>12 (57)</td><td>3 (15)</td></tr>
<tr><td>>30 days</td><td>8 (38)</td><td>8 (40)</td></tr>
<tr><td>Still overdue at 90 days</td><td>1 (5)</td><td>9 (45)</td></tr>
<tr><td>Total</td><td>21 (100)</td><td>20 (100)</td></tr>
</table>
Baseline coverage in hospital catchment area 90-91%</td></tr>
</table>

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Schools: ***Qualitative evidence:*** **Evidence Statement 41:** There is evidence from an interview study with head teachers (n=31), school nurses (n= 12) and parents (of 1411 children) in inner-city London (Bedford et al., 1992) (Quality +) that although most parents (69%) whose children were not fully immunised were in favour of opportunistic school-based immunisations (e.g. at the school health interview), there were mixed views among school nurses and head teachers. Findings from a postal survey of 24 school nurses in Oxfordshire found that where school-based immunisations have taken place it has greatly increased school nurses' workload (Saffin, 1992) (Quality -). There is evidence from a questionnaire that sought to determine and identify lessons for future practice, training needs, operational planning and resource management of school nurses (throughout England; response rate 57.6%) after undertaking a nationwide rubella and measles immunisation programme for 5 to 16 year olds (Bagnall, 1995) (Quality +). It found that: The timing of the campaign was not ideal for school nurses with the dates coinciding with the beginning of school holidays, a time when most school nurses do not work. 75% felt confident in undertaking immunisations but a few nurses who did not have access to training admitted to lacking confidence. The majority (95%) found the campaign tiring and many put in extra time that was not remunerated. 92% of nurses had found the campaign a challenge and stimulating and most (96%) enjoyed working in a team. Those that worked within a team structure felt more confident and enjoyed the camaraderie. There is evidence from a semi-structured focus group study involving parents (n= 39) and children (n=50) in Glasgow (Hinds & Cameron, 2004) (Quality ++) that explored immunisation in general and universal hepatitis B vaccination that most parents agreed with vaccinations being delivered at school, and felt that their children thought likewise. A minority of pupils and parents perceived a lack of privacy and embarrassment to be barriers to vaccination in school. Pupils liked receiving vaccine at school as they felt supported by their peers.						
Evidence Statement 42: There is evidence from one Cohort study (Grade -; N=4487) from Canada that offering children Hepatitis B vaccinations at school, during school hours results in higher uptake compared with offering them in community settings during weekends and evenings (Guay et al., 2003).						
Guay et al., 2003;	Cohort –	S-CLSC: children offered vaccination in school hours C-CLSC: children offered vaccination in community on weekends and evenings	Comparison of 2 strategies	Universal	Grade 4 pupils at local community service centres	School based (S-CLSC) programme resulted in higher levels of HBV than community based (C-CLSC). 92%, 93%, 95% (in S-CLSC) versus 73% (CLSC)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Canada	Sample: N=4487	Vaccine/s: Hep B				Baseline not reported
Prisons and youth offender institutions						
Evidence Statement 43: There is evidence from one ITS (Grade +) from the UK that offering Hepatitis B vaccination to all injecting drug users who were inmates (aged 16-20 years) of youth offender institutions and prisons, significantly increases uptake (Hutchinson et al., 2004).						
Hutchinson et al., 2004;	ITS +	HBV vaccination offered to all inmates in YOI and prisons in Scotland	NR	Targeted	IDUs who had injected in last 5 years recruited from the street, NEX and drug treatment settings.	Uptake of HBV in 16-20 year olds increased during the study period from 14% (1993) to 56% (1999) 1993 pre = 6/43 (14%) 1994 pre = 5/25 (20%) 1999 (pre-Jan) = 4/18 (22%) 1999 (early) = 12/26 (46%) 2002 (post) = 23/41 (56%) Pre versus post intervention $X^2 = 18.0$ $p<0.0001$
Country: UK	Sample: NR	Vaccine/s: Hep B				

9. National immunisation programmes

National immunisation programmes are typically multi-component. From the examples identified here, one study focuses solely on MMR uptake and one focuses on all childhood vaccinations. In England there is an incentive payment programme for GPs linked to vaccination coverage for the registered child population. In response to a rise in measles cases over recent years the Department of Health has initiated a MMR catch-up campaign.

Evidence Statement 44:
There is evidence from 9 studies from 2 countries (Australia and Finland) to suggest that multicomponent National Immunisation Campaigns are effective at increasing uptake of vaccinations. The Australian model comprised mass media campaigns and information/letters to parents emphasising the need for vaccination, reminders (both client and provider), school based immunisations and 'School Entry Requirements', monetary incentives for parents and GP's, monitoring and evaluation of immunisation targets and provider feedback, 'Immunisation Days' (held in areas with low immunisation coverage, supported with a range of educational materials), a 'Measles Eradication Campaign', education and research. Eight studies found that the campaign resulted in higher practice coverage rates and an increase in age appropriate vaccination coverage (Bond et al., 2002; Australian Government Department of Health and Aging, 2004; KPMG, 2000; NCIRS, 1999a,b,c,d,e) all BA, 3 Grade +, 5 Grade ++). One study from Finland found that the National MMR campaign which incorporated mass media, reminder letters to healthcare professionals and parents of non-vaccinated children, increased MMR vaccination coverage from 87.4% to 96.4% (Paunio et al.,1991).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
There is also evidence from one study that found in Australia, low SES areas improved coverage greater than the high SES areas and in areas where accessibility was known coverage improved along a gradient from areas highly accessible to those that are more remote (KPMG Consulting, 2000).						
Bond et al,. 2002; Country: Australia	BA ++ Sample: N=3371	Incentive scheme, lining child care benefits and maternity allowance to immunisation status (introduced in April 1998). From inception those using formal child care had to demonstrate immunisation of their child Vaccine/s: DTP, Hib, polio, MMR	N/A	Universal	Children at one of 47 child care centres and 13 council operated day carers	93% fully immunised in 2000 which was a 9% (6%-11%) increase from 1997 ($p<0.001$). 80% fully immunised by 2nd birthday in 1997 compared with 94% in 2000. In those receiving child care benefits, immunisation levels were 10% higher in 2000 than 1997 compared to 7% in those not receiving benefits. Centres reporting 90% children fully immunised: 1997= 8(17%) childcare centres and 2 (21%) councils 2000 = 33 (70%) childcare centres and 16 (84%) councils Fewer families reported delaying imms because of minor illness in 2000 compared to 1997 (27% v 44%)
Australian Government Department of Health and Aging, 2004	BA++ Sample Number of	Provides financial incentives to GPs who monitor, promote and provide immunisation services to children under the age of seven years. It is made up of three components: 1. A Service Incentive Payment (SIP) - a payment to GPs and Other Medical Practitioners (OMPs), who notify the ACIR of a vaccination that completes an immunisation schedule;	N/A	Universal	All GP practices in Australia with children under 7 on patient lists Age: Less than 7 years	Increase in practice coverage rates between 1998 and 2003 with the proportion of practices with 80%+ coverage increasing from 35.6% (1998) to 93.1% (2003) and the proportion of practices achieving 90%+ increasing from 5.7% (1998)to 67.9% (2003)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Australia	practices August 1998 n= 3,015 February 1999 n= 3,552 February 2000 n= 5,406 February 2001 n= 5,541 February 2002 n= 5,520 February 2003 n= 5,483 May 2003 n = 5,487	2. An Outcomes Payment - practices that achieve 90% or greater proportions of full immunisation providing the practice attains 10 WPEs (Whole Patient Equivalents); NB payments for the scheme changed since its introduction and originally had two lower tiers of 80 to < 85%, and 85% to <90% which were removed in January 2002 and January 2003 respectively and 3. Immunisation infrastructure funding - which provides funds to Divisions of General Practice, State-Based Organisations and funding for a National GP Immunisation Coordinator to improve the proportion of children who are immunised at local, State and national levels. Vaccine/s: Universal according to Australian Immunisation Schedule				
KPMG, 2000	BA ++	National multifaceted approached that comprised: 1. *Initiatives for Parents* 2. The GPII scheme 3. *Monitoring and evaluation of immunisation targets* 4. *Immunisation Days (*held in areas with low immunisation coverage, supported with a range of educational materials). 5. *Measles Eradication – MCC* 6. *Education and Research*	N/A	Universal	Australian children Age: Under 7 years	<u>pre 7-point plan</u> For children aged <7 years immunisation rates were: Fully immunised 52.1% Partially immunised 46.0% Unimmunised or unknown 1.9% <u>Children aged 12-15 months using population cohort coverage</u> Immunisation coverage increased from 75.8% in Feb 1998 to 88.4% in June 2000.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Australia	Sample: Not reported	7. *School Entry Requirements* Vaccine/s: Universal according to Australian Immunisation Schedule				<u>Children aged 24-27 months using population cohort coverage</u> Immunisation coverage increased from 63.8% in August 1998 to 81.7% in June 2000. <u>National immunisation coverage</u> (using headcount coverage children <7 years) Immunisation coverage increased from 71.4%% in Sept 98 to 79.2% in Sept 99 <u>Children aged 12-15 months using population cohort coverage</u> Immunisation coverage increased from 75.8% in Feb 1998 to 88.4% in June 2000. <u>Children aged 24-27 months using population cohort coverage</u> Immunisation coverage increased from 63.8% in August 1998 to 81.7% in June 2000. <u>National immunisation coverage</u> (using headcount coverage children <7 years) Immunisation coverage increased from 71.4%% in Sept 98 to 79.2% in Sept 99
NCIRS, 1999a	BA++	Information distributed to primary schools Information distributed to parents of primary school children. Appointed vaccination day at each school to vaccinate all children regardless of their history of measles vaccination	N/A	Universal	Primary school children identified by the department of Education, the Association of Independent Schools, and	75% (1.33/1.78 million) of children received 1 dose of MMR vaccine between July and December 1998.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Australia	N=1.78million	Vaccine/s: MMR			the Catholic Education Commission in each State and Territory in Australia. Age: 5-12 years	
NCIRS, 1999b Country: Australia	BA+ N=1.78million – subsample of 30 schools analysed	Information distributed to primary schools Information distributed to parents of primary school children. Appointed vaccination day at each school to vaccinate all children regardless of their history of measles vaccination Vaccine/s: MMR	N/A	Universal	Primary school children Age: 5-12 years	Analysed at regional level Rural schools vaccinated significantly more pupils than metropolitan schools ($p<0.0001$); Schools with pupils that all spoke English was higher than those with >1 that spoke English as a Second Language ($p<0.05$); Schools that used verbal reminders as opposed to written or other reminders also had significantly higher vaccination coverage ($p<0.01$). The mean difference between schools by region, school size, school type, number of staff assigned to campaign, problem identified and time between information and vaccination were all non significant. 80% children vaccinated at school; 16% by other providers only 3.7% were vaccinated prior to the campaign.
NCIRS, 1999c	BA+	Measles control campaign: i) Changing the schedule for the 2nd	N/A	Universal	Pre-school (aged 12	From the sub sample of 886 who took part in the survey vaccination with MMR

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Australia	N=1601	dose of MMR from 10-16 years to 4-5 years ii) A national media and educational program to encourage participation iii) A pre-school intervention iv) A primary school intervention v) Letters sent to parents of all high school children aged 12-18 years encouraging them to ensure their children received 2 doses of MMR vaccine Vaccine/s: MMR			months to 3.5 years) identified on ACIR as being due or not up-to-date (n= 162,143) with MMR1. Intervention was evaluated using a sub sample of 1601 of these children. Age: 12 months to 3.5 years	increased from 700/886 (79%) to 797/886 (89%).
NCIRS, 1999d Country:	BA++ N=	Measles control campaign: i) Changing the schedule for the 2nd dose of MMR from 10-16 years to 4-5 years ii) A national media and educational program to encourage participation iii) A pre-school intervention iv) A primary school intervention v) Letters sent to parents of all high school children aged 12-18 years encouraging them to ensure their children received 2 doses of MMR vaccine Vaccine/s:	N/A	Universal	Australian children enrolled on Medicare and registered on the ACIR identified on the ACIR as not having received a dose of MMR before 23 July 1998 Age:	162,143 children were identified as overdue at census date (March 31 1999) 37% (60,028) had received a dose of MMR, of these 40,000 were found to have a date pre July 25 when the reminder letters were sent Some were recorded to have vaccination dates as far back as 1996, which the authors report may be as results of CCB requirements and the GPII scheme. Of the 20,127 recorded as being vaccinated after July 25 81% were aged 11-24 months 86% of those aged 11-24 months and 59% of children aged 24-51 months were vaccinated before the end of the campaign

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Australia	162,143	MMR			0-7 years	in November
NCIRS, 1999e Country: Australia	BA+ N= 5847	Measles control campaign: i) Changing the schedule for the 2nd dose of MMR from 10-16 years to 4-5 years ii) A national media and educational program to encourage participation iii) A pre-school intervention iv) A primary school intervention v) Letters sent to parents of all high school children aged 12-18 years encouraging them to ensure their children received 2 doses of MMR vaccine Vaccine/s: MMR	N/A	Universal	Australian children and young people aged 0-18 years who had submitted sera samples for diagnostic tests across Australia. Age: 0-18 years	There was a significant increase in the proportion of children and young people who were sera positive for measles – specific IgG from before to after the MCC campaign (84.5% to 89.8%; P<0.001).
Paunio et al., 1991 Country: Finland	BA ++ Sample: 562,931	National MMR vaccination programme comprising: 1) Mass media campaign; 2) letter reminders to health care professionals with details of non-vaccinated children; 3) letter reminders to parents of non-vaccinated children Vaccine/s: MMR	N/A	Universal	All children aged to 6 years (including hard-to-reach children) Ages: To 6 years	Total number of children vaccinated increased following intervention from baseline levels. All interventions significantly increased the number of children defined as hard-to-reach who received vaccinations. Numbers vaccinated increased from 87.4% to 96.4%

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
10. Multicomponent interventions Multicomponent interventions involved several of the above intervention types, the most common components were; patient tracking, reminder/recall, information/education and outreach work/home visiting.						
Evidence statement 45: There is evidence from one Cohort study (Grade -) from the USA that a multicomponent intervention comprising provider education and incentives, computerised data management and tracking, client reminders, education, incentives ($10 gift certificate), transportation assistance, and home visits for children not up-to-date with vaccinations significantly increased completeness rates for the recommended vaccination series compared with children who didn't receive the intervention. Completeness rates for those in the intervention group were also significantly higher for those who received a home visit compared with those who didn't (Browngoehl, et al., 1997).						
Browngoehl, et al., 1997; Country: USA	Cohort – Sample: 2511	Computerised data management and tracking, client reminders, education, incentives ($10 gift certificate), transportation assistance, and home visits for children not up-to-date with vaccinations. Providers received education, incentives and fee-for-service in addition to monthly capitation payments. Vaccines: DTP, OPV, MMR, Hib	No intervention	Targeted	All children enrolled in a particular health plan in a Medicaid Managed Care Organisation. Age: To 35 months	Those who received the intervention had significantly higher completeness rates for all combined series and individual vaccines (with the exception of Hib and series of which Hib was a part). Completeness rates for those in the intervention group were significantly higher in those who received a home visit versus those who didn't ($p<0.05$). Baseline coverage data not reported.
Based on client incentives/disincentives						
Evidence statement 46: There is evidence from one RCT (Grade +; N=565) from the USA that an intervention in which the usual 3 month supply of an immunisation-linked voucher incentive is given monthly until the child is up-to-date for immunisations, delivered with phone reminders (both in advance and if appointment missed) and mailed reminders (if calls unsuccessful) is no more effective at increasing vaccination rates at 12 months of age compared with children whose families received the voucher incentive only (Hoekstra et al., 1999).						
Hoekstra et al., 1999;	RCT +	Voucher incentive (usual 3-month supply of vouchers given monthly until child is up-to-date for immunisations) plus phone reminders (both in advance and if appointment missed) plus mailed reminders (if calls unsuccessful).	Voucher incentive only	Targeted	Children of families enrolled in the WIC programme.	Vaccination rates at 12 months of age did not differ significantly between groups. Voucher incentive plus reminder 80%± 4%; voucher incentive alone, 79%± 5% (p=0.749)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: N=565	Vaccine/s: Immunisation schedule			Ages: To 12 months.	**Baseline levels:** Immunisation coverage at 3 months (before intervention) 75% ±5% with voucher incentive +reminder v 77% ±5% with voucher alone.

Community-based outreach

Evidence statement 47:

There is strong evidence from 10 studies that targeted multicomponent community-based interventions are effective at increasing uptake of childhood immunisations:

- Four RCT's (3 Grade +; 1 Grade -) and four BA studies (1 Grade + and 3 Grade -) found that multicomponent community-based interventions targeting children at-risk of low immunisation uptake (e.g. already behind in their vaccinations or from low-income or BME families) increase the number of children who are up-to-date with the recommended vaccination series or who receive vaccinations, at least in the short term (6 months to 1 year) compared with children who don't receive community-based outreach (Barnes et al., 1999 [RCT+; N=434]; Johnson et al.,1993; 2000 [RCT+; N=232]; Wood, et al., 1998 [RCT+; N=419]; Wilcox et al., 2001 [RCT- N=1752]; Rosenberg et al., 1995 [BA+ N=2676]; Crittenden & Rao, 1994 [BA- N=93]; Findley et al., 2004 [BA- N=2433]; Fitzpatrick et al., 1997 [BA-, N=39]). Although intervention components varied between studies they generally comprised home visits, advice and support for parents (Barnes et al., 1999; Johnson et al.,1993; 2000; Wood, et al., 1998; Wilcox et al., 2001; Crittenden & Rao, 1994; Findley et al., 2004; Fitzpatrick et al., 1997), local media campaigns and networking with local organisations (Rosenberg et al., 19950 and vaccination-specific components such as referral and reminders of upcoming vaccinations (Barnes et al., 1999; Findley et al., 2004) working with parents to ensure they understand the immunisation schedule, reduced their misconceptions about vaccinations or encouraged them to be proactive and request immunisations from their providers (Wood, et al., 1998; Crittenden & Rao, 1994), directly contacting the family's immunisation providers (Wilcox et al., 2001; Rosenberg et al., 1995), immunising in other settings such as hospitals (Crittenden & Rao, 1994), and immunisation-linked incentives (Findley et al., 2004).

- One RCT (Grade +; N=286) found that a multicomponent community-based intervention comprising home visits, parent-infant developmental play groups, parent support groups and monthly support calls, targeting children from black, low income families, significantly improved uptake of immunisations to 9 months compared with children receiving standard social services. Although there was no significant difference in completion of primary immunisation series at 12 months, drop out was >50%, limiting reliability of this finding (El-Mohandes et al., 2003).

- One nRCT (Grade +; N=1508) compared a media-based education and outreach campaign to encourage Vietnamese-American parents to get their children vaccinated with Hepatitis B vaccine with a community mobilisation strategy undertaken by a Vietnamese-American community-based organisation that developed an action plan of activities and timeline with the goal of improving vaccination rates and found that both strategies significantly increased uptake of Hepatitis B vaccine compared with a control group that did not receive any intervention (McPhee et al., 2003).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
However, there is mixed evidence on the long term effectiveness of community-based outreach interventions at increasing immunisation uptake. One RCT followed up children for 7 years and found there was no significant difference between intervention and control groups in the proportion of children that had received MMR or the school booster, although subsequent children of mothers in the intervention group were significantly more likely to have completed polio and Hib immunisations compared with subsequent children of mothers in the control group (Johnson et al., 2000). Two RCTs (Grade + and -) assessed universal multicomponent community-based interventions which comprised postnatal home visits in addition to parental advice and support (Johnston et al., 2006; RCT+) or postcard or phone reminders for parents to attend for vaccinations and a number of provider-based interventions (Rodewald et al., 1999; RCT-), significantly improved up-to-date vaccination coverage rates compared with no intervention.						
Barnes et al., 1999; Country: USA	RCT + Sample: N=434	Immunisation outreach, tracking, and follow-up were provided by community volunteers. The intervention group received basic immunisation education and referral from the community volunteers. During subsequent contacts (home visits or telephone calls) throughout the remainder of follow-up (a maximum of 6 months), families were reminded of upcoming vaccinations and were re-contacted to ensure that requisite vaccines were received. Vaccine/s: Recommended immunisation schedule	No volunteer driven outreach programme. Control children were notified of immunisation status at enrolment but received no further contact until the conclusion of follow-up (mean, 6.4 months).	Targeted	Infants less than 24 months; immunisation deficient; and a no-show for a scheduled appointment at either of two ambulatory paediatric clinics.	At 6 month follow-up, significantly more children in the intervention group were up-to-date with their vaccination series than children in the control group (75% vs. 54%; P=.03). Children in the control group were 2.8 times more likely to be late for a vaccine than intervention children (odds ratio=2.8; P=.02). 21% lost to follow-up in the intervention group and 9.5% in the control group.
Johnson, et al., 1993; And 7 yr follow-up: Johnson, et al., 2000	RCT +	Standard support plus the services of a community mother who was scheduled to visit monthly during the first year of the child's life to provide support and encouragement to first time parents.	Standard support from the public health nurse, which included, visits at birth and six weeks and at other times as required, both groups received invitations to	Targeted	Disadvantaged 1st time mothers who gave birth in Dublin in 1989.	After 1 year, significantly more children were up-to-date with primary immunisations with Intervention compared with control (85% [108/127] versus 65% [68/105]). At 7 years follow up (67.2% lost to follow up) subsequent children in the intervention

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Ireland	Sample: N=232 mothers	Vaccine/s: Primary immunisations	attend for primary immunisations and a development assessment		Ages: To 12 months; and then 8 years.	group were significantly more likely to have completed Hib and polio immunisations compared with control. However, there was no significant difference between intervention and control in the proportion of initial children that had received MMR or the school booster (MMR: 94.6% with intervention v100% with control, RR 0.95, 95% CI 0.88-1.02,p=0.15; school booster: 100% with intervention v 94.6% with control; RR: 1.06, 95% CI 0.98-1.14, p=0.15).
Wood, et al., 1998 Country: USA	RCT + Sample: 419	Case management comprising: health and needs assessment, developing a service plan and goals with participants, coordinating services, advocacy with larger institutions and public assistance programmes (such as Medicaid), and monitoring and follow-up. Case managers conducted in-depth assessments before infants were six weeks of age, at home visits two weeks prior to scheduled immunisations, provided additional follow-up as needed and ensured that mothers understood the immunisation schedule, and also sought to reduce misconceptions about vaccination and encouraged mothers to be proactive and request immunisations from their providers. Vaccine/s: DPT, OPV, Hib	Health passport only	Targeted	African-American infants predominantly from low income families. Age: To 1 year	63.8% of participants in the case management group were up-to-date with immunisations (3 DTP, 2 OPV, 3 Hib) compared to 50.6% of the control group (p=0.01) (CI not reported). Baseline not reported
El-Mohandes	RCT +	Home visits, parent-infant	Standard social services	Targeted	Black, low	At 4 months

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
et al., 2003; Country: USA	Sample: 286	developmental play groups, parent support groups, monthly support calls from Pride in parenting. Vaccine/s: Polio, Hib			income pregnant women of Washington DC receiving inadequate care or no prenatal care	1DTP/1 Polio/ 1 Hib: Intervention = 66.7% Control = 54.3% p=0.0463 At 6 months 2 Polio: Intervention = 49.5% Control = 34.9% p=0.0307 at least 2 DTP: Intervention = 48.6% Control = 33.7% p=0.0277 2DTP/2 Polio/2 Hib: Intervention = 41.1% Control = 28.9% p=0.0556 At 9 months Completion of primary imms schedule Intervention = 37.4% Control = 20.8% OR 2.2 (1.09-.53); p=0.0143 At 12 months(>50% drop out) Completion of primary imms Intervention = 40.7% Control = 35.1% p=0.2797
Johnston et al., 2006;	RCT +	Postnatal home visits by Healthy Steps Specialists (HSS), developmental	Health plans standard package	Universal	English speaking	At 24 months higher % up-to-date with immunisations in Intervention (90%)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Ireland	Sample: N=439	advice, parent initiated telephone support, reach out and read literacy programme and other risk based screening services and parenting classes Vaccine/s: MMR, Hib, Polio, School Booster			women in 2nd trimester of pregnancy in 1 of 5 primary care groups	compared to Control (85%) Adjusted RR 1.06 (1.02-1.09) Baseline n=439, 92 loss to follow up 343 analysed Baseline not reported
Rodewald, et a., 1999 Country: USA	RCT – Sample: 3015	There were 3 interventions: 1) tracking/ outreach (lay workers recruited from the local neighbourhood who determined immunisation status of subjects) plus postcard or phone reminders for parents to attend for vaccinations and prompting (provider-based interventions to reduce number of missed opportunities for vaccination); 2) tracking/ outreach only, 3) prompting only Vaccines: DTP, OPV, MMR, Hib	No intervention	Universal	Infants born in one of nine primary care sites serving impoverished and middle-class children Ages: 0-12 months	The tracking/outreach/prompting group and the tracking/outreach group had significantly higher up-to-date vaccination coverage rates compared to control ($p<0.001$). The prompting alone group was not significantly different to the control group. Change in point prevalence of age appropriate immunisation from study entry to study conclusion were 85% to 95% tracking/outreach-prompting group; 81% to 95% for the tracking/ outreach group; 80% to 76% for the prompting group, and 81% to 74% for the control group.
Wilcox, et al., 2001	RCT –	Community outreach comprising identification and location of the family, assessing immunisation history and assess whether the child was up-to-date. If the child was not up-to-date the outreach worker helped the family obtain care and updated the registry. In the case of children who were not up-to-date, outreach workers made an average of four attempts to contact the family or the provider.	No intervention	Targeted	Mothers receiving outreach in Philadelphia, USA. Mothers more likely to have received inadequate prenatal care, to be teenagers,	Children in the outreach group were significantly more likely to receive an immunisation during the study period than children in the control group (61% vs. 43%, $p<0.001$). Children receiving outreach were 2.5 times more likely to have received a vaccination than children in the control group (85% CI: 1.5 to 3.9).

<table>
<tr><th>Study/ Country</th><th>Design/ Grade/ Sample</th><th>Intervention Vaccine/s</th><th>Control</th><th>Targeted/ Universal</th><th>Targeted Population and Age[4]</th><th>Result</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>unmarried and from BME groups.

Age:
6-10 months</td><td></td></tr>
<tr><td>Country:
USA</td><td>Sample:
1752</td><td>Vaccine/s:
DTP, OPV, Hib, Hep B.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>McPhee, et al., 2003

Country:
USA</td><td>nRCT +

Sample:
1508</td><td>1) A media-based education and outreach campaign to encourage Vietnamese-American parents to get their children vaccinated with the Hepatitis B vaccine
2) A community mobilisation strategy undertaken by a Vietnamese-American community-based organisation that developed an action plan of activities and timeline with the goal of improving vaccination rates.

Vaccines:
Hepatitis B</td><td>The control group did not receive any intervention.</td><td>Targeted</td><td>Vietnamese-American residents of Texas

Age:
3 to 18 years</td><td>There was a significant increase in receipt of 3 Hep B vaccinations from pre- to post-intervention in the community mobilisation area compared with control.

There was also a significant increase in receipt of 3 Hep B vaccinations from pre- to post-intervention in the media intervention area compared with control.

<table><tr><td>Intervention</td><td>Pre</td><td>Post</td></tr><tr><td>Media</td><td>28.5</td><td>39.4</td></tr><tr><td>Community</td><td>26.6</td><td>38.8</td></tr><tr><td>Control</td><td>37.8</td><td>35.5</td></tr></table></td></tr>
<tr><td>Rosenberg, et al., 1995;</td><td>BA +</td><td>A variety of community-based outreach interventions comprising postpartum visits, door-to-door visits, group presentations, street outreach (such as talking to women gathered to at self service laundries, day care centres, street fairs etc), flier campaigns, the media, and networking between local organisations. Follow-up of no-shows included telephone calls to families and home visits. Tracking subsequent visits included calls to families and calls to individual provider</td><td>N/A</td><td>Targeted</td><td>Children not up-to-date in their immunisations.</td><td>After nine months the proportion of children up-to-date with their immunisations rose from 24% pre-intervention to 73% post-intervention ($p<0.05$).

The proportion of children age appropriately immunised for DTP, OPV, MMR was significantly different for all age groups of children pre and post intervention ($P<0.05$).</td></tr>
</table>

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: 2676	Vaccine/s: DTP, OPV, MMR, Hib			Age: Not specified	
Crittenden & Rao 1994; Country: UK	BA – Sample: 93	Immunisation coordinator, general practitioners, health visitors, and paediatricians met to discuss reasons for non-attendance. Subsequent (tailored) interventions included: letter to parents giving reassurance or specific information, such as the side effects of immunisation. In some cases, the GP or health visitor visited the family to deliver information. Some vaccinations were carried out in hospital. Vaccines: Primary vaccinations or Pre-school booster. (DPT, OPV, MMR and DT/polio booster)	N/A	Targeted	Children not up-to-date with their vaccinations. Age: To 5 years	After one year, 28/49 (57%) infants were immunised for primary vaccines 30/33 (90%) eligible children were immunised for pre-school booster (DT/polio). Uptake of the primary booster increased from 87% to 90%.
Findley, et al., 2004; Country: USA	BA– Sample: 2433	Start Right Programme: a community-based immunisation programme consisting of outreach and tracking that included a series of educational and counselling sessions, reminders (at time of enrolment and telephone follow-up in advance of due appointment) and feedback with enrolled parents. Parents received a gift when their child completed their immunisations. Vaccines: DTP, OPV, MMR, Hib and Hep B	N/A	Targeted	Children enrolled in a Start Right Programme (among the most disadvantaged communities in the USA). Age: To 5 years	71.3% of the cohort that enrolled in 2002 were up-to-date at enrolment compared to 87.8% of the cohort enrolled in 2003. Of children older than 18 months at post assessment, 76.6% were up-to-date, a 32% increase compared to baseline.
Fitzpatrick, et	BA-	Services of a community mother offered	N/A	Targeted	Travelling	A total of 22/39 (56.4%) traveller children

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
al., 1997; Country: Ireland	Sample: N=39	by the family developmental nurse who was scheduled to visit monthly during the first year of the child's life to provide support and encouragement to first time parents (intervention was the same as that described in Johnson et al., 1993 and 2000, see above.). Vaccine/s: Primary Immunisations			mothers having recently delivered within Dublin	received all three of their primary immunisations by their 1st birthday. l

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Enhancing access ***Qualitative evidence:*** **Evidence Statement 48:** ***Barriers to immunisation uptake:*** A nationally representative interview survey with 18,488 mothers found that parents of partially immunised children were likely to refer to practical or logistical problems with getting to immunisation clinics as reasons for incomplete immunization (Samad, et al., 2006b) (Quality ++). An interview study with parents of 1,411 children in inner-city London found that recent immigration was a practical barrier to immunisation, although the study did not elaborate on the types of barriers caused by immigration (Bedford et al.,1992) (Quality +). **Evidence Statement 49:** **Parental and health professional views on interventions to reduce barriers to immunisation uptake:** Evidence from two studies, one postal survey of health professionals (including school nurses, clinical medical officers and health visitors), and one focus group study (involving Health visitors and Parents), identified a number of practical suggestions for improving immunisation uptake. These include: mobile or home-based immunisation; incentives for parents to bring their children for immunisation; special clinics solely for immunisation; general improvements to the immunisation service (Reid 1989; n=174 health professionals; Quality -) and varying clinic timing (Lewendon & Maconachie 2002; n=15 health visitors and parents; Quality -). Only 6-9% of professionals supported compulsory immunisation. An interview study with 759 parents found that 25% of parents would prefer immunisation in the home by a health visitor (Gill & Sutton, 1993) (Quality -). Another interview study of 22 parents indicated that parents had a preference for a flexible appointment system for immunisation appointments (Tickner, Leman, & Woodcock 2007) (Quality ++). There is evidence from an interview study with 10 orthodox-Jewish mothers (Loewenthal & Bradley 1996) (Quality -) and a questionnaire study with 67 orthodox-Jewish parents (Cuninghame et al., 1994) (Quality +) that identified a number of interventions such as reducing clinic waiting times, improving play facilities in the clinics and reducing overcrowding in the waiting room that may help to improve immunisation uptake, many of which sought to address practical barriers such as having large families to care for and multiple competing demands on time.						
Evidence statement 50: There is evidence from one RCT (Grade -; N=1139) from the USA that a multicomponent programme comprising free transportation plus developmental screening for referral services does not improve immunisation rates in infants of BME families compared with a multicomponent programme comprising free transportation plus intensive nurse home visiting during pregnancy, a postpartum visit in hospital and a visit at home (Kitzman et al., 1997).						
Kitzman et	RCT –	4 treatment groups	2 compared with 4	Targeted	African	No programme effect on immunisation

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
al., 1997 Country: USA	Sample: N=1139	1. Free transportation for scheduled prenatal care 2. As 1. plus developmental screening for referral services at 6, 12 and 24 months of age 3. As 1. plus intensive nurse home visiting during pregnancy, 1 postpartum visit in hospital and 1 visit at home. 4. As 3 plus continued visiting by nurses until child's 2nd birthday Vaccine/s: DTP, OPV, MMR, Hib			American women who delivered at Regional medical centre	rates for infants in group 2 compared to group 4.
Enhancing access plus reminder/recall						
Evidence statement 51: There is evidence from two studies (one RCT+ and one ITS-) that targeted multicomponent programmes based on enhancing access to vaccination services in combination with reminder/recall interventions is effective at increasing uptake of immunisations. The first study found that an intervention based on reminder/recall in addition to home visitation and transportation to the clinic for children of low income families in need of vaccinations is effective at increasing proportion of infants up-to-date with immunisations compared with children receiving no contact (Hambidge et al., 2004, [RCT+; N=2665]). The second study (ITS-; N=384) found that a programme comprising a community-wide reminder, recall and outreach system in which children behind in their immunisations received recall/reminder (telephone, postcard, or letter) with increasing intensity for children who were further behind in immunisations, and home visits for those where all previous strategies failed, significantly increased immunisation rates in city and suburban settings from baseline after 3 years, although after 6 years the increase was no longer statistically significant (Szilagyi et al., 2002).						
Hambidge et al., 2004; Country: USA	Cluster RCT + Sample: N=2665	1) Reminder phone call and/or post-card plus home visit and transportation to the clinic for those enrolled in Medicaid. 2) Monthly recall visits were generated for children in need of a well child visit who did not have an appointment for a future visit. Vaccine/s: DTP, OPV, Hib, Hep B.	No contact	Targeted	Children of low income families 'in need of' immunisations Ages: To 12 months	More infants in the intervention arms were up-to-date with immunisations compared with the control group at 12 months, although significance not reported (76% with immunisation v 77% with well child visit v 71%).
Szilagyi, et	ITS –	A community-wide reminder, recall, and	N/A	Universal	Three regions:	Baseline immunisation rates (1993) for 24-

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
al., 2002 Country: USA	Sample: 3184	outreach system. Outreach workers set up a filing system to track immunisation status of their caseload. For children behind in their immunisations, a recall/reminder intervention was administered with increasing intensity for children who were further behind in immunisations. Most received some type of reminder (telephone, postcard, or letter); many received multiple reminders; and a small number of children for whom all previous strategies failed (5%) received home visits to address barriers to care Vaccine/s: DTP, OPV, MMR, Hib.		and Targeted	the inner city of Rochester, which contains the greatest concentration of poverty (among 2-year-old children, 64% had Medicaid); the rest of the city of Rochester (38% had Medicaid); and the suburbs of the county (8% had Medicaid). Age: 0-2 years	month-olds were: inner city (55%), rest of city (64%), and suburbs (73%); for suburbs versus inner city this was significant ($p<0.001$). By 1996, immunisation rates rose significantly with inner city (76%), rest of the city (82%) and suburbs (84%), which was again significant between suburbs and inner city ($p<0.001$). In 1999, the results were not significant with immunisation rates being similar across geographic regions: inner city (84%), rest of city (81%), and suburbs (88%). The disparity between suburbs and inner city had reduced to 4%, which was not significant ($p<0.2$) (CI not reported).
Provider-based						
Evidence statement 52: There is evidence from one BA study (Grade ++; N=464) from Ireland that a targeted multicomponent provider-based intervention comprising checking of practice immunisation records and implementation of opportunistic immunisations, sending postal reminders to non-vaccinated children and providing monthly written feedback of uptake figures to all practice staff, significantly increased uptake of DPT and Hib after the postal reminders were sent in children aged >6 months living in a deprived area (Murphy et al., 1996).						
Murphy, et al, 1996;	BA ++	A collaborative immunisation programme which comprised: Developing an immunisation list from practice records and cross-checking the list with Eastern Health Board (EHB) records, Opportunistic immunisations (over a	N/A	Targeted	Children in an area an area with a deprived socio-economic profile	In infants aged > 6 months, uptake of DPT rose from 44% before the programme, to 57% after the postal reminders were sent as part of the programme ($p<0.0005$). Uptake of DT decreased from 17% before the postal reminders had been sent, to

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: Ireland	Sample: N=464	3 month period) with postal reminders sent to the remaining non-vaccinated children, Monthly written feedback provided to all practice staff for uptake figures. Vaccine/s: DTP, DT, Polio, Hib, MMR				13% after the programme (NS) and uptake of Hib rose from 18% before the postal reminders had been sent, to 50% after the programme (p<0.0005). In those aged > 15 months, uptake of MMR rose from 67% before the postal reminders had been sent to 75% after the programme (p<0.0005).
Based on the provision of information/health education						
Evidence statement 53: There is evidence from a BA study (Grade +; N=106) from the USA that a targeted multicomponent intervention based on the provision of health information/education for homeless and runaway youth is effective at increasing the proportion who have completed the recommended 3-dose Hepatitis B vaccination schedule (Steele & O'Keefe, 2001). Conversely, there is evidence from a Cohort study (Grade +; N=514) from the USA that a universal multicomponent programme based on the provision of health information/education for rural families delivered in conjunction with a reminder system to encourage well child care and timely immunisations is not effective at increasing vaccination uptake in these children, compared with families not enrolled in the programme (Hellerstedt et al., 1999).						
Steele & O'Keefe, 2001; Country: USA	BA + Sample: N=106	Bright Futures – diagnosis, treatment and counselling for drug use, STIs other health issues and education Vaccine/s: Hep B	NA – before and after data	Targeted	Homeless and runaway youth resident care centre for homeless (New Orleans)	Completion of 3 dose Hep B vaccination from 12% to 59%
Hellerstedt, et al., 1999	Cohort +	A public health nursing programme, which focused on provision of regular contact (health education materials), and a reminder system to encourage well child care and timely immunisations. Newsletters were sent to mothers immediately after delivery and until the infant was five years old. Enrolees received a newsletter two	Families not enrolled in the programme.	Universal	Families living in a rural area.	There was no significant difference between enrolees and non-enrollees in infants who received at least one vaccination (100% v 98.5%; p=0.074); or in vaccination rates between enrolees v non-enrollees for polio, DTP and MMR. Baseline not reported

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: USA	Sample: 514	weeks before every well-child exam and immunisation was due and follow up phone calls. Vaccines: DTP, Polio, Hib, Hepatitis B, MMR.			Age: To 16 months	

11. Interventions specific for increasing uptake of MMR vaccine

All studies identified in which interventions were aimed specifically at increasing uptake of MMR vaccine comprised patient reminder with or without information provision and opportunistic vaccination. With the incidence of measles rising in the UK there is currently a catch-up campaign in England involving allocation of funds to PCTs, information provision to parents and healthcare professionals and additional supplies of MMR vaccine.

Qualitative evidence:

Evidence Statement: 54:
Differences in knowledge and beliefs between MMR accepting and MMR refusing parents:
There is evidence that there are differences in knowledge and beliefs between MMR accepting and MMR refusing parents:

- A survey of parents in a PCT in North East England found that 84.2% of MMR acceptors and 47.7% of MMR refusers thought that their children could get measles if not vaccinated. Furthermore MMR-refusing parents were significantly less likely to agree that scientific evidence has shown the vaccine to be safe (with no link with autism) than parents who had given it to their children. (Casiday et al., 2006) (Quality ++)
- One survey found that parents who immunised were more likely to believe that immunisation was effective in preventing measles and that immunisation was safe, compared with MMR non-acceptors (Mullaney, et al., 2002; 633 questionnaires returned of 1757; 38% response rate) (Quality -).
- A case control study in North Wales found that non-acceptors were significantly more likely to have a worry about the safety of the MMR vaccine than acceptors (Petrovic, et al., 2003) (Quality +) (101 cases /200 controls).
- A postal questionnaire of 1757 parents to show that acceptors had significantly higher levels of trust than non- acceptors in all sources of information (government ministers, GPs, practice nurses, health visitors, hospital doctors, vaccine manufacturers and scientific experts) (Mullaney, 2002) (Quality -)

Parental reasons for declining or delaying MMR vaccination:
A questionnaire of 131 non immunising parents in Bristol reported the following reasons for declining the first dose of MMR (Lunts, 2002) (Quality -):

68% of parents gave more than one reason
52% mentioned fear of autism
43% had 'alternative' views on autism
24% had a fear of acute vaccine damage
18% reported they had not got around to bringing the child for their vaccination

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

17% reported a mistrust of GPs, government, pharmaceutical industry
4% of children had medical problems/specific-contraindications
2% did not believe in any immunisations
3% of children were immunised abroad

There is evidence from a recent interview study undertaken in October-November 2006 with mothers of children aged less than 3 years (N= 1016) that found that only seven percent of mothers had delayed giving the MMR vaccine for safety reasons (although some allowed the vaccine to be given at a later date) and a further 4% had refused the vaccine completely. Including mothers who reported that they would reject the MMR vaccine for future children with those who had delayed giving the vaccine indefinitely and those who had refused completely, a subgroup of 6% were identified as 'hardcore rejecters'. There was little difference in age, socio-economic status or whether first-time parents in this group (Smith et al., 2007; Quality ++).

There is evidence from three studies that reported mixed views on how serious different vaccine-preventable diseases are perceived to be:

- One recent interview study undertaken in October-November 2006 with mothers of children aged less than 3 years (N= 1016) found that meningitis was perceived as being the most severe disease, while mumps, measles and rubella were seen as the least severe (Smith et al., 2007; Quality ++)
- One questionnaire study with 68 parents in an inner-city setting (Smailbegovic, Laing, & Bedford, 2003) (Quality +) found that meningitis was perceived to be the most serious disease, with pertussis, diphtheria and measles perceived as serious or very serious and rubella perceived as mild.
- One interview study with 13 parents in an inner-city setting (Sporton & Francis, 2001) (Quality -) found that diphtheria, tetanus and polio are perceived as serious, whilst measles, mumps and rubella are perceived as mild.

One study using focus groups with 48 parents (43 mothers) in Avon and Gloucestershire found vaccines in general were perceived by some non-acceptors as placing stress on a child's immature immune system, with possible short and long-term consequences for their health such as an increased susceptibility to allergies, asthma, and eczema and the potential for developing autoimmune diseases, cancer, and AIDS (Evans, 2001) (Quality +).

A focus group study (Hilton, Pettigrew & Hunt, 2006) of 72 parents purposively selected from a range of ages, socio-economic circumstances, and family circumstances in Central Scotland found that for non MMR accepting parents or those who chose to immunise with single vaccines it was common that they felt children's immune systems varied greatly, and that some children were better at fighting infections and others more susceptible to contracting infections. In the same study some parents (not further quantified) who rejected that diseases are caused by micro-organisms or considered it not necessarily advantageous to avoid diseases altogether believed healthy individuals may benefit from contracting a disease, and suggested mass immunisation in the UK was out-dated.

There is evidence from two papers that resulted from three focus groups and individual interviews with 87 parents in Cambridge and Durham between November 2002 and October 2004 that found that parents tend to delay vaccination and opt for single vaccines when faced with uncertainty and contradictory information (Casiday, 2006; Casiday, 2007) (Both Quality +).

Parental reasons for accepting MMR vaccination: There is evidence from one survey of orthodox Jewish parents (n=67) in London that found that most parents perceived

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
vaccine-preventable diseases including measles as very serious or serious (Cuninghame et al., 1994). An ethnographic study (Poltorak et al., 2005) (Quality +) conducted in Brighton and Hove with 17 health professionals and 23 mothers of children <3 years of age found that many mothers described drawing on the history of vaccination decisions and disease experiences in their own and other families and that the decision to vaccinate did not necessarily reflect resolution or acceptance of the safety of the MMR. Isolation from peers, lack of confidence, lack of knowledge and vulnerability were reasons for vaccination, or at least for handing over judgment about it to health professionals. A need for combined parental responsibility on the issue was also highlighted. There is evidence from one recent survey of parents (n=511 at baseline and 898 at follow-up) whose children were due to receive an invitation for MMR vaccination that most parents (97%) had been encouraged by others to have their children vaccinated. The majority of respondents (86%) also agreed that measles, mumps and rubella were severe illnesses and that they were concerned about the consequences of their decisions. However, only half of all parents disagreed with a statement that vaccinations were unhealthy, with many (42%) responding that they were unsure (Flynn and Ogden, 2004; Quality +). The consequence of decisions and self blame was a theme in two studies; one reported interviews with 15 parents at a nursery in Norfolk (Raithatha et al., 2003) (Quality +) and the second reported on 114 questionnaires sent randomly to parents of children aged 10-12 months of age in Bromley (Wroe et al., 2005) (Quality +). There was also evidence from the latter to suggest that the strongest predictor of MMR decision making was anticipated regret if harm occurred as a result of not immunising. There is evidence from a recent interview study undertaken in October-November 2006 with mothers of children aged less than 3 years (N= 1016) that found that since 2002 (N=not stated), there has been an increase in the proportion of mothers who consider the MMR vaccine completely safe or posing only a slight risk (74% up from 60%) and fewer mothers felt that the MMR vaccine posed a greater risk than the diseases it protected against (14% in 2006 compared with 24% in 2002) (Smith et al., 2007; Quality ++). **Evidence Statement: 55:** **Differences in knowledge and beliefs across different ethnic groups:***:* There is evidence from a study that used mixed methods (quantitative analysis and focus groups with 37 mothers) in Brent, North West London to suggest a significant relationship between uptake of MMR1 vaccine and ethnicity. Uptake of MMR1 vaccine was highest amongst children from Indian backgrounds followed by Afro-Caribbean children and lastly white children. (Mixer, Jamrozik, & Newsom, 2007) (Quality ++) Amongst people of Asian origin, immunisation was seen as beneficial, possibly influencing their uptake; these people followed their cultural tradition of consulting their elders, especially their mother-in-law, for advice about immunisation. Asian mothers were also more likely to consult their general practitioner for advice and were most trusting of such advice. Conversely, Afro-Caribbean and white mothers were more likely to question the pro-MMR vaccination advice given by healthcare professionals. (Mixer et al., 2007) (Quality ++). **Differences in knowledge and beliefs across different socioeconomic groups:***:* There is evidence from a recent interview study undertaken in October-November 2006 with mothers of children aged less than 3 years (N= 1016) that found that mothers from lower socioeconomic groups were significantly more likely to consider the MMR vaccine completely safe compared with mothers from higher socioeconomic groups.						

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Furthermore, the study also found that before 2002 (N=not stated), a greater proportion of mothers from higher socioeconomic groups considered the MMR vaccine to pose a greater risk than diseases it protected against than did mothers from lower socioeconomic groups, although the gap had narrowed in subsequent years and by 2006 the proportion was 14% in both groups (Smith et al., 2007; Quality ++).						
Targeted interventions:						
Reminder recall **Qualitative evidence:** **Evidence Statement 56:** There was evidence from a postal questionnaire of parents (Quality -; n=633; 38% response rate) to suggest that about two-thirds of parents did not take up MMR vaccination because they did not receive an appointment (Mullaney, 2002).						
Evidence Statement 57: There is mixed evidence from 4 studies (3 RCTs and 1 BA study) as to the effectiveness of reminder/recall interventions at increasing MMR uptake in children who have not received their first MMR vaccination. Two RCT's (Grades ++ and +) were conducted in the UK and both reported no significant difference in the proportion of infants up-to-date with MMR by their second birthday between those whose parents were sent mailed reminders and those who received no contact (Morgan and Evans, 1998 [RCT++; N=451] and Mason & Donnelly, 2000 [RCT+; N=511]. It is important to note that the study by Mason & Donnelly, (2000) was conducted after publication of the Wakefield study (1998) which suggested a link between MMR vaccination and onset of behavioural problems, including autism. Similarly, one poor quality BA study (Grade -; N=5087) from the UK found that children of parents that received a routine vaccination invitation letter in addition to a letter emphasising the risks of measles and mumps produced a smaller increase in uptake of MMR uptake of MMR relative to the control group that received only the standard invitation (Lamden, unpublished). The third RCT (Grade +) was conducted in the USA and found that computer generated recall letters significantly increased MMR uptake by age 2 compared to a control group which received no contact (Lieu et al., 1997; [RCT+; N=321]).						
Morgan & Evans 1998; Country: UK	RCT ++ Sample: N=451	1) A non-directive phone call to the child's health visitor in which the child's immunisation status was confirmed. Although follow-up was anticipated, it was not specifically requested. 2) Mailed reminder to the child's parents Vaccine/s: DTP, OPV, Hib, MMR	No contact	Targeted	Children not up-to-date with their vaccinations. Ages: To 21 months	No significant difference between the intervention and control groups in the proportion completing the primary course or MMR immunisation at post-assessment.
Mason &	RCT +	A personal reminder letter and leaflet,	No contact	Targeted	Children	There was no significant difference in the

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Donnelly 2000; Country: UK	Sample: 511	'MMR the facts' sent to all parents with a copy sent to the child's GP and health visitor. Vaccines: MMR.			unvaccinated against MMR (according to the Child health record system). Age: To 21 months	proportion of intervention infants (aged 21-24 months or >24 months) immunised with MMR compared to control (AR: 7.2% versus 6.1%; 95% CI -3.3 to 5.5; AR: 8.4% versus 7.4%; 95% CI for difference -3.6 to 5.7; respectively. Outcomes reported as proportions vaccinated at follow up: intervention versus control
Lieu et al., 1997; Country: USA	RCT + Sample: N=321	Computer generated recall letters. Vaccine/s: MMR	No recall letter	Targeted	Children not up-to-date with their MMR vaccinations. Ages: 20 months	Significantly more children had received MMR at 24 months of age with intervention compared with control (54% v 35%). Outcomes reported as proportions vaccinated at follow up: intervention versus control
Lamden, unpublished, Country: UK	BA- N=5087	In addition to the standard routine invitation, a letter was sent to parents to emphasise to parents that measles and mumps were a real risk to their child. The letter was not personalised and was addressed "Dear Parent or Guardian". Vaccine/s: MMR	Controls only received standard invitation	Universal	Children aged 13 months in West Lancashire PCT and Chorley and South Ribble PCT. Age: 13months	Relative to the control group the intervention group reduced uptake of the MMR by 4.4% [95%CI 8.6% to 2.6%] p= 0.037.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Universal interventions:						
Information systems ***Qualitative evidence:*** **Evidence Statement 58:** There is evidence from a survey of GPs, health visitors and practice nurses from Scotland that found that a process of data validation and subsequent recalculation demonstrated significantly improved uptake in all childhood immunisations, with the exception of MMR (MacDonald et al., 2004) (Quality +).						
Opportunistic vaccination **Evidence Statement 59:** There is evidence from one nRCT (Grade -; N=1500+) that routine checking of MMR vaccination status followed by vaccination of all eligible young people (aged 11-18) on presentation to a GP clinic regardless of the reason for their appointment, is effective at significantly increasing the uptake of MMR, compared with clinics in which there was no system for opportunistic MMR vaccination. The study was conducted in USA in an area with low socio-economic status (Harper and Murray, 1994).						
Harper & Murray, 1994; Country: USA	nRCT- Sample: Not clear minimum 1500	The intervention clinic used a system to assess MMR vaccination status and vaccinate eligible young people with MMR regardless of the reason for their appointment. Nurses screened, obtained consent, and advised the physician to order the MMR vaccination at conclusion of the visit. Vaccine/s: MMR	In the comparison clinic, there was no system to facilitate MMR vaccination of young people.	Targeted	Young people aged 11-18 years at urban family practice clinics serving low socio-economic populations.	The mean percentage of immunisations given in the intervention clinic increased from 7.8% to 17.4% (Student's t=3.02; p=0.0087) compared to the mean percentage of immunisations given in the comparison clinic which decreased from 16.4% to 10.3% (Student's t= -1.13; p=0.28). The mean percentage of up-to-date visits in the intervention clinic increased from 17.2% to 38.6% (Student's t=8.33; p<0.0001) compared to the mean percentage of up-to date visits in the comparison clinic 27.5% pre- to 26.1% post-intervention (Student's t= -0.26; p=0.80).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

Provision of information to parents

Qualitative evidence:

Evidence Statement 60:

There was evidence from three studies on where parents sourced information on the MMR:

- One postal survey with 150 mothers of children aged 5-12 months and 150 mothers of children aged 21-35 (Pareek & Pattison, 2000) (Quality +) found the most common source of information to be the health visitor, with television the most commonly cited source of information about side effects.
- A study (Ramsay, 2002) (Quality -) using face-to-face interviews with 1013 mothers showed 74% of mothers reported seeking advice from health professionals before having their children immunised.
- A postal questionnaire completed by 996 parents located with Durham primary care Trust (Casiday, 2006) (Quality ++) showed 93.8% of parents had consulted one or more sources of information about the MMR vaccine. Health visitors and the 'MMR the Facts' leaflet were the most frequently consulted sources. MMR-refusers were more likely than MMR acceptors to have used health visitors, general practitioners, anti-MMR organisations and other sources of advice ($p<0.00001$).

There is evidence from two studies to suggest that parents' held varying views on the role of the media in influencing parental vaccination decisions. A focus group study with 48 parents in Avon and Gloucestershire, found that media publicity about the possible link between MMR, autism, and Crohn's disease raised doubts in the minds of people who had not previously questioned the safety of immunisation (Evans, 2001)(Quality +). However, a more recent survey of parents (n=511 at baseline and 898 at follow-up) whose children were due to receive an invitation for MMR vaccination found that the majority (72%) had 'little faith' in the media (Flynn and Ogden, 2004; Quality +).

Similarly in a focus group study (Hilton, 2007) of 64 mothers and 8 fathers from Central Scotland (Quality +) parents found it difficult to distance themselves from the debate, and felt particularly drawn to newspaper stories that involved real life people. Some viewed journalists as scaremongers, whilst others thought of them as valuable information providers (no figures provided). Parents felt that the media are acutely aware of the fact that health stories, especially those involving children, are of huge interest to the public

Parental Trust:

Health professionals were consistently reported as the most trusted source of information on the MMR vaccine :

- A recent interview study undertaken in October-November 2006 with mothers of children aged less than 3 years (N= 1016) found that mothers were more likely to trust information from health professionals and the NHS rather than the Government (exact figures not reported) (Smith et al., 2007; Quality ++);
- One study (McMurray et al., 2004) (Quality ++) with 69 parents most frequently cited GPs and health visitors as the best or most trusted source of information on MMR.
- A postal questionnaire (Casiday, 2006) (Quality ++) of 996 parents in Durham found that parents trusted their own doctors far more than the medical establishment.
- Likewise in focus groups (Casiday, 2006; Casiday, 2007) (Quality +) with 87 parents in Cambridge and Durham, advice from medical practitioners' was generally trusted when they showed concern for the individual child, as opposed to merely protecting the population or their own professional reputations.

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

Health Professionals:

There is evidence from a survey of parents (n=511 at baseline and 898 at follow-up) whose children were due to receive an invitation for MMR vaccination to suggest that some lack confidence in doctors (Flynn & Ogden, 2004; Quality +). This is supported by findings from two studies that suggest a range of factors influence parents trust in health professionals (McMurray et al., 2004) (Quality ++) (Hilton, 2007) (Quality +). These include:

- GPs receiving payments for meeting immunisation targets
- Partiality and concerns as to acceptability or legitimacy of discussion during consultation
- Health visitors applying unwanted pressure on parents and in some cases ostracizing them for not complying with the recommended vaccines

There is contradictory evidence from a focus group study (Hilton, 2007) (Quality +) with 64 mothers and 8 fathers from Central Scotland to suggest that on one hand Andrew Wakefield was regarded as an important whistle-blower and champion of ordinary parents and that criticism of Wakefield by public health officials appeared counter-productive, and was taken to be evidence of their attempts to suppress the 'truth'. Conversely, some parents implied Wakefield should shoulder much of the blame for their uncertainty about MMR safety (no proportions reported).

There is evidence from an ethnographic study (Poltorak et al., 2005) (Quality +) conducted in Brighton and Hove with 17 health professionals and 23 mothers to suggest 'many' mothers (no figures provided) do not raise questions with GPs, seeing them as time-constrained and probably partial in their advice and worry about appearing ignorant. Some mothers actively seek out those who will support their particular perspective on vaccination.

There was evidence from two papers that resulting from focus groups and individual interviews with 87 parents in Cambridge and Durham (Casiday, 2006; Casiday, 2007) (Quality +) to suggest parents value personal relationships, experience and training of health professionals and are reassured by the existence of professional codes of practice.

Other Parents:

There is evidence from three studies to suggest that information acquired through other parents was considered highly:

- An ethnographic study with 17 health professionals and 23 mothers in Brighton and Hove suggested mothers rarely seek or give advice but rather learn from hearing and sharing experiences and tips, generally valuing forms of information sharing grounded in the unique relationship and responsibility that each has for their child (Poltorak et al., 2005) (Quality +).
- Likewise a focus group study with 87 parents suggested parents' placed great importance on other parents' claims because they felt parents know their own children better than anybody else and are in a unique position to notice changes in their behaviour (Casiday, 2006; Casiday, 2007) (Quality +).
- A focus group study with 64 mothers and 8 fathers from Central Scotland suggested accounts from other parents appeared to carry as much, if not more, weight than either evidence from epidemiological studies or assurances from politicians and public health officials. Parents could understand other parents' concerns and could assess their credibility(Hilton, 2007) (Quality +)

Government:

There was evidence to suggest considerable mistrust in the government in relation to the MMR:

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
• A focus groups with 87 parents (Casiday, 2006; Casiday, 2007) (Quality +) suggests parents do not accept the government's decisions until they evaluate the relevant evidence themselves. • Similarly, a postal questionnaire (Casiday, 2006) (Quality ++) of 996 parents from Durham indicated a considerable distrust in the government's role in regulating risk, particularly among the MMR-refusing parents with only 39.4% agreeing that the government would stop MMR if there was evidence of a serious risk and 41.6% agreeing that the government does a good job in protecting us from risks to health. • A focus group study of 64 mothers and 8 fathers from Central Scotland (Hilton, 2007)(Quality +) to suggest that general consensus among parents was that politicians were untrustworthy in matters of health. • A focus group study with 48 parents in Avon and Gloucestershire, to suggest that parents did not have confidence in statements issued by the government about the safety of MMR and that this led to parents obtaining information from a variety of other sources (no further details provided). Although parents were generally well informed about immunisation, they reported that inadequate information had hampered their decision-making process. For many parents the possible link with autism and Crohn's disease was not resolved, so they were unwilling to accept MMR (Evans, 2001) (Quality +). **Leaflets and information packs:** There is evidence from a postal questionnaire (Gellatly, McVittie, & Tiliopoulos, 2005) (Quality -) of 110 parents from five nurseries in Edinburgh to suggest that current research and helpfulness of leaflets and information packs significantly increased vaccination status. There is evidence from a focus group study (Evans, 2001) (Quality +) with 48 parents in Avon and Gloucestershire, to suggest that more information from independent sources should be easily available at GP surgeries and community clinics and that available leaflets were limited in scope and failed to address their concerns. There is evidence from focus groups with 87 parents (Casiday, 2006; Casiday, 2007) (Quality +) in Durham and Cambridge to show parents (no figures provided) were concerned that epidemiological evidence would overlook some children who might have really been harmed by the MMR vaccine. There is evidence from one study (Hilton, 2007; N=72 parents) (Quality +) that found that parents felt ill equipped to assess research studies for themselves.						
Evidence Statement 61: There is evidence from one recent RCT (Grade + N=142) from the UK that found that children were significantly more likely to have been vaccinated with MMR if their parents had received the NHS Health Scotland information 'MMR your questions answered' and were also invited to attend a parent-led intervention, a one-off, two-hour parent meeting consisting of information giving and a Q&A session, support network and enablement, compared with parent s that received only standard information (Grade +; (Jackson, 2007).						
Jackson, 2007	Cluster RCT +	Intervention group received the NHS Health Scotland information (MMR your questions answered) and assumed to receive their usual general practice policy relating to giving advice on the	Standard information	Universal	Children eligible or approaching eligibility for first or second	Uptake of MMR 3 months post intervention: Intervention group more likely to have had child vaccinated Chi^2 (1, N=66) = 4.43, p=0.04).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: UK	N=142	MMR vaccination. They were also invited to attend a parent-led intervention, a one-off, two-hour parent meeting consisting of information giving and Q&A session, support network and enablement intervention			dose of MMR vaccination Age: 6 months to 5 years.	

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

Provider education and training

Qualitative evidence:

Evidence Statement 62:

Some professionals lack knowledge on the safety of the MMR vaccine

Recent qualitative evidence from one survey (n=not reported) of GPs (31% response rate), health visitors (63%) and practice nurses (63%) found that the majority of health professionals felt confident explaining MMR and the second dose to parents, and thought that the policy of giving a second dose was appropriate. This confidence had remained high over time and was reported as being at the highest level ever reported (no figures reported). The most common solution for managing parental concerns (reported by 75% of practice nurses, 71% of health visitors and 54% of GPs) was to refer to a colleague. Fifty-nine percent of GPs who made referrals did so to a paediatrician *(BMRB Social Research, 2008; Quality -).*

There is evidence from one questionnaire study with 254 health care professionals (GP's, Practice Nurses and Health visitors) that found differences in the level of confidence in the safety of MMR vaccine before and after publication of the 1998 Lancet paper. In general, practice nurses and health visitors were less confident about the safety of MMR vaccine than general practitioners. A significant proportion were unsure about the need for a second dose and were more likely to encourage uptake of first rather than second dose. Over half of respondents (61%) felt that more research was warranted to establish the safety of MMR and 19% were not sure (Smith, McCann, & McKinlay 2001).

There is evidence from one postal questionnaire survey undertaken in North Wales in 1998 of GPs (165 responded/206 invited), health visitors (140/148), and practice nurses (204/239) that most (>70%) health visitors and practice nurses and some GP's (42%) reported that they would have liked more information or training on the MMR vaccine (Petrovic, Roberts, & Ramsay, 2001). The study also found that professionals who stated that they would be very confident in explaining the rationale behind the second MMR vaccination were significantly more likely to agree completely with the policy of giving the second dose of the vaccine (GPs OR 5.2, 95% CI 2.6 to 10.4; health visitors OR 5.3, 95% CI 2.4 to 11.9; practice nurses OR 2.1, 95% CI 1.1 to 4.0). Thirty-nine health professionals reported on various problems they saw with the rationale for the second dose. Problems included difficulty with the concept of herd immunity, doubting the necessity of a second dose or of using it as an opportunity for giving a first dose to non-attenders

There is evidence from a semi-structured postal questionnaire survey of general practitioners (GPs) in Scotland that found that 92% and 86%, respectively, believed that the benefits of the first and second doses of MMR outweighed the risks. However, only 57% of GP's described themselves as 'very confident' in discussing MMR with parents. The study also reported that some (not further quantified) respondents were misinformed regarding the adverse events associated with the MMR vaccine (Henderson et al., 2004; Quality +)). Compared with earlier studies, the evidence suggests that health professionals are becoming more informed as to the risks and benefits of MMR vaccine. For example, one study carried out in 1998 found that 33% of practice nurses (54/163) surveyed reported that an association between the MMR vaccine and Crohn's disease was very likely or possible, and 27% (44/164) believed there to be an association with autism. Twelve percent of practice nurses (19/161) believed an association with asthma to be very likely or possible. Eighty percent of all respondents (364/457) reported that they either did not know whether the vaccine was associated with idiopathic thrombocytopenic purpura or thought it unlikely (Petrovic, Roberts, & Ramsay, 2001).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result

There is evidence from a second survey of GPs, health visitors and practice nurses from Scotland that found a lack of confidence in MMR, and also a lack of knowledge concerning potential adverse effects (MacDonald et al., 2004)(Quality +).

One survey of 136 General Practitioners, 78 Practice Nurses and 40 Health Visitors found that in July 1998 the majority of health professionals had confidence in the MMR. However, practice nurses and health visitors were less confident about the safety of MMR vaccine than general practitioners (Smith, 2001) (Quality -).

There is qualitative evidence from one questionnaire study (Reid 1989) that found that health professionals (health visitors, school nurses and clinical medical officers) judged that different vaccines offered different levels of protection with measles and pertussis vaccines given lower scores than others. It also found that more health professionals thought it very important to prevent diphtheria, polio, tetanus, and whooping cough, but less thought measles prevention to be very important.

There is evidence from a semi-structured postal questionnaire (Henderson, 2004) (Quality -) of 206 GPs (response rate 73%) to suggest that confidence of health professionals in government agencies and expert groups was shaken by the MMR controversy, which was further compromised by the BSE crisis.

Evidence Statement 63:
Provider-Client relationship:
There is evidence from one postal questionnaire survey undertaken in North Wales in 1998 of GPs (165 responded/206 invited), health visitors (140/148), and practice nurses (204/239) that found that fifty-five percent of health professionals (246/445) reported that health visitors were the best initial source of advice on the second MMR vaccine. Sixty-one percent of health visitors (86/140) felt very confident about explaining the rationale behind the two-dose schedule to a well-informed parent, compared with 46% of GPs (73/158). Twenty percent of health visitors (28/138) reported they would definitely recommend the second dose to an unsure parent (Petrovic, Roberts, & Ramsay, 2001).

There is evidence from 38 parents of autistic children from across the UK (34 mothers and 4 fathers) (Hilton, 2007) (Quality +) that suggests that 'some' parents received unwelcome pressure from health professionals if they had refused the second dose of MMR vaccine for their child with autism or for their second child and that parents felt frustrated, annoyed and ignored by health professionals when discussing the MMR vaccine.

There is evidence from one study reported in two papers (Casiday, 2007;Casiday, 2006) (Both Quality +) that resulted from focus groups and individual interviews with 87 parents in Cambridge and Durham that suggest that the decision about MMR was difficult and stressful and parents experienced unwelcome pressure from health professionals to comply.

There is evidence from one-to-one interviews with 69 parents (64 mothers, 5 fathers) and 12 health practitioners at five general practices in Leeds to suggest parents found the influence of primary care providers on the vaccination decision was limited by concerns over consultation legitimacy, discussion opportunity and perception of financial and political partiality. The rushed nature of the consultation which reduced discussion opportunity was also felt by the health practitioner. Parents would prefer new collaborative as well as individual approaches to information exchange designed to relate the risks and benefits of MMR vaccination to the parent's local circumstances and

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
individual child (McMurray et al., 2004) (Quality ++). There is evidence from one study that used group interviews with eight general practitioners (GPs), three practice nurses and six health visitors (Poltorak et al., 2005) (Quality +) to suggest that: • Most GPs (no further details) feel little involvement in parents' MMR decisions. • Health visitors generally appreciated parents' dilemmas and do not want to compromise carefully built trust relationships. • Vaccination is not the immediate priority for health professionals working with parents who are perceived as deprived, with many related health and social problems. • Established trust between parents and health professionals does not necessarily affect parents' vaccination decisions						
Evidence Statement 64: There is a lack of quantitative evidence of the effectiveness of interventions that have focused on training or education for health professionals specifically in MMR vaccination, on increasing uptake of MMR vaccine. ***See also Evidence Statement 28***						
12. Interventions specific for increasing uptake of neonatal Hepatitis B vaccination The interventions focusing on neonatal Hepatitis B centred on identification of at risk mothers and having in place a clear process for beginning a course of vaccinations In England all women are routinely offered screening for Hepatitis B when receiving antenatal care, although it is difficult to ascertain whether the first dose of Hepatitis B vaccine is routinely given in hospital						
Qualitative evidence: **Evidence Statement 65:** There is evidence from a questionnaire that sought to determine possible problems encountered with the process of Hepatitis B immunisation among GPs caring for babies born to mothers who were HbsAg positive at antenatal screening in Glasgow. The questionnaire found that barriers to successful completion of Hepatitis B immunisation of infants at risk were: lack of coordination, inadequate communication, lack of clarity of responsibility for immunisation and problems with the delivery of medical services to patients from ethnic minority groups. Furthermore, most GPs (61%) thought that Hepatitis B immunisation should be their responsibility and most (76%) thought that an appointment system similar to that in operation for primary immunisations would help increase successful completion of Hepatitis B immunisation for at risk infants (Penrice, McMenamin, & Cameron, 2000) (Quality -).						
Evidence Statement 66 There is mixed evidence from two ITS studies (Grade -) and 2 Cohort studies (Grade +) to suggest that neonatal Hepatitis B immunisation strategies centred around early identification of Hepatitis B positive mothers and commencement of the vaccination schedule in hospital can increase neonatal Hepatitis B vaccination coverage. The first study (Cohort +; N=832) in which HbsAg positive mothers were contacted by phone, letter or home visit and counselled around the risks of transmission and importance of screening household contacts found that babies were significantly more likely to complete the Hepatitis B series if the first dose was given in hospital (Henning et al., 1992).						

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
The second study (Cohort +; N=265) from the UK found that a hospital based service in which the immunisation clinic was held in the hospital at the same time as the neonatal follow up clinic led to higher levels of vaccination compared with a neighbouring area with no hospital intervention (Larcher et al., 2001). However, one poor quality study (ITS -; N=323) found that a comprehensive immunisation strategy including dose 1 given in hospital and nomination of a GP to continue the vaccination schedule did not increase the proportion of eligible infants receiving the recommended 3 doses of vaccine (Riley et al., 1993). Finally, one study from Italy (ITS-) reported that over a 4 year period the proportion of eligible infants immunised against Hepatitis B significantly increased with introduction of a policy to inject infants with Hep B Immunoglobulin within 24hrs of birth and 1st dose of Hep B vaccine within 7 days of birth.						
Riley et al., 1993 Country: Australia	ITS – Sample: 323	Comprehensive immunisation strategy comprising: Identification of eligible infants. First vaccine dose given in hospital and parents were required to nominate a general practitioner to give subsequent doses. Details of infant passed to Regional Hepatitis B Co-ordinator and relevant Early Childhood Nurse to remind families when subsequent does were due. The Regional Co-ordinator liaised with medical practitioners and kept a vaccination register. Vaccine/s: Hep B	N/A	Targeted	Infants from ethnic groups with a high rate of chronic Hepatitis B virus (HBV) infection (predominantly Aboriginal Australians, and Asians) and infants of HBV carrier mothers.	The proportion of infants vaccinated with all three doses of Hepatitis B did not increase over the study period. 1987 - 60% 1988 – not reported 1989 – 63% 1990 – 63% Although the proportion of infants receiving all 3 doses did not alter the number of eligible infants increased over the same time period which may reflect greater knowledge amongst health care professionals.
Stroffolini & Pasquini, 1990; Country: Italy	ITS – Sample: NR	Infants born to HBsAg +ve mothers injected with Hep B Immunoglobulin within 24hrs of birth and 1st dose of Hep B vaccine within 7 days of birth (Introduced in 1984) Vaccine/s: Hep B	NA	Targeted	Infants born to women who tested HBsAg +ve in 3rd trimester of pregnancy	Intervention increased the % of eligible babies immunised against Hep B: 1984 = 24% 1985 = 39% 1986 = 41% 1987 = 45% 1988 = 62% 1988 significantly greater than 1984 ($p<0.01$)

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Henning, et al., 1992 Country: USA	Cohort + Sample: 832 infants	Contact with HBsAg positive women by telephone, letter, or home visit; and counselling regarding HBV transmission, the importance of screening household contacts and the need for neonatal Hepatitis B vaccination. Vaccine: Hepatitis B	Infants who received their first dose of Hepatitis B at non-programme hospitals (not further defined).	Targeted	Hepatitis B positive pregnant women and their infants Age: Newborns	Coverage for the combined Hepatitis B vaccine dose 1, 2, and 3 were 97%, 89%, and 67%, respectively. Babies were significantly more likely to complete the Hep B series if they received their first does in one of the program hospitals compared with non-programme hospitals. (73% v 59%; RR 1.24, 95%CI 1.05 to 1.46). Baseline not reported
Larcher et al., 2001;	Cohort +	Hospital based immunisation service to vaccinate Infants born to Hepatitis B positive mothers (both low and high risk carriers). Babies were scheduled to receive vaccine at birth, 1,and 6 months. Serological responses to vaccination were tested at one year. To facilitate attendance, the immunisation clinic was held in the hospital at the same time as the neonatal follow up clinic. Weekly clinics were held, but an opportunistic policy for vaccine administration was followed for late comers and those who inadvertently attended the baby clinic. All babies who failed to attend one of their vaccinations were notified to their GP, health visitor, and community paediatrician and given the next available appointment. If they failed to	Comparative data for Hepatitis B vaccine uptake were obtained for 1995 from a neighbouring district where there is a primary care based vaccination programme, but where the number of eligible babies is fewer.	Targeted	Babies born in a London hospital to Hep B +ve mothers	During the study period 265 infants (1.45%) were born to HBsAg positive mothers of whom 46 (17%) were identified as high risk. Of the eligible infants, 242 (91%) received three doses of vaccine and 217 (82%) had serological responses measured. Two children born to high risk mothers became HBsAg positive. One had received no vaccine and the other child failed to complete her course. Significantly more babies completed their Hep B course at the hospital-based programme compared with the primary care based programme (53/58 [91%] in hospital v 7/22 [32%] in primary care; X2 = 27, $p < 0.01$). More babies were lost to follow up in the primary care programme compared with the hospital programme (9/22 [41%] v 0/58).

Study/ Country	Design/ Grade/ Sample	Intervention Vaccine/s	Control	Targeted/ Universal	Targeted Population and Age[4]	Result
Country: UK	Sample: 265	attend a second time, hospital based liaison health visitors contacted the family's health visitor and attempted to contact the family themselves to reinforce the need for attendance. Vaccine/s: Hep B				
Lam & McLaws, 1998 Country: Australia	Cohort – N= 658	An extension to the existing HBV neonates policy to include (in addition to vaccinating neonates born to HBV carrier mothers) neonates born to mothers from high risk countries (including Vietnam) irrespective of their HBV status. Vaccine/s: Hepatitis B	Historical control – older children in the cohort who would not have experienced the extension to neonatal Hepatitis B policy	Targeted	Children born to Vietnamese women in New South Wales attending Vietnamese language classes Age: Not reported	Significantly more children (68%) were vaccinated in the younger cohort compared to the older cohort (31%) p<0.001) Those in the younger cohort were significantly more likely to be fully vaccinated than the older cohort (OR 2.00 95% CI 1.65 to 2.42 p = 0.0000) Equal proportions in each cohort were partially vaccinated (23%) **NB it is not clear which children were the denominator for these calculations**

Appendix 1: Excluded studies:

Table 3: List of intervention studies excluded (see p1)

Studies	Reason for exclusion
Not applicable to UK health care provision	
Fairbrother, et al., 1999; RCT +	Study assessed impact of different physician immunization-linked payments such as enhanced fee-for-service.
Fairbrother, at al., 2001; RCT –	Study assessed impact of different physician immunization-linked payments such as enhanced fee-for-service.
Joyce & Racine, 2005; BA +	Study assessed impact of State Children's Health Insurance Programme (SCHIP) on vaccination coverage rates.
Kirschke et al., 2004; BA –	Study assessed impact of a State wide Medicaid managed care plan on vaccination coverage rates.
Morrow, Gooding, & Clark, 1995; BA –	Study assessed impact of changing physician immunization-linked payments from fee-for-service to capitation basis.
Recipient reminder/recall systems	
Campbell, et al., 1994. RCT –;	Coverage of children 'up-to-date' with DTP vaccination at 7 months was <70% post intervention.
Dini et al., 2000. RCT +;	Coverage of children 'up-to-date' with vaccination series at 24 months was <70% post-intervention.
Hicks et al., 2007. BA +;	Baseline coverage of children 'up-to-date' with vaccinations up to 35 months of age was <70%.
Irigoyen et al., 2006. RCT +;	Immunisation coverage of children was <70% post-intervention at 3 and 6 months.
LeBaron et al., 1998 nRCT +;	Baseline coverage of children 'up-to-date' with vaccination series <70%.
LeBaron et al., 2004; RCT ++;	Coverage of children 'up-to-date' with vaccination series at 24 months was <70% post-intervention.
Waterman, et al., 1996;	Coverage of children 'up-to-date' with vaccination series at 24 months was <70% post-intervention.

Cohort –;	
Client/recipient incentive programmes:	
Hoekstra, et al., 1998 BA +	Coverage of children 'up-to-date' with vaccination series at 24 months was <70% at baseline.
Kreuter, et al., 2004; nRCT –	Coverage of children 'up-to-date' with vaccination series at 24 months was <70% at baseline for control group.
School-based vaccination programmes:	
Brabin et al 2008; Cohort +	Intervention to increase uptake of HPV vaccine.
Counard, Nimke, & Vernon, 2008	Coverage of high school children having received Tdap was <70% at baseline.
Reeve et al., 2008; Feasibility +	Intervention to increase uptake of HPV vaccine.
Multicomponent interventions	
Hutchins et a., 1999; BA –	Coverage of children 'up-to-date' with vaccination series at 1 and 2 years of age was <70% at both pre- and post-intervention.
Mayer et al., 1999; BA –	Coverage of children 'up-to-date' with vaccination series at was <70% pre- and post-intervention.
Mohr, et al., 2003 BA +	Coverage of children 'up-to-date' with vaccination series at 24-36 months was <70% pre-intervention.
Niederhauser et al., 2007; BA +	Coverage of children 'up-to-date' with vaccination series across all age groups was <70% pre-intervention.
Oeffinger, et al., 1992 RCT +	Coverage of children 'up-to-date' with vaccination series at 12 months was <70% post-intervention.
Smith, Connery et al., 1999; BA –	Baseline coverage of children 'up-to-date' with vaccination series was <70%.

References

Abramson, J. S., O'Shea, T. M., Ratledge, D. L., Lawless, M. R., & Givner, L. B. 1995, "Development of a vaccine tracking system to improve the rate of age-appropriate primary immunization in children of lower socioeconomic status", *Journal of Pediatrics*, 126(4) pp.583-586

Ahmed, S., Hicks, N. R., & Stanwell-Smith, R. 1992, "Policy and practice - an audit of neonatal BCG immunization in Avon", *Journal of Public Health Medicine*, 14(4) pp.389-392

Alderson, P., Mayall, B., Barker, S., Henderson, J., & Pratten, B. 1997, "Childhood immunization: Meeting targets yet respecting consent", *European Journal of Public Health*, 7(1) pp.95-100

Alemi, F., Alemagno, S. A., Goldhagen, J., Ash, L., Finkelstein, B., Lavin, A., Butts, J., & Ghadiri, A. 1996, "Computer reminders improve on-time immunization rates", *Medical Care*, 34(10 Suppl) p.OS45-OS51

Alto, W. A., Fury, D., Condo, A., Doran, M., & Aduddell, M. 1994, "Improving the immunization coverage of children less than 7 years old in a family practice residency", *Journal of the American Board of Family Practice*, 7(6) pp.472-477

Ashton-Key, M. & Jorge, E. 2003, "Does providing social services with information and advice on immunisation status of "looked after children" improve uptake?", *Archives of Disease in Childhood*, 88(4) pp.299-301

Australian Government Department of Health and Ageing 2004, *Review of the General Practice Immunisation Incentives (GPII) Scheme. In consultation with the GPII Advisory Group*, Australian Government Department of Health and Ageing, Canberra.

Averhoff, F., Linton, L., Peddecord, K. M., Edwards, C., Wang, W., & Fishbein, D. 2004, "A middle school immunization law rapidly and substantially increases immunization coverage among adolescents", *American Journal of Public Health*, 94(6) pp.978-984

Bagnall, P. 1995, "School nurses' response to the measles vaccination campaign", *Nursing Times*, 91(40) pp.38-39

Barnes, K., Friedman, S. M., Namerow, P. B., & Honig, J. 1999, "Impact of community volunteers on immunization rates of children younger than 2 years", *Archives of Pediatrics and Adolescent Medicine*, 153(5) pp.518-524

Bartu, A., Sharp, J., Ludlow, J., & Doherty, D. A. 2006, "Postnatal home visiting for illicit drug-using mothers and their infants: a randomised controlled trial", *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 46(5) pp.419-426

Bedford, H. & Lansley, M. 2006, "Information on childhood immunisation: parents' views", *Community Practitioner*, 79(8) pp.252-255

Bedford, H. E., Masters, J. I., & Kurtz, Z. 1992, "Immunisation status in inner London primary schools", *Archives of Disease in Childhood*, 67(10) pp.1288-1291

Bell, L. M., Pritchard, M., Anderko, R., & Levenson, R. 1997, "A program to immunize hospitalized preschool-aged children: evaluation and impact", *Pediatrics*, 100(2 Pt 1) pp.192-196

Bond, L., Davie, G., Carlin, J. B., Lester, R., & Nolan, T. 2002, "Increases in vaccination coverage for children in child care, 1997 to 2000: an evaluation of the impact of government incentives and initiatives", *Australian and New Zealand Journal of Public Health*, 26(1) pp.58-64

Bond, L. M., Nolan, T. M., & Lester, R. A. 1998, "Home vaccination for children behind in their immunisation schedule: A randomised controlled trial", *Medical Journal of Australia*, 168(10) pp.487-490

Brink, S. G. 1989, "Provider reminders. Changing information format to increase infant immunizations", *Medical Care*, 27(6) pp.648-653

British Market Research Bureau Social Research 2008, *Health Professionals 2007/08 Childhood Immunisation Survey. 2008 Summary Report*, NHS Immunisation Information.

Browngoehl, K., Kennedy, K., Krotki, K., & Mainzer, H. 1997, "Increasing immunization: a Medicaid managed care model", *Pediatrics*, 99(1) p.E4

Casiday, R. 2006, "Uncertainty, decision-making and trust: lessons from the MMR controversy", *Community Practitioner*, 79(11) pp.354-357

Casiday, R., Cresswell, T., Wilson, D., & Panter-Brick, C. 2006, "A survey of UK parental attitudes to the MMR vaccine and trust in medical authority", *Vaccine*, 24(2) pp.177-184

Casiday, R. E. 2007, "Children's health and the social theory of risk: Insights from the British measles, mumps and rubella (MMR) controversy", *Social Science and Medicine*, 65(5) pp.1059-1070

Centers for Disease Control and Prevention 2000, "Vaccination Coverage Among Adolescents 1 year Before the Institution of a Seventh Grade School Entry Vaccination Requirement -- San Diego, California, 1998", *Morbidity and Mortality Weekly Report*, 49(5) pp.101-102

Centers for Disease Control and Prevention 2001, "Effectiveness of a middle school vaccination law--California, 1999-2001", *MMWR - Morbidity and Mortality Weekly Report*, 50(31) pp.660-663

Chappel, D. & Fernandes, V. 1996, "Improving the coverage of neonatal BCG vaccination", *Journal of Public Health Medicine*, 18(3) pp.308-312

Condon, L. 2002, "Maternal attitudes to preschool immunisations among ethnic minority groups", *Health Education Journal*, 61(2) pp.180-189

Conway, S. P. 1999, "Opportunistic immunisation in hospital.", *Archives of Disease in Childhood*, 81(5) pp.422-425

Crittenden, P. & Rao, M. 1994, "The immunisation coordinator: improving uptake of childhood immunisation", *Communicable Disease Report*, 4(7) p.R79-R81

Cuninghame, C. J., Charlton, C. P. J., & Jenkins, S. M. 1994, "Immunization uptake and parental perceptions in a strictly orthodox Jewish community in north-east London", *Journal of Public Health Medicine*, 16(3) pp.314-317

Department of Health (2005) Vaccination services: reducing inequalities in uptake. London:

Department of Health

Department of Health (2006) Immunisation against infectious disease. London: Department of

Health

El-Mohandes, A. A. E., Katz, K. S., El-Khorazaty, M. N., Neely-Johnson, D., Sharps, P. W., Jarrett, M. H., Rose, A., White, D. M., Young, M., Grylack, L., Murray, K. D., Katta, P. S., Burroughs, M., Atiyeh, G., Wingrove, B. K., & Herman, A. A. 2003, "The effect of a parenting education program

on the use of preventive pediatric health care services among low-income, minority mothers: a randomized, controlled study", *Pediatrics*, 111(6) pp.1324-1332

Evans, M., Stoddart, H., Condon, L., Freeman, E., Grizzell, M., & Mullen, R. 2001, "Parents' perspectives on the MMR immunisation: A focus group study", *British Journal of General Practice*, 51(472) pp.904-910

Ferson, M. J., Fitzsimmons, G., Christie, D., & Woollett, H. 1995, "School health nurse interventions to increase immunisation uptake in school entrants", *Public Health*, 109(1) pp.25-29

Findley, S., Irigoyen, M., Sanchez, M., Guzman, L., Mejia, M., Sajous, M., Levine, D., Chimkin, F., & Chen, S. 2004, "Community empowerment to reduce childhood immunization disparities in New York City", *Ethnicity and Disease*, 14(3 SUPPL. 1) p.S134-S141

Fitzpatrick, P., Molloy, B., & Johnson, Z. 1997, "Community mothers' programme: extension to the travelling community in Ireland", *Journal of Epidemiology and Community Health*, 51(3) pp.299-303

Flynn, M. & Ogden, J. 2004, "Predicting uptake of MMR vaccination: a prospective questionnaire study", *British Journal of General Practice*, 54(504) pp.526-530

Franzini, L., Rosenthal, J., Spears, W., Martin, H. S., Balderas, L., Brown, M., Milne, G., Drutz, J., Evans, D., Kozinetz, C., Oettgen, B., & Hanson, C. 2000, "Cost-effectiveness of childhood immunization reminder/recall systems in urban private practices", *Pediatrics*, 106(1) pp.177-183

Freed, G. L., Freeman, V. A., Mauskopf, A., & Jacobson, R. M. 1999, "Age-appropriate immunization laws: A randomized trial of information dissemination", *Ambulatory Child Health*, 5(1) pp.43-51

Gellatly, J., McVittie, C., & Tiliopoulos, N. 2005, "Predicting parents' decisions on MMR immunisation: A mixed method investigation", *Family Practice*, 22(6) pp.658-662

Gill, E. & Sutton, S. 1993, "Immunisation uptake: the role of parental attitudes," in *Immunisation Research: a Summary Volume*, V. Hey, ed., Health Education Authority, London.

Gill, J. & Scott, J. 1998, "Improving the uptake of selective neonatal BCG immunisation", *Communicable Disease and Public Health*, 1(4) pp.281-282

Gill, J. M., Saldarriaga, A., Mainous, I. I. I. A., & Unger, D. 2002, "Does continuity between prenatal and well-child care improve childhood immunizations?", *Family Medicine*, 34(4) pp.274-280

Goldstein, K. P., Lauderdale, D. S., Glushak, C., Walter, J., & Daum, R. S. 1999, "Immunization outreach in an inner-city housing development: reminder-recall on foot", *Pediatrics*, 104(6) p.E69

Gordon, M., Roberts, H., & Odeka, E. 2007, "Knowledge and attitudes of parents and professionals to neonatal BCG vaccination in light of recent UK policy changes: a questionnaire study", *BMC Infectious Diseases*, 7(82)

Gore, P., Madhavan, S., Curry, D., McClurg, G., Castiglia, M., Rosenbluth, S. A., & Smego, R. A. 1998, "Persuasive messages. Development of persuasive messages may help increase mothers' compliance of their children's immunization schedule", *Marketing Health Services*, 18(4) pp.32-43

Guay, M., Clouatre, A., Blackburn, M., Baron, G., De, W. P., Roy, C., Desrochers, J., & Milord, F. 2003, "Effectiveness and cost comparison of two strategies for hepatitis B vaccination of schoolchildren", *Canadian Journal of Public Health*, 94(1) pp.64-67

Hambidge, S. J., Davidson, A. J., Phibbs, S. L., Chandramouli, V., Zerbe, G., LeBaron, C. W., & Steiner, J. F. 2004, "Strategies to improve immunization rates and well-child care in a

disadvantaged population: a cluster randomized controlled trial", *Archives of Pediatrics and Adolescent Medicine*, 158(2) pp.162-169

Harper, P. G., Madlon-Kay, D. J., Luxenberg, M. G., & Tempest, R. 1997, "A clinic system to improve preschool vaccinations in a low socioeconomic status population", *Archives of Pediatrics and Adolescent Medicine*, 151(12) pp.1220-1223

Harper, P. G. & Murray, D. M. 1994, "An organizational strategy to improve adolescent measles-mumps-rubella vaccination in a low socioeconomic population. A method to reduce missed opportunities.", *Archives of Family Medicine*, 3(3) pp.257-262

Hellerstedt, W. L., Olson, S. M., Oswald, J. W., & Pirie, P. L. 1999, "Evaluation of a community-based program to improve infant immunization rates in rural Minnesota", *American Journal of Preventive Medicine*, 16(3 SUPPL.) pp.50-57

Henderson, L., Millett, C., & Thorogood, N. 2008, "Perceptions of childhood immunization in a minority community: qualitative study.", *Journal of the Royal Society of Medicine*, 101(5) pp.244-251

Henderson, R., Oates, K., Macdonald, H., & Smith, W. C. 2004, "General practitioners' concerns about childhood immunisation and suggestions for improving professional support and vaccine uptake", *Communicable Disease and Public Health*, 7(4) pp.260-266

Henning, K. J., Pollack, D. M., & Friedman, S. M. 1992, "A neonatal hepatitis B surveillance and vaccination program: New York City, 1987 to 1988", *American Journal of Public Health*, 82(6) pp.885-888

Hill CM, Mather M, Goddard J (2003) Cross sectional survey of meningococcal C immunisation in children looked after by local authorities and those living at home. BMJ 326: 364–5

Hilton, S., Hunt, K., & Petticrew, M. 2006, "Gaps in parental understandings and experiences of vaccine-preventable diseases: A qualitative study", *Child: Care, Health and Development*, 33(2) pp.170-179

Hilton, S., Hunt, K., & Petticrew, M. 2007, "MMR: Marginalised, misrepresented and rejected? Autism: A focus group study", *Archives of Disease in Childhood*, 92(4) pp.322-327

Hilton, S., Petticrew, M., & Hunt, K. 2006, "'Combined vaccines are like a sudden onslaught to the body's immune system': Parental concerns about vaccine 'overload' and 'immune-vulnerability'", *Vaccine*, 24(20) pp.4321-4327

Hilton, S., Petticrew, M., & Hunt, K. 2007, "Parents' champions vs. vested interests: Who do parents believe about MMR? A qualitative study", *BMC Public Health*, 7(42)

Hinds, A. & Cameron, J. C. 2004, "Acceptability of universal hepatitis B vaccination among school pupils and parents", *Communicable Disease and Public Health*, 7(4) pp.278-282

Hoekstra, E. J., LeBaron, C. W., & Johnson-Partlow, T. 1999, "Does reminder-recall augment the impact of voucher incentives on immunization rates among inner-city infants enrolled in WIC?", *Journal of Pediatrics*, 135(2 Pt 1) pp.261-263

Hutchinson, S. J., Wadd, S., Taylor, A., Bird, S. M., Mitchell, A., Morrison, D. S., Ahmed, S., & Goldberg, D. J. 2004, "Sudden rise in uptake of hepatitis B vaccination among injecting drug users associated with a universal vaccine programme in prisons", *Vaccine*, 23(2) pp.210-214

Irigoyen, M. M., Findley, S., Earle, B., Stambaugh, K., & Vaughan, R. 2000, "Impact of appointment reminders on vaccination coverage at an urban clinic", *Pediatrics*, 106(4 part 2) p.-23

Jackson, C. 2007, *What is the most effective approach to support informed parental decision-making in relation to the MMR vaccine?*, University of Leeds, Leeds.

Johnson, Z., Howell, F., & Molloy, B. 1993, "Community mothers' programme: randomised controlled trial of non-professional intervention in parenting", *British Medical Journal*, 306(6890) pp.1449-1452

Johnson, Z., Molloy, B., Scallan, E., Fitzpatrick, P., Rooney, B., Keegan, T., & Byrne, P. 2000, "Community Mothers Programme--seven year follow-up of a randomized controlled trial of non-professional intervention in parenting", *Journal of Public Health Medicine*, 22(3) pp.337-342

Johnston, B. D., Huebner, C. E., Anderson, M. L., Tyll, L. T., & Thompson, R. S. 2006, "Healthy steps in an integrated delivery system: child and parent outcomes at 30 months", *Archives of Pediatrics and Adolescent Medicine*, 160(8) pp.793-800

Kempe, A., Lowery, N. E., Pearson, K. A., Renfrew, B. L., Jones, J. S., Steiner, J. F., & Berman, S. 2001, "Immunization recall: effectiveness and barriers to success in an urban teaching clinic.", *Journal of Pediatrics*, 139(5) pp.630-635

Kerpelman, L. C., Connell, D. B., & Gunn, W. J. 2000, "Effect of a monetary sanction on immunization rates of recipients of aid to families with dependent children.", *JAMA: the journal of the American Medical Association*, 284(1) pp.53-59

Kitzman, H., Olds, D. L., Henderson, J., Hanks, C., Cole, R., Tatelbaum, R., McConnochie, K. M., Sidora, K., Luckey, D. W., Shaver, D., Engelhardt, K., James, D., & Barnard, K. 1997, "Effect of prenatal and infancy home visitation by nurses on pregnancy outcomes, childhood injuries, and repeated childbearing: A randomized controlled trial", *JAMA: the journal of the American Medical Association*, 278(8) pp.644-652

Kolasa, M. S., Chilkatowsky, A. P., Stevenson, J. M., Lutz, J. P., Watson, B. M., Levenson, R., & Rosenthal, J. 2003, "Do laws bring children in child care centers up to date for immunizations?", *Ambulatory Pediatrics*, 3(3) pp.154-157

Koniak-Griffin, D., Anderson, N. L. R., Brecht, M. L., Verzemnieks, I., Lesser, J., & Kim, S. 2002, "Public health nursing care for adolescent mothers: Impact on infant health and selected maternal outcomes at 1 year postbirth.", *Journal of Adolescent Health*, 30(1) pp.44-54

Koniak-Griffin, D., Verzemnieks, I. L., Anderson, N. L. R., Brecht, M., Lesser, J., Kim, S., & Turner-Pluta, C. 2003, "Nurse visitation for adolescent mothers: two-year infant health and maternal outcomes", *Nursing Research*, 52(2) pp.127-136

KPMG Consulting 2000, *Evaluation of the General Practice Immunisation Incentives Scheme. Volume 1. Methods, findings and recommendations*, Commonwealth Department of Health and Aged Care, Canberra.

Lam, L. P. & McLaws, M. L. 1998, "Hepatitis B vaccination coverage of Vietnamese children in south-western Sydney", *Australian and New Zealand Journal of Public Health*, 22(4) pp.502-504

Lamden, K. 2005, *Evaluation of the use of a parental MMR invitation letter - for children at the age of 13 months*.

Larcher, V. F., Bourne, J., Aitken, C., Jeffries, D., Hodes, D., Sloan, D., Ramsay, M., Goldberg, D., & Bramley, C. 2001, "Overcoming barriers to hepatitis B immunisation by a dedicated hepatitis B immunisation service", *Archives of Disease in Childhood*, 84(2) pp.114-119

Lawrence, G. L., Macintyre, C. R., Hull, B. P., & McIntyre, P. B. 2004, "Effectiveness of the linkage of child care and maternity payments to childhood immunisation", *Vaccine*, 22(17-18) pp.2345-2350

Lewendon, G. J. & Maconachie, M. 2002, "Why are children not being immunised? Barriers to immunisation uptake in South Devon", *Health Education Journal*, 61(3) pp.212-220

Lieu, T. A., Black, S. B., Ray, P., Schwalbe, J. A., Lewis, E. M., Lavetter, A., Morozumi, P. A., & Shinefield, H. R. 1997, "Computer-generated recall letters for underimmunized children: how cost-effective?", *Pediatric Infectious Disease Journal*, 16(1) pp.28-33

Lieu, T. A., Capra, A. M., Makol, J., Black, S. B., & Shinefield, H. R. 1998, "Effectiveness and cost-effectiveness of letters, automated telephone messages, or both for underimmunized children in a health maintenance organization", *Pediatrics*, 101(4) p.E3

Loewenthal, K. M. & Bradley, C. 1996, "Immunization uptake and doctors' perceptions of uptake in a minority group: Implications for interventions", *Psychology, Health and Medicine*, 1(2) pp.223-230

Lunts, E. & Cowper, D. 2002, "Parents refusing MMR: do GPs and health visitors understand why?", *Community Practitioner*, 75(3) pp.94-96

Macdonald, H., Henderson, R., & Oates, K. 2004, "Low uptake of immunisation: contributing factors", *Community Practitioner*, 77(3) pp.95-100

Margolis, P. A., Lannon, C. M., Stuart, J. M., Fried, B. J., Keyes-Elstein, L., & Moore, D. E. J. 2004, "Practice based education to improve delivery systems for prevention in primary care: randomised trial", *British Medical Journal*, 328(7436) pp.388-392

Mason, B. W. & Donnelly, P. D. 2000, "Targeted mailing of information to improve uptake of measles, mumps, and rubella vaccine: a randomised controlled trial", *Communicable Disease and Public Health*, 3(1) pp.67-68

McMurray, R., Cheater, F. M., Weighall, A., Nelson, C., Schweiger, M., & Mukherjee, S. 2004, "Managing controversy through consultation: a qualitative study of communication and trust around MMR vaccination decisions.", *British Journal of General Practice*, 54(504) pp.520-525

McPhee, S. J., Nguyen, T., Euler, G. L., Mock, J., Wong, C., Lam, T., Nguyen, W., Nguyen, S., Ha, M. Q., Do, S. T., & Buu, C. 2003, "Successful promotion of hepatitis B vaccinations among Vietnamese-American children ages 3 to 18: results of a controlled trial", *Pediatrics*, 111(6) pp.1278-1288

Minkovitz, C., Holt, E., Hughart, N., Hou, W., Thomas, L., Dini, E., & Guyer, B. 1999, "The effect of parental monetary sanctions on the vaccination status of young children: An evaluation of welfare reform in Maryland", *Archives of Pediatrics and Adolescent Medicine*, 153(12) pp.1242-1247

Minkovitz, C. S., Belote, A. D., Higman, S. M., Serwint, J. R., & Weiner, J. P. 2001, "Effectiveness of a practice-based intervention to increase vaccination rates and reduce missed opportunities", *Archives of Pediatrics and Adolescent Medicine*, 155(3) pp.382-386

Mixer, R. E., Jamrozik, K., & Newsom, D. 2007, "Ethnicity as a correlate of the uptake of the first dose of mumps, measles and rubella vaccine", *Journal of Epidemiology and Community Health*, 61(9) pp.797-801

Morgan, M. Z. & Evans, M. R. 1998, "Initiatives to improve childhood immunisation uptake: a randomised controlled trial", *British Medical Journal*, 316(7144) pp.1569-1570

Morita, J. Y., Ramirez, E., & Trick, W. E. 2008, "Effect of a school-entry vaccination requirement on racial and ethnic disparities in hepatitis B immunization coverage levels among public school students", *Pediatrics*, 121(3) p.E547-E552

Muehleisen, B., Baer, G., Schaad, U. B., & Heininger, U. 2007, "Assessment of immunization status in hospitalized children followed by counseling of parents and primary care physicians improves vaccination coverage: an interventional study", *Journal of Pediatrics*, 151(6) pp.704-706

Mullaney, C., Heathcock, R., Victor, C., Jones, I., & Smith, H. In the context of controversy over safety of MMR and an outbreak of measles, what parental factors are associated with uptake of MMR? 2008.

Murphy, A. W., Harrington, M., Bury, G., O'Doherty, K., O'Kelly, F., Smith, M., Vickers, L., & Johnson, H. 1996, "Impact of a collaborative immunisation programme in an inner city practice", *Irish Medical Journal*, 89(6) pp.220-221

National Centre for Immunisation Research and Surveillance 1999a, "Evaluation of the intervention for school aged children (aged 5 - 12 years). Part A. Estimation of overall MMR coverage using real time data collected during the Campaign.," in *Australian Measles Control Campaign 1998. Evaluation Report*, National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, Sydney, pp. 19-30.

National Centre for Immunisation Research and Surveillance 1999b, "Evaluation of the intervention for school aged children (aged 5 - 12 years). Part B. Post Campaign surveys.," in *Australian Measles Control Campaign 1998. Evaluation Report*, National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, Sydney, pp. 31-44.

National Centre for Immunisation Research and Surveillance 1999c, "Evaluation of the intervention fro preschool aged children (aged 12 months to 3.5 years)," in *Australian Measles Control Campaign 1998. Evaluation Report*, National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, Sydney, pp. 55-82.

National Centre for Immunisation Research and Surveillance 1999d, "Evaluation of the response to the Campaign using data from the Australian Childhood Immunisation Register (children aged from birth to 7 years)," in *Australian Measles Control Campaign 1998. Evaluation Report*, National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, Sydney, pp. 83-97.

National Centre for Immunisation Research and Surveillance 1999e, "Serological evaluation of the Campaign (children and young people aged 1 - 18 years)," in *Australian Measles Control Campaign 1998. Evaluation Report*, National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, Sydney, pp. 83-97.

Norr, K. F., Crittenden, K. S., Lehrer, E. L., Reyes, O., Boyd, C. B., Nacion, K. W., & Watanabe, K. 2003, "Maternal and Infant Outcomes at One Year for a Nurse-Health Advocate Home Visiting Program Serving African Americans and Mexican Americans.", *Public Health Nursing*, 20(3) pp.190-203

O'Sullivan, A. L. & Jacobsen, B. S. 1992, "A randomized trial of a health care program for first-time adolescent mothers and their infants", *Nursing Research*, 41(4) pp.210-215

Pareek, M. & Pattison, H. M. 2000, "The two-dose measles, mumps, and rubella (MMR) immunisation schedule: Factors affecting maternal intention to vaccinate", *British Journal of General Practice*, 50(461) pp.969-971

Paunio, M., Virtanen, M., Peltola, H., Cantell, K., Paunio, P., Valle, M., Karanko, V., & Heinonen, O. P. 1991, "Increase of vaccination coverage by mass media and individual approach: Intensified measles, mumps, and rubella prevention program in Finland", *American Journal of Epidemiology*, 133(11) pp.1152-1160

Peckham C, Bedford H, Seturia Y et al. (1989) The Peckham report – national immunisation study: factors influencing immunisation uptake in childhood. London: Action Research for the Crippled Child

Penrice, G. M., McMenamin, J., & Cameron, S. O. 2000, "Hepatitis B immunisation of infants at risk", *Communicable Disease and Public Health*, 3(3) pp.215-216

Petrovic, M., Roberts, R., & Ramsay, M. 2001, "Second dose of measles, mumps, and rubella vaccine: questionnaire survey of health professionals.", *British Medical Journal*, 322(7278) pp.82-85

Petrovic, M., Roberts, R. J., Ramsay, M., & Charlett, A. 2003, "Parents' attitude towards the second dose of measles, mumps and rubella vaccine: a case-control study", *Communicable Disease and Public Health*, 6(4) pp.325-329

Poltorak, M., Leach, M., Fairhead, J., & Cassell, J. 2005, "'MMR Talk' and Vaccination Choices: An Ethnographic Study in Brighton", *Social Science and Medicine*, 61(3) pp.709-719

Raithatha, N., Holland, R., Gerrard, S., & Harvey, I. 2003, "A qualitative investigation of vaccine risk perception amongst parents who immunize their children: A matter of public health concern", *Journal of Public Health Medicine*, 25(2) pp.161-164

Ramsay, M. E., Yarwood, J., Lewis, D., Campbell, H., & White, J. M. 2002, "Parental confidence in measles, mumps and rubella vaccine: Evidence from vaccine coverage and attitudinal surveys", *British Journal of General Practice*, 52(484) pp.912-916

Redsell, S. A., Bedford, H., Siriwardena, N., Collier, J., & Atkinson, P. Health visitors' role in comunicating with parents about childhood immunisation. 2008.

Reid, J. A. 1989, "Vaccination viewpoints", *Health Visitor*, 62(4) pp.121-123

Ressler, K. A., Orr, K., Bowdler, S., Grove, S., Best, P., & Ferson, M. J. 2008, "Opportunistic immunisation of infants admitted to hospital: are we doing enough?", *Journal of Paediatrics and Child Health*, 44(6) pp.317-320

Riley, D. J., Mughal, M. Z., & Roland, J. 1991, "Immunisation state of young children admitted to hospital and effectiveness of a ward based opportunistic immunisation policy.", *British Medical Journal*, 302(6767) pp.31-33

Riley, R., Maher, C., & Kolbe, A. 1993, "Hepatitis B vaccination of high-risk neonates in the South West Region of New South Wales: Evaluation of program coverage", *Australian Journal of Public Health*, 17(2) pp.171-173

Rodewald, L. E., Szilagyi, P. G., Humiston, S. G., Barth, R., Kraus, R., & Raubertas, R. F. 1999, "A randomized study of tracking with outreach and provider prompting to improve immunization coverage and primary care", *Pediatrics*, 103(1) pp.31-38

Rodewald, L. E., Szilagyi, P. G., Humiston, S. G., Raubertas, R. F., Wassilak, S., Roghmann, K. J., & Hall, C. B. 1996, "Effect of emergency department immunizations on immunization rates and subsequent primary care visits", *Archives of Pediatrics and Adolescent Medicine*, 150(12) pp.1271-1276

Rogers, A. & Pilgrim, D. 1994, "Rational non-compliance with childhood immunisation: personal accounts of parents and primary health care professionals," in *Uptake of Immunisation: Issues for Health Education*, Health Education Authority, London.

Rosenberg, Z., Findley, S., McPhillips, S., Penachio, M., & Silver, P. 1995, "Community-based strategies for immunizing the 'hard-to-reach' child: The New York State immunization and primary health care initiative", *American Journal of Preventive Medicine*, 11(3 SUPPL.) pp.14-20

Samad L, Tate AR, Dezateux C et al. (2006) Differences in risk factors for partial and no immunisation in the first year of life: prospective cohort study. BMJ 332: 1312–3

Saffin, K. 1992, "School nurses immunising without a doctor present", *Health Visitor*, 65(11) pp.394-396

Shah, S., Raman, S., Moreira, C., & Macintyre, C. R. 2001, "School immunisation certificates--a review over time in a disadvantaged community", *Australian and New Zealand Journal of Public Health*, 25(6) pp.534-538

Simpson, N., Lenton, S., & Randall, R. 1995, "Parental refusal to have children immunised: extent and reasons", *British Medical Journal*, 310(6974) p.227

Sinn, J. S., Morrow, A. L., & Finch, A. B. 1999, "Improving immunization rates in private pediatric practices through physician leadership", *Archives of Pediatrics and Adolescent Medicine*, 153(6) pp.597-603

Skinner, S. R., Imberger, A., Nolan, T., Lester, R., Glover, S., & Bowes, G. 2000, "Randomised controlled trial of an educational strategy to increase school-based adolescent hepatitis B vaccination", *Australian and New Zealand Journal of Public Health*, 24(3) pp.298-304

Skull, S., Krause, V., Roberts, L., & Dalton, C. 1999, "Evaluating the potential for opportunistic vaccination in a Northern Territory hospital", *Journal of Paediatrics and Child Health*, 35(5) pp.472-475

Smailbegovic, M. S., Laing, G. J., & Bedford, H. 2003, "Why do parents decide against immunization? The effect of health beliefs and health professionals", *Child: Care, Health and Development*, 29(4) pp.303-311

Smith, A., McCann, R., & McKinlay, I. 2001, "Second dose of MMR vaccine: health professionals' level of confidence in the vaccine and attitudes towards the second dose", *Communicable Disease and Public Health*, 4(4) pp.273-277

Smith, A., Yarwood, J., & Salisbury, D. M. 2007, "Tracking mothers' attitudes to MMR immunisation 1996-2006", *Vaccine*, 25(20) pp.3996-4002

Sporton, R. K. & Francis, S. A. 2001, "Choosing not to immunize: are parents making informed choices", *Family Practice*, 18(2) pp.181-188

Steele, R. W. & O'Keefe, M. A. 2001, "A program description of health care interventions for homeless teenagers", *Clinical Pediatrics*, 40(5) pp.259-263

Stehr-Green, P. A., Dini, E. F., Lindegren, M. L., & Patriarca, P. A. 1993, "Evaluation of telephoned computer-generated reminders to improve immunization coverage at inner-city clinics", *Public Health Reports*, 108(4) pp.426-430

Stille, C. J., Christison-Lagay, J., Bernstein, B. A., & Dworkin, P. H. 2001, "A simple provider-based educational intervention to boost infant immunization rates: A controlled trial", *Clinical Pediatrics*, 40(7) pp.365-373

Stroffolini, T. & Pasquini, P. 1990, "Five years of vaccination campaign against hepatitis B in Italy in infants of hepatitis B surface antigen carrier mothers", *Italian Journal of Gastroenterology*, 22(4) pp.195-197

Szilagyi, P. G., Rodewald, L. E., Humiston, S. G., Fierman, A. H., Cunningham, S., Gracia, D., & Birkhead, G. S. 1997, "Effect of 2 urban emergency department immunization programs on childhood immunization rates", *Archives of Pediatrics and Adolescent Medicine*, 151(10) pp.999-1006

Szilagyi, P. G., Rodewald, L. E., Humiston, S. G., Pollard, L., Klossner, K., Jones, A. M., Barth, R., & Woodin, K. A. 1996, "Reducing missed opportunities for immunizations: Easier said than done", *Archives of Pediatrics and Adolescent Medicine*, 150(11) pp.1193-1200

Szilagyi, P. G., Schaffer, S., Barth, R., Shone, L. P., Humiston, S. G., Ambrose, S., & Averhoff, F. 2006, "Effect of telephone reminder/recall on adolescent immunization and preventive visits: Results from a randomized clinical trial", *Archives of Pediatrics and Adolescent Medicine*, 160(2) pp.157-163

Szilagyi, P. G., Schaffer, S., Shone, L., Barth, R., Humiston, S. G., Sandler, M., & Rodewald, L. E. 2002, "Reducing geographic, racial, and ethnic disparities in childhood immunization rates by using reminder/recall interventions in urban primary care practices", *Pediatrics*, 110(5) p.E58

Taylor, J. A., Davis, R. L., & Kemper, K. J. 1997, "Health care utilization and health status in high-risk children randomized to receive group or individual well child care", *Pediatrics*, 100(3) p.E1

Tickner, S., Leman, P. J., & Woodcock, A. 2007, "'It's just the normal thing to do': Exploring parental decision-making about the 'five-in-one' vaccine", *Vaccine*, 25(42) pp.7399-7409

Tseng, E., Nesbitt, A., & O'Sullivan, D. 1997, "Audit of the implementation of selective neonatal BCG immunisation in south east London", *Communicable Disease Report*, 7(11) p.R165-R168

Vallely, L. A., Roberts, S. A., Kitchener, H. C., & Brabin, L. 2008, "Informing adolescents about human papillomavirus vaccination: What will parents allow?", *Vaccine*, 26(18) pp.2203-2210

Vivier, P. M., Alario, A. J., O'Haire, C., Dansereau, L. M., Jakum, E. B., & Peter, G. 2000, "The impact of outreach efforts in reaching underimmunized children in a Medicaid managed care practice", *Archives of Pediatrics and Adolescent Medicine*, 154(12) pp.1243-1247

Wilcox, S. A., Koepke, C. P., Levenson, R., & Thalheimer, J. C. 2001, "Registry-driven, community-based immunization outreach: A randomized controlled trial.", *American Journal of Public Health*, 91(9) pp.1507-1511

Wilson, T. R., Fishbein, D. B., Ellis, P. A., & Edlavitch, S. A. 2005, "The impact of a school entry law on adolescent immunization rates", *Journal of Adolescent Health*, 37(6) pp.511-516

Wood, D., Halfon, N., Donald-Sherbourne, C., Mazel, R. M., Schuster, M., Hamlin, J. S., Pereyra, M., Camp, P., Grabowsky, M., & Duan, N. 1998, "Increasing immunization rates among inner-city, African American children: A randomized trial of case management", *JAMA: the journal of the American Medical Association*, 279(1) pp.29-34

Wroe, A. L., Bhan, A., Salkovskis, P., & Bedford, H. 2005, "Feeling bad about immunising our children", *Vaccine*, 23(12) pp.1428-1433