

NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

PUBLIC HEALTH DRAFT GUIDANCE

Issue date:

Reducing differences in the uptake of immunisations (including targeted vaccines) in children and young people aged under 19 years

NICE public health guidance X

Introduction

The Department of Health (DH) asked the National Institute for Health and Clinical Excellence (NICE) to produce public health guidance on reducing differences in the uptake of immunisations, including targeted vaccinations, among children and young people aged under 19 years.

The guidance focuses on increasing immunisation uptake among children and young people aged under 19 in groups and settings where immunisation coverage is low. It also focuses on increasing vaccinations of babies born to mothers infected with hepatitis B.

It is for NHS and other professionals, commissioners and managers who have a direct or indirect role in, and responsibility for, the immunisation of children and young people. This includes those working in: local authorities, education and the wider public, private voluntary and community, sectors. It may also be of interest to parents, carers and all those who look after the health and wellbeing of children and young people and other members of the public.

This guidance supports national policy and guidance from the Department of Health as set out in the 'Green book' (DH 2006) and the NHS immunisation website www.immunisation.nhs.uk It complements, but does not replace, NICE guidance on reducing the transmission of sexually transmitted

infections, diagnosing and managing tuberculosis and antenatal and postnatal care (for further details, see section 7).

The Public Health Interventions Advisory Committee (PHIAC) has considered both the review of the evidence and the economic analysis.

This document sets out the Committee's preliminary recommendations. It does not include all sections that will appear in the final guidance. NICE is now inviting comments from stakeholders (listed on our website at www.nice.org.uk).

Note that this document does not constitute NICE's formal guidance on reducing differences in the uptake of immunisations. The recommendations made in section 1 are provisional and may change after consultation with stakeholders and fieldwork.

The stages NICE will follow after consultation (including fieldwork) are summarised below.

- The Committee will meet again to consider the comments, reports and any additional evidence that has been submitted.
- After that meeting, the Committee will produce a second draft of the guidance.
- The draft guidance will be signed off by the NICE Guidance Executive.

For further details, see 'The public health guidance development process: an overview for stakeholders including public health practitioners, policy makers and the public' (this document is available at www.nice.org.uk/phprocess).

The key dates are:

Closing date for comments: 2 June 2009.

Fourth Committee meeting: 19 June 2009.

Members of PHIAC are listed in appendix A and supporting documents used to prepare this document are listed in appendix E.

Reducing differences in the uptake of immunisations consultation draft

This guidance was developed using the NICE public health intervention process.

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1 Recommendations

When writing the recommendations, the Public Health Interventions Advisory Committee (PHIAC) (see appendix A) considered the evidence of effectiveness and cost effectiveness. Note: this document does not constitute NICE's formal guidance on this intervention. The recommendations are preliminary and may change after consultation.

The recommendations support implementation of the vaccination courses as indicated in the 'Green book' (DH 2006) and timely vaccination according to the recommended schedule (www.immunisation.nhs.uk).

The evidence statements underpinning the recommendations are listed in appendix C.

The evidence review, supporting evidence statements and economic analysis are available at www.nice.org.uk/Guidance/PHG/Wave15/9

Recommendation 1: immunisation programmes

Who is the target population?

- Children and young people aged under 19, particularly those who may not have been immunised or have only been partially immunised.
- Parents and carers of children and young people aged under 19.

Who should take action?

- Commissioners, managers and coordinators of children's services in primary care trusts (PCTs), children's trusts, Sure Start children's centres and services run by family nurse partnerships.
- Health professionals responsible for children's immunisation services, including directors of public health, paediatricians, GPs and health visitors.
- Immunisation coordinators and others who work in immunisation services in strategic health authorities (SHAs), PCTs and GP practices.

- Health protection specialists and immunisation leads in health protection units (HPUs).

What action should they take?

Ensure the Department of Health's (DH) guidance and recommendations on immunisation are disseminated and implemented. This includes adopting a multifaceted, coordinated programme across different settings to increase timely immunisation among groups with low or partial uptake. The programme should form part of the local child health strategy and should include the following actions:

- Monitor vaccination status as part of a wider assessment of children and young people's health.
- Ensure an identified healthcare professional in the GP practice is responsible for implementing the local childhood immunisation programme.
- Provide parents, carers and young people with tailored information, advice and support to ensure they know about the recommended routine childhood vaccinations and the benefits and risks. This includes detail on the infections they prevent. Information should be provided in alternative formats for example, to help those whose first language is not English.
- Ensure parents and carers have an opportunity to discuss any concerns they might have. This could either be in person or by telephone with a GP, health visitor, school nurse or practice nurse.
- Send tailored reminders and recall invitations when a child does not attend vaccination appointments. Reminder invitations could be delivered by text message, telephone or letter.
- Improve access to immunisation services for example, by extending clinic times, reducing waiting times and ensuring waiting areas are child-friendly.
- Check immunisation status at every appropriate opportunity whether in primary care (for example, as part of a healthy child development review),

hospital in- or outpatient and accident and emergency departments, walk-in centres or minor injuries units. Use the personal child health record (PCHR) as appropriate. Discuss outstanding vaccinations with the parent, carer and young person. Where parents or carers have expressed views about immunisation and this is documented, these appointments should be used as an opportunity to have a further discussion. If appropriate, offer vaccinations by trained staff before they leave the hospital. In such cases, notify the child or young person's GP so that the GP records can be updated.

- Consider offering vaccinations at home for children whose parents and carers have not responded to reminders, recall invitations or appointments for immunisation.

Recommendation 2: information systems

Who is the target population?

- Children and young people aged under 19, particularly those who may not have been immunised or have only been partially immunised.
- Parents and carers of children and young people aged under 19.

Who should take action?

- Those responsible for information services within SHAs, PCTs, acute trusts and GP practices.
- SHA and PCT immunisation coordinators, directors of public health and community paediatricians.
- Health protection specialists and immunisation leads in HPUs.
- GPs, nurses and health visitors.
- Independent and private sector providers of immunisation services.

What action should they take?

- Ensure there is a clear system within GP practices, PCTs and SHAs for recording and maintaining accurate information on the vaccination status of all children. The same data should be used for cover of vaccination evaluated rapidly (COVER) and GP childhood immunisation target reporting. It should be possible to identify patients from this data.
- Ensure information systems can record vaccinations carried out by private providers on children and young people who live in the SHA, PCT or practice area.
- Private providers should report all vaccinations carried out on children and young people to the relevant GP practice or PCT so they can be recorded on the appropriate information system.
- Record the factors which make it less likely that a child or young person will be up-to-date with vaccinations. For example, note if children and young people are looked after, have special needs or have any contraindications to vaccination. Also note if the parents or carers have expressed their views on vaccination.
- Regularly update and maintain the databases for recording children and young people's immunisation status. Follow-up on any missing data to ensure up-to-date vaccination coverage data are available to all healthcare professionals.
- Record administered vaccinations in the personal child health record (PCHR or 'Red book').
- Use recorded information to inform local immunisation needs assessments and support delivery of an immunisation programme for children and young people.

Recommendation 3: training

Who is the target population?

Those who advise on and provide vaccination and immunisation services. including:

- GPs, health visitors, practice nurses, community nurses (including school nurses), midwives, nurses working in neonatal care and nursery nurses
- PCT immunisation coordinators and HPU immunisation leads
- hospital and community paediatricians and pharmacists
- public health professionals
- NHS health trainers
- support staff including clinic clerks and receptionists.

Who should take action?

- Professional bodies, skills councils and other organisations responsible for setting competencies and developing continuing professional development programmes for health professionals.
- HPUs.
- PCTs and SHAs.
- Private and independent sector providers of immunisation services for children and young people aged under 19.

What action should they take?

- Ensure all staff involved in immunisation services are appropriately trained. Training should be tailored to individual needs to ensure staff have the necessary skills (for example, communication skills) and knowledge to fulfil their immunisation role.

- Health professionals who deliver vaccinations should have received training that complies with the 'National minimum standard for immunisation training' (Health Protection Agency et al. 2005a¹).
- Professional bodies should ensure health professionals working with children and young people have the appropriate knowledge and skills to give advice on the core topics defined in the Health Protection Agency's 'Core curriculum for immunisation training' (Health Protection Agency et al. 2005b²).

Recommendation 4: nurseries, schools, colleges of further education

Who is the target population?

- Children and young people aged under 19 attending nurseries, schools and colleges, particularly those who may not have been immunised or have only been partially immunised.
- Parents and carers of children and young people aged under 19.

Who should take action?

- PCT directors of public health, immunisation coordinators and community paediatricians.
- Community nurses including health visitors, school nurses and those involved in family nurse partnerships.
- Head teachers, school governors, heads of further education colleges.
- Nursery, pre-school and early years providers.
- Managers, nurses and early years support staff in Sure Start children's centres and children's services.

¹ www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1204100464376

² www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1204100466949?p=1153846674367

What action should they take?

- The Healthy Child team (led by a health visitor working with the local GP) should be able to check each child's immunisation record, including the personal child health record (PHCR), when they join a nursery, start pre-school education and school. They should do this in conjunction with staff at the nursery, Sure Start children's centre or school.
- School and community nurses, working with the local GP and school, should check the vaccination status of children and young people when they transfer to a new school or to college. Working with the PCT, they should also advise students, parents and carers about the tetanus, diphtheria and polio booster dose. This is recommended between the ages of 13 and 18 (that is, before leaving school).
- School nurses should provide children and young people who are not up-to-date with immunisations with advice and information. They should offer vaccinations to help them catch up with the recommended immunisation cover (for example, where necessary, offer them MMR).
- Explain to students, parents and carers why immunisation is important. Encourage children and young people who have not completed the recommended vaccination schedule to be vaccinated. Vaccinations can be given by the school nurse or their GP. Provide parents and carers with information in an appropriate language and format.
- Encourage schools to become venues for vaccination of children and siblings, as part of their extended school role.

Recommendation 5: groups at increased risk of not being fully immunised**Who is the target population?**

- Children and young people aged under 19 from groups at risk of not being immunised or only partially immunised.

- Parents and carers of these children and young people.

Who should take action?

- Commissioners, managers and coordinators of children's services in PCTs, children's trusts and Sure Start children's centres.
- Health professionals responsible for children's immunisation services, including directors of public health, paediatricians, GPs, health visitors and those involved in family nurse partnerships.
- Immunisation coordinators and others who work in immunisation services in SHAs, PCTs and GP practices.
- Health professionals who have contact with children and young people aged under 19.

What action should they take?

- Improve access for those with transport, language or communication difficulties, and those with physical or mental disabilities. For example, provide walk-in vaccination clinics, services offering extended hours and mobile or outreach services.
- Provide accurate, up-to-date written information on the benefits of childhood immunisation against vaccine-preventable diseases, tailored for different communities and groups, according to local circumstances. For example, offer translation services and provide information in multiple languages. Consider using pharmacies, retail outlets, libraries and local community venues to promote and disseminate the information.
- Health professionals should check the immunisation history of asylum seekers when they arrive in the country. Discuss outstanding vaccinations with the parent, carer and young person and offer appropriate ones, administered by trained staff.
- Prison health services should check the immunisation history of young offenders. They should discuss outstanding vaccinations with the parent,

carer and young person and offer appropriate ones, administered by trained staff.

- Offer looked after children vaccinations during their annual health plan review or via school-based immunisation programmes.

Recommendation 6: neonatal hepatitis B

Who is the target population?

- Children born to mothers who are hepatitis B-positive.
- Parents and carers of children who are hepatitis B-positive.

Who should take action?

- GPs, health visitors, midwives, neonatal and community paediatricians, nursery and neonatal nurses, support workers and those involved in family nurse partnerships.
- PCT directors of public health and immunisation coordinators.
- Managers and family health and support teams in children's services
- Managers, health professionals and early years support staff in Sure Start children's centres.

What action should they take?

- Develop and implement a clear process for the local neonatal hepatitis B vaccination programme. It should ensure that antenatal, postnatal, neonatal paediatric, primary care and community support teams communicate effectively. Babies born to hepatitis B-positive mothers should be given the first dose promptly, whether delivered in hospital or the community. They should also receive all other recommended doses at the right time.
- Consider having an identified person responsible for vaccination of babies at risk of hepatitis B.

- Health professionals should record the mother's hepatitis B status in the personal child health record (PCHR) as soon as possible after birth (and before the neonatal period ends (that is, 28 days after birth)).
- Health professionals should provide information, advice and support to parents and carers to prevent the transmission of hepatitis B. In addition, they should emphasise the importance of ensuring babies complete the recommended vaccination course at the right time.

(See also NICE clinical guideline 62 on antenatal care at www.nice.org.uk/CG62)

2 Public health need and practice

The government is committed to an effective childhood immunisation programme to reduce the incidence of childhood infections such as meningitis C and measles. This commitment is emphasised in the government strategy for children and young people's health (DH 2009a) and the 'National service framework for children, young people and maternity services' (DH 2004). A priority for primary care trusts (PCTs) is to increase the proportion of children who have received all their immunisations (DH 2008; 2009b).

The national childhood immunisation programme is offered routinely through primary care and other health services. However, differences in uptake persist and are associated with a range of social, demographic, maternal- and infant-related factors (Peckham et al. 1989; Samad et al. 2006).

Immunisation coverage varies within and between strategic health authority (SHA) regions. In most localities, uptake of the primary vaccines (diphtheria, tetanus, pertussis, polio, haemophilus influenza type B, meningitis C and pneumococcal vaccine) is above 90%. (These are due to be completed by the time a child is aged 24 months.) The exception is London (all vaccines) and measles mumps and rubella (MMR) vaccination (nationally); lower levels are also reported for booster doses. Even where coverage appears to be high, there may still be groups of children who are at risk of acquiring vaccine-preventable infections.

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Groups at risk

Evidence has shown that the following groups of children and young people are at risk of not being fully immunised:

- those who have missed previous vaccinations (whether as a result of parental choice or otherwise)
- looked after children
- those with physical or learning difficulties
- children of teenage or lone parents
- those not registered with a GP
- younger children from large families
- children who are hospitalised
- those from a minority ethnic group
- those from non-English speaking families
- vulnerable children, such as those whose families are travellers, asylum seekers or are homeless.

(DH 2005; Hill et al. 2003; Peckham et al. 1989; Samad et al. 2006.)

In addition, some groups are less likely to have received certain vaccines.

There is some evidence that uptake of MMR has declined at a greater rate among children of more highly educated parents and those living in more affluent areas (Wright and Polack 2005). Pearce et al. (2008) found that maternal education to degree level was a risk factor for not receiving the MMR triple vaccine. A study of over a million children born in Scotland between 1987 and 2004 found that children of more affluent parents were generally either vaccinated on time or not at all. Late MMR vaccination was associated with socioeconomic disadvantage (Friederichs et al. 2006).

An estimated 3 million children aged 18 months to 18 years may have missed either their first or their second MMR vaccination (DH 2008). The potential exposure of so many children and young people to the measles virus means that there is a risk of a large outbreak, particularly in London. As measles can lead to serious complications – and can even be fatal, PCTs have been

supported and funded to help these children have the MMR vaccination during 2008/9 (DH 2008).

Neonatal hepatitis B

Hepatitis B infection can be transmitted at birth to babies whose mothers are infected with the hepatitis B virus, so all pregnant women should be offered screening for hepatitis B during pregnancy (DH 2006).

If a pregnant woman has hepatitis B, the baby should receive an initial dose of the vaccine within 24 hours of birth, with further doses at 1, 2 and 12 months. Some babies, including those who are born prematurely or born weighing less than 1500g, may also need hepatitis B immunoglobulin at birth (DH 2006).

Hepatitis B infection is relatively uncommon in the UK. The rates are higher among groups that have their origins in endemic countries compared with groups born in the UK. The incidence of infection is also higher among south Asian residents in England and Wales, particularly children (Hahné et al. 2004). Infection in children rarely leads to acute hepatitis. Chronic infection is more common however, and, if untreated it may result in cirrhosis or liver cancer, leading to liver failure and death.

Although coverage for the birth dose of the hepatitis B vaccine appears to be high, subsequent vaccinations may be delayed or never received (Sloan et al. 2005). Routine coverage data suggests that coverage at age 12 months is 69%, with considerable variation between regions. London has the highest percentage of babies born to infected mothers, yet the reported coverage at 12 months is only 54%³.

3 Considerations

PHIAC took account of a number of factors and issues when developing the recommendations

³ Health Protection Agency Vaccine coverage and COVER [online]. Available at www.hpa.org.uk/webw/HPAweb&Page&HPAwebAutoListName/Page/1204031507699?p=1204031507699

- 3.1 Childhood immunisation needs to be part of a wider healthy child programme. This is because children who are not up-to-date with vaccinations may also be behind on other healthy child programme activities – or may have other health needs. The parents and carers of these children and young people may need additional support, information and encouragement to ensure their children complete the vaccination programme.
- 3.2 The UK childhood immunisation schedule is timed to take into account when children are likely to encounter vaccine-preventable infections and when, physiologically, they can produce a protective immune response. Although vaccinations should always be given, even when there has been a delay, the focus should be on ensuring children and young people receive them in line with the national recommended schedule.
- 3.3 There was little published evidence on information recording and monitoring systems. However, PHIAC considered that evidence from practice was a valid and appropriate basis for a recommendation. It also recognised the fundamental role that accurate records and effective information systems play in enabling services to contact in children and young people who may not be fully immunised.
- 3.4 Most published research on interventions to increase immunisation uptake is non-UK based (85%). Nevertheless, PHIAC judged that some of the evidence was applicable to the UK, particularly in terms of at-risk groups. As such, it deemed it could be used to inform the recommendations.
- 3.5 Evidence from other countries suggests that legislation or a requirement for proof-of-immunisation for nursery or school entry does increase vaccine coverage. PHIAC noted that school entry offers an opportunity for checking immunisation status and to provide relevant advice and information. It believes this may be

acceptable to parents, carers and schools. However, PHIAC also noted that an over-reliance on school entry as a checkpoint for immunisation status could have an adverse impact on timely vaccination in the pre-school years.

- 3.6 PHIAC noted that the timing of some research affected how it might apply to the current UK context. For example, research published in 1998 raised concerns about the safety of the MMR vaccine, suggesting a link with autism and certain bowel problems. As a result, some parents and carers chose not to immunise their children, delayed the immunisation or only allowed their children to receive one of the two doses of the vaccine. Despite extensive studies that have found no evidence to link the vaccine to adverse events, and advice from professionals (including the DH), some parents remain concerned. The subsequent reduction in vaccination coverage in England has led to outbreaks of measles. More recently, MMR vaccine coverage has begun to increase.
- 3.7 Vaccination can provide indirect benefits to people who are not immunised – so-called ‘herd immunity’. The higher the proportion of the population who are vaccinated against an infection, the lower the proportion at risk of becoming infected (and the lower the chance of infection spreading within the population). People who have not been immunised (by choice or for medical reasons) and those in whom immunisation did not produce a protective immune response also benefit from this reduced transmission. Once the proportion of people vaccinated reaches a critical level, there may still be cases of the infection but there will not be an epidemic. This level varies for different infections, but is over 95% for measles. The current UK coverage for MMR at age 2 is 84.5% for the whole of England and 74.8% for London⁴. This is below the level needed to prevent epidemics and, consequently, measles outbreaks are

⁴www.hpa.org.uk/webw/HPAweb&Page&HPAwebAutoListName/Page/1204031507699?p=1204031507699

occurring. Even if vaccine coverage levels are higher than needed to prevent an epidemic, it is important to maintain these levels unless the infection has been eradicated globally. This is because an imported case could be transmitted to susceptible people.

- 3.8 The human papillomavirus (HPV) immunisation programme for girls aged 12–13, and a catch-up programme for older girls and young women, was introduced in September 2008. PHIAAC was unable to make specific recommendations related to HPV vaccination, as there is limited UK evidence on uptake.
- 3.9 PHIAAC acknowledged that there may be various reasons why children and young people might not be up-to-date with their vaccinations. Logistical difficulties associated with large families has been identified as one factor. Other children and young people may be at risk of missing vaccinations because they are not in contact with primary care services. These include those who are homeless, asylum seekers, drug users (or whose parents are drug users). Children from minority ethnic groups and those whose first language is not English may be more vulnerable, because services are not flexible enough and information is not provided in a language they understand. Some children from at-risk groups may be in contact with children's services and other health services – but not necessarily immunisation services. This includes young offenders, those in the care of child and adolescent mental health services and looked after children.
- 3.10 Economic modelling was carried out for measles (as the most relevant example of a universal immunisation in terms of the current UK situation) and for hepatitis B among at-risk neonates (as the most relevant example of a targeted vaccination in terms of the current UK situation).

Economic modelling showed that, at current levels of immunisation, efforts to increase the uptake of the measles vaccine were highly

cost effective in groups with both high and low immunisation coverage. Increasing coverage among low-coverage groups was shown to be marginally more efficient compared with increasing the proportion vaccinated in high-coverage groups. (This is true if the cost per child were the same in each group.) It would also do more to reduce health inequalities. The modelling suggested that home visits (likely to be the most expensive means of increasing coverage by one percentage point) would be a cost effective use of NHS resources. The implication is that any method of increasing coverage would be cost effective, provided it is efficient. Given the simultaneous protection that is offered by the combined MMR vaccine, the model underestimates cost effectiveness because it does not ascribe any benefits to the concurrent prevention of mumps and rubella infection.

- 3.11 Economic modelling demonstrates that the current UK hepatitis B programme, whereby immunisation is targeted at babies of mothers who are hepatitis B-positive, is cost effective.

This section will be completed in the final document.

4 Implementation

NICE guidance can help:

- NHS organisations, social care and children's services meet the requirements of the DH's 'Operating framework for 2008/09' and 'Operational plans 2008/09–2010/11'.
- NHS organisations, social care and children's services meet the requirements of the Department of Communities and Local Government's 'The new performance framework for local authorities and local authority partnerships'.
- National and local organisations within the public sector meet government indicators and targets to improve health and reduce health inequalities.

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- Local authorities fulfil their remit to promote the economic, social and environmental wellbeing of communities.
- Local NHS organisations, local authorities and other local public sector partners benefit from any identified cost savings, disinvestment opportunities or opportunities for re-directing resources.
- Provide a focus for multi-sector partnerships for health, such as local strategic partnerships.

NICE will develop tools to help organisations put this guidance into practice. Details will be available on our website after the guidance has been issued (www.nice.org.uk/PHxx).

5 Recommendations for research

This section will be completed in the final document.

More detail on the gaps in the evidence identified during development of this guidance is provided in appendix D.

6 Updating the recommendations

This section will be completed in the final document.

7 Related NICE guidance

Published

Antenatal care. NICE clinical guideline 62 (2008) Available from www.nice.org.uk/CG62

Behaviour change. NICE public health guidance 6 (2007) Available from www.nice.org.uk/PH6

Prevention of sexually transmitted infections and under 18 conceptions. NICE public health guidance 3 (2007) Available from www.nice.org.uk/PH3

Postnatal care. NICE clinical guideline 37 (2006). Available from www.nice.org.uk/CG37

Clinical diagnosis and management of tuberculosis, and measures for its prevention and control. NICE clinical guideline 33 (2006) Available from [/www.nice.org.uk/CG33](http://www.nice.org.uk/CG33)

Under development

Bacterial meningitis and meningococcal septicaemia in children. NICE clinical guideline (publication expected June 2010)

Looked after children. NICE public health guidance (publication expected September 2010)

8 References

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Appendix A Membership of the Public Health Interventions Advisory Committee (PHIAC), the NICE project team and external contractors

Public Health Interventions Advisory Committee

NICE has set up a standing committee, the Public Health Interventions Advisory Committee (PHIAC), which reviews the evidence and develops recommendations on public health interventions. Membership of PHIAC is multidisciplinary, comprising public health practitioners, clinicians (both specialists and generalists), local authority officers, teachers, social care professionals, representatives of the public, patients and/or carers, academics and technical experts as follows.

Professor Sue Atkinson CBE Independent Consultant and Visiting Professor, Department of Epidemiology and Public Health, University College London

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External reviewers: effectiveness review

Review 1: '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' was carried out by the National Collaborating Centre for Women's and Children's Health. The principal authors were: Jane Tuckerman, Nina Balachander, Sharangini Rajesh, Ceri Oeppen, Anna Bancsi, Paul Jacklin, Jay Banerjee and Andrew Clegg.

External reviewers: economic analysis

Analysis one: 'The impact of increasing vaccine coverage on the distribution of disease: measles in the UK' was carried out by the London School of Hygiene and Tropical Medicine. The principal authors were: John Edmunds and Albert Jan Van Hoek (Health Protection Agency).

Analysis two: 'An exploration of the cost-effectiveness of interventions to reduce the difference in uptake of childhood immunisations in the UK using threshold analysis' was carried out by the National Collaborating Centre for Women's and Children's Health. The principal author was Paul Jacklin.

Analysis three: 'The estimated cost-effectiveness of vaccination in infants born to hepatitis B virus positive mothers' was carried out by the London School of Hygiene and Tropical Medicine. The principal authors were: John Edmunds and Mary Ramsay.

Appendix B Summary of the methods used to develop this guidance

Introduction

The reports of the review and economic analyses include full details of the methods used to select the evidence (including search strategies), assess its quality and summarise it.

The minutes of the PHIAC meetings provide further detail about the Committee's interpretation of the evidence and development of the recommendations.

All supporting documents are listed in appendix E and are available at www.nice.org.uk/Guidance/PHG/Wave15/9

Guidance development

The stages involved in developing public health intervention guidance are outlined in the box below.

1. Draft scope released for consultation
2. Stakeholder meeting about the draft scope
3. Stakeholder comments used to revise the scope
4. Final scope and responses to comments published on website
5. Evidence review(s) and economic analysis undertaken
6. Evidence and economic analysis released for consultation
7. Comments and additional material submitted by stakeholders
8. Review of additional material submitted by stakeholders (screened against inclusion criteria used in review/s)
9. Evidence and economic analysis submitted to PHIAC
10. PHIAC produces draft recommendations
11. Draft guidance released for consultation and for field testing
12. PHIAC amends recommendations
13. Final guidance published on website
14. Responses to comments published on website

Key questions

The key questions were established as part of the scope. They formed the starting point for the reviews of evidence and were used by PHIAC to help develop the recommendations. The overarching questions were:

What interventions are effective and cost effective at reducing differences in immunisation uptake in children and young people 19 years or younger?

What are the views and experiences of parents and carers, those receiving and those delivering either immunisations themselves or interventions to increase uptake of immunisations in the UK to children and young people 19 years or younger?

Reviewing the evidence of effectiveness

A review of effectiveness was conducted for each intervention that reduced differences in immunisation uptake.

Identifying the evidence

The following databases were searched for published literature (1 January 1988 to 31 March 2008):

- ASSIA
- Campbell Collaboration.
- CINAHL
- Cochrane Library (Cochrane Database of Systematic Reviews and Database of Abstracts of Reviews of Effectiveness [DARE])
- Embase
- Eppi-centre databases
- ERIC
- Medline
- PsycINFO
- Sociological Abstracts

The review team contacted relevant external people for additional information and also searched the following websites for relevant studies:

- CDC
- American Academy of Pediatrics
- Canadian Coalition for Immunization awareness and Promotion
- Canadian Pediatric Society

- Department of Health
- DIPEX: personal experiences of health and illness
- European Centre for Disease Prevention and Control
- Eurosurveillance
- Evidence for Social Policy and Practice Co-ordinating Centre
- Health Evidence Bulletins Wales
- Health Protection Agency
- Health Protection Scotland
- Immunisation advisory centre
- Immunise Australia
- Intute (previously OMNI)
- National Centre for Immunisation Research and Surveillance
- NHS Quality Improvement Scotland
- NHS Wales
- Public Health Organization of Canada
- Scottish Intercollegiate Guidelines Network (SIGN)
- US Centers for Disease Control and Prevention
- Vaccine Education Center, Philadelphia Children's Hospital
- World Health Organization

Selection criteria

Qualitative studies were included in the effectiveness review if:

- they took place in the UK
- they reported on the knowledge, attitudes, values and beliefs relating to immunisations for children and young people under 19 years.
- they reported on immunisation uptake rates in people under 19.

Quantitative and economic studies were included in the effectiveness review if:

- they reported on interventions that seek to reduce differences in the uptake of universal or targeted vaccination programmes for children and young people under 19 years.

Studies were excluded if they:

- were published in a language other than English
- were conducted in developing countries
- reported interventions that sought to reduce differences in the uptake of immunisations in people aged 19 or older
- explored the setting of national immunisation strategies, policies, priorities and targets
- targeted vaccination of young people at occupational risk of infection (for example, vaccination of healthcare workers for hepatitis B and varicella)
- targeted vaccination of children and young people travelling to countries with increased prevalence of infectious agents (for example, vaccination for typhoid, rabies or tick-borne encephalitis)
- targeted vaccination of children and young people who were clinically at risk of infection with a vaccine-preventable disease as a result of an underlying condition (for example, vaccination of asplenic or immunocompromised people for pneumococcal or Haemophilus influenzae type b infections)
- aimed to increase uptake of single vaccines for measles, mumps and rubella
- did not report findings from primary research (for example, were secondary reviews of the literature)
- were published before 1988
- were published as abstracts only or were not held by the British Library.

The evidence in this review was subject to further analysis and revision. This revision was carried out by NICE.

The revised analysis excluded studies if they were not transferrable to the UK context. It also excluded studies if they:

- involved the provision of free vaccines either alone or as part of a health insurance package
- involved immunisation-linked, provider payments on a capitation or fee-for-service basis

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- reported baseline coverage levels of less than 70% (with the exception of MMR coverage)
- presented post-intervention and control (no-intervention) levels less than 70% (however, if multiple vaccines or age groups were considered and at least one baseline level was greater than 70%, then the study was included)
- aimed to increase uptake of human papillomavirus vaccine.

Quality appraisal

Included papers were assessed for methodological rigour and quality using the NICE methodology checklist, as set out in the NICE technical manual 'Methods for the development of NICE public health guidance' (see appendix E). Each study was graded (++, +, –) to reflect the risk of potential bias arising from its design and execution.

Study quality

- ++ All or most of the methodology checklist criteria have been fulfilled. Where they have not been fulfilled, the conclusions are thought very unlikely to alter.
- + Some of the methodology checklist criteria have been fulfilled. Those criteria that have not been fulfilled or not adequately described are thought unlikely to alter the conclusions.
- Few or no methodology checklist criteria have been fulfilled. The conclusions of the study are thought likely or very likely to alter.

Summarising the evidence and making evidence statements

The review data was summarised in the revised analysis and in revised evidence tables..

The findings from the revised analysis were synthesised and used as the basis for a number of revised evidence statements relating to each key question. The revised evidence statements were prepared by NICE. The

statements reflect its judgement of the strength (quantity, type and quality) of evidence and its applicability to the populations and settings in the scope.

Economic analysis

The economic analysis consisted of a review of economic evaluations and a cost-effectiveness analysis which consisted of three economic models.

Review of economic evaluations

The following databases were searched for the period from 1 January 1988 to 31 March 2008;

- Health Economics Evaluation Database(HEED)
- Econlit (1969-March 2008)
- Health Technology Assessment
- NHS Economic Evaluation Database (NHS EED)

Cost-effectiveness analysis

An economic model for measles was constructed 'The impact of increasing vaccine coverage on the distribution of disease: measles in the UK'. Further results are reported in: 'An exploration of the cost-effectiveness of interventions to reduce the difference in uptake of childhood immunisations in the UK using threshold analysis'.

Additional economic modelling was undertaken to produce: 'The estimated cost-effectiveness of vaccination in infants born to hepatitis-B-virus-positive mothers'. The three economic modelling reports are available on the NICE website at: www.nice.org.uk/Guidance/PHG/Wave15/9

Fieldwork

This section will be completed in the final document.

How PHIAC formulated the recommendations

At its meetings in October 2008, January and March 2009, PHIAC considered the evidence of effectiveness and the revised analysis, plus the cost-effectiveness analyses to determine:

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- whether there was sufficient evidence (in terms of quantity, quality and applicability) to form a judgement
- whether, on balance, the evidence demonstrates that the intervention is effective, ineffective or equivocal
- where there is an effect, the typical size of effect.

PHIAC developed draft recommendations through informal consensus, based on the following criteria.

- Strength (quality and quantity) of evidence of effectiveness and its applicability to the populations/settings referred to in the scope.
- Effect size and potential impact on the target population's health.
- Impact on inequalities in health between different groups of the population.
- Cost effectiveness (for the NHS and other public sector organisations).
- Balance of risks and benefits.
- Ease of implementation and any anticipated changes in practice.

Where possible, recommendations were linked to an evidence statement(s) (see appendix C for details). Where a recommendation was inferred from the evidence, this was indicated by the reference 'IDE' (inference derived from the evidence).

Appendix C The evidence

This appendix lists evidence statements from the revised analysis of the review of effectiveness (see appendix A and B) and links them to the relevant recommendations. (See appendix B for the key to quality assessments.) The evidence statements are presented here without references – these can be found in the report of the revised analysis (see appendix E for details). It also sets out a brief summary of findings from the economic analysis.

Evidence statement number 7 indicates that the linked statement is numbered 7 in the revised analysis of the review of effectiveness.

The review and economic analysis are available at www.nice.org.uk/Guidance/PHG/Wave15/9 Where a recommendation is not directly taken from the evidence statements, but is inferred from the evidence or from expert testimony given at a PHIAC meeting, this is indicated by **IDE** (inference derived from the evidence) below.

Recommendation 1: evidence statements 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 38, 39, 40, 41, 47, 48, 49, 51, 52, 55, 61; IDE

Recommendation 2: IDE

Recommendation 3: evidence statements 25, 26, 27, 28; IDE

Recommendation 4: evidence statements 20, 41; IDE

Recommendation 5: evidence statements 16, 43, 48, 49, 51

Recommendation 6: 66; IDE

Evidence statements

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 socioeconomic status. One RCT ([++]
N=601 [n is the number of participants]) found that reminder postcards in Reducing differences in the uptake of immunisations consultation draft

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. The second RCT ([+] 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. Finally, one RCT ([-] 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.

Evidence Statement 6

There is mixed evidence from three studies from the USA: two RCTs (both -) and one non-randomised controlled trial (nRCT) (+) as to the effectiveness of universal reminder/recall interventions for children aged under 2 years. Two studies 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 (RCT [-] N=1138) and DTP, OPV, Hib, and MMR (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 7 months compared with a control group that received no reminder/recall letters ([-] N=1351).

Evidence statement 7

There is evidence from one RCT ([++] 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.

Evidence statement 8

There is evidence from one BA study ([+] 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.

There is evidence from one RCT ([+] n=220) from the USA that a community-based outreach programme comprising seven home visits during the baby's first 15 months of life together with advice and support for mothers is as effective at ensuring age-appropriate immunisations regardless of whether it is delivered on a one-to-one basis or a group basis.(See also evidence statement 45.)

Evidence statement 10

There is evidence from one RCT from the USA reported in two articles ([+] and [-] n=102) to suggest that an intervention targeting pregnant adolescents which incorporated intensive home visits (approximately 17 antenatal and postnatal visits) extended from pregnancy to 1 year postpartum significantly improved vaccination uptake at age 12 months compared with a control group that received one or two visits. Evaluation of the programme at 24 months postpartum found that the intervention group was less likely than the control group to be up-to-date with immunisations, although more than 40% of participants had been lost to follow-up by 24 months, limiting the reliability of this finding.

Evidence statement 11

There is evidence from one RCT ([++] n=152) from Australia to suggest that regular home visits up to 6 months postpartum by midwives to new mothers who were 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. Vaccination rates at 2 and 4 months were higher (although not significantly) in the intervention group compared with control.

Evidence statement 12

Conceptions of the severity of vaccine-preventable diseases: There is evidence from a focus group study with 66 parents (+) and an interview study with 22 parents (++) that many parents lacked 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 aged under 3 years (n=15,000) carried out over a 10-year period from 1991 to 2001 (+) that the perceived severity of vaccine-preventable diseases has changed over time, with the perceived severity of some diseases having decreased (diphtheria, pertussis and polio), increased (meningitis C), remained stable (tetanus and mumps), or varied (Hib, measles and rubella).

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 having completed their immunisations. A postal survey of 44 parents (-) suggested that parents of children with incomplete immunisations were less likely to see childhood diseases as being severe. Conversely, an interview study with 759 parents (-) found that there were few differences between the beliefs of parents who had and had not had their children immunised regarding incidence and severity of vaccine-preventable diseases.

There was evidence from two qualitative studies with parents living in inner-city settings to suggest that vaccine-preventable childhood diseases were perceived to be severe or serious. One interview and focus group study with 21 Somali, Pakistani and African-Caribbean mothers (+) 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 being very serious or serious (+).

However, three studies found that there were mixed views on how serious different vaccine-preventable diseases were perceived to be. One recent

interview study undertaken in October and November 2006 with mothers of children aged under 3 years (n=1016) found that meningitis was perceived as being the most severe disease, while measles, mumps and rubella were seen as being the least severe (++) . One questionnaire study with 68 parents in an inner-city setting (+) found that meningitis was perceived to be the most serious disease, with pertussis, diphtheria and measles being perceived as serious or very serious and rubella being perceived as mild. One interview study with 13 parents in an inner-city setting (-) found that diphtheria, tetanus and polio were perceived as serious, whilst measles, mumps and rubella were perceived as mild.

There is evidence from one focus group study (++) with 25 orthodox Jewish mothers and 10 local healthcare 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 healthcare providers occasionally supported, although this was not done consistently.

Evidence statement 13

Misconceptions about the safety of vaccines: There is evidence from one study comprising 20 surveys of mothers of children aged under 3 years carried out over 10 years ([+] n=15,000) that most mothers (more than 90%) trust the safety of immunisations. However, there is evidence from five studies that some mothers and parents consider the risks of vaccines to be greater than the risks of acquiring vaccine-preventable diseases ([++] n=18,488; [-] n=87; [+] n=68; [-] n=29; [-] n=13).

There is evidence to suggest that 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 (-), a nationally representative interview survey with 18,488 mothers (++) , and a postal survey of 44 parents (-). A fear of vaccines being contraindicated for existing medical conditions such as eczema was indicated by some parents (proportion not stated) in an interview study with 759 parents (-). Concerns

about combined antigens putting too much stress on a baby's immune system were identified by three studies ([+] n=72; [++] n=22; [-] n=44).

There is evidence from one survey (n=NR) that reported that one in three parents of children aged 0–2 years 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 being around a lack of information and worries about the effect on the child, but also concern about the way health professionals carry out immunisation appointments (a perceived lack of empathy, concern and time, in particular[-]).

There is evidence from an interview study with 10 orthodox Jewish mothers (-) that mothers' fears of adverse reactions to vaccines were a reason for low uptake. A multi-method study with 21 Somali, Pakistani and African-Caribbean mothers (+) 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 groups with health professionals (-) found that health professionals thought that parents' fears of side effects were a reason for low uptake and that in close-knit communities negative reports about immunisation were perpetuated.

Some studies indicated that parents making the decision to immunise their children weighed up the risks and benefits of immunisation as they perceived them, as illustrated in a postal questionnaire with 87 parents (-), an interview study with 13 parents in an inner-city setting (-), a questionnaire study with 68 parents in an inner-city setting (+) and an interview study with 19 mothers and 10 health professionals (-). 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 (+) suggests that the majority of parents discuss

immunisation with a health professional before uptake. However, the same study and an interview study with 759 parents (-) 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 ([+] n=22 health visitors; [+] n=58 primary healthcare professionals).

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 ([+] n=859 parents; [+] n=278 parents and n=322 health professionals; [-] n=44 parents; [-] n=NR; [-] n=759).

Evidence statement 15

Satisfaction with information sources: There is evidence from two UK postal surveys that found that although the majority of parents (70%) were satisfied with information on immunisation, parents of fully immunised children were more likely to be satisfied with available information than parents whose children were unimmunised or only partially immunised ([+] n=859 parents of children aged 18–24 months; [-] n=20 parents). 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 ([+] n=278 parents).

There is evidence from an interview study with 13 parents in an inner-city setting who had chosen not to immunise their children (-), and a questionnaire study with 68 parents in an inner-city setting with children with incomplete immunisation (+) to suggest that some parents mistrusted the information provided (proportion not reported 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 (+) 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 44 parents (24 of whom had completely immunised children and 20 of whom had partially or unimmunised children [-]).

A postal questionnaire study of 859 parents reported that there were mixed views on the preferred timing of information (for example, either before the baby's birth, at the first health visitor's visit or at the 6–8 week postnatal check[+]).

Evidence statement 16

Tailoring information to population subgroups: Three studies (two [+] and one [-]) indicated a need to tailor immunisation information to particular groups. There is evidence from a multi-method study with 21 Somali, Pakistani and African-Caribbean mothers (+) and an interview study with 22 health visitors (+) that there are concerns about the accessibility of immunisation literature (whether translated or not), particularly for migrants with low levels of literacy. Concerns were also raised by African-Caribbean mothers in one study (+) 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 (-) and another focus group study with 25 orthodox Jewish mothers and 10 local healthcare workers from an orthodox Jewish community in North East London (++) found that the research participants felt 'cut off' from the media as a source of information and instead relied on sources of information within their social networks.

Evidence statement 20

There is evidence from an interview study with head teachers (n=31), school nurses (n=12) and parents (of n=1411 children) in inner-city London (+) that the majority of head teachers would be in favour of asking about immunisation

status on school entry, and would be prepared to recommend that parents had their children fully immunised before school entry.

Evidence statement 25

Poor knowledge of the benefits and risks of vaccines: There is evidence from one questionnaire study with 174 health professionals in Liverpool (-) and one postal questionnaire including 116 health visitors and practice nurses in Scotland (+) to suggest that there are mixed views from health professionals about what constitutes a contraindication to some vaccines.

There is evidence from one questionnaire study (-) 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 evidence from one recent survey (n=NR) of GPs (31% response rate), health visitors (63%) and practice nurses (63%) that found one-third of health professionals who stated concerns about immunisation reported their main concern as being that babies were given too many immunisations (-). Similar concerns were reported in a postal questionnaire of 116 health visitors and practice nurses in Scotland (+) that found that several health professionals (n=NR) were concerned about the ability of babies' immune systems to cope with vaccines. Other concerns raised by health professionals included difficulties with the practicalities of administering the number of vaccinations in the current schedule, the complexity of and changes to the schedule, and difficulties with keeping up-to-date (-).

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

Evidence statement 26

Health professionals views on immunisation education and training: There is 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 ([-] n=174; [+] n=116). Recent evidence from one survey (n=NR) 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 immunisation training (89% of health visitors versus 94% of practice nurses versus 49% of GPs) and their local immunisation coordinator (89% of health visitors versus 94% of practice nurses versus 49% of GPs). The study also found that health visitors and practice nurses were more likely to have attended 1–2 sessions of immunisation training in the preceding 2 years than were GPs (69% of health visitors versus 72% of practice nurses versus 64% of GPs; p value not reported; [-]).

Evidence statement 27

Information sources for health professionals: There is evidence from two surveys that found that DH publications (including the 'Green book' and Chief Medical Officer letters or updates) and NHS information and publications are important and frequently used sources of information for GPs, health visitors and practice nurses (one [-] and one [+]). One study reported that in addition to being the most frequently used source of information, DH/NHS information and publications were the most useful source of information. The DH website was mentioned most frequently (21% of GPs versus 46% of health visitors versus 36% of practice nurses). The NHS Immunisation Information website was the second most commonly mentioned Internet site (6% of GPs versus 23% of health visitors versus 18% of practice nurses). GPs continued 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 25% using it very often).

There is evidence from one recent survey that found that health professionals' (including GPs, health visitors and practice nurses) preferred format for the Reducing differences in the uptake of immunisations consultation draft

DH 'Green book' was hard copy (around 30% in each group), with very few preferring an Internet-only version (-).

There is evidence from one recent survey that found that other sources of information on immunisation used by health professionals included medical and nursing journals, the media (for example, television, 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 information sources, with GPs generally using a more restricted range of materials (-).

Evidence statement 28

There is evidence from four UK studies (one ITS [+] and three BA [-]) that education and training for health professionals (including midwives, health visitors, GPs and paediatricians) in the implementation of targeted neonatal BCG vaccination policies (comprising identification and referral of at-risk neonates; administration of the BCG vaccine, identification of contraindications etc) was effective at increasing the proportion of at-risk neonates that received timely vaccination (Gill and Scott, 1998; one ITS [+] and three BA [-];).

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 (+).

Evidence statement 39

There is strong evidence from seven studies from the UK (one BA [-] and one BA [+]), USA (one RCT [+]; one BA [++]; one BA [+]; one cohort [-]), and Australia (one BA [+]), that hospital-based opportunistic immunisation strategies are effective for 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 them of under-

immunisation status or had vaccinated before discharge compared with no intervention, although the difference was not significant. Two BA 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 who were age-appropriately immunised (BA [++] n=2006) and reduced the number of missed opportunities for vaccination (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. Two studies from the UK found that some children were successfully brought up-to-date with the recommended vaccination schedule after hospital-based immunisation (BA [+] n=56; and BA [-] n=1000). although one study found that some carers refused, preferring to have vaccinations administered by their primary care provider. Finally, one cohort study ([-] n=1301) from the USA found that the proportion of pre-school children not up-to-date with the recommended immunisation schedule on admission to the emergency department significantly decreased on discharge after hospital-based vaccination. However, by 6 months, there was no significant difference in the proportion of children up-to-date on discharge compared with that on hospital admission.

Evidence statement 40

There is evidence from two studies from Australia and Switzerland (one NRCT [-] and one 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, was effective at encouraging vaccination within 30 days compared with children whose parents were not given a reminder (NRCT [+] n=430; NRCT [-] n=54).

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 (+) that although most parents (69%) whose children were not fully immunised were in favour of opportunistic school-based immunisations (for example, 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 had taken place they had greatly increased school nurses' workload (-).

There is evidence from a questionnaire that sought to 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 children aged 5–16 years ([-] n=288). The study 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 pupils (n=50) in Glasgow (++) that explored immunisation in general and universal hepatitis B vaccination. It found 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 because they felt supported by their peers.

Evidence statement 43

There is evidence from one ITS (+) from the UK that offering hepatitis B vaccination to all injecting drug users (aged 16–20 years) who were inmates of youth offender institutions and prisons, significantly increased uptake.

Evidence statement 47

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

Four RCTs (three [+] and one [-]) and four BA studies (one [+] and three [-]) found that multicomponent community-based interventions targeting children at risk of low immunisation uptake (for example, already behind in their vaccinations or from low-income or black and minority ethnic group families) increased the number of children who were up-to-date with the recommended vaccination series or who received vaccinations, at least in the short term (6 months to 1 year) compared with children who did not receive community-based outreach. Although intervention components varied between studies they generally comprised: home visits; advice and support for parents; local media campaigns and networking with local organisations; vaccination-specific components such as referral and reminders of upcoming vaccinations; working with parents to ensure they understood the immunisation schedule, reduced their misconceptions about vaccinations or encouraging them to be proactive and request immunisations from their providers; direct contact with the family's immunisation providers; immunising in other settings such as hospitals and immunisation-linked incentives.

One cluster RCT ([+] n=286) found that a multicomponent community-based intervention comprising home visits, parent-baby developmental play groups, parent support groups and monthly support calls, targeting children from black, low-income families, significantly improved uptake of immunisations to age 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 greater than 50%, limiting reliability of this finding.

One NRCT ([+] n=1,508) compared a media-based education and outreach campaign to encourage Vietnamese American parents to have 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. It found that both strategies significantly increased uptake of hepatitis B vaccine compared with a control group that did not receive any intervention.

However, there is mixed evidence on the long-term effectiveness of community-based outreach interventions at increasing immunisation uptake. One RCT ([+] n=232) 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.

Two RCTs (1 [+] and 1 [-]) found that universal multicomponent community-based interventions which comprised postnatal home visits in addition to parental advice and support (RCT [+] n=439) or postcard or telephone reminders for parents to attend for vaccinations and a number of provider-based interventions (RCT [-] n=3015) significantly improved up-to-date vaccination coverage rates compared with no intervention.

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 immunisation (++).

An interview study with parents of 1411 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 (+).

Evidence statement 49

Parental and health professional views on interventions to reduce barriers to immunisation uptake: There was 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), that identified a number of practical suggestions for improving immunisation uptake. These included: 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 ([-] n=174 health professionals), and varying clinic timing ([-] n=15 health visitors and parents). Only 6–9% of professionals supported compulsory immunisation.

An interview study with 759 parents found that 25% of them would prefer immunisation in the home by a health visitor (-). Another interview study of 22 parents indicated that parents had a preference for a flexible system for immunisation appointments (++).

There is evidence from an interview study with 10 orthodox Jewish mothers (-) and a questionnaire study with 67 orthodox Jewish parents (+) that identified a number of interventions such as reducing clinic waiting times, improving play facilities in clinics and reducing overcrowding in waiting rooms that may help to improve immunisation uptake, many of which sought to address practical barriers such as having to care for large families and multiple competing demands on time.

Evidence statement 51

There is evidence from two studies (one cluster 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 (cluster RCT [-] Reducing differences in the uptake of immunisations consultation draft

n=2665) found that an intervention based on reminder/recall in addition to home visits and transportation to the clinic for children of low-income families in need of vaccinations was effective at increasing the proportion of babies up-to-date with immunisations compared with children receiving no contact ([+] n=2665). The second study (ITS [-] n=3184) found that a programme comprising a community-wide reminder/recall and outreach system in which children behind in their immunisations received reminder/recall (telephone, postcard, or letter) with increasing intensity for children who were further behind in immunisations, and home visits for those where all previous strategies had failed, significantly increased immunisation rates in city and suburban settings from baseline after 3 years. After 6 years the increase was no longer statistically significant.

Evidence statement 52

There is evidence from one BA study ([++] 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 after the postal reminders were sent of DTP and Hib among children aged more than 6 months living in a deprived area.

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 and found a significant relationship between uptake of the first dose of MMR vaccine and ethnicity. Uptake of the first dose of MMR vaccine was highest among children from Indian backgrounds followed by African-Caribbean children and lastly white children (++).

Among 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 mothers-in-law, for advice about

immunisation. Asian mothers were also more likely to consult their GPs for advice and were most trusting of such advice. Conversely, African-Caribbean and white mothers were more likely to question pro-MMR vaccination advice given by healthcare professionals (++).

Differences in knowledge and beliefs across different socio-economic groups: There is evidence from a recent interview study undertaken in October and November 2006 with mothers of children aged under 3 years (n=1016) that found that mothers from lower socioeconomic groups were significantly more likely to consider the MMR vaccine as being completely safe compared with mothers from higher socioeconomic groups. Furthermore, the study found that before 2002, 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 (++).

Evidence statement 61

There is evidence from one recent cluster RCT ([+] 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 leaflet 'MMR – your questions answered' and were also invited to attend a parent-led intervention, a one-off, 2-hour parent meeting (consisting of information giving and a question and answer session), a support network and enablement, compared with parents that received only standard information.

Evidence statement 66

There is mixed evidence from two cohort studies (one [+] and one [-]) and two ITS studies (both [-]) to suggest that neonatal hepatitis B immunisation strategies centred around early identification of hepatitis B positive mothers and initiation of the vaccination schedule in hospital can increase neonatal hepatitis B vaccination coverage. The first cohort study ([+] n=265) from the UK found that a hospital-based service in which an 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. The second cohort study ([-] n=832), in which HBsAg-positive mothers were contacted by phone, letter or home visit and counselled about the risks of transmission and importance of screening household contacts found that babies were significantly more likely to complete the hepatitis B vaccination series if the first dose was given in hospital. However, one poor-quality study (ITS [-] n=323) found that a comprehensive immunisation strategy where the first dose of hepatitis B vaccine was given in hospital and a GP was nominated to continue the vaccination schedule did not increase the proportion of eligible babies receiving the recommended three doses of the vaccine.

One study from Italy (ITS [-] n=NR) reported that over a 4-year period the proportion of eligible babies immunised against hepatitis B increased significantly following introduction of a policy to administer intramuscular hepatitis B immunoglobulin within 24 hours of birth and the first dose of hepatitis B vaccine within 7 days of birth.

Finally, one cohort study in Australia ([-] n=658) found that extension of an existing neonatal hepatitis B vaccination policy (covering neonates born to mothers who carried HBV) to include neonates born to mothers from high-risk countries (including Vietnam), irrespective of the mother's hepatitis B status significantly increased hepatitis B vaccine coverage rates, although the applicability of this study to the UK context may be limited.

Cost-effectiveness evidence

At current levels of coverage, immunisation against measles is estimated to save the NHS money (that is, the money saved as a result of not having to treat a case of measles more than pays for the immunisation). This is likely to be true even when taking into account the cost of home visits targeting unimmunised children. (It would only cost money if the refusal rates were very high.) The level of vaccine coverage required against measles is higher than for other universal vaccinations (such as mumps and rubella). It follows that

immunisation against these infections would be cost saving in almost all circumstances, as it is given as a combined vaccine.

Currently, the targeted immunisation programme to reduce the incidence of neonatal hepatitis B is estimated to be cost saving, where it costs less than about £30 per injection. It would still be cost effective (but not cost saving) if the administration costs were up to several hundred pounds, as the cost of one case of neonatal hepatitis B is far more expensive.

Appendix D Gaps in the evidence

PHIAC identified a number of gaps in the evidence relating to the interventions under examination, based on an assessment of the evidence and stakeholder and expert comments. These gaps are set out below.

1. There is a lack of UK evidence on the effectiveness and cost-effectiveness of different interventions aimed at increasing immunisation uptake in children and young people aged under 19 years, particularly in population sub-groups that may not have been immunised or only partially immunised.
2. There is a lack of UK evidence on the differential effect of universal interventions to increase immunisation uptake across different groups.
3. There is a lack of UK evidence on the effectiveness and cost-effectiveness of interventions aimed at increasing uptake of the school leavers' booster.
4. There is a lack of UK evidence to determine whether removal of the barriers to accessing immunisation services increases immunisation uptake in children and young people aged under 19 years. In particular, whether it increases immunisation rates among population subgroups at increased risk of not being immunised – or not being fully immunised.
5. There is a lack of UK evidence to judge whether or not interventions to increase uptake of immunisations in children and young people aged under 19 have any unintended or negative effects. For example, how repeat reminder or recalls to those who do not want their child immunised, may affect their relationship with the GP.
6. There is a lack of evidence on the differential effect of using different professionals (such as nurses, GPs and other practitioners) to deliver interventions to increase immunisation uptake in children and young people aged under 19 years. In particular, there is a lack of evidence on

how this affects subgroups that are at increased risk of not being immunised or not being fully immunised.

Appendix E Supporting documents

Supporting documents are available at

www.nice.org.uk/Guidance/PHG/Wave15/9. These include the following.

- Review of effectiveness:
 - ‘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’
 - ‘Revised analysis of the evidence of interventions to reduce differences in immunisation uptake (including targeted vaccines) in people younger than 19 years’

- Economic analysis:
 - Analysis one: ‘The impact of increasing vaccine coverage on the distribution of disease: measles in the UK’
 - Analysis two: ‘An exploration of the cost effectiveness of interventions to reduce the difference in uptake of childhood immunisations in the UK using threshold analysis’
 - Analysis three: ‘The estimated cost effectiveness of vaccination in infants born to hepatitis B virus positive mothers’

For information on how NICE public health guidance is developed, see:

- ‘Methods for the development of NICE public health guidance’ available at www.nice.org.uk/phmethods
- ‘The public health guidance development process: an overview for stakeholders including public health practitioners, policy makers and the public’ available from: www.nice.org.uk/phprocess