Prevention of neonatal whooping cough in England: The essential role of the midwife

Abstract

Following an increase in the incidence of whooping cough (pertussis) in the general population from 2011, coupled with neonatal pertussis mortality seen in 2012, a programme of maternal pertussis immunisation was introduced to the UK in the same year. The programme aims to provide passive immunity from birth, until active immunity can be provided through the routine immunisation programme from 8 weeks of age. Since its introduction, evaluation of the vaccine given in pregnancy has demonstrated its safety, efficacy and patient acceptability. Uptake of the vaccine has reached 70% and its continued use is an opportunity to protect newborn babies from a serious and sometimes fatal vaccine-preventable infection. Midwives should discuss pertussis immunisation with pregnant women and either signpost them to their GP to receive it or, if commissioned to do so, administer the vaccine themselves.

Keywords

Whooping cough | Pertussis | Immunisation | Vaccine | Pregnancy

Pertussis is a vaccine-preventable disease of global public health significance. Estimates from the World Health Organization (WHO, 2011) suggest that, in 2008, about 16 million cases of pertussis occurred worldwide, 95% of which were in developing countries, and about 195 000 children died from the disease. In the UK, it remains the most common vaccine-preventable cause of death in children under the age of 1 year (Amirthalingam, 2013). Pertussis is a cyclical disease, with increased pertussis activity occurring every 3–4 years (Health Protection Agency (HPA), 2012).

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Pertussis is a highly infectious and sometimes fatal infection caused by the bacterium *Bordatella pertussis*. It is easily transmitted by respiratory droplets and has an incubation period of 6–20 days (Heymann, 2008). Pertussis symptoms start with a catarrhal phase which is followed by a cough, often irritating, over 1–2 weeks which gradually becomes paroxysmal in nature. The coughing paroxysms are followed by a characteristic inspiratory 'whoop' and sometimes vomiting. However, in infants, the whoop may not be present and instead the paroxysmal cough is followed by periods of apnoea (Hawker et al, 2005). The cough can be prolonged over several weeks or even months—in China, pertussis is known as 'the cough of 100 days' (Carbonetti, 2007).

Complications range from relatively minor, such as sub-conjunctival haemorrhage, facial oedema, nosebleeds, mouth ulcers and otitis media; to serious, such as pneumonia, weight loss, cerebral hypoxia and death. Serious complications are more common in those aged under 6 months, with some requiring admission to paediatric intensive care (Crowcroft et al, 2003).

Vaccines against pertussis infection

Prior to the introduction of a vaccine against pertussis in 1957, there were about 120 000 cases per year in the UK (Public Health England (PHE), 2015). Early vaccines against pertussis were inactivated whole cell vaccines; that is, the entire killed pertussis bacterial cell was included in the vaccine. While highly immunogenic, the vaccine was associated with higher incidence of fever and febrile convulsions, leading to public and professional concerns about its safety. By 1978, uptake had dropped to only 30% (PHE, 2015) and in the same year, 65 000 cases and 12 deaths from whooping cough were reported (Amirthalingam, 2013).

Public confidence in pertussis vaccines gradually

returned; by the mid-1990s, over 90% of children aged 2 years had completed a primary course of pertussis immunisation and disease notifications fell to ≤1500 cases per year, for the period 2000–11 (PHE, 2015). In 2004, the UK switched from using whole cell pertussis vaccines to acellular vaccines. These are also made from inactivated (killed) pertussis bacteria, but rather than containing whole bacteria, they are made using selected proteins and purified pertussis toxins (PHE 2016a).

Acellular pertussis vaccines are thought to provide protection at least as good as whole cell vaccines but with fewer unwanted effects, particularly fever. The vaccine against pertussis given to babies in the UK is offered at 8, 12 and 16 weeks of age, with a booster dose at 3 years and 4 months. Pertussis vaccines, like natural infection with pertussis, do not confer lifelong immunity. The aim of the childhood immunisation programme, therefore, is to protect those most at risk of serious complications of pertussis, i.e. the very young. Adolescents and adults, including those previously immunised and whose immunity has waned over time, remain a potential source of infection (Crowcroft et al, 2003; van Hoek et al, 2013) and ongoing transmission (Campbell et al, 2014), potentially infecting newborn babies and others.

Recent epidemiology of pertussis and the maternal immunisation programme

An increase in the incidence of pertussis, mainly in adolescents and adults, was seen from mid-2011 onwards, with 9700 cases reported in England and Wales (HPA, 2012). This was followed in 2012 by 14 deaths in infants all under 3 months of age and therefore too young to have been fully protected against pertussis through routine immunisation (Amirthalingam, 2013). A number of developed countries such as the USA and Australia, which have existing childhood immunisation programmes against pertussis, have also seen a resurgence of pertussis activity (Clark, 2014; Pillsbury et al, 2014).

In April 2012, a national pertussis outbreak was declared (HPA, 2012) and in response to deaths in young infants, an emergency immunisation programme was introduced in October 2012 (Chief Medical Officer (CMO), 2012). The emergency nature of the programme, coupled with the need for its rapid implementation, left little time for detailed planning at local level. This resulted in little time to formulate patient group directions (PGDs), or offer specific training to general practice nurses, midwives and other health care workers who might have contact with women during pregnancy.

When first introduced, the programme offered a pertussis-containing vaccine to all pregnant women between 28 and 38 weeks' gestation. The optimal time for the vaccine to be administered was between 28 and 32 weeks (CMO, 2012). However, in 2016, following further research into the optimal timing of the pertussis vaccine in pregnancy (Eberhardt et al, 2016), the UK's Joint Committee on Vaccination and Immunisation (JCVI) recommended that the vaccine should be administered between 16 and 32 weeks (JCVI, 2016). For operational reasons, PHE has recommended that the vaccine is best offered at, or after, the fetal anomaly scan at around 20 weeks (PHE, 2016a). A number of other countries including Belgium, US, Argentina and Australia have also introduced maternal pertussis immunisation programmes (WHO, 2016). Influenza vaccine, also offered to women in pregnancy, can be administered at the same time as pertussis vaccine. However, as influenza vaccine can be given at any stage of pregnancy, it is not necessary to delay influenza vaccine until the woman is eligible for pertussis vaccine.

The aim of the antenatal immunisation programme is to boost maternal pertussis antibodies so that they cross the placental barrier, providing the newborn with passive immunity. The programme is designed to complement the active protection an infant will get from its routine immunisations starting at 8 weeks of age by ensuring the infant also has passive protection from birth. As the antibodies decline over time, women should be offered pertussis vaccines in each pregnancy, regardless of the number of fetuses in the pregnancy or the time elapsed between pregnancies (Public Health England 2016a).

Some medicines administered in pregnancy may have harmful effects on the embryo or fetus (Joint Formulary Committee, 2017). The pertussis containing vaccine (Boostrix-IPV) is an inactivated vaccine with well-documented side effects; these commonly include pain, and redness and swelling at the injection site (Electronic Medicines Compendium, 2016), which are more likely with repeated doses. However, an observational study evaluating the safety of the vaccine in more than 20 000 women who received pertussis-containing vaccine in pregnancy found 'no evidence of an increased risk of any of an extensive predefined list of adverse events related to pregnancy' (Donegan et al, 2014: 4).

The UK was the first country to demonstrate the effectiveness of pertussis-containing vaccines given in pregnancy to protect newborns from infection with pertussis (Amirthalingam et al, 2016). Effectiveness of pertussis-containing vaccines in preventing whooping cough in the first 3 months of life has been estimated to be between 91% and 93% (Amirthalingam et al, 2014; Dabrera et al, 2014). A recent study found that 96% of women would definitely, or probably, accept a vaccine in pregnancy to protect their baby, and that 90% would ideally like information about the vaccine from their midwife (Campbell et al, 2015). It is therefore reassuring that, when trying to prevent pertussis in infants too

young to be immunised themselves, there is a vaccine that is highly effective, can safely be given in pregnancy and is acceptable to the target population. To support health care workers in their communication with pregnant women about immunisation in pregnancy, PHE (2016b) has produced a leaflet which can be ordered free of charge, about pertussis and influenza immunisation.

Pertussis activity is continuing to persist at increased levels compared to the years before the 2012 outbreak. The increased incidence of pertussis in the UK, coupled with reassuring data on the safety and efficacy of the vaccine, led the JCVI to recommend the maternal immunisation programme be extended by a further 4 years (JCVI, 2014).

In 2016, pertussis activity reached higher levels than seen between 2013 and 2015 (PHE, 2016c). Following the introduction of the maternal immunisation programme in 2012, the incidence of infection in infants aged under 3 months, whose mothers would have been eligible for the vaccine while pregnant, declined to levels seen prior to 2012; this demonstrates the effectiveness of the maternal immunisation programme (PHE, 2016c).

During the first 12 months of the immunisation programme, uptake of pertussis vaccine in pregnancy in England was 56.4% (PHE, 2013). Uptake remained broadly similar in the period April 2014 to March 2015 at 53.8% (PHE, 2015). Throughout both periods, monthly fluctuations were seen, with uptake highest during the influenza season (September to February). It is possible that the availability of seasonal influenza vaccines for pregnant women during these months had a positive effect on uptake of pertussis vaccines. However, for the period May–September 2016, uptake improved to 70%. This increase is likely to be linked to changes in the way data were extracted from general practices from April 2016; prior to this data extraction may have underestimated true uptake. In addition, from April 2016, the pertussis vaccine was available to women earlier in pregnancy (from 16 weeks rather than 28 weeks) and this may also have contributed to the increase (PHE, 2016c). Despite the improvements seen in the uptake of pertussis vaccine in pregnancy, there is wide variation between different areas of England: 57.1% in London to 77.7% in Wessex (PHE, 2016c).

PHE is currently conducting an audit of local commissioning of pertussis vaccine in pregnancy to ascertain whether additional provision via maternity services results in higher local uptake. These data may be a useful guide for the future commissioning of the programme in England.

Between the start of the maternal immunisation programme in October 2012 and the end of May 2016, there were 16 deaths from confirmed pertussis in young babies (Public Health England 2016c). Of the 16 deaths, 14 babies were born to women who had not been vaccinated against pertussis during pregnancy. The two whose mothers had been vaccinated were born too close to vaccination for optimal passive immunity to have transferred to the infant (PHE, 2015).

Commissioning of the maternal pertussis immunisation programme in England

The emergency maternal pertussis immunisation programme was directly commissioned by the Department of Health, using general practices as the sole nationally contracted service provider (CMO, 2012). Following reforms to the health service in England since April 2013, NHS England has continued to commission the service from general practices (NHS England, 2016). In England, maternity care is commissioned locally by clinical commissioning groups (CCGs). GPs remain the sole providers of maternal pertussis immunisation; while some immunisations, such as neonatal hepatitis B and BCG vaccines, are included in the maternity pathway payment (NHS England, 2015), pertussis and influenza are not. Instead, both of these programmes are commissioned by NHS England.

The delivery model in England for the administration of the pertussis-containing vaccines in pregnancy is likely to vary depending on local commissioning arrangements. In some areas, the vaccine will only be available via the woman's general practice. However, in some areas of England, the provision of the pertussis vaccine has been expanded by NHS England public health commissioning teams by contracting the immunisation service from local maternity service providers. Under these arrangements, the midwife may offer the pregnant woman the pertussis vaccine as part of antenatal care, although it would still be available to her via general practice. If this model is adopted by maternity service providers, it is important that notification of immunisation is communicated to the woman's GP, as national surveillance of pertussis vaccine uptake in pregnancy is automatically extracted by PHE from individual general practices in England (PHE, 2016c). Alternatively, in areas where maternity services have not been locally commissioned to provide the vaccine, the pregnant woman can be signposted to her GP to receive it. To help general practices accurately identify eligible women, invite them for immunisation, and report accurate uptake data to PHE, it is important that maternity services inform general practice when a woman is pregnant, or no longer pregnant through birth, miscarriage or termination.

Implementing maternal immunisation in Lewisham and Greenwich

Lewisham and Greenwich NHS Trust has been actively involved in the vaccination of pregnant women for

influenza and pertussis since its inception in 2013. The large acute Trust provides comprehensive maternity care to women living in the London Boroughs of Lewisham, Greenwich and Bexley.

The Trust was successful in securing additional funding from the CCG to provide bespoke additional midwife-led clinics to provide vaccination clinics. This engagement programme made considerable efforts to target pregnant women to provide information and encouragement to get an influenza and pertussis vaccination. A cohort of midwives received additional training and were rostered to cover influenza and pertussis vaccination clinics throughout the influenza season. The clinics were held Monday to Friday in the main hospital; women were counselled about the vaccinations following their obstetric dating scan at 10–12 weeks of pregnancy and their anomaly scan at 20–21 weeks. More than 700 women at University Hospital Lewisham and 900 women at Queen Elizabeth Hospital would be seen by these midwives every month. The midwives also attended the labour wards and maternity inpatient wards to provide vaccinations to those women who were inpatients in hospital.

The engagement programme was advertised on the maternity units' social media pages (Facebook and Twitter); all community midwives were informed to direct women to the antenatal clinics, and GPs were contacted to inform them of the initiative. For every vaccination administered, GPs were contacted by the maternity department to be informed.

Following the implementation of this service, there has been a significant increase in the uptake of influenza and pertussis in the London Boroughs of Lewisham, Greenwich and Bexley. Owing to this success, the Trust has now secured additional funding to embed the engagement programme within its midwifery workforce so this continues throughout 2017/18.

Conclusion

Pertussis remains a serious threat to the health of infants and is associated with increased risk of death. Since the introduction of the maternal immunisation programme, neonatal morality has reduced through the use of a safe and effective vaccine. While uptake in England has seen recent improvements, 3/10 pregnant women are still not receiving the vaccine, leaving their newborns potentially at risk of pertussis infection prior to receiving active immunisation. Regardless of the local delivery model, pregnant women should be made aware of the risks to their baby from pertussis infection, the benefits of the vaccine and where they may access it. New parents should be encouraged to ensure their baby receives vaccination and therefore active immunity against pertussis, on time at 8, 12 and 16 weeks of age. Midwives, in their role as the key professional in the care of pregnant women (Chief Nursing Officers of England, Scotland, Northern Ireland and Wales, 2010), are ideally placed and trusted by pregnant women to discuss pertussis (and influenza) immunisations.

The privileged and trusted position of the midwife should be built on to inform, administer and, where necessary, signpost pregnant women so they can make a fully informed decision regarding immunisation. Helping pregnant women to access appropriate vaccinations in pregnancy also fulfils the Nursing and Midwifery Council (NMC, 2015) requirement to prevent ill health. Midwives themselves should be supported with yearly immunisation updates, to enhance knowledge and confidence in immunisation, allowing them to make a positive impact on the uptake of pertussis vaccination, thereby improving the outcome to infants exposed to whooping cough in the first few months of life. **BJM**

Key points

- Pertussis (whooping cough) is a serious vaccine-preventable disease with increased risk of mortality in the very young
- An increase in the incidence of pertussis in England from 2011, coupled with 14 neonatal deaths in 2012, led to the introduction of an emergency maternal immunisation programme
- The maternal pertussis immunisation programme is successful, with evidence of good vaccine efficacy, safety in pregnancy and acceptability among pregnant women
- Uptake of the vaccine in pregnancy is currently 70% in England, but there is significant variation across different regions
- Midwives are the key professional from whom pregnant women wish to receive information about immunisation
- Midwives should discuss pertussis immunisation with pregnant women and either signpost them to their GP to receive it or, if commissioned to do so, administer it to the pregnant woman

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CPD reflective questions

- What knowledge about pertussis infection in neonates will you need to adequately explain the risk to pregnant women?
- Why can inactivated pertussis vaccines be given in pregnancy?
- What knowledge do you need to adequately explain the benefits of the pertussis vaccine in pregnancy?
- What are the common unwanted effects of pertussis in pregnancy?
- If immunising against pertussis in pregnancy, have you had adequate training and, if required, have you read and signed a valid Patient Group Direction?