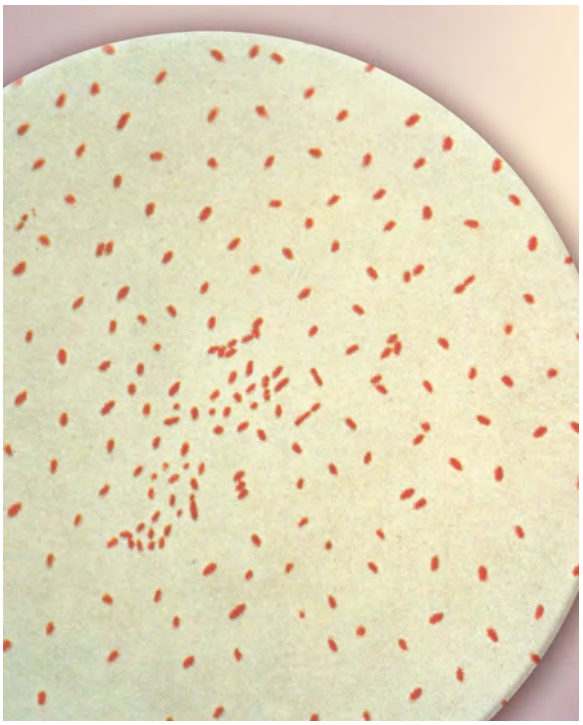
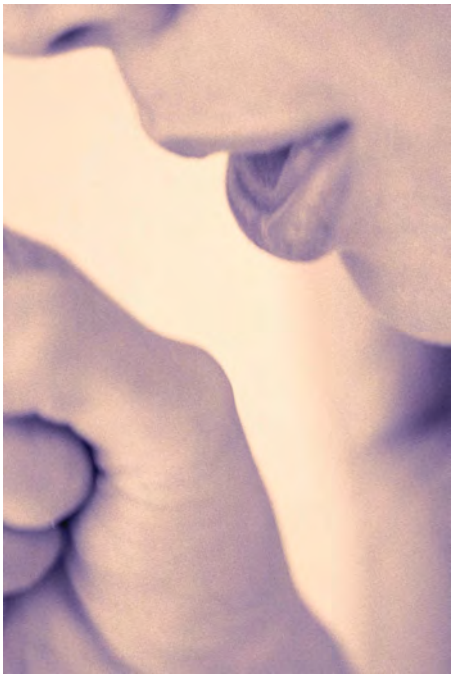
Health Protection Agency

HPA Guidelines for the Public Health Management of Pertussis





Health Protection Agency

Guidelines for the Public Health Management of Pertussis

Summary of Changes

These guidelines update and consolidate the guidance published in 2002 for use of erythromycin chemoprophylaxis in persons exposed to pertussis (Dodhia et al. *Journal of Public Health Medicine* 2002;Vol 24:No 3:pp 200-206). A specialist HPA working group was established to review all currently available scientific evidence and consult with experts where required. The revised guidelines have been circulated within the HPA for comment and signed off by the HPA Vaccine Programme Board.

These guidelines incorporate recommendations for use of newer macrolides in the treatment and prevention of pertussis and use of the TdaP/IPV vaccine for contacts over 10 years of age for whom chemoprophylaxis is indicated. The guidelines have also been extensively restructured to improve ease of reference.

The information presented by this guidance is intended to supplement, not substitute for, the expertise and judgement of healthcare professionals.

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Pertussis Guidelines Group

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PART ONE: Background and rationale

1.1 Introduction

Pertussis or whooping cough is an acute bacterial infection caused by *Bordetella pertussis*, an exclusively human pathogen which can affect people of all ages. Whilst adolescents and adults tend to display mild symptoms, infants are the most vulnerable group with the highest rates of complications and mortality. Transmission of the organism occurs as a result of close direct contact with an infected person.[1] It is highly contagious, with up to 90% of household contacts developing the disease.[2]

The incubation period of pertussis is on average between 7–10 days (range 5–21 days). The usual clinical presentation is an initial catarrhal stage with a cough that becomes paroxysmal. Paroxysms of cough usually increase in frequency and severity as the illness progresses and persist for 2–6 weeks. These paroxysms may end in vomiting, cyanosis and/or a characteristic inspiratory whoop. Patients with pertussis are most infectious in the initial catarrhal stage and during the first three weeks after the onset of cough.[3] Symptoms slowly improve in the convalescent phase, which generally lasts 2–6 weeks but can persist for months. Serious complications include pneumonia, seizures and encephalitis. Vaccination provides the most effective strategy for preventing pertussis transmission in the population, although protection afforded by vaccination or from past infection is not lifelong.

1.2 UK strategy for pertussis control

Whole-cell pertussis vaccination was introduced into the UK routine childhood immunisation schedule in the 1950s. In order to optimise pertussis control, the current accelerated primary schedule consisting of three primary doses at two, three and four months replaced the previous three, five and ten month schedule in 1990. In October 2001, an acellular pertussis booster was introduced at three years four months to five years of age and the five-component diphtheria/tetanus/acelluar pertussis/inactivated polio/*Haemophilus influenzae* type b (DTaP/IPV/Hib) vaccine Pediacel™ replaced whole-cell pertussis vaccine in the routine primary schedule in October 2004. This combination vaccine offers the advantages of a less reactogenic pertussis component [4-6] and no risk of vaccine-associated paralytic poliomyelitis given the inclusion of an inactivated polio virus component.[7]

1.3 Disease burden

There was a fall in vaccine coverage in the 1970s linked to high profile scares about the safety of the vaccine, followed by a period of recovery in the 1980s. Since 1991,

coverage by second birthday has remained above 90% in England and reached 94% in 2007/08.[8] During this period, there has been a marked reduction in notifications of pertussis in England and Wales, although the typical 3–4 yearly cyclical pattern continues to occur with 2008 reported as the most recent peak year. Cases continue to occur in very young infants too young to be afforded direct protection through current immunisation schedules and in adolescents and adults.

In England and Wales, the burden of disease in children under one year has fallen since the introduction of the accelerated schedule and concomitant period of sustained high coverage. The highest rates of disease, however, occur in infants less than three months (laboratory confirmed pertussis: 103.8 per 100,000 population in 2008) who account for the highest proportion of all hospitalised cases (68-89% of all hospitalised cases).[9] Rates of pertussis in older children and adolescents have also increased with a marked rise since 2006 for 10–14 year olds and since 2004 for those 15 years and over. However, improved ascertainment of cases through the introduction of serology testing is thought to account for most of this rise.

1.4 Surveillance of pertussis

Pertussis remains a notifiable disease under the Health Protection Legislation (England) Guidance 2010 and suspected cases should be notified to the proper officer of the local authority and to the Health Protection Agency (HPA). Notification to the local Health Protection Unit (HPU) would fulfil the responsibility to notify the local authority proper officer. This should be done by telephone as soon as is practicable and in writing within three days. In addition, from October 2010, all diagnostic laboratories are required to report all confirmed cases of *B. pertussis* infection to the HPA.[10]

Laboratory confirmation of clinically suspected cases can be made by isolation of the causative organism *B. pertussis* or detection of its DNA (typically from pernasal swabs or nasopharyngeal aspirates) or serological tests which usually only provide a late or retrospective diagnosis. The Bordetella reference facility at the Health Protection Agency Microbiology Services-Colindale (MS-Colindale) currently offers *B. pertusiss* PCR for acutely ill children age twelve months or under admitted to a paediatric intensive care unit (PICU) or paediatric ward with respiratory illness compatible with pertussis, and estimation of anti-pertussis toxin (PT) IgG antibody for the serological diagnosis of pertussis infection on single serum samples taken more than two weeks after onset for any individuals with a history of prolonged cough (the

serological service is now a referred charged test; see HPA website for full details). Staff at MS-Colindale follow-up all cases of pertussis confirmed by the reference laboratory and all confirmed cases reported from diagnostic laboratories to obtain further epidemiological and clinical information as well as vaccination status.

The Immunisation, Hepatitis and Blood Safety department, Health Protection Agency is responsible for reporting annual case based information on confirmed cases to the European surveillance network (EUVAC.NET) (http://euvac.net/graphics/euvac/index.html) and also annually to the World Health Organization (WHO) European region and the European Centre for Disease Control (ECDC).

1.5 Laboratory confirmation of clinically suspected cases

1.5.1 Culture

Laboratory confirmation is conventionally performed by isolating the *B. pertussis* organism through culture from nasopharyngeal aspirates or pernasal swabs. However, culture can lack sensitivity as the organism is delicate and can be affected by processing delays. The sensitivity of nasopharyngeal culture decreases with time after onset and is highly dependent on specimen quality. Cultures are unlikely to be positive after two weeks from the onset of the catarrhal stage or one week of paroxysmal cough or for more than a few days after commencing antibiotics.[11] Based on HPA enhanced surveillance data, less than one third of all culture positive cases in 2009 (where onset date was recorded) were confirmed more than two weeks post onset of symptoms. It is also more difficult to culture the organism in vaccinated compared with unvaccinated children.[12] Given the limited 'window of opportunity' for positive culture, it is important to emphasise that a negative culture does not exclude pertussis. Despite the low yield, culture should be attempted as isolation of the causative organism is definitive. The isolates should be referred to MS-Colindale for confirmation and serotyping which allows further genotypic and phenotypic analyses. Turnaround time varies but culture can be slow and take up to seven days to obtain a clear result.

1.5.2 Serology

Detection of anti-pertussis toxin (PT) IgG antibody levels in serum is well-established and can be performed using an enzyme immuno-assay. This referred charged service is offered by MS-Colindale when the sample has been taken more than fourteen days after the onset for older children and adults with a history of a

prolonged cough. Serology may confirm the diagnosis of pertussis in patients who have been symptomatic for some weeks when culture and PCR are unlikely to yield positive results. It has been used predominantly in older children and adults. However, serological diagnosis amongst infants has some limitations e.g. infants less than three months may not develop measurable antibodies and recent vaccination (primary or booster vaccination) within approximately one year of testing can confound the test results. A serologically confirmed case is defined as an anti-pertussis toxin IgG titre >70 International Units per millilitre (IU/ml)[13] in the absence of vaccination within the past year. The routine turnaround time for this service is 2–10 days.[a]

1.5.3 Genome detection by real-time PCR

PCR is a more robust tool than culture for diagnosis in the later stages of illness or when antibiotics have been administered.[14] PCR is invaluable in diagnosing pertussis in young infants in whom serology is difficult and the yield from culture may be low. Since April 2002, PCR was offered to investigate suspected cases in infants up to six months of age from pernasal swabs or nasopharyngeal aspirates. From April 2007, this was extended to all children 12 months and under who are acutely unwell and admitted to hospital with a respiratory illness compatible with pertussis. Two PCRs are undertaken on each sample: one designed in-house, targeting the pertussis toxin S1 promoter (*ptxA*-pr), which includes an internal process control to test for sample inhibition and reagent performance; the other targeting the insertion element IS*481.*[15] PCR is usually more sensitive than culture as the organism does not need to be viable. A same-day service is provided by the reference laboratory at MS-Colindale for samples meeting defined criteria received by 10am.

1.6 Rationale for public health action

Outbreaks of pertussis can occur in households, schools, healthcare settings and in the community. Cases amongst adolescents and adults are particularly relevant given that adults in the household are often the source of infection for cases occurring in very young infants, who are most at risk of severe complications. In a US study of infants with reported pertussis, over 70% had been infected by their mother or other family member, the majority of whom were aged 20 years or more.[16] In a study of infants admitted to a UK Paediatric Intensive Care unit with respiratory

[a] From June 2007 to September 2009 a new oral fluid service for pertussis confirmation was introduced as part of the enhanced surveillance programme as a pilot. This provided routine follow-up for all notified cases which had not been confirmed by other methods (culture, PCR or serology).

complications, 20% had laboratory evidence of pertussis and half of these were infected from an adult family member.[17]

If outbreaks are detected at an early stage, prompt action including chemoprophylaxis and vaccination can limit the spread.[18;19] Cases occurring in households where there are vulnerable contacts (infants who have received less than three doses of DTaP/IPV/Hib; women in the last month of pregnancy; adults who work in a healthcare, social care or childcare facility and immunocompromised individuals) need to be identified so that prompt post-exposure prophylaxis may be offered to all household contacts.[1]

In addition to parents, other adults in close contact with young infants including healthcare workers can be responsible for transmission.[20] In healthcare settings, outbreaks can be prolonged involving groups of adults with waning immunity who have multiple opportunities for transmission. Exclusion of staff in hospital and school settings can be very disruptive and costly.[21]

1.6.1 Use of antibiotics in the treatment and prevention of pertussis

UK guidelines published in 2002 recommend chemoprophylaxis with erythromycin in households with vulnerable contacts within twenty one days from the onset of disease.[1] Erythromycin is recommended as the drug of choice for the prophylaxis and treatment of pertussis, except for infants below one month, although it is poorly tolerated, causing gastrointestinal side effects in up to 30% of patients [22;23] which may lead to non-compliance with therapy.[18] Treatment with erythromycin is primarily aimed at eradicating *B. pertussis* from cases and preventing secondary transmission. It has a limited effect in improving the clinical course of the illness especially if administered beyond 2–3 weeks after the onset of symptoms. A 1998 UK review of the use of erythromycin in the management of persons exposed to pertussis reported little effect in preventing secondary transmission, which was limited to close prolonged household type contact.[18] Effects of erythromycin were modest, short term and associated with gastrointestinal side effects.[18] As a result, the use of chemoprophylaxis in the UK has been limited to households with vulnerable contacts where the risk of severe complications and/or ongoing transmission is high.[1] This compares with the US approach of recommending more widespread use of chemoprophylaxis to all household contacts and other close contacts regardless of age and immunisation status.[24]

Newer macrolides such as azithromycin and clarithromycin offer the advantages of improved absorption, a longer half-life, good in vitro activity against *B. pertussis* and a better side effect profile.[25] In addition, these agents involve less frequent dosing and shorter duration of therapy. A number of studies have established the safety and efficacy of newer macrolides for eradicating *B. pertussis*.[25;26] The improved side effect profile has also been shown to improve compliance with treatment.[27] Recent data suggest that there is no evidence of macrolide-resistant strains in the UK.[28] For those patients where a macrolide is contra-indicated or is not tolerated, co-trimoxazole is effective in eradicating *B. pertussis* from the nasopharynx and can serve as an alternative agent, although it is unlicensed for chemoprophylaxis.[29-31]

In a 2007 Cochrane systematic review of antibiotics for pertussis, the authors concluded that although antibiotic therapy for cases was effective in eliminating *B. pertussis,* it did not alter the subsequent clinical course of the illness.[30] Short term antibiotics (azithromycin for 3–5 days; clarithromycin or erythromycin for seven days) were as effective as long term (erythromycin for 10–14 days) in eradicating *B. pertussis* from the nasopharynx (RR 1.02, 95% CI 0.98, 1.05) but had fewer side effects (RR 0.66, 95% CI 0.52, 0.83).

The review concluded that there was insufficient evidence to determine the benefit of prophylactic treatment of pertussis contacts.[30] In the two trials included in the review, which investigated the effectiveness of chemoprophylaxis with erythromycin, clinical symptoms in the treatment group were slightly less (not statistically significant) than the placebo group.[23;32] The number of contacts that became culture-positive were slightly less in the erythromycin group (3/142, 2.1%) compared to placebo (8/158, 5.1%) but the difference was not statistically significant (RR 0.42; 95% CI 0.11, 1.54).[23] Although there have been no specific studies of prevention of secondary transmission using these newer macrolides, their biological effect is considered to be similar to erythromycin.

Post-exposure chemoprophylaxis for contacts over six months of age did not significantly improve clinical symptoms or the number of cases developing culture positive *B. pertussis*, although timing of prophylaxis was thought to be a critical factor. Whilst early administration may improve the efficacy of chemoprophylaxis in preventing secondary transmission, this requires clinical diagnosis, which is likely to be a challenge given that adolescents and adults who are often the source of infection, generally do not seek timely health advice.

1.6.2 Post-exposure vaccination

In the UK, use of pertussis-containing vaccines at the time of exposure has been recommended for unvaccinated or partially immunised contacts up to ten years of age to provide long term protection.[33] However, more recently, a number of studies have demonstrated the safety and immunogenicity of a combined tetanus/low dose diphtheria vaccine/low dose acellular pertussis (Tdap) vaccine in adolescents and adults up to 65 years.[34-36] The introduction of a TdaP-IPV[b] vaccine (Repevax®) for use as a pre-school booster provides the only licensed low dose acellular pertussis-containing vaccine suitable for adolescents and adults in the UK.

Although duration of immunity following acellular pertussis vaccination has not been clearly established, a recent review based on limited studies suggested duration of protection for 5–6 years.[37] Persistence of immunity for 6–9 years after a booster administered in the second year of life was reported for children receiving a three-component acellular pertussis vaccine.[38] In October 2001, a booster dose of a three-component acellular pertussis-containing vaccine was introduced into the UK routine schedule for children aged between three years four months and five years. Children born before November 1996 would have been eligible for only three primary doses of (whole cell) pertussis-containing vaccine during infancy. In these individuals in particular, protection is likely to have waned.[39] Therefore, in the event of exposure, contacts over ten years (many of whom would only have been eligible to receive a three-dose primary course), whether they be unvaccinated, partially or fully immunised, may benefit from a dose of pertussis-containing vaccine, especially given their importance as a source of transmission.

To determine the potential value of vaccination as part of an outbreak control strategy in adults, the immediate immune response to vaccination in adult healthcare workers at the time of exposure has been investigated.[19] Of the 106 healthcare staff immunised during a 2006 US outbreak, Tdap antibody responses were noticeable at one week following vaccination with more than 50% of subjects showing a response to filamentous haemagglutinin, pertactin and fimbriae and 46% showing a booster response to pertussis toxoid.[19] By two weeks, between 88–94% showed a booster response depending on the specific pertussis antigen. Vaccine effectiveness could not be determined in this study because there was no unvaccinated control

[b] Studies using Tdap referred to in this guidance have equivalent pertussis antigen content to Repevax. However, Repevax is referred to as TdaP/IPV in this guidance in line with the SPC and the Green Book.

population.[40] However, the data suggest early Tdap vaccination may be valuable in preventing illness and transmission among adults in outbreak settings, reducing susceptibility of the population within 1–2 weeks.

One key concern regarding the use of pertussis-containing vaccines in children over ten years is increased rates of severe local reactions, including Arthus-type reactions if TdaP-IPV is administered too soon after a previous Td-IPV vaccine in older children and adults, either as part of the school leaver booster (which is offered to all 13–18 year olds in the UK), as a booster prior to travel or as part of the post exposure management for diphtheria or tetanus.[41] In pre-licensure clinical trials of Tdap in adolescents, those who had received doses of a diphtheria or tetanus toxoid-containing vaccine during the preceding five or ten years were excluded.[42] However, a Canadian study, which investigated the safety of administering a dose of Tdap at intervals less than five years after paediatric DTaP or Td concluded that Tdap can be safely administered at intervals of more than 18 months since a previous Td vaccine.[43] Two smaller Canadian post-licensure safety studies in adolescents have also shown acceptable safety when Tdap is administered at intervals less than five years.[44;45]

Based on these findings, Canada's National Advisory Committee on Immunization (NACI) concluded that there is no evidence of increased risk of severe adverse events for Canadian adolescents after receiving diphtheria and tetanus toxoid-containing vaccines at intervals of less than five years.[45] In 2006, the US Advisory Committee on Immunisation Practices (ACIP) recommended that adolescents who have received Td booster vaccine should receive Tdap for added protection, preferably with a five-year interval to reduce the risk of local and systemic reactions, although an interval of less than five years may be used.[42]

More recently, the authors of a randomised double-blind study in France, which assessed the safety of Tdap-IPV administered one month after vaccination with Td-IPV in 500 healthy adults, concluded that Tdap-IPV may be administered to adults as little as one month after Td-IPV without significantly increasing the frequency or severity of side effects relative to considerably longer vaccination intervals.[46]

In 2010, the ACIP published updated recommendations for pertussis immunisation, advising that when indicated, pertussis vaccination should not be delayed and should be administered regardless of interval since the last tetanus or diphtheria toxoid-

containing vaccine.[47] While longer intervals between Td and Tdap vaccination could decrease the occurrence of local reactions, the benefits of protection against pertussis outweigh the potential risk for these adverse events.

Therefore based on the currently available evidence, these revised HPA guidelines recommend extending the offer of post-exposure vaccination with TdaP-IPV. In households where there is a clinically suspected or confirmed case of pertussis and a vulnerable contact, in addition to vaccinating unimmunised or partially immunised contacts below ten years of age, TdaP-IPV should also be offered to household contacts aged between 10–64 years who have not had a Td-IPV booster within the past month (see Section 2.6.3)

PART TWO: Management and investigation of suspected cases of pertussis and their contacts

2.1 Minimum details to be taken when a case is reported

Caller details

- Name, address, designation and contact number

Demographic details

- Name, date of birth, sex, ethnicity, NHS number
- Address including postcode
- Contact details including phone number
- Occupation (if applicable)
- Place of work / education (if applicable)
- GP name and contact details (including address and phone number)

Clinical /Epidemiological details

- Clinical information – onset dates, cough (including duration), presence of inspiratory whoop / apnoea / post-tussive vomiting, complications, admission to hospital, treatment
- Immunisation history (including dates)
- Contact with confirmed or suspected case
- Any vulnerable close contacts
- Context: household, school, healthcare setting

2.2 Risk assessment for the index case

The positive predictive value of a clinical diagnosis of pertussis is not very high, particularly amongst adolescents and adults who may present with atypical features. (In 2006, between 17–40% of all serology samples were positive.) Risk assessment should be based on a combination of clinical and epidemiological factors such as clinical presentation, vaccination history and epidemiological links. Management should proceed based on clinical suspicion without waiting for the results of laboratory testing.

2.3 Case definitions

Suspected case of pertussis

- Any person in whom a clinician suspects pertussis infection **or**
- Any person with an acute cough lasting for 14 days or more, without an apparent cause plus one or more of the following:-
    - Paroxysms of coughing
    - Post-tussive vomiting
    - Inspiratory whoop

AND

- Absence of laboratory confirmation
- No epidemiologic link to a laboratory confirmed case.

Confirmed case of pertussis

Any person with signs and symptoms consistent with pertussis with:

- *B. pertussis* isolated from nasopharyngeal aspirate or pernasal swab **or**
- Anti- Pertussis toxin IgG titre >70 IU/ml[13] (in the absence of vaccination within the past year) **or**
- Confirmed *B. pertussis* PCR positive on any clinical specimen.

Epidemiologically linked case of pertussis

- A suspected case with signs and symptoms consistent with pertussis, but no laboratory confirmation, who was in contact with a laboratory confirmed case of pertussis in the 21 days before the onset of symptoms.

2.4 Investigation of Suspected Cases

The HPA Bordetella reference facility, MS-Colindale, offers a range of reference and referred tests to seek laboratory confirmation of clinically suspected cases of pertussis and the choice of test is largely based on factors such as age and date of testing in relation to onset of symptoms.

Recommendations for testing

- ***INFANTS*** *(up to and including one year of age)*

A. Hospitalised Infants

PCR testing which is offered by the reference laboratory at MS-Colindale is recommended for these infants as soon as possible post onset.

B. Infants Not Requiring Hospitalisation

Laboratory investigation by **culture** is recommended for these infants as soon as possible post onset.

- ***CHILDREN OVER 12 MONTHS AND ADULTS***

A. Early (within two weeks of onset or 48 hours of antibiotics therapy)

Culture is recommended in the early stages of illness.

B. Late (more than two weeks from onset of cough/more than 48 hours since commenced antibiotic therapy)

Serology is recommended for individuals whose onset of illness is greater than fourteen days **AND** who have not been immunised against pertussis in the previous year regardless of whether they have been on antibiotic treatment for more than 48 hours.

Urgent Diagnosis

If an urgent diagnosis is required (for example, where rapid protection of vulnerable contacts in a healthcare setting may be required) please contact the Bordetella reference facility at MS-Colindale on 0208 327 7327 and discuss with senior staff.

2.5 Case management

2.5.1 Exclusion

Children with suspected, epidemiologically linked or confirmed pertussis who are being treated with antibiotics should be excluded from schools or nurseries for five days from commencing therapy.[48] For adults working in educational, social and healthcare settings, contact with vulnerable groups should be avoided for five days from commencing antibiotic therapy.

2.5.2 Antibiotic therapy

For suspected, epidemiologically linked or confirmed cases, recommended antibiotic regimens are summarised in Table 1. Antibiotics should be administered as soon as

possible after onset of illness in order to eradicate the organism and limit ongoing transmission. The effect of treatment on reducing symptoms, however, is limited or lacking especially when given late during the disease and therefore antibiotic treatment for the case is recommended within three weeks of onset of illness.

Given the adverse effects associated with erythromycin, azithromycin and clarithromycin should be considered as suitable alternative agents. Azithromycin is the preferred agent for use in infants below one month of age. For individuals in whom macrolides are contra-indicated or not tolerated, co-trimoxazole may be used.

2.5.3 Immunisation

It is important that unvaccinated and partially immunised cases up to ten years of age complete their course of primary immunisation and booster vaccine, once they have recovered from their acute illness, according to the recommended UK schedule. (Available at http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1194947406156)

Table 1: Recommended antibiotic treatment and post exposure prophylaxis for pertussis by age group[c]

Age group	Erythromycin	Clarithromycin	Azithromycin	Co-trimoxazole*
<1 month	Not preferred due to association with hypertrophic pyloric stenosis 12.5mg/kg every 6 hours for 7 days	Not preferred in this age group	**Under 6 months:** 10mgs/kg once a day for 5 days	Not recommended for infants below 6 weeks
1 -24 months	125mg every 6 hours for 7 days	Under 8kgs: 7.5mg/kg twice a day for 7 days 1-2 yrs: 62.5mg twice a day for 7 days	**Infants and children ≥ 6 months:** 10mg/kg (maximum 500mg) on day 1, followed by 5mg /kg (maximum 250mg) on days 2-5	6 weeks – 5 months: 120mg twice a day for 7 days
2-8 years	250 mg every 6 hours for 7 days	3-6 yrs: 125 mg twice a day for 7 days 7-9 yrs: 187.5mg twice a day for 7 days		6 months – 5 years: 240mg twice a day for 7 days
Children > 8 years	250-500mg every 6 hours for 7 days	≥10 yrs: 250 mg twice a day for 7 days		6-12 years: 480mg twice a day for 7 days
Adults	250 – 500 mg every 6 hours for 7 days	500mg twice a day for 7 days	500mg on day 1 followed by 250mg once daily on days 2-5	960mg twice a day for 7 days

*consider if macrolides contra-indicated or not tolerated

Please note that the doses for treatment and prophylaxis are the same.

[c] The above information has been taken from BNF 59, Children's BNF. Azithromycin doses based on SPC and CDC Guidelines[3].

2.6. Contact management

Management of contacts should proceed for all clinically suspected, epidemiologically linked and laboratory confirmed cases.

Definition of close contacts

Family members or people living in the same household are considered close 'household contacts'. Contacts in institutional settings with overnight stays in the same room, e.g. healthcare settings, should also be considered close contact. Other types of contact, e.g. contact at work or school, would generally not be considered close contact although each situation would need to be assessed on an individual basis where vulnerable contacts are involved.

Definition of vulnerable contacts

These include individuals who are themselves at increased risk of complications from pertussis as well as those at risk of transmitting the infection to others at risk of severe disease.

- Newborn infants born to symptomatic mothers
- Infants under one year who have received less than three doses of DTaP/IPV/Hib
- Unimmunised and partially immunised infants or children up to ten years
- Women in the last month of pregnancy
- Adults who work in a healthcare, social care or childcare facility
- Immunocompromised individuals (as defined in the Green Book)
- Presence of other chronic illnesses e.g. asthma, congenital heart disease.

2.6.1 Exclusion

Exclusion for asymptomatic contacts is ***NOT*** required.

2.6.2 Chemoprophylaxis

Given the limited benefit of chemoprophylaxis, antibiotic prophylaxis should only be offered to close contacts when both of the following conditions apply:

- Onset of disease in the index case is within the preceding twenty one days **AND**
- There is a vulnerable close contact present (as defined above).

Where both these conditions are met, ***ALL*** close contacts (regardless of age and previous immunisation history) should be offered chemoprophylaxis. The dose of antibiotics for use as chemoprophylaxis is the same as for the treatment of cases (see Table 1). Chemoprophylaxis is ***NOT*** required where there are no vulnerable close contacts.

For pregnant women with suspected or confirmed pertussis, who are still infectious at delivery (i.e. within twenty one days of onset), the newborn infant should be offered chemoprophylaxis with azithromycin for five days.

2.6.3 Immunisation

Immunisation should be considered for those who have been offered chemoprophylaxis.

- Unimmunised and partially immunised contacts up to the age of ten years should complete the schedule with the appropriate vaccine.
- A booster dose of TdaP-IPV is recommended for individuals aged 10–64 years who have not received a dose of pertussis-containing vaccine in the last ten years and no Td-IPV vaccine in the preceding month.

2.7 Special situations

2.7.1 Outbreaks

In the event of a hospital or community outbreak, an outbreak control team should be convened. An appropriate outbreak control team is likely to include:

- Health protection specialist from the local HPU
- Education representative (if educational setting)
- PCT representative
- Acute trust representatives including director of infection prevention and control, infection control nurse, microbiologist (healthcare setting)
- Communications leads (from HPA, PCT and acute trust as necessary).

Expert advice on outbreak investigation and treatment is available from the Immunisation, Hepatitis and Blood Safety Department, HPS-Colindale, HPA (020

8200 6868/4400) and on laboratory investigation from the Bordetella reference facility, MS-Colindale (0208 327 7327).

2.7.2 Healthcare settings

Healthcare workers can be an important source of pertussis transmission to patients, particularly young children and immunocompromised patients who are at risk of severe complications.

When one or more suspected or confirmed cases are identified in a hospital setting, infection control procedures need to be implemented immediately and this will require close liaison with the director of infection prevention and control (DIPC), microbiologist (if different), infection control team and occupational health manager. Infection control measures are likely to include standard respiratory isolation of cases until they are no longer infectious, rapid investigation to confirm cases, chemoprophylaxis for close contacts staying overnight in the same bay as the case during the infectious period, and booster vaccination as appropriate. This will include offering a booster dose of TdaP-IPV to healthcare staff identified as a close contact by the outbreak control team.

Other options to be considered by the hospital infection control team may include carrying out active surveillance amongst exposed patients and staff and rapidly investigating staff members and patients who present with a coughing illness.

2.7.3 Nursery and school settings

Confirmed and suspected cases should be excluded from nursery or school for five days from commencing antibiotic therapy. Asymptomatic contacts do ***NOT*** need to be excluded.

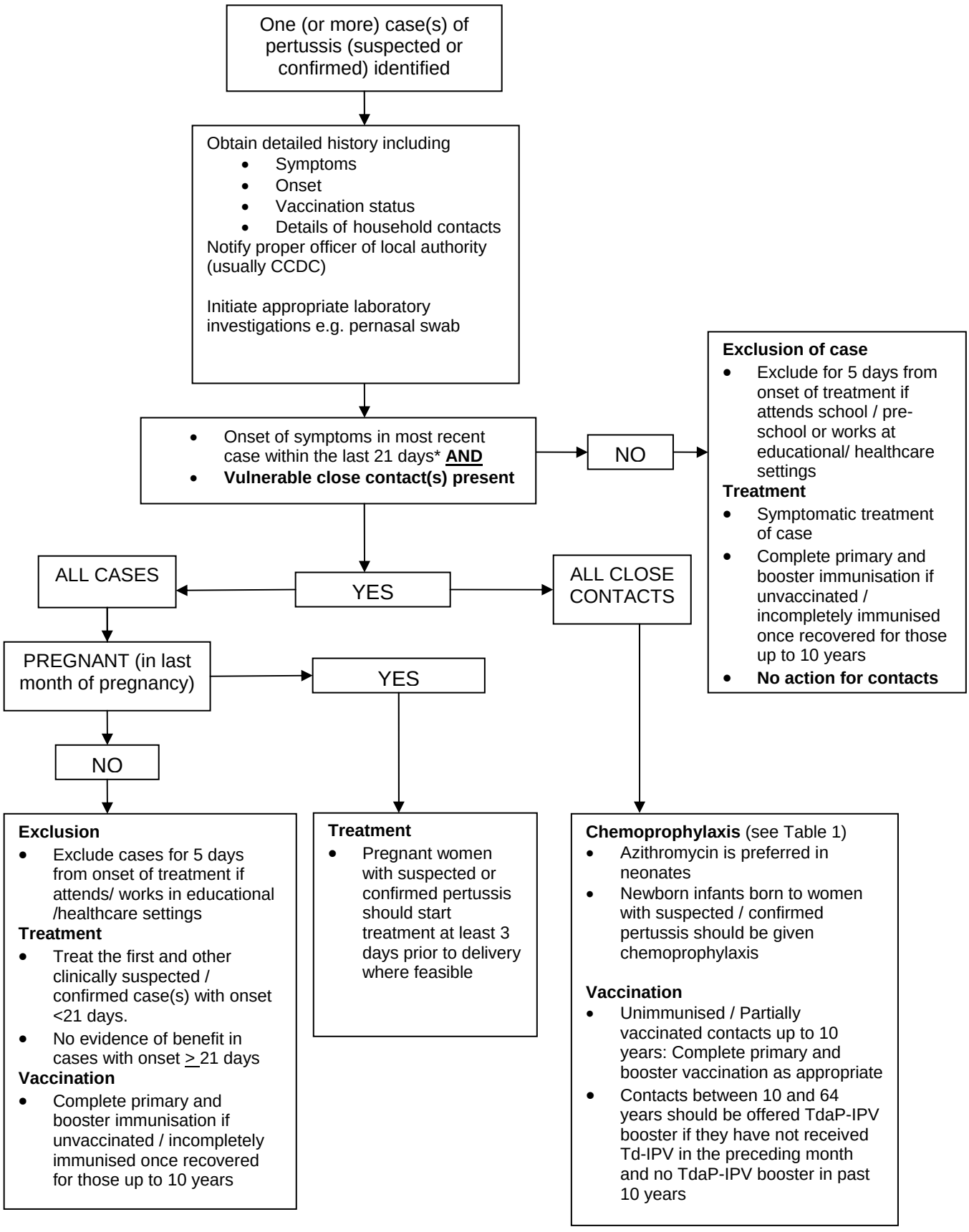
In exceptional circumstances, wider chemoprophylaxis for a school/nursery outbreak may be considered by the outbreak control team and may be informed by a number of factors including:

- Duration of the outbreak and thus the likely benefit of chemoprophylaxis.
- Presence of a clearly defined group who can be identified for chemoprophylaxis.
- Practicality and feasibility of widespread chemoprophylaxis.

- Acceptability and compliance with antibiotics.
- Residential setting e.g. boarding school, children's respite care homes.

Although vaccination will not control the outbreak, all unimmunised and partially immunised children should be advised to complete vaccination as appropriate. This information should be provided to parents in the form of an appropriate letter which may be forwarded to the school/nursery for dissemination. The Director of Public Health should also be informed.

HPA Guidelines for the management of cases and close contacts of pertussis



* If there are prolonged multiple chains of transmission, the benefit of chemoprophylaxis is likely to be minimal

APPENDIX 1: Table of quality of evidence for recommendations

Strongly recommended on the basis of more than two consistent, well conceived, well executed studies with control groups or longitudinal measurements.

Recommended on the basis of more than one well conceived, well executed, controlled, or time series study; or more than three studies with more limited execution.

Indicated on the basis of previous scientific observations and theoretic rationale, but case controlled or prospective studies do not exist.

Recommendation	Level of Evidence
Children with suspected/ epidemiologically linked / confirmed pertussis should be excluded from school / nurseries for 5 days from commencing antibiotic therapy	Indicated
Suspected / epidemiologically linked / confirmed cases should be treated with antibiotics	Strongly recommended
Unvaccinated and partially immunised cases and contacts up to 10 years of age should complete their course of primary immunisation and booster vaccine according to the recommended UK schedule	Indicated
Chemoprophylaxis should be offered to all close contacts when onset of illness in index case is within the preceding twenty one days AND there is a vulnerable close contact present	Recommended
A booster dose of TdaP-IPV is recommended for individuals aged 10–64 years who have not received a dose of pertussis containing vaccine in the last 10 years and no Td-IPV vaccine in the preceding month	Indicated

Health Protection Agency **In Confidence**

Follow-up of laboratory confirmed *B. pertussis* infection

You have been sent this form following laboratory confirmation of *B. pertussis* infection by culture, serology or PCR.

Note: If a case is confirmed by more than one laboratory method you may receive this form twice in error. Please accept our apologies. It is not necessary to complete it twice.

For HPA use only	Date of laboratory confirmation	Date of specimen

Please complete as far as possible, ticking appropriate boxes where applicable.

Patient Details

Surname:	First name:	Sex: M ☐ F ☐
NHS number:	Date of birth: _____/_____/_____	Age:

Clinical History of Patient

Date of first symptom onset: _____/_____/_____

Please indicate whether the following complications were present:

Apnoeic attacks: Yes ☐ No ☐ NK ☐	Pneumonia: Yes ☐ No ☐ NK ☐
Convulsions: Yes ☐ No ☐ NK ☐	Conjunctival haemorrhage: Yes ☐ No ☐ NK ☐

Death: Yes ☐ No ☐ NK ☐ If yes, date of death: _____/_____/_____

Did the patient receive erythromycin or another macrolide? Yes ☐ No ☐ NK ☐

If yes, was this: For prevention: Yes ☐ No ☐ NK ☐ If yes, date started: _____/_____/_____

For treatment: Yes ☐ No ☐ NK ☐ If yes, Date started: _____/_____/_____

Was the patient admitted to hospital? Yes ☐ No ☐ NK ☐

If yes, which hospital were they admitted to:_____

If this patient was admitted please include a copy of the hospital discharge summary with this form.

Had this patient been immunised against pertussis before symptom onset? Yes ☐ No ☐ NK ☐

How many doses of pertussis vaccine did they receive before symptom onset?_____

Dates of vaccination:	1st dose	_____/_____/_____
	2nd dose	_____/_____/_____
	3rd dose	_____/_____/_____
	4th dose	_____/_____/_____

Did the patient have contact with a suspected or known case of pertussis in the month before onset? Yes ☐ No ☐ NK ☐

If yes, please specify where the contact took place: home ☐ playgroup ☐ school ☐ work ☐ Hospital ☐ other ☐ _____

And the age of the contact: <1 ☐ 1-4 ☐ 5-9 ☐ 10-14 ☐ 15-44 ☐ 45+ ☐

If in the home, was the contact the: mother ☐ father ☐ sibling ☐ other ☐

Completed by (please print):_____	Signature:_____	Date:
Position:_____	Tel no. _____	Date:

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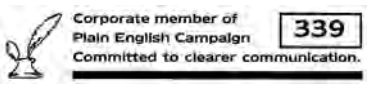

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