Public Health England

Chartered Institute of Environmental Health

# Interim - Public Health Operational Guidelines for Typhoid and Paratyphoid (Enteric Fever)

A joint guideline from Public Health England and the Chartered Institute of Environmental Health

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# Introduction

The aim of this guidance is to support public health practitioners in identifying the sources of typhoid or paratyphoid infection, and reduce the risks of secondary transmission. This guidance provides information and a framework for Health Protection Teams (HPTs) and Environmental Health Officers/Local Authorities to respond appropriately to laboratory reports and/or clinical notifications of typhoid and paratyphoid infection.

Enteric fever (typhoid or paratyphoid fever) is notifiable by Registered Medical Practitioners and laboratories under the Health Protection (Notification) Regulations 2010.

The 2012 guidance was based on the available evidence, comparison of schedules from other non-endemic countries, expert opinion and previous scientific observation supported by professional consensus of the Typhoid and Paratyphoid Reference Group (TPRG). A summary of the evidence base has been published[1]. This revised guidance also reflects the findings from the national evaluation of the public health management of enteric fever based on the utilisation of the 2012 version of this guidance[2].

Key updates in this version:

- only co-travelling contacts in risk groups require screening and other contacts only require ‘warn and inform’ advice unless symptomatic
- further emphasis on the investigation of source of infection for cases unlikely to be travel-related regardless of whether the case is in a risk group

Box 1: Recommendations for public health management of cases and contacts

| | |
|---|---|
| **Cases** | • for diagnosis of possible cases: ONE faecal sample ASAP, and exclusions for all cases as per routine gastrointestinal ‘48 hours after last symptom’ rule<br>• for clearance of probable/confirmed cases in risk groups: THREE culture negative samples 48 hours apart, starting at least ONE week after completion of treatment. Advise exclusion or redeployment until clearance. No clearance necessary for cases not in risk group |

| | |
|---|---|
| **Contacts** | • if the case's infection is likely to be *travel-related*: co-travellers in risk groups require ONE faecal sample ASAP for screening but no exclusion unless symptomatic; all non-travelling contacts and other co-travellers require 'warn and inform' information, but no screening samples or exclusion unless symptomatic<br>• if the case's infection is not thought to be travel-related: contacts require 'warn and inform' information, and may require ONE faecal sample for screening purposes to investigate source<br>• if any contacts have a positive faecal sample or become symptomatic, manage as a case, completing a further risk assessment and with appropriate clearance/exclusions depending on risk group or activities |

# 1. Case definitions for public health action

Table 1: Typhoid and paratyphoid case definitions

| **Possible case** |
| --- |
| • a person with a clinical history compatible with enteric fever and where the clinician suspects typhoid or paratyphoid as the most likely diagnosis<br>• a person with clinical history of fever and malaise and /or gastrointestinal symptoms with an epidemiological link to a source of enteric fever, eg from 'warn and inform' information<br>• a returning traveller reporting a diagnosis abroad with positive serological testing or salmonella PCR from faeces but no documented evidence of a positive blood or faecal culture positivity |
| **Probable case** |
| • a person with a local laboratory presumptive identification of *Salmonella* Typhi or Paratyphi on faecal and/or blood culture or culture of another sterile site (eg urine) , with or without clinical history compatible with enteric fever<br>• a returning traveller giving a clinical history compatible with enteric fever and documentation of a positive blood/faecal culture (or positive PCR for *S. typhi / S. Paratyphi* on blood) and/or treatment for enteric fever overseas |
| **Confirmed case** |
| • a person with S. Typhi or S. Paratyphi infection confirmed by the Public Health England Gastrointestinal Bacteria Reference Unit, Salmonella Reference Service (SRS)<br>• a person with documented confirmatory evidence from a recognised overseas reference laboratory |

Table 2: Definition of a travel-related case

| **Travel-related case** |
| --- |
| A case who develops symptoms of enteric fever within 28 days* of travel to an endemic region of the world.<br>* Based on national enhanced surveillance data, 96% of cases with a travel history have onset within 28 days of travel. Hence, this guidance defines a case of enteric fever as *likely* acquired abroad (travel-related) if symptoms develop within 28 days of arriving in the UK after travel to an endemic region.<br>The 28-day timeframe should be used as a guide but should not be seen as prescriptive. Cases outside or at the upper limit of the 28-day period require an assessment of other possible sources and local professional judgement of likely source is essential, based on the individual details of each case (see Appendix A). |

| Endemic region |
| --- |
| The majority of endemic countries are those in the Indian subcontinent, South-East Asia, sub-Saharan Africa and Latin America **.<br>** Enteric fever may occasionally be acquired from travel to a country outside these regions: see http://travelhealthpro.org.uk/country-information/ for country specific enteric fever risks. |

Table 3: Definition of carriers

| Convalescent carrier |
| --- |
| A person who is still excreting *S.* Typhi or *S.* Paratyphi after two courses of appropriate antibiotic therapy, but has been excreting for less than 12 months. |
| **Chronic carrier** |
| A person who continues to excrete *S.* Typhi or *S.* Paratyphi for 12 months or more. |

Table 4: Definition of contacts

| CONTACTS |
| --- |
| • co-traveller: someone who travelled closely with the case and who is likely to have been exposed to the same sources of infection as the case (rather than someone who merely travelled on the same bus/plane or was in the same tour group as the case). They may not necessarily live with the case |
| • household: someone who lives/stayed in the same household as the case and/or has shared a bathroom and/or have eaten food prepared by the case regularly whilst the case was symptomatic and up to 48 hours after commencement of antibiotics |
| • other contacts: may include close/sexual contacts or close friends/family members who have eaten food prepared by the case whilst they were symptomatic |
| • wider contacts: may need to be considered if there is evidence of transmission or for investigation of non- travel associated cases |

Table 5: Groups at higher risk of transmitting gastrointestinal pathogens (risk groups)

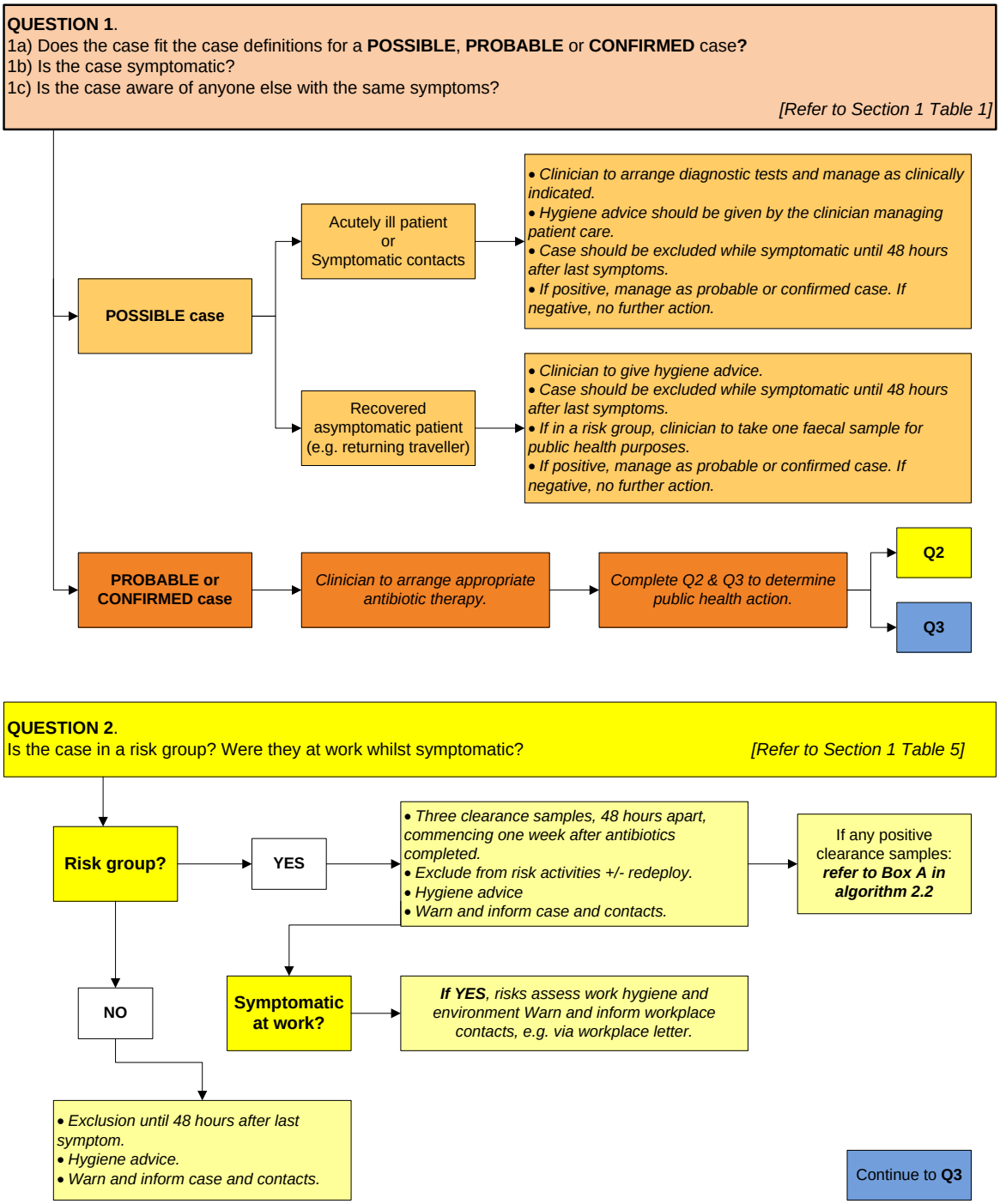
| Risk Group | Description | Additional Comments |
| --- | --- | --- |
| **Group A** | Any person of doubtful personal hygiene or with unsatisfactory toilet, hand washing or hand drying facilities at home, work or school. | Risk assessment should consider, for example, hygiene facilities at the workplace. |

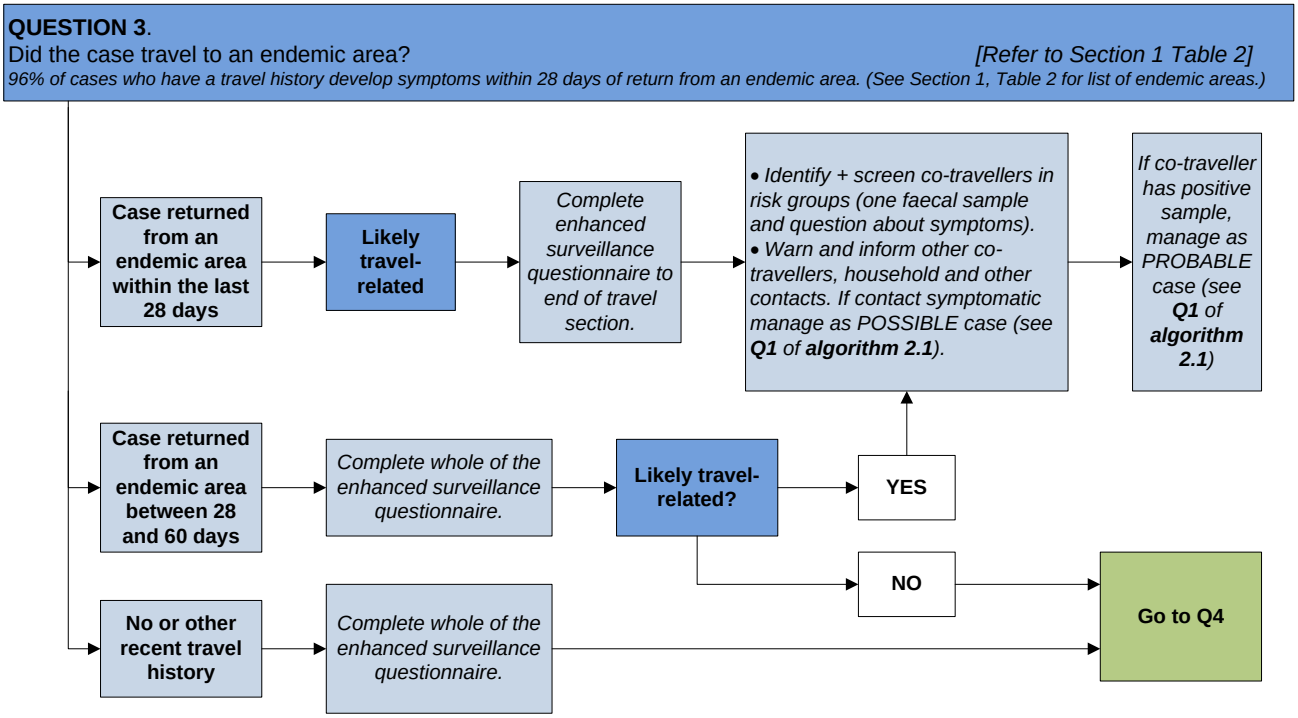
| Risk Group | Description | Additional Comments |
|---|---|---|
| **Group B** | All children aged five years old or under who attend school, pre-school, nursery or similar childcare or minding groups. | Explore informal childcare arrangements . |
| **Group C** | People whose work involves preparing or serving unwrapped food to be served raw or not subjected to further heating. | Consider informal food handlers, eg someone who regularly helps to prepare buffets for a congregation. |
| **Group D** | Health care worker, social care or nursery staff who work with young children, the elderly, or other particularly vulnerable people, and whose activities increase the risk of transferring infection via the faeco-oral route. Such activities include helping with feeding or handling objects that could be transferred to the mouth. | Someone may be an informal carer, eg caring for a chronically sick relative. |

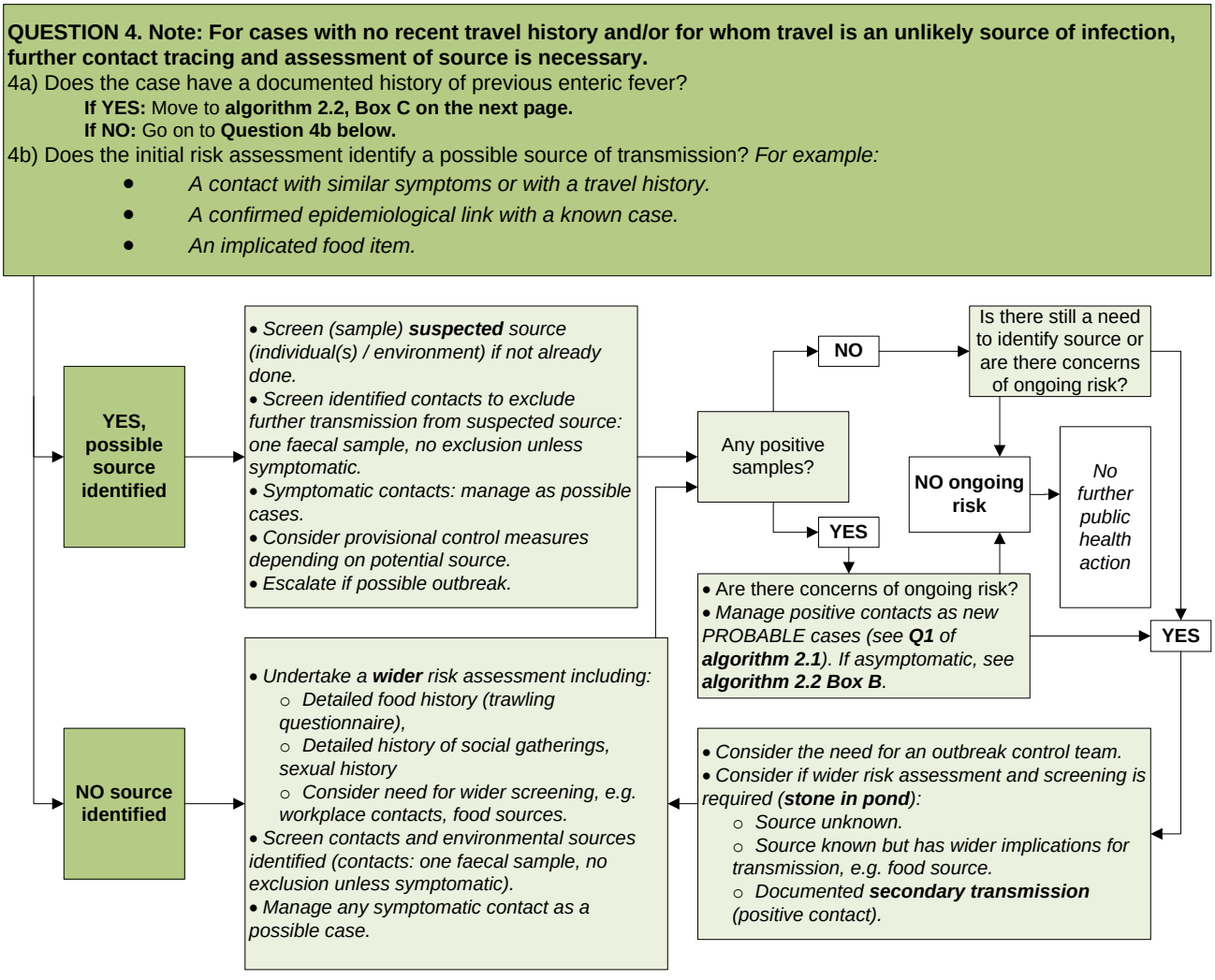
# 2. Algorithms for public health management

**The initial risk assessment (Q1 and Q2) should be completed on the same day as notification, including out-of-hours as per local arrangements.**

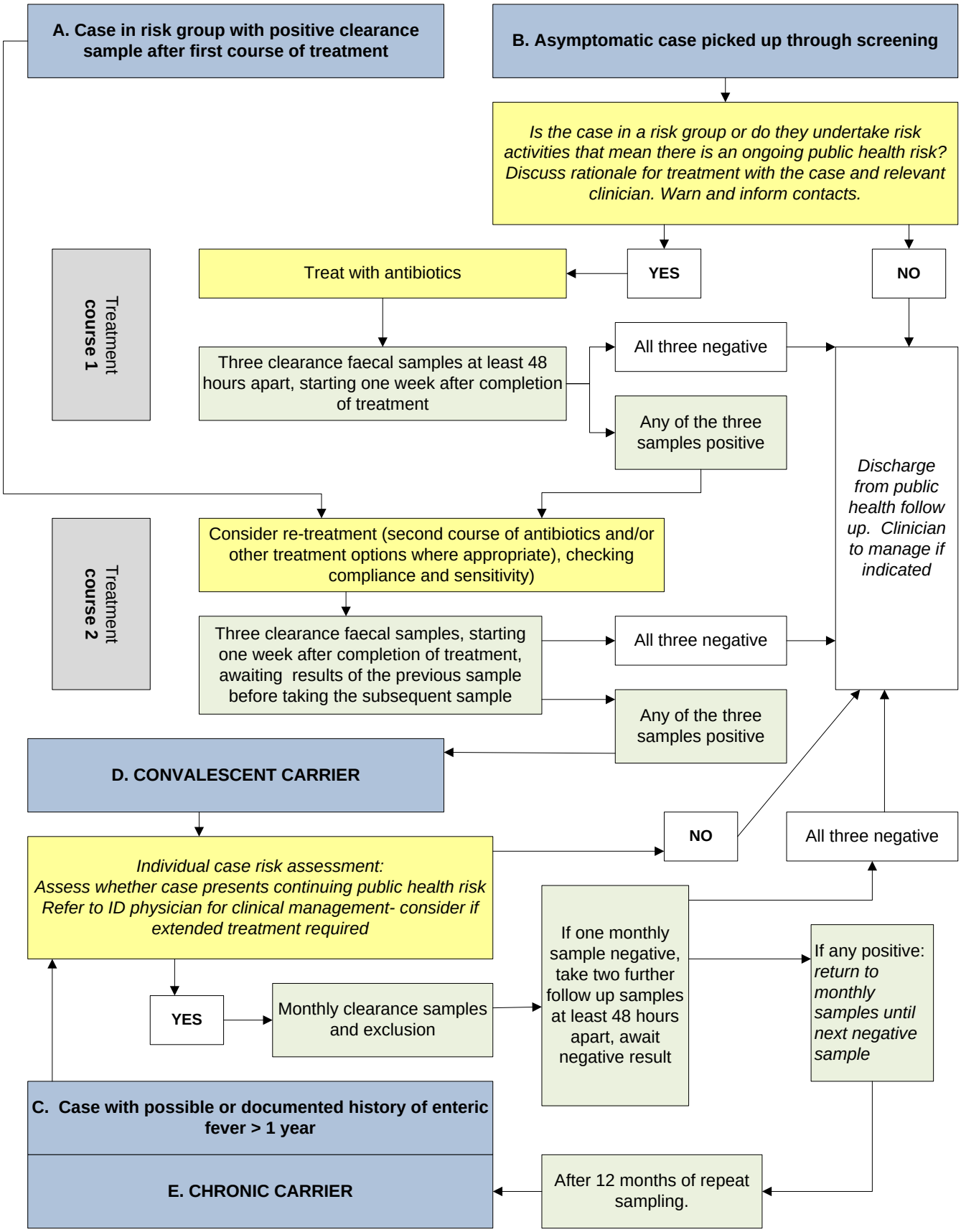
## 2.1 Public health management of cases and contacts




QUESTION 3.
Did the case travel to an endemic area?
[Refer to Section 1 Table 2]
96% of cases who have a travel history develop symptoms within 28 days of return from an endemic area. (See Section 1, Table 2 for list of endemic areas.)
Case returned from an endemic area within the last 28 days
Likely travel-related
Complete enhanced surveillance questionnaire to end of travel section.
• Identify + screen co-travellers in risk groups (one faecal sample and question about symptoms).
• Warn and inform other co-travellers, household and other contacts. If contact symptomatic manage as POSSIBLE case (see Q1 of algorithm 2.1).
If co-traveller has positive sample, manage as PROBABLE case (see Q1 of algorithm 2.1)
Case returned from an endemic area between 28 and 60 days
Complete whole of the enhanced surveillance questionnaire.
Likely travel-related?
YES
NO
No or other recent travel history
Complete whole of the enhanced surveillance questionnaire.
Go to Q4


QUESTION 4. Note: For cases with no recent travel history and/or for whom travel is an unlikely source of infection, further contact tracing and assessment of source is necessary.
4a) Does the case have a documented history of previous enteric fever?
If YES: Move to algorithm 2.2, Box C on the next page.
If NO: Go on to Question 4b below.
4b) Does the initial risk assessment identify a possible source of transmission? For example:
• A contact with similar symptoms or with a travel history.
• A confirmed epidemiological link with a known case.
• An implicated food item.
YES, possible source identified
• Screen (sample) suspected source (individual(s) / environment) if not already done.
• Screen identified contacts to exclude further transmission from suspected source: one faecal sample, no exclusion unless symptomatic.
• Symptomatic contacts: manage as possible cases.
• Consider provisional control measures depending on potential source.
• Escalate if possible outbreak.
Any positive samples?
NO
Is there still a need to identify source or are there concerns of ongoing risk?
NO ongoing risk
No further public health action
YES
• Are there concerns of ongoing risk?
• Manage positive contacts as new PROBABLE cases (see Q1 of algorithm 2.1). If asymptomatic, see algorithm 2.2 Box B.
YES
NO source identified
• Undertake a wider risk assessment including:
○ Detailed food history (trawling questionnaire),
○ Detailed history of social gatherings, sexual history
○ Consider need for wider screening, e.g. workplace contacts, food sources.
• Screen contacts and environmental sources identified (contacts: one faecal sample, no exclusion unless symptomatic).
• Manage any symptomatic contact as a possible case.
• Consider the need for an outbreak control team.
• Consider if wider risk assessment and screening is required (stone in pond):
○ Source unknown.
○ Source known but has wider implications for transmission, e.g. food source.
○ Documented secondary transmission (positive contact).

## 2.2 Public health management of cases with positive screening/clearance samples and those with previous documented history of enteric fever



# 3. Risk assessment

Formalised local arrangements between the HPT and the local authority should stipulate who is responsible for conducting the initial risk assessment in any particular circumstance.

The initial risk assessment (Q1 and Q2) needs to be performed as soon as possible on the same day as notification, including out-of-hours as per local arrangements. This will allow for the early identification of possible source, exclusion of symptomatic cases in risk groups, and identification and management of symptomatic contacts. Completion of the national enhanced surveillance questionnaire can be delayed until the next working day.

Exclusion from workplace, care facility, school and nursery:

Risk assessment should not automatically result in exclusions. Redeployment away from activities that involve an unacceptable risk in the workplace/care facility should always be considered as an alternative to exclusion.

Any recommendation for exclusion should be based on a risk assessment of possible secondary transmission arising from the activities undertaken by the individual case in their work/care role, and should take account of the hygiene behaviour of the individual as well as infection control measures in place at workplace/care facility.

Use of statutory powers for exclusion:

Where it is necessary to impose requirements to protect public health there are powers available to the local authority contained within the Public Health (Control of Disease) Act 1984 (as amended) and accompanying regulations[3].

Guidance on the use of these provisions was issued jointly by the Health Protection Agency and the Chartered Institute of Environmental Health[4]. Any exclusion can be arranged by the local authority where the case is resident, or by the local authority of their employment or other occupation, for instance education.

Clearance for public health purposes:

Microbiological clearance for public health purposes is demonstrated through negative faecal sampling, and in some situations will be required prior to the case/contact being allowed to resume normal work/school/nursery activities. The number of samples and timings need to be explained as well as the arrangements for delivery/collection.

Risk assessments should be reviewed and updated when new information is obtained, for example as a result of a ‘warn and inform’ letter.

To support the risk assessment, complete the national enhanced surveillance questionnaire and use the case definitions (Section 1, Tables 1-5) and algorithms (Section 2) contained in this guidance.

# 4. Microbiology and case management

## 4.1 Microbiological confirmation of diagnosis

Definitive diagnosis of enteric fever is by culture of the *S*. Typhi or *S*. Paratyphi from blood, urine, or from another sterile site or faeces. The causal organisms can be isolated from blood early in the disease and from urine and faeces after the first week. Presumptive culture results should be available within 72 hours.

Initiate early discussions with the local PHE consultant microbiologist if further clarity is necessary about any aspects of diagnosis or investigation.

Send all presumptive isolates from local laboratories to the PHE National Infections Service Gastrointestinal Bacteria Reference Unit, Salmonella Reference Service (SRS) for confirmation and typing.

Some returning travellers with symptoms may have serology or a positive PCR on faeces for Salmonella. Define these travellers as possible cases for management and take a diagnostic sample. If they have confirmation of a positive PCR on blood for S. typhi or S. paratyhpi, repeat a diagnostic sample but manage them as probable cases.

Whole genome sequencing following consultation with the PHE Salmonella Reference Service may assist in the investigation of travel and non-travel related cases.

## 4.2 Management of probable cases of paratyphoid B:

In some cases, provisional laboratory reports of *S*. Paratyphi B may subsequently be confirmed by the SRS as *Salmonella* Java, which causes gastrointestinal illness rather than enteric fever. *S*. Paratyphi B should be suspected as the most likely cause of illness if:

- the isolate from the original sending laboratory is from blood
- the patient has a clinical picture compatible with enteric fever
- there is a history of travel to an endemic country and/or the case is epidemiologically linked to a probable or confirmed case

If the probable case is in a risk group and/or there is a need for a wide public health investigation, contact the SRS to request that processing of the sample is expedited.

## 4.3 Case management

Advice on clinical management and treatment is outside the scope of this guidance. Clinicians with a patient whom they suspect may have enteric fever should obtain

advice from the local consultant microbiologist or infectious disease physician. Antibiotic resistance is increasingly common, thus it is essential to ensure appropriate therapy and confirm antibiotic sensitivity. The SRS offers clinical advice for complicated cases and can confirm antimicrobial susceptibility for presumptive multidrug resistant isolates. https://www.gov.uk/government/collections/bacteriology-reference-department-brd#gbru-documents

# 5. Public health management of possible cases

Refer to Section 1, Table 1 for case definitions for possible cases of enteric fever.

Refer to the algorithm in Section 2.1 for public health management.

Refer to Appendix A for advice on serology

Possible cases of enteric fever may self-report to their GP or attend hospital. This may also occur as a result of 'warn and inform' information sent to contacts of a probable or confirmed case who subsequently develop symptoms. A possible case of enteric fever (see case definitions in Table 1) should be managed as follows:

- hygiene advice should be given ('warn and inform') so that the case and contacts are aware of signs and symptoms and the need to contact their GP for a clinical assessment should they become symptomatic
- if acutely ill (including any symptomatic contacts):
    - a clinician should arrange appropriate diagnostic tests, give hygiene advice and manage as clinically indicated
- if recovered and asymptomatic (for example, a returning traveller reporting a diagnosis abroad who presents to their GP without supporting diagnostics or with diagnosis such as a positive Widal test or Salmonella PCR on faeces and completed treatment)
    - clinician should be requested to provide/reinforce hygiene advice
    - if they are in a risk group their clinician should be advised to take one faecal sample for public health purposes (screening).The Widal test is unreliable for diagnosis, thus management of these travellers should be on the basis of the faecal sample result and the presence of symptoms.
- all possible cases should be excluded only while symptomatic and until 48 hours after last symptoms, regardless of risk group, as recommended for all gastrointestinal diseases. Possible cases who are asymptomatic, and have been for

at least 48 hours, do not need to be excluded whilst awaiting the result of a faecal sample

- if the sample is presumptive positive on culture, the case should then be managed as a new probable/confirmed case including risk assessment of case and contacts and appropriate clearance/exclusions

# 6. Public health management of probable and confirmed cases

Refer to Section 1, Table 1 for case definitions for probable and confirmed cases of enteric fever.
Refer to the algorithm in Section 2.1 for public health management:

- all cases and their immediate contacts should be provided with comprehensive hygiene advice (by the HPT, GP or LA depending on local arrangements) especially concerning hand hygiene and preparation of food for household contacts. Advice should preferably be given verbally and confirmed in writing ('warn and inform' information) through local arrangements. The advice should include the recommendation of typhoid immunisation for future travel to endemic areas

Further investigation of case:

| Q2: Is the case in a risk group?<br>Manage as per algorithm in Section 2.1 |
|---|

Based on the risk assessment, a decision should be made as to whether the case is in a risk group for onward transmission of infection (see Section 1, Table 5 for detail of risk groups):

- cases in a risk group:
  - exclusion from risk activities or redeployment until microbiologically cleared
  - faecal sampling should commence one week after completion of antibiotic treatment. For all risk groups (A-D), three consecutive negative faecal samples should be required at least 48 hours apart for clearance, prior to being allowed to resume normal work/school/nursery activities
  - cases with positive clearance samples after treatment should be retreated and managed according to Box A in algorithm 2.2, and the text in Section 8.2
  - if the case was at work whilst symptomatic, a wider risk assessment of work hygiene, contacts and environment should be undertaken. Workplace contacts may need to be 'warned and informed', eg via 'warn and inform' information as provided in Section 11.2.
- cases not in a risk group:
  - clearance faecal samples are not required
  - cases should be excluded only if symptomatic, and should not return to school/work until at least 48 hours after resolution of symptoms.

| Q3: Did the case travel to an endemic area?<br>Manage as per algorithm in Section 2.1 |
|---|

- if the case has developed symptoms of enteric fever within 28 days of travel to an endemic region of the world: consider as a ‘travel-related’ case. See Section 7.1 for management of contacts
- if travel to an endemic region is identified near the upper limit or outside the 28-day timeframe: consider other possible non travel-related sources of infection. This should include the possibility of a secondary case from a symptomatic or asymptomatic travel-related case/carrier in the household
- cases without a definitive travel history to an endemic area: consider extensive investigation* in an attempt to identify the source of the infection even if cases are not in a risk group. Household and other close contacts should be screened. The genomic sequence can be compared with other cases in the PHE database

  *This should be undertaken using the national enhanced surveillance enteric fever questionnaire, and potentially the trawling questionnaire. This will entail a ‘stone in the pond’ approach to clearance of contacts to widen investigation of a possible source of infection, discussed below in Section 8.2. Box 2 outlines areas for inclusion in the wider risk assessment

Box 2: Investigation and risk assessment of cases without a travel history

- establish if the case has possible carrier status eg a) previous history of enteric fever-like illness, and whether previously confirmed or not. b) history of biliary tract illness. c) born or previously living in an endemic area
- conduct a detailed assessment of contacts and visitors, within a 28-day* period, including:
  - Identifying epidemiological links with other known cases.
  - Ascertaining whether and when household or other contacts have travelled (eg within last 56 days, so as to cover the 28-day period from infection to onset of symptoms for index case following travel and an additional 28 days for the contact following exposure to index case).
  - Ascertaining whether household or other contacts such as those handling food have had a history of enteric fever-like illness.
- consider food history and food establishments, as well as any food sources from abroad (imported foodstuffs); identification of attendance at gatherings or events. If necessary administer the additional food trawling questionnaire [Link]
- consider sexual contacts
- consider in exceptional instances, such as possible outbreaks involving food handlers, the need for food and environmental sampling at the home and/or work place
- check whole genome sequencing results for relatedness with other cases

* The 28-day timeframe should be used as a guide but should not be seen as prescriptive. See Table 2 and Appendix A for rationale

# 7. Public health management of contacts

Any symptomatic contacts should be managed as possible cases, as per algorithm 2.1.

## 7.1 Management of contacts of a travel-related case

| |
|---|
| *Q3:* Did the case travel to an endemic area?<br>*Manage as per algorithm in Section 2.1* |

### 7.1.1 Co-travelling contacts

All members of a defined group who travelled with the case and consistently stayed in the same premises, shared food and drinking water should be identified[5]. Co-travellers who are in risk groups should be screened. Close travellers that do not form such a defined group or who are not in a risk group do not require screening, unless symptomatic, but 'warn and inform' information should be given.

Co-travellers in a risk group with consistently similar exposures as described above:

- co-travellers in a risk group who have consistently similar exposure to the case should have one faecal sample taken as soon as possible
- those who are symptomatic should be treated as a possible case (Question 1 in algorithm 2.1)
- hygiene advice should be given ('warn and inform') so that the contact is aware of the signs and symptoms and the need to contact their GP for a clinical assessment should they become symptomatic
- if the sample is positive, the co-traveller should be managed as a travel-related case (see Section 1 Table 5, and algorithm 2.1). Medical treatment may not always be warranted for asymptomatic co-travellers with a positive sample but they should be referred for ID consultant advice. However, regardless of the absence of symptoms, the probable co-traveller in a risk group will require exclusion until clearance. Therefore, treatment may expedite clearance

Other co-travellers:

- for larger groups such as travel parties where travellers may not consistently have had similar exposures through their travel, 'warn and inform' information should be given to each traveller and the local HPT informed. A line list of travellers uploaded in the HP zone record of the initial case. The context, eg 'XXX travel group', should be added in HP zone specific contexts as a congregation for all cases
- if a positive co-traveller contact from a larger tour party is identified, there may be a need to revisit the initial risk assessment for the co travelling contacts to decide if the cohort of close co-travellers needs to be redefined

### 7.1.2 Non-travelling contacts

Contacts who did not travel with the case are unlikely to have been exposed to the same source of infection as the case:

- no sample or exclusion is necessary
- hygiene advice and information about symptoms should be given ('warn and inform') so that the contact is aware of the need to contact their GP or the HPT if they become symptomatic
-

## 7.2 Management of contacts of a non-travel-related case

| Q4: Does the initial risk assessment identify the likely source of infection?<br>Manage as per algorithm in Section 2.1 |
|---|

Cases with enteric fever infection that is unlikely to be travel-related require further investigation in an attempt to identify the possible source. The initial investigation will focus on household members or other contacts and the possibility of a contaminated food source if carrier status is considered unlikely. Therefore, public health management of household and other contacts of non-travel-related cases should include the following:

- risk assessment as per Section 6, Box 2 to determine history of typhoid-like illness/travel history/food history/visitors from endemic areas
- screening of all identified household and other close contacts with one faecal sample to ascertain asymptomatic carriage should take place for all non-travel-related cases. (Section 2.1, Q3)
- initial investigation should start with possible contacts in the last 28 days. If no positive samples or history of illness are found in immediate household contacts, then a 'stone in pond' approach should be used to expand the range of likely contacts
- contacts should not be excluded unless they are symptomatic
- hygiene advice and information about symptoms should be given ('warn and inform') so contacts are aware of the need to contact their GP or the HPT if they become symptomatic

If any asymptomatic contacts are found to be positive on screening, refer to the text in Section 8.1 below, and Box B of algorithm 2.2

# 8. Public health management of cases with positive screening/clearance samples or with previous documented history of enteric fever

Refer to the algorithm in Section 2.2.

## 8.1 Asymptomatic cases identified on screening

Travel-related asymptomatic cases:

- for asymptomatic co-travellers who are identified on screening, refer to algorithm 2.1 and Section 8.1.1

Non travel-related asymptomatic cases:

- an asymptomatic case may be identified from screening of a non-travel-related case. Refer to Box B in algorithm 2.2
- an asymptomatic case may be identified from a history of previously documented enteric fever, in which case establish that the current infection is the same species and subtype as isolated in the previous infection. Occasionally, cases may be identified incidentally during surgery such as cholecystectomy. If yes, refer to Box C in algorithm 2.2. If no, manage as a new case using algorithm 2.1

If secondary transmission is suspected the following should be assessed:

- risk of further secondary transmission within and outside the household
- activities and behaviours of the cases
- infection control measures to be deployed for home, work or care arrangements

The outcome of this assessment will inform any decision to offer treatment to the individual, based on whether the case is in a risk group or undertakes risk activities. If the risk assessment does highlight ongoing public health risk:

- the case should be offered treatment, and informed of the rationale for treatment
- exclusion from risk activities or redeployment should be considered until microbiologically cleared
- faecal sampling should commence one week after completion of antibiotic treatment. Three consecutive negative faecal samples should be required at least 48 hours

apart for clearance, prior to being allowed to resume normal work, school or nursery activities

## 8.2 Cases who have a positive clearance sample after one course of treatment

Refer to Box A in algorithm 2.2.

- 5-10% of cases may relapse 1-3 weeks after the initial infection with a milder disease presentation, thus are likely to need further treatment with the same antibiotic sensitivity[6]
- check antibiotic sensitivities and compliance for all cases who are symptomatic after treatment, or who are still shedding
- consider a second course of appropriate antibiotics especially if the case is in a risk group, and poses a public health risk
- a further set of three negative faecal samples should be required, starting one week after completion of antibiotic treatment and confirming a negative result from each sample before taking the subsequent sample
- exclusion from risk activities or redeployment should continue until microbiologically cleared

## 8.3 Convalescent carriers

Refer to Box D in algorithm 2.2.

Up to 10% of cases may shed initially after treatment, with 1-4% shedding at 3 months[7].

If clearance for public health purposes is necessary, consider the following:

- the managing clinician, along with the local microbiologist should be made aware of the public health implications and the need for clearance. Discussion regarding the public health implications and continued excretion should be held with relevant others (HPT/LAs). A plan for the management of the case should be agreed which may also include the referral/advice from an ID physician and possible extended treatment
- the case must be fully informed of the rationale for any further treatment/investigation and all possible steps taken to obtain their agreement. This might include the involvement of other non-medical and non-regulatory agencies
- if the case is assessed to present a continuing public health risk, monthly clearance samples (for up to 12 months) are necessary, and exclusion from risk activities or redeployment should be considered until microbiologically cleared
- faecal sampling: if any monthly sample is negative, then two further samples should be taken, confirming a negative result from each sample before taking the subsequent sample. If all three are negative, then the case can be discharged from public health follow up. If any samples are positive, then return to monthly sampling

- the need for strict hygiene both within the household and at work should be reinforced
- hygiene advice and information about symptoms should be given to contacts (‘warn and inform’) so they are aware of the need to contact their GP or the HPT if they become symptomatic
- contacts in risk groups do not require exclusion
- there should be adherence to confidentiality and ethical principles, subject to robust public health grounds for breaking any confidentiality

## 8.4 Chronic carriers

Refer to Box E in algorithm 2.2.

Chronic carriers, who have had several unsuccessful treatments, may continue to excrete for years. For chronic carriers in a risk group, a risk assessment should be carried out, with the case, specialist physician and the relevant agencies (HPT/LAs) to consider:

- safe arrangements for continuing in work or alternative occupations. For example, a food handler may need to be permanently redeployed
- continuing need for strict hygiene both within the household and at work

In addition:

- hygiene advice and information about symptoms should be given to contacts (‘warn and inform’) so they are aware of the need to contact their GP or the HPT if they become symptomatic
- contacts in risk groups do not require exclusion

The typhoid vaccine should not be recommended for contacts of carriers because there is little evidence of it being effective in these circumstances. It is more effective to advise the family members to seek travel advice and relevant vaccinations before their next visit to an area of high prevalence.

# 9. Outbreaks

Outbreaks should be managed in accordance with current Outbreak Plans.

# 10. Primary prevention: role of travel advice and vaccination

## 10.1 Food, water and personal hygiene

Typhoid and paratyphoid fever are spread from person to person by the faecal-oral route. Therefore, their prevention and control is dependent on good sanitation, clean water and scrupulous personal hygiene. Emphasis needs to be placed on hand washing and sanitary disposal of faeces, hygienic food preparation and proper arrangements for safe water supplies.

## 10.2 Typhoid vaccine

Typhoid vaccine is indicated for active immunisation against typhoid fever. Two types of typhoid vaccine are available in the UK: a polysaccharide vaccine and an oral, live, attenuated vaccine. Cumulative three-year efficacy of either vaccine is 65%[8] and protective antibody titres fall over time. Further details are given in the Department of Health's Green Book[9] and the National Travel Health Network and Centre http://travelhealthpro.org.uk/typhoid-and-paratyphoid/.

The typhoid vaccine is recommended for:

- travellers to countries where typhoid is endemic, including South Asia, and for certain groups of travellers to parts of South-East Asia, the Middle East, Central and South America, and Africa - see http://travelhealthpro.org.uk/country-information/[10] for specific countries where typhoid vaccine might be recommended. Vaccination is especially important for travellers staying with or visiting the local population; those at higher risk include: travellers visiting friends and relatives, those in contact with an infected person, long-term travellers and those visiting areas of poor sanitation and laboratory personnel who may handle *S.* Typhi in the course of their work

Because the vaccine offers limited protection against typhoid fever and no protection at all against paratyphoid fever, the importance of scrupulous attention to personal, food and water hygiene must still be emphasised for those travelling to endemic areas.

Typhoid vaccine is not recommended for household or other contacts of either cases or carriers, or during an outbreak of typhoid fever in the UK.[9]

# 11. Resources and Contacts

## 11.1 National reference material

- PHE website: Typhoid and paratyphoid: guidance, data and analysis (includes links to these guidelines, national surveillance form and national surveillance reports): https://www.gov.uk/government/collections/typhoid-and-paratyphoid-guidance-data-and-analysis
- PHE Migrant Health Guide: Enteric fevers page - key messages for primary care practitioners: https://www.gov.uk/guidance/enteric-fevers-migrant-health-guide
- PHE website: Typhoid: health advice for travellers (Urdu, Punjabi, Gujurati and Bengali translated versions also available): https://www.gov.uk/government/publications/typhoid-health-advice-for-travellers
- Travel Health Pro website: Typhoid and paratyphoid factsheet: http://travelhealthpro.org.uk/typhoid-and-paratyphoid/

## 11.2 Companion documents to this guidance

- Template letter and fact sheet for contacts for a case of enteric fever, also available on the PHE website at: https://www.gov.uk/government/publications/typhoid-and-paratyphoid-public-health-operational-guidelines
- Enhanced surveillance questionnaire for enteric fevers (also available as an E-questionnaire at: https://surveys.phe.org.uk/Login.aspx) see PHE website for further information: https://www.gov.uk/government/publications/typhoid-and-paratyphoid-enhanced-surveillance-questionnaire
- National trawling questionnaire.

## 11.3 Contact information

- Contact local Health Protection Teams for initial advice on cases/contacts
- Travel Health and Migrant Section, Public Heath England
- Salmonella Reference Service, National Infection Service Public Health England.

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# 13. Appendix: Disease information

Collectively, these infections are referred to as Typhoid and Paratyphoid infections, or enteric fever.

| | TYPHOID | PARATYPHOID |
|---|---|---|
| **NAME** | *Salmonella enterica* subsp. *enterica* serovar Typhi (commonly *S.* Typhi). | *Salmonella enterica* subsp. *enterica* serovar Paratyphi – A, B, C (commonly *S.* Paratyphi A, B and C). |
| **EPIDEMIOLOGY** | International<br>Globally, there are an estimated 22 million (range 16 to 33 million) new cases of enteric fever every year with 200,000 deaths.[11] Most cases occur in endemic regions of the developing world, with the greatest burden in the Indian subcontinent and South-East Asia. Outbreaks of typhoid have been reported from countries in Eastern Europe.<br>In developed countries where standards of sanitation are high, the diseases are sporadic and are mainly associated with foreign travel. | |
| | England, Wales and Northern Ireland[12]<br>Reports of typhoid and paratyphoid in England, Wales and Northern Ireland have been decreasing in recent years. Cases decreased by 26% to 363 in 2012 and have decreased each year to 326 in 2013 and 312 in 2014. On average, since 2006, 53% of cases were typhoid, 44% paratyphoid A, 3% paratyphoid B and the rest (<1%) were either mixed infections or paratyphoid C.<br>Regional distribution<br>Regionally, London reports the highest proportion of cases reported in England (40%).<br>Demographic breakdown<br>Between 2007 and 2014, 3,975 individual cases of enteric fever were reported and confirmed by the PHE Salmonella Reference Service, for which 3,367 surveillance questionnaires were received (85% completion rate). Of all cases reported, there was a slightly higher proportion of males (54%) and 25% were aged 16 or under. The median age was 27 years [range <1 to 98 years], and the majority of cases (79%) were of Indian, Pakistani or Bangladeshi ethnicity (where ethnicity was known).<br>Travel history<br>From enhanced surveillance, the majority (92%) of cases were presumed to have been acquired abroad. The bulk of travel was to the Indian subcontinent, and mainly to India, Pakistan and Bangladesh (usually countries of the cases' ethnic origin). Eighty- | |

| | TYPHOID | PARATYPHOID |
|---|---|---|
| | seven per cent of those who travelled were visiting friends and relatives (VFR).<br>Eight per cent of cases (299 cases) had no relevant travel history, and in most cases, a source of infection was not identified. In line with the general distribution, the highest numbers of non-travel cases were reported in London (127 cases, 42%). | |
| **CLINICAL FEATURES** | Typhoid fever is a systemic bacterial disease with insidious onset of sustained fever, marked headache, malaise, anorexia, relative bradycardia, splenomegaly, non-productive cough in the early stage of the illness[13]<br>Although some texts state that rose spots are found on the trunk in 25% of white-skinned patients and constipation is seen more often than diarrhoea in adults[13], a 10-year study of enteric fever in a UK regional infectious diseases unit found that fever, headache, diarrhoea and abdominal pain were the main presenting symptoms, rose spots were observed in only 7% of patients, and symptoms of bradycardia and constipation were rare.[14]<br>The clinical picture varies from mild illness with low-grade fever to severe clinical disease with abdominal discomfort and multiple complications. Severity is influenced by factors such as strain virulence, quantity of inoculum ingested, duration of illness before adequate treatment, age and previous exposure to vaccination. Complications typically arise in | Paratyphoid fever is an illness clinically similar (although spots are more frequent and brighter red than in typhoid) but usually less severe than typhoid. Complications are less common and typically arise in the third week[13].<br>Serovar Paratyphi B refers to the invasive biotype that is associated with paratyphoid fever. A variant referred to as serovar Paratyphi B var. Java is associated with routine gastrointestinal disease. Since the distinction between these two biovars is currently based on a single phenotypic trait, they can be easily confused. Relapses may occur in anywhere between 3-4%[9] up to 9%[14] of paratyphoid cases. *S.* Paratyphi C infections are rare.[9] |

| | TYPHOID | PARATYPHOID |
|---|---|---|
| | the third week of disease. In the abdomen, ulceration of Peyer's patches may result in haemorrhage or intestinal perforation (about 1-4% of cases), especially late in untreated cases. Renal failure can occur in severe cases. Osteomyelitis may develop, especially in those predisposed by sickle cell disease. Other rare complications include cholecystitis, meningitis and typhoid pneumonia.[15]<br>The case-fatality rate of 10–20% observed in the pre-antibiotic era can fall below 1% with prompt antimicrobial therapy. Depending on the antimicrobials used, texts state that between 5–10% of patients may experience relapses (generally milder than the initial clinical illness)[5,6]. Some evidence suggests that both faecal carriage and relapse rates in UK patients with typhoid fever may be less than 3%.[16] | |
| **DIAGNOSIS** | Definitive diagnosis of enteric fever is by culture of the organism from blood, faeces, urine, or a sterile site. The causal organisms can be isolated from blood early in the disease and from urine and faeces after the first week. Presumptive culture results should be available in 72 hours.<br>Urine is not a useful substitute for faecal samples and stool cultures are required for clearance ( for the purposes of public health actions).<br>Although widely used in developing countries because of its low cost, standard serological tests such as the Widal test are of little use in the confirmation of infection or recent infection and are not recommended. Newer serological tests are somewhat more sensitive and specific and can be useful, eg standard immunoblotting and | |

| | TYPHOID | PARATYPHOID |
|---|---|---|
| | ELISA techniques. Some cases may have molecular assays like *S.* Typhi PCR performed on blood[17].<br>PHE Salmonella Reference Service does not offer serological testing or confirmatory assays. | |
| **CLINICAL MANAGEMENT** | Enteric fever can be successfully treated with antibiotic therapy and general medical support. Strains of *S.* Typhi have become increasingly resistant to antibiotics, particularly in South Asia.[14] [18, 19, 20] There is evidence of emergence of antibiotic-resistant paratyphoid in India.[21] Treatment should be subject to clinical opinion and antibiotic sensitivity.[5] Complex cases can be discussed with the PHE regional microbiologist or the Salmonella reference service and antimicrobial susceptibility tests can be confirmed by the Salmonella reference service. | |
| **RESERVOIR** | The main reservoir for both typhoid and paratyphoid is the human intestinal tract of cases and carriers. *S.* Paratyphi *B* infections have occasionally been associated with cattle. The organisms can survive for days in ground water, pond water or seawater, and for months in contaminated eggs and frozen oysters[6]. | |
| **MODE OF TRANSMISSION** | Primarily via the oral route following ingestion of food or water contaminated by faeces and, occasionally, the urine of persons acutely ill with typhoid or those who are chronic carriers. Direct faecal–oral transmission can also occur in poor hygiene conditions and sexual transmission | |
| | *S*. Typhi is extremely infectious. Infection may occur with ingestion of fewer than 100,000 organisms[9] especially in susceptible individuals, although one million or more organisms may be required to cause illness in healthy individuals[6, 9]. Achlorhydria and disturbance of bowel flora (eg by antibiotics) decrease the minimum infective dose. Splenectomy (eg in sickle cell disease, or immune defects) makes it more difficult to eradicate *S*. Typhi[9]. | The infective dose for paratyphoid is higher than for typhoid[18]. |
| | The risk of contracting typhoid and paratyphoid fever is highest for travellers to areas of high endemicity. In the Indian subcontinent, a | |

<table>
<tr><th></th><th>TYPHOID</th><th>PARATYPHOID</th></tr>
<tr><td></td><td colspan="2">region of high incidence of typhoid fever, the attack rate for travellers has been estimated at 1 to 10 per 100,000 journeys.[22] Overall, the estimated incidence of typhoid among travellers to developing countries as a whole is 3–30 cases per 100,000 travellers[8,16,17].</td></tr>
<tr><td></td><td colspan="2">Imported food-stuffs from endemic countries have also been identified as a source of infection in a number of cases.[23, 24, 25]</td></tr>
<tr><td>INCUBATION PERIOD</td><td>Incubation period depends on host factors and the size of the infecting dose. The incubation period for S. Typhi is usually 8-14 days, although can be significantly longer or shorter (eg in extreme 3-60 days)[6].</td><td>Incubation period depends on host factors and the size of the infecting dose. The incubation period for S. Paratyphi is significantly shorter than for typhoid, usually 1-10 days[6].</td></tr>
<tr><td>Working definition of ‘travel-related’ infection, for public health investigation and management</td><td colspan="2">The incubation period between infection and development of symptoms is important for public health management, including the identification of the likely source of infection. For this reason, time between return from travel and onset of symptoms is significant. Although the literature cited above suggests that incubation periods differ for typhoid and paratyphoid, the national enhanced surveillance data from England, Wales and Northern Ireland for 2007-2010 does not show any significant differences in the dates of onset. following return from travel between typhoid and paratyphoid[26].<ul><li>Of cases with documented travel history, 91% had an onset date within 21 days of travel.</li><li>An additional 5% had an onset date between 22-28 days.</li><li>A further 2% had an onset date between 29-35 days.</li><li>In total, 98% of cases with a travel history had an onset date within 35 days of return.</li><li>There was no observable difference between typhoid and paratyphoid in date of onset of symptoms relative to arrival in UK.</li></ul>Therefore, based on this data, this guidance does not give separate definitions of ‘travel-related’ for typhoid and paratyphoid cases, and defines a case of enteric fever as more likely to be acquired abroad (‘travel-related’) if symptoms develop within 28 days of arriving in the UK after travel to an endemic region.<br>Public health professionals will need to risk assess each case based on whether the case has travelled to an endemic region, and on the dates of travel to determine whether it is likely to be travel-related. Therefore, 28 days is used as a guide but should not be seen as a prescriptive timeframe: local professional judgement based on the individual details of each case is essential.</td></tr>
</table>

| | TYPHOID | PARATYPHOID |
|---|---|---|
| **INFECTIOUS PERIOD** | All patients with typhoid and paratyphoid excrete the organisms at some stage during their illness, and the infectious period lasts as long as bacilli are present in the faeces[6]. The initial illness is septicaemia and it is not until around the end of the first week that bacteria are detected in faeces or urine.[27,28] Cases are not usually considered infectious prior to the onset of symptoms. | |
| | Approximately 10% of untreated typhoid patients will excrete bacteria for at least three months after the onset of acute symptoms[6]. Approximately 2-5% of those infected with *S.* Typhi become chronic carriers[5,6]. This carrier state may last many years and is more common in females and those with biliary tract abnormality[10].<br>Some evidence suggests that both faecal carriage and relapse rates in UK patients with typhoid fever may be less than 3%[12]. | There is less published literature on the excretion of *S*. Paratyphi. It appears that excretion is similar to most other salmonellae: most people will excrete it for 5-6 weeks whilst a small minority continue excreting for months or even years[29]. The issue of prolonged biliary excretion applies in some cases, as in typhoid. |
| **OTHER** | Following natural infection with typhoid, an immune response develops that may partially protect against reinfection and severity of disease[30]. | |

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