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# Assessment of returning travellers with fever

Jayne Ellis

Pasco Hearn

Victoria Johnston

## Abstract

Millions of people travel to the tropics each year and a significant minority of them become ill, either during their stay or shortly after their return. Most have mild, self-limiting illnesses, but a few have a life-threatening condition. This article outlines how to evaluate fever in the returning traveller and discusses important infection control and public health measures. A detailed travel history, which takes into account travel destinations, specific activities and risk factors in relation to the onset of symptoms, is essential for constructing a comprehensive list of differential diagnoses and guiding appropriate investigations. Importantly, all travellers returning from the tropics with a fever should be investigated for malaria.

**Keywords** Fever aetiology; fever assessment; fever diagnosis; imported fever; MRCP; travel; traveller

## Why is this topic important?

In 2015, UK residents made 10.1 million visits to countries other than Europe and North America.<sup>1</sup> In addition in 2015, there were 36.1 million visits to the UK from overseas residents.<sup>1</sup> Up to 70% of travellers to developing countries report health problems, and 8–15% are unwell enough to seek medical attention, with fever a common complaint.<sup>2</sup>

Although many of these patients have self-limiting illnesses, for example influenza, an important minority have a more serious tropical infection that, if missed, could become life-threatening (as with malaria – [Case 1](#)) or have significant public health implications (as with enteric fever – [Case 2](#)). The difficulty is in identifying these low-frequency events. This paper provides a pragmatic approach to the assessment of fever in the returned traveller. Additional telephone advice is available, 24 hours a day, to support with further evaluation of these patients (see Sources of help box).

**Jayne Ellis** MB BS MRCP DTM&H is a Registrar in Infectious Diseases at the Hospital for Tropical Diseases, University College London Hospitals NHS Foundation Trust, UK. Competing interests: none declared.

**Pasco Hearn** MSc MRCP FRCPath is a Registrar in Microbiology at the Royal Free London NHS Foundation Trust, UK. Competing interests: none-declared.

**Victoria Johnston** PhD FRCP DTM&H is an Associate Professor at the London School of Hygiene and Tropical Medicine, London, UK and a Consultant Physician at the Hospital for Tropical Diseases, University College London Hospitals NHS Foundation Trust, UK. Competing interests: none declared.

## Key points

- Always remember to take a travel history in any patient presenting with a fever or history of fever
- Think why this *person*, from this *place*, is developing these *symptoms* at this *time*
- A malaria rapid diagnostic test and malaria film should be requested in all patients returning from the tropics with a history of fever. A positive malaria result should be acted upon on the same day
- Assess the risk of a transmissible infection and isolate the patient where appropriate (fever + diarrhoea or respiratory symptoms or rash)
- Patients with a febrile illness within 21 days of travel to a country where viral haemorrhagic fever (VHF) is endemic should be isolated and have a VHF risk assessment performed
- Antimicrobial resistance is an emerging global problem. Travel outside northern Europe and Australasia and hospitalization is associated with an increased risk of antimicrobial resistance. If bacterial infection is suspected, discuss antibiotic choices with your local microbiologist

## How to take a travel history

[Table 1](#) outlines the key themes that should be covered when taking a comprehensive travel history.

**Travel destination:** the risk of acquiring an infection while travelling varies according to the country visited ([Table 2](#)), the local environs (urban or rural) and the activities or exposures encountered ([Table 3](#)). Knowledge of the geographical distribution and relative incidence of infectious diseases is important in assessing these patients and can aid clinicians in constructing their differential diagnosis. For example, among travellers returning from South-East Asia or the Caribbean with a fever, dengue is an important differential diagnosis, whereas enteric fever is more likely in travellers from South Asia.<sup>2</sup> In contrast, malaria remains the most important single cause of fever in travellers returning from sub-Saharan Africa.<sup>2</sup>

As seen with the recent Ebola outbreak in West Africa or the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak, travellers can rarely present with life-threatening infections that if missed have significant public health consequences. Travellers whose symptoms started within 21 days of travel to sub-Saharan Africa, in particular West and Central Africa, should have a more detailed risk assessment for viral haemorrhagic fevers (VHFs) (see [Case 1](#)). It should be noted, however, that some VHFs, in particular Crimean–Congo haemorrhagic fever, have a more global distribution. It is often worth asking the patient whether they are aware of any local outbreaks (e.g. Ebola, *Legionella*) while they were travelling, or local areas of particularly high endemic risk (e.g. for

### Case 1. Malaria

A 41-year-old man presented to a district hospital with a 48-hour history of fever, headache and myalgia. Three days earlier, he had returned from Nigeria, where he had been visiting friends and relatives. At triage, he was febrile (39°C) and tachycardic (122 beats per minute), with a normal blood pressure. His Glasgow Coma Scale score was 15/15 and his respiratory rate 24 breaths per minute, and he had normal oxygen saturation on room air.

Given his recent travel to West Africa, he was identified as being at risk of a viral haemorrhagic fever (VHF) and isolated in a side room. Because of concerns about infection risk, no initial investigations were sent. The patient was discussed with the National Imported Fever Service and, after a further risk assessment, personal protection measures were implemented. The patient had stayed in basic accommodation in an area endemic for Lassa fever. He denied contact with funerals, hospitals or unwell individuals, and reported no exposure to caves, mines, bats, primates or ticks. Given his geographical exposure, he was classified as a high possibility for VHF, the laboratory was informed, and an urgent test for malaria was performed.

His blood film revealed *Plasmodium falciparum* (parasitaemia 14%), and subsequent investigations revealed acute kidney injury (serum creatinine 312 micromol/litre). He was treated with intravenous artesunate and transferred to intensive care in a regional infectious diseases unit. Initial concerns about VHF led to unnecessary delays in making the diagnosis of malaria; fortunately, he made a full recovery.

#### Learning points

- The initial presenting symptoms and signs of many tropically acquired infections are often non-specific
- VHF is very rare in travellers. Travellers are far more likely to have malaria or another infection. All returning travellers with fever or history of fever should be tested for malaria
- A VHF risk assessment should be performed in travellers with a fever >37.5°C whose symptoms started within 21 days of travel to a VHF-endemic area (see Sources of help box). Specifically, ask about the following: (1) contact with individuals with known or strongly suspected disease; (2) travel to area with a known outbreak; (3) living or working in basic rural conditions in a Lassa-endemic region; (4) visits to caves or mines, or contact with bats, primates or antelopes (Ebola, Marburg); and (5) tick bites, crushed ticks or attendance at animal slaughter (Crimean–Congo haemorrhagic fever)
- Screening for VHF should prompt the use of appropriate personal protective equipment (see Sources of help box) but should not delay investigations. Any delay in the diagnosis of falciparum malaria can lead to serious and sometimes fatal consequences
- Any patient thought to be at risk of VHF should be discussed with the National Imported Fever Service (see Sources of help box).

schistosomiasis). Up-to-date information on disease outbreaks is available online (see Sources of help box).

**Purpose and duration of travel:** travellers visiting friends and relatives (VFR), expatriates, overseas healthcare workers and

### Case 2. *Salmonella typhi*.

A 34-year-old man returned to the UK after spending 4 weeks visiting his family in Bangladesh. He was up to date with travel vaccinations, including typhoid and hepatitis A. One week before his return, he had developed a febrile illness and had been treated for malaria, with no improvement. After further blood tests, was told he had typhoid and was treated with ciprofloxacin.

On arrival home, he presented to hospital with fever, headache and a dry cough. He had a temperature of 39.0°C and a respiratory rate of 28 breaths per minute. Although tachycardic, he had an adequate blood pressure. His chest was clear and he had 2 cm hepatomegaly. Investigations revealed a normal differential white count, normal renal function, mildly raised transaminases and a clear chest radiograph. A provisional diagnosis of enteric fever was made, and his antibiotic was changed to intravenous ceftriaxone. He gradually improved.

Two sets of blood cultures taken before changing the antibiotic were sterile, so a bone marrow aspirate was performed. Bone marrow cultures confirmed the presence of *Salmonella typhi*, resistant to ciprofloxacin. Following 3 days of intravenous ceftriaxone, treatment was changed to oral azithromycin. He completed 14 days of effective therapy.

#### Learning points

- Enteric fever is an uncommon but important cause of fever, particularly in travellers returning from Asia
- Vaccination provides incomplete protection against *Salmonella Typhi* and none against *Salmonella paratyphi*
- Many resource-limited settings lack facilities for blood culture, so use serology (Widal's test) instead. In most settings, this lacks sensitivity and specificity, and it is often positive in individuals who have previously been vaccinated. It is not recommended
- Blood cultures have a sensitivity of >80%, with their highest yield within the first week of symptoms. Stool and urine cultures become positive after the first week of illness. Although invasive, a bone marrow aspirate has a higher sensitivity than blood culture and should be considered in patients who have already taken antibiotics and in whom there is diagnostic uncertainty<sup>2</sup>
- Antimicrobial resistance is an emerging global issue and should be considered in all returning travellers as it can influence antibiotic choices
- More than 80% of *Salmonella typhi* and *S. paratyphi* isolates imported into the UK from Asia are resistant to fluoroquinolones but remain sensitive to ceftriaxone.<sup>5</sup> This is therefore the recommended first-line agent, particularly for severe disease. Oral azithromycin can be used for uncomplicated infection; however, if the isolate is proven to be sensitive, ciprofloxacin remains the most effective treatment option. Regardless of which antibiotic is used, the fever takes several days to respond. If the isolate is known to be sensitive, failure to defervesce is not a reason to change antibiotics

backpackers often stay for longer periods than tourists and can have closer contact with local populations. This can put them at greater risk of acquiring certain infections, for example malaria, enteric fever, tuberculosis, hepatitis A and sexually transmitted

### Key components of a travel history

Themes	Specific details required
Travel destination(s)	Detailed history of travel outside the UK in last 12 months, including dates of arrival/departure
Environments	Rural versus urban, humidity/temperature, season, altitude, accommodation
Activities	Fresh/saltwater swimming, safari, caving, hiking, hunting, etc.
Diet	Street food, meat, bottled water
Bites	Recall of animal, insects or tick bites
Sexual history	Protected/unprotected sexual intercourse, nature of contacts (e.g. casual/regular, men who have sex with men, commercial sex workers, etc.)
Malaria prophylaxis and pre-travel health	Use of chemoprophylaxis, mosquito net and insect repellent Pre-travel/childhood immunization history
Health while travelling	Details of any illness episodes while travelling and any healthcare accessed Admission to hospital or intensive care unit Detail of anti-infectives taken to date
Unwell contacts	Contact with unwell contacts in the community or in hospital Funeral attended

Table 1

### Common causes of fever associated with geographical area of travel

Destination	Common	Occasional	Rare but important
Sub-Saharan Africa	Malaria, rickettsial infection (tick typhus)	Amoebic liver abscess, brucellosis, dengue, Chikungunya, Zika, enteric fever, Katayama fever, HIV seroconversion, meningococcus	Other arbovirus (West Nile, Rift Valley, yellow fever, etc.), histoplasmosis, trypanosomiasis, VHF (Lassa, Ebola, Marburg, CCHF), visceral leishmaniasis
North Africa, Middle East, Mediterranean		Brucellosis, Q fever, Toscana (sandfly fever)	Visceral leishmaniasis, MERS-CoV
Eastern Europe and Scandinavia		Lyme disease	Hantavirus, tick-borne encephalitis, tularaemia
South and Central Asia	Dengue, enteric fever, malaria	Chikungunya, visceral leishmaniasis	CCHF, other arbovirus (Japanese encephalitis, Nipah), rickettsial infections
South-East Asia	Dengue, enteric fever, malaria	Chikungunya, Zika, leptospirosis	Other arbovirus (Japanese encephalitis, Nipah, Hantavirus), melioidosis, penicilliosis, rickettsial infection (scrub typhus)
North Australia		Dengue, Murray Valley fever, Q fever, rickettsial infection, Ross River fever	Other arbovirus (Barmah Forest), melioidosis
Latin America and Caribbean	Dengue, Chikungunya, Zika, enteric fever, malaria	Coccidioidomycosis, histoplasmosis, leptospirosis	Acute Chagas disease (American trypanosomiasis), arboviruses (e.g. yellow fever), Hantavirus, paracoccidioidomycosis
North America		Coccidioidomycosis, histoplasmosis, Lyme disease, Rocky Mountain spotted fever	Arbovirus (Eastern and Western equine encephalitis, West Nile fever), babesiosis, ehrlichiosis

CCHF, Crimean–Congo haemorrhagic fever; MERS-CoV, Middle East respiratory syndrome coronavirus; VHF, viral haemorrhagic fever.

Adapted from British Infection Society recommendations. See Johnston et al.<sup>2</sup>

Table 2

## Common causes of fever associated with specific risk activities

Risk activities	Common	Occasional	Rare but important
<b>Bites</b>			
Tick	Lyme disease, tick typhus	Q fever	Other borreliosis (tick bite fever, relapsing fever), CCHF (tick bite, crushed tick), ehrlichiosis, tick-borne encephalitis, tularaemia
Tsetse fly		Trypanosomiasis	
Animal	Cellulitis	Q fever, tularaemia	Anthrax, rabies, rat bite fever
<b>Environmental exposure</b>			
Dust exposure (e.g. caves, mines, deserts)	Coccidioidomycosis, histoplasmosis		Rabies, Ebola/Marburg (caves)
Cruise ships/resorts	<i>Legionella</i> , norovirus		
Hospital admission	Multidrug-resistant bacteria (colonization, infection)		MERS-CoV
Freshwater exposure	Katayama fever (acute schistosomiasis), leptospirosis		Acanthamoeba
Game parks	Tick typhus		Anthrax, trypanosomiasis
Farms or animal slaughter exposure	Brucella, Q fever		CCHF
Contact with camels			MERS-CoV
Contact with or ingestion of antelope, primates or bats			Marburg/Ebola
<b>Ingestion</b>			
Faecally contaminated water	Amoebiasis, enteric fever, gastroenteritis (bacterial or viral), hepatitis A/E		Poliomyelitis
Unpasteurized milk	<i>Listeria</i> , <i>Salmonella</i> , <i>Shigella</i>	<i>Brucella</i>	
Undercooked/raw food	Bacterial gastroenteritis, amoebiasis		Trichinosis
Sexual exposure	HIV, hepatitis A/B/C, syphilis, gonorrhoea, reactive arthritis, pelvic inflammatory disease		
<b>Host factors</b>			
Immunocompromised	Amoebiasis, non-typhoid <i>Salmonella</i> , tuberculosis	Visceral leishmaniasis, STI (e.g. syphilis)	<i>Blastomyces dermatitidis</i> , coccidioidomycosis, histoplasmosis, penicilliosis

CCHF, Crimean–Congo haemorrhagic fever; MERS-CoV, Middle East respiratory syndrome coronavirus; STI, sexually transmitted infection.

Table 3

infections, including HIV.<sup>2</sup> Military personnel and other travellers to isolated geographical regions can come into close contact with specific vectors that put them at high risk of infections such as rickettsial disease and leishmaniasis.<sup>2</sup>

**Specific activities and exposures:** an essential part of any travel history involves asking about potential risk exposures, including contact with animals, insect bites, freshwater exposure, safaris, ingestion of exotic foods, hospital admissions and sexual exposure (Table 3). For example, a diagnosis of African trypanosomiasis should be considered in febrile travellers who recall painful bites while on safari in East/Central Africa. A detailed risk assessment is particularly important when assessing travellers returning from a VHF-endemic country (see Case 1) and for travellers who return from the Middle East with a severe acute

respiratory illness. These travellers should be asked about contact with camels, hospitals or a person with a confirmed case of MERS-CoV in the 14 days prior to symptom onset.

**Host factors:** travellers who are immunocompromised, as a result of HIV, malignancy or immunomodulatory drugs including corticosteroids, are at increased risk of opportunistic infections (Table 3). Pregnant women should also be considered as a specific risk group because of their increased risk of developing complications of infection. For example, pregnant women are at increased risk of severe malaria, and, in the case of Zika virus, transmission of the virus to the fetus, resulting in congenital Zika virus syndrome.<sup>3</sup> In contrast, migrants returning to their country of origin can be immune to certain infections (e.g. hepatitis A, Katayama fever – acute schistosomiasis).

**Preventive measures:** no vaccination, chemoprophylaxis or insect repellent is 100% effective, but most interventions reduce the risk of acquiring infection and sometimes the severity of the resulting illness. Information about the specific malaria prophylaxis regimen taken and adherence to chemoprophylaxis should be routinely sought. Malaria chemoprophylaxis is often taken inadequately, particularly by VFR individuals, who can falsely consider themselves immune to malaria; this can delay symptom onset and lead to initial blood films being falsely negative (see Advising the traveller on pages 59–65 and Malaria on pages 52–58).<sup>4</sup>

### Incubation periods and risk of infection

Knowledge of incubation periods for common travel-related infections, together with dates of travel and/or risk exposures,

facilitates an appropriate differential diagnosis (Table 4). Although most travellers present within a month of returning from the tropics, some infections such as malaria, acute schistosomiasis and hepatitis A and E, can present weeks to months later.<sup>2</sup>

### Initial investigations

Recommended initial investigations for evaluating returning travellers with undifferentiated fever are listed in Table 5.

### Infection control and notifiable infections

Source isolation, ranging from standard barrier nursing to respiratory isolation or high-level protection, may be required during the initial assessment and following confirmation of the

Incubation periods	
Incubation period	Infection
Short (<10 days)	Acute gastroenteritis (bacterial, viral) Arboviral infections (e.g. dengue, Chikungunya, Zika) Meningitis (bacterial, viral) Relapsing fever ( <i>Borrelia</i> spp.) Respiratory tract infection (bacterial, viral including influenza and coronavirus) Rickettsial infection (e.g. tick typhus, scrub typhus)
Medium (10–21 days)	<b>Bacterial</b> <ul style="list-style-type: none"> <li>• Brucellosis</li> <li>• Enteric fever (typhoid, paratyphoid fever)</li> <li>• Leptospirosis</li> <li>• Q fever</li> </ul> <b>Fungal</b> <ul style="list-style-type: none"> <li>• Coccidioidomycosis</li> <li>• Histoplasmosis (can be as short as 3 days)</li> </ul> <b>Protozoal</b> <ul style="list-style-type: none"> <li>• Chagas disease (acute)</li> <li>• Malaria (<i>Plasmodium falciparum</i>)</li> <li>• East African trypanosomiasis (<i>Trypanosoma brucei rhodesiense</i>)</li> </ul>
Long (>21 days)	<b>Viral</b> <ul style="list-style-type: none"> <li>• CMV, EBV, HIV, VHF</li> </ul> <b>Bacterial</b> <ul style="list-style-type: none"> <li>• Brucellosis</li> <li>• Tuberculosis</li> </ul> <b>Fluke</b> <ul style="list-style-type: none"> <li>• Schistosomiasis, acute (Katayama fever)</li> </ul> <b>Protozoal</b> <ul style="list-style-type: none"> <li>• Amoebic liver abscess</li> <li>• Malaria (including <i>Plasmodium falciparum</i>)</li> <li>• West African trypanosomiasis (<i>Trypanosoma brucei gambiense</i>)</li> <li>• Visceral leishmaniasis</li> </ul> <b>Viral</b> <ul style="list-style-type: none"> <li>• HIV</li> <li>• Viral hepatitis (A–E)</li> </ul>

CMV, cytomegalovirus; EBV, Epstein–Barr virus; HIV, human immunodeficiency virus.

Adapted from British Infection Society recommendations. See Johnston et al.<sup>2</sup>

**Table 4**

### Recommended initial investigations in returning travellers presenting with undifferentiated fever<sup>a</sup>

Investigation	Interpretation
Malaria film ± antigen test (RDT)	<ul style="list-style-type: none"> <li>• Perform in all patients who have visited a tropical country within 1 year of presentation</li> <li>• The sensitivity of a thick film read by an expert is equivalent to that of an RDT, but blood films are necessary for speciation and parasite count, and should be sent to the reference laboratory for confirmation</li> <li>• Three thick films/RDTs over 72 hours (as an outpatient if appropriate) should be performed to exclude malaria with confidence</li> </ul>
FBC	<ul style="list-style-type: none"> <li>• Lymphopenia: common in viral infection (dengue, HIV) and typhoid</li> <li>• Eosinophilia (<math>&gt;0.45 \times 10^6/\text{litre}</math>): can be indicative of infectious cause (e.g. parasitic, fungal)</li> <li>• Thrombocytopenia: malaria, dengue, acute HIV, typhoid, also seen in severe sepsis</li> </ul>
U&E, LFTs	<ul style="list-style-type: none"> <li>• High transaminases consistent with a viral hepatitis, but low-level transaminitis is common in many infections</li> <li>• Isolated high alkaline phosphatase is often found in amoebic liver abscess</li> </ul>
Blood cultures	<ul style="list-style-type: none"> <li>• Two sets should be taken before antibiotics</li> </ul>
HIV test	<ul style="list-style-type: none"> <li>• HIV testing should be offered to all febrile patients</li> </ul>
Respiratory virus PCR swab	<ul style="list-style-type: none"> <li>• Respiratory viral PCR swab should be considered in all patients with fever, coryza ± myalgia. Remember seasonal influenza epidemics occur in the northern and southern hemispheres at different times</li> </ul>
EDTA for PCR <sup>b</sup>	<ul style="list-style-type: none"> <li>• Early in the illness, PCR tests for specific infections can be performed, e.g. VHF, arboviruses, meningococcal PCR</li> </ul>
Serological tests <sup>b</sup>	<ul style="list-style-type: none"> <li>• 'Geographic panel-based serological tests can be performed at the Rare and Imported Pathogen Laboratory. These are panels of diagnostic tests that group the world into 10 regions based on the global epidemiology of infectious diseases. The specific panel of tests performed will be selected by the laboratory and depend on the symptoms, countries visited and exposures and duration of illness</li> <li>• Amoebic ± hydatid serology should be considered in patients with fever and liver abscess</li> <li>• It can be useful to take a serum sample that can be saved by the laboratory in case additional serological testing is indicated at a later date, e.g. <i>Brucella</i> serology</li> </ul>
Urinalysis	<ul style="list-style-type: none"> <li>• Proteinuria and haematuria in leptospirosis</li> <li>• Haemoglobinuria in malaria (rare)</li> </ul>
Chest X-ray ± liver ultrasound	

FBC, full blood count; HIV, human immunodeficiency virus; LFTs, liver function tests; PCR, polymerase chain reaction; RDT, rapid diagnostic test; U&E, urea and electrolytes.

<sup>a</sup> Patients classified as having a high possibility of VHF following a VHF risk assessment should be discussed with the laboratories. All patients should be tested urgently for malaria. FBC, U&E, LFTs, C-reactive protein, coagulation screen, glucose and blood cultures can be requested for these patients as the risk to laboratory workers from processing samples in routine autoanalysers is low.

<sup>b</sup> Discuss with the National Imported Fever Service to ensure that the correct tests are done. An adequate travel history *must* be documented on request forms. This includes locations visited, dates of travel, dates of symptom onset and risk activities undertaken. Pathogen-specific request forms are required by the reference laboratory for some infections, such as dengue and other arboviral infections. These are available on the Public Health England (PHE, previously HPA) website.

Source: Adapted from British Infection Society recommendations. See Johnston et al.<sup>2</sup>

Table 5

## Important notifiable diseases

Bacteria	Mycobacteria	Protozoa	Syndromes	Virus
Anthrax	Leprosy	Malaria	Acute encephalitis	Acute infectious hepatitis
Botulism	Tuberculosis		Acute meningitis	Acute poliomyelitis
Brucellosis			Food poisoning	Measles
Cholera			Haemolytic–uraemic syndrome	Mumps
Diphtheria			Infectious bloody diarrhoea	Rabies
Enteric fever				Rubella
Invasive group A <i>Streptococcus</i>				Severe acute respiratory syndrome (SARS)
Legionnaire's disease				Smallpox
Leptospirosis				Viral haemorrhagic fever
Meningococcal septicaemia				Yellow fever
Plague				
Relapsing fever				
Scarlet fever				
Tetanus				
Typhus				
Whooping cough				

Table 6

## Sources of help

### Information on outbreaks

- ProMED-mail (electronic reporting system for infectious diseases outbreaks): [www.promedmail.org](http://www.promedmail.org)
- WHO outbreak data: [www.who.int/csr/don/en](http://www.who.int/csr/don/en)

### VHF guidance

- Public Health England (PHE, previously HPA): [www.gov.uk/government/publications/viral-haemorrhagic-fever-algorithm-and-guidance-on-management-of-patients](http://www.gov.uk/government/publications/viral-haemorrhagic-fever-algorithm-and-guidance-on-management-of-patients)

### Guidelines and other online resources

- British Infection Association, for UK recommendations and guidelines: [www.britishinfection.org](http://www.britishinfection.org)
- US Centers for Disease Control and Prevention: [www.cdc.gov](http://www.cdc.gov)
- UK National Travel Health Network and Centre: [www.nathnac.org](http://www.nathnac.org)

### Telephone advice

- National Imported Fever Service, PHE, UK: +44 (0) 844 778 8990  
Contact after discussion with the local microbiology, virology or infectious diseases consultant
- Hospital for Tropical Diseases, UCLH, London, UK. Tel: +44 (0) 203 456 7890 and ask for the on-call tropical/infectious diseases physician  
[www.thehtd.org](http://www.thehtd.org); [www.uclh.nhs.uk](http://www.uclh.nhs.uk)
- Tropical and Infectious Diseases, Royal Liverpool University Hospital, Liverpool, UK. Tel.: (24 hours) +44 (0) 151 706 2000 and ask for the on-call tropical/infectious diseases physician  
[www.rbuht.nhs.uk/departments/medical-specialisms/infection-and-immunology/tropical-and-infectious-diseases/](http://www.rbuht.nhs.uk/departments/medical-specialisms/infection-and-immunology/tropical-and-infectious-diseases/)

illness. This is particularly important where VHF is suspected, but should also be considered in any traveller suspected of having a notifiable disease, or with an unexplained fever associated with a respiratory illness, diarrhoea or rash. Finally, any patient who has had a hospital admission overseas should be considered at risk of colonization and/or infection with multidrug-resistant bacteria. These individuals should be isolated and discussed with the infection control team. It is a statutory requirement that certain infections, suspected or confirmed, are notified to the local public health team in order to implement appropriate public health measures and prevent outbreaks (Table 6). ◆

## KEY REFERENCES

- 1 Office for National Statistics UK. Travel trends. 2015. Office for National Statistics. <https://www.ons.gov.uk/peoplepopulationandcommunity/leisureandtourism/articles/traveltrends/2015> [Accessed 7 May 2017].
- 2 Johnston V, Stockley JM, Dockrell D, et al. Fever in returning travellers presenting in the United Kingdom: recommendations for investigation and initial management. *J Infect* 2009; **59**: 1–18.
- 3 Brasil P, Pereira Jr JP, Moreira ME, et al. Zika virus infection in pregnant women in Rio de Janeiro. *N Engl J Med* 2016; **375**: 2321–34.
- 4 Reyburn H, Behrens RH, Warhurst D, Bradley D. The effect of chemoprophylaxis on the timing of onset of falciparum malaria. *Trop Med Int Health* 1998; **3**: 281–5.
- 5 Dave J, Warburton F, Freedman J, et al. What were the risk factors and trends in antimicrobial resistance for enteric fever in London 2005–2012? *J Med Microbiol* 2017; **66**: 698–705.



## TEST YOURSELF

To test your knowledge based on the article you have just read, please complete the questions below. The answers can be found at the end of the issue or online [here](#).

### Question 1

A 48-year-old Guinean man presented with a 48-hour history of feeling unwell with fevers, dry cough and headaches. He had returned 12 days previously from visiting friends and relatives in Guinea, where he was staying in a rural village.

On clinical examination, his temperature was 38.0°C, heart rate 110 beats/minute and blood pressure 110/80 mmHg. He was clinically dehydrated. His Glasgow Coma Scale score was 15/15, and there was no evidence of meningism. Kernig's test was negative. The respiratory examination, including respiratory rate and oxygen saturations, was normal.

#### What is the most likely diagnosis?

- A. Acute bacterial meningitis
- B. Malaria
- C. Acute encephalitis
- D. Bacterial pneumonia
- E. Ebola virus disease

### Question 2

A 52-year-old man presented with a 2-day history of fever, wheeze and severe shortness of breath. Three days previously, he had returned from Saudi Arabia, where he had visited his elderly father who had been in intensive care with a similar febrile respiratory illness.

#### What is the most appropriate infection control measure at this time?

- A. No isolation is necessary at this stage; nurse him on an open ward
- B. Nurse him in a side room
- C. Isolate him, using full personal protective equipment
- D. Notify the public health authorities
- E. Place him in positive-pressure ventilation side room

### Question 3

A 24-year-old man presented with fever, headache, myalgia and a rash. He had been on safari with his family in South Africa. He did not recall being bitten by anything.

On clinical examination, his temperature was 37.7°C. He had a widespread macular blanching rash and an ulcer on his lower leg with a dry, dark centre and surrounding erythema.

#### What is the most likely diagnosis?

- A. African trypanosomiasis
- B. Anthrax
- C. Dengue
- D. African tick bite fever
- E. HIV seroconversion