



RISK ASSESSMENT

Public health risks related to communicable diseases at the Rio de Janeiro Olympic and Paralympic Games, Brazil, 2016

First update, 9 June 2016

Main conclusions and options for response

Conclusions

Visitors to the 2016 Olympics and Paralympics Summer Games in Rio de Janeiro, Brazil will be most at risk of gastrointestinal illness and vector-borne infections. Therefore, they should pay attention to standard hygiene measures to reduce the risk of gastrointestinal illness and protect themselves against mosquito/other insect bites using insect repellent and/or by wearing long-sleeved shirts and trousers in regions where vector-borne diseases are endemic.

The risk of colonisation (digestive tract carriage) of multidrug-resistant Enterobacteriaceae should be considered for all travellers, irrespective of whether they have contact with healthcare facilities while in Brazil, during the three months following their return from Brazil. Surveillance for communicable diseases should be sensitive enough to detect threats at a stage when interventions would be likely to prevent or reduce the impact of outbreaks.

The Olympic Games will take place during the winter season in Rio de Janeiro when the cooler and drier weather will reduce mosquito populations. This will significantly lower the risk of mosquito-borne infections - such as Zika virus, dengue and chikungunya - for visitors, except in Manaus where six football matches will be held. Although the probability of being bitten by an infected mosquito is expected to be low during the events, the risk cannot be excluded that travellers may become infected and return to regions of the EU where competent vectors are active.

This assessment is limited by the absence of regular notification of cases of Zika virus disease at state level and uncertainty about the possible impact on vector-borne transmission dynamics of above-normal temperatures predicted by the International Research Institute for Climate and Society (IRI). Because of these limitations, there is a continued need to closely monitor the evolution of the Zika epidemic in Brazil in the weeks ahead of the Games.

In recent years, Brazil has eliminated rubella transmission and, since July 2015, measles transmission has also been interrupted. However, these are diseases which are still endemic in many other countries and could be imported to Brazil by international visitors.

Options for response

Visitors to Brazil should consult the advice for vaccinations issued by the Brazilian health authorities and the Pan American Health Organization (PAHO) and follow their own country's recommendations.

All travellers are advised to arrange comprehensive healthcare insurance before travelling to Brazil. If healthcare is needed, travellers should contact Brazil's healthcare system (Sistema Único de Saúde – SUS) through local hospitals or make use of their private health insurance through any healthcare provider.

The information for travellers in ECDC's [latest risk assessment on Zika virus](#) (published on 20 May 2016 and updated with a [public health development](#) on the ECDC website on 7 June 2016) remains valid. Pregnant women and women who are planning to become pregnant should postpone non-essential travel to areas with widespread

transmission until after delivery. Brazil is currently considered to be experiencing widespread Zika transmission and, in the absence of regular updated information on the trend of the epidemic in the various states, this situation is likely to continue on a nationwide basis during the Olympic Games.

The list of countries and territories with active Zika virus transmission (sporadic and widespread transmission) during the past three months is available on the [ECDC website](#). An update of this information for travellers returning from areas with active transmission of Zika virus is also available on the [ECDC website](#).

Based on the epidemiological profile for infectious diseases in Brazil and the profile of the visiting populations, ECDC will conduct enhanced epidemic intelligence surveillance for communicable diseases from 1 August to 25 September 2016.

The proposed options for response related to communicable diseases at the Olympic and Paralympic Games in Rio de Janeiro, Brazil, 2016 are summarised below.

Prior to travelling, visitors to Rio de Janeiro, Brazil in 2016

- Should have checked the status of and, where necessary, updated their vaccinations according to the schedule in their EU country of residence, including poliomyelitis, diphtheria, tetanus, pertussis, measles, mumps and rubella.
- Be aware that there is an increased risk of hepatitis A in Brazil compared to the EU and ensure that their vaccination status against hepatitis A is up-to-date.
- Be aware that there is sylvatic yellow fever in parts of Brazil, and follow the vaccination recommendations for these areas, especially if planning to attend football matches in Belo Horizonte, Brasilia, or Manaus.
- Be aware that there is rabies in Brazil and avoid all contact with stray dogs and cats, consult a doctor regarding the need for post-exposure prophylaxis if bitten by an animal; and consider vaccination against rabies before travelling if planning to stay longer than one month and/or in rural areas.
- Be aware that malaria exists in parts of Brazil outside of Rio de Janeiro, and consider malaria chemoprophylaxis if appropriate.
- Consider the need for other vaccinations based on lifestyle, activities or underlying health problems. This includes vaccination against influenza (preferably with the 2016 southern hemisphere seasonal vaccine) because the event takes place at the end of the influenza season in the southern and south-eastern regions.

While in Brazil, travellers should:

- Ensure standard hygiene measures to decrease the risk of gastrointestinal illness: consume only bottled drinks, mineral water and factory-produced ice cubes; ensure that meat and fish are thoroughly cooked, that mixed meals such as feijoada (a typical Brazilian dish) or lasagne are served at temperatures above 60°C, and salads below 5°C, and that fruits and vegetables are properly washed before consumption.
- Consider general hygiene conditions when consuming local products, such as freshly made fruit juices, coconut water, drinks and cocktails.
- Avoid sexual risk behaviour and practice safe sex, including the use of condoms, to prevent sexually-transmitted infections.
- Take measures to prevent mosquito bites indoors and outdoors, especially during the daytime when the *Aedes* mosquito vectors of dengue, chikungunya and Zika are most active and biting [1]. These measures include:
 - Use of mosquito repellent in accordance with the instructions indicated on the product label.
 - Wearing long-sleeved shirts and long trousers, especially during the period when the *Aedes* mosquitoes are most active.
 - Sleeping or resting in screened or air-conditioned rooms or otherwise using mosquito nets, at night and during the day.

Travellers with immune disorders or severe chronic illnesses should consult their doctor or seek advice from a travel clinic – particularly with regard to effective prevention measures – before travelling to countries with active transmission.

Upon returning from Brazil:

- If requiring hospitalisation in the EU within one year after having been hospitalised in Brazil, travellers should report their previous hospital care in Brazil in order to ascertain a possible acquisition of antimicrobially-resistant bacteria and the implementation of appropriate prevention and control measures to prevent spread in the EU.
- Follow current recommendations for prevention of sexual transmission of Zika upon return from affected areas.
- Use insecticide repellents for three weeks if returning to an area with active *Aedes aegypti* and/or *Aedes albopictus* mosquitoes.

Source and date of request

ECDC internal decision, 2 June 2016.

Public health issue

International mass gatherings pose a risk for communicable disease outbreaks and rapid global spread. The aim of this document is to assess the health risks related to communicable diseases and other health threats for European citizens during their stay in Brazil for the Rio 2016 Olympics and Paralympics Summer Games, and the public health implications for European countries after travellers return to Europe. In addition, the document assesses the risk of disease importation from Europe to Brazil. This assessment provides the basis for ECDC's monitoring of health threats during the Olympics and Paralympics Summer Games in Brazil.

Consulted experts

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Health risks associated with mass gatherings

The World Health Organisation (WHO) defines a mass gathering as 'an event attended by a sufficient number of people to strain the planning and response resources of a community, state or nation' [2]. International mass gatherings increase the risk of communicable disease transmission and pose a challenge to public health response [2]. For host countries, several challenges are associated with mass gathering such as the introduction of communicable diseases, influx of susceptible individuals, crowding, outbreaks of endemic or imported infectious diseases, opportunistic and often uncontrolled sale of food and beverages, increased risk behaviour associated with alcohol and other recreational substances, language barriers for the dissemination of public information, increased pressure on sanitary facilities, and heightened security levels. The increased sensitivity for identifying potential health threats, coupled with heightened media attention and political pressure, can place a considerable burden on public health functions and decision-making processes [4].

Documented infectious disease threats associated with mass gatherings in the EU or in other international settings include an outbreak of *Escherichia coli* O157 infection at a rock festival in the south west of England, June 1997 [5], Legionnaires' disease cases during the football Euro Cup in France 1998 [6], *Neisseria meningitidis* outbreaks in returning pilgrims from the Hajj in 2000 and 2001 [6], a norovirus outbreak during the 2006 FIFA World Cup in Germany [8], an outbreak of *Shigella* during a Boom festival in Portugal in 2008 [9], a measles outbreak in Canada in 2010 linked to the Winter Olympics [9] and another in Germany in 2014 associated with a religious gathering in France 2010 [10], and a salmonellosis outbreak following a street festival in Newcastle, England, with more than 400 associated cases in 2013 [12]. No outbreaks were reported during the last Olympic Games in London in 2012, except for a few gastrointestinal and respiratory infections [12]. Similarly, no public health events of potential international concern were reported during the FIFA World Cup hosted by Brazil in 2014.

The public health risks associated with mass gathering events can be classified as follows:

- Risks associated with the movement of visitors to the host countries;
- Risks to the visiting population and the local population due to increased international travel activities related to the mass gathering event;
- Risks associated with being a participant or a spectator at the mass gathering event;
- Risks associated with the return of participants and visitors from the host country (exportation of communicable diseases).

Factors that determine the level of risk include:

- Demographics, epidemiology and behaviour of the population attending the mass gathering (e.g. age, health status, risk behaviour before and during the event, movements and interactions between host and visiting populations, vaccination status, etc.);
- Demographics, epidemiology and behaviour of the host population;
- Environment, climate, time of year, seasonality of endemic diseases at the location;
- Risk assessments, planning, preparation, surveillance and preventive public health interventions: pre-travel advice, on-site information at the mass gathering venue (e.g. information campaigns, food inspection, etc.).

Event background information

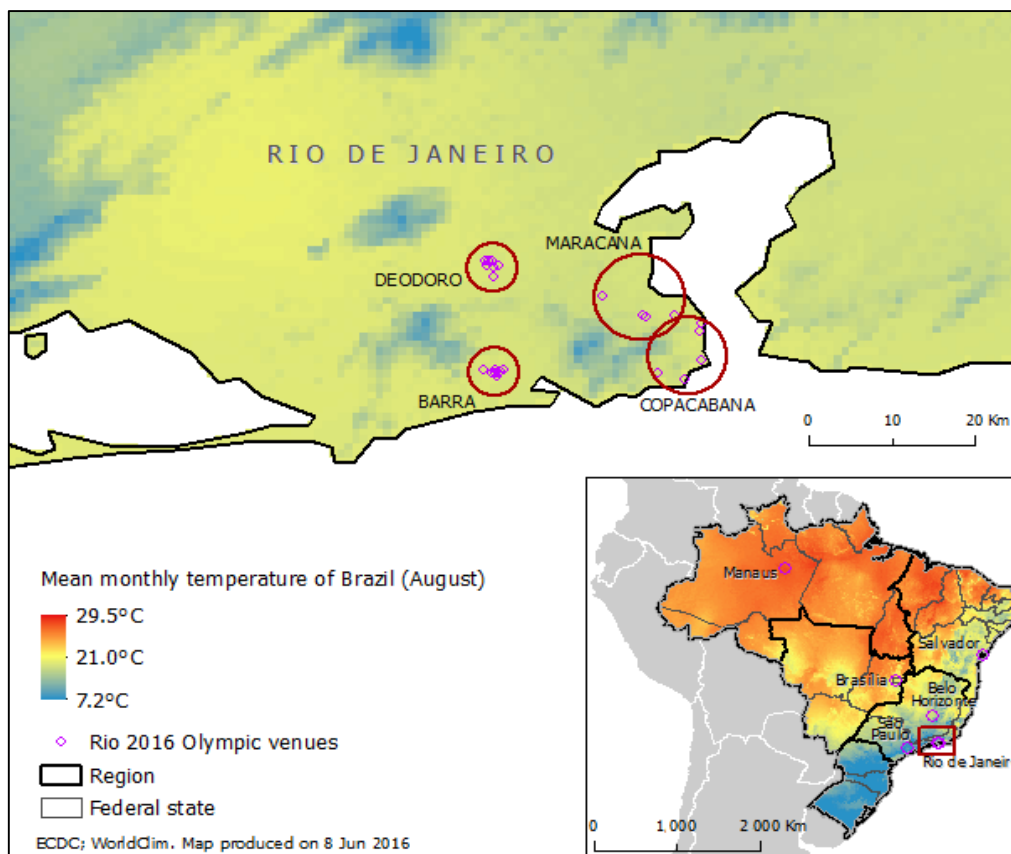
Olympic and Paralympic Games in Rio, Brazil 2016

The 2016 Summer Olympics will take place from 3 to 21 August 2016 with more than 10 500 athletes from 205 countries participating. The 2016 Paralympics will take place from 7 to 18 September, involving 4 350 athletes from 176 countries. More information is available at <http://www.rio2016.com/en>.

The Brazilian Tourist Board (Embratur) estimated that Rio de Janeiro will receive between 350 000 and 500 000 international visitors during the period of the Olympic and Paralympic Games in 2016 [14], although this number may be exceeded. Most European travellers will reach Brazil using commercial airlines and will mainly visit the venues in Rio de Janeiro (Figure 1). However, they may also visit other Brazilian cities where Olympic football matches will be held (Manaus, Salvador, Brasilia, Belo Horizonte and Sao Paulo, see Figure 1). Domestic travel in Brazil will be mostly by commercial aircraft or by public/private ground transportation near the event venues. The 2016 Olympic Games will take place during the austral winter, with tropical heat in the north and cooler temperatures in the south of the country (see map of Brazil Figure 1 below and monthly average precipitation and temperature by state with Olympic venues, Annex 2).

Based on the seasonal climate forecasts provided by the International Research Institute for Climate and Society (IRI), precipitation patterns will be normal for the months June, July and August in Brazil. However, the IRI multi-model probability forecast for temperature estimates a 60% probability of above-normal temperature patterns in Brazil during this period [15].

Figure 1. Venues for Rio 2016 Olympics and average monthly temperature in August



Brazil: communicable disease epidemiology

Food- and waterborne diseases

In 2015, the waters of Olympic aquatic venues in the Guanabara Bay, in the Rodrigo de Freitas Lagoon and in the waters along Copacabana Beach were found to be highly contaminated with sewage [16,17]. While efforts are being made to complete the remedial infrastructural work for mitigation and pollution abatement in the one Olympic venue that required more substantial interventions, testing protocols are being refined to minimise the risk of gastrointestinal and respiratory illnesses caused by waterborne pathogens to athletes competing at these venues.

Foodborne outbreaks are a public health concern during mass gatherings [18]. Although important advancements in food and water hygiene in Brazil have been implemented during the period 2000 to 2013 [19], the Brazilian Ministry of Health reports an average of 665 foodborne outbreaks per year [20]. Causative agents of these infections were, in order of frequency, *Salmonella* sp., *Staphylococcus aureus*, *Escherichia coli* and *Bacillus cereus*. The settings most often associated with these outbreaks were private residences, followed by food outlets and pastry shops [19]. A study in travellers returning from Brazil identified *Campylobacter* and *Giardia* spp. as the most frequent pathogens associated with gastrointestinal illness [21]. Furthermore, over the last two decades, the cause of diarrhoeal diseases in the general population has shifted from bacterial infections through the faecal-oral transmission route to viral infections through person-to-person transmission [22]. WHO classifies Brazil as a country with intermediate endemicity of hepatitis A which is therefore prone to such outbreaks [22]. Typhoid and paratyphoid fevers are rarely reported in Brazil [20,23,24]. Brazil has been cholera-free since 2005 [25].

Emerging and vector-borne diseases

Zika virus infection

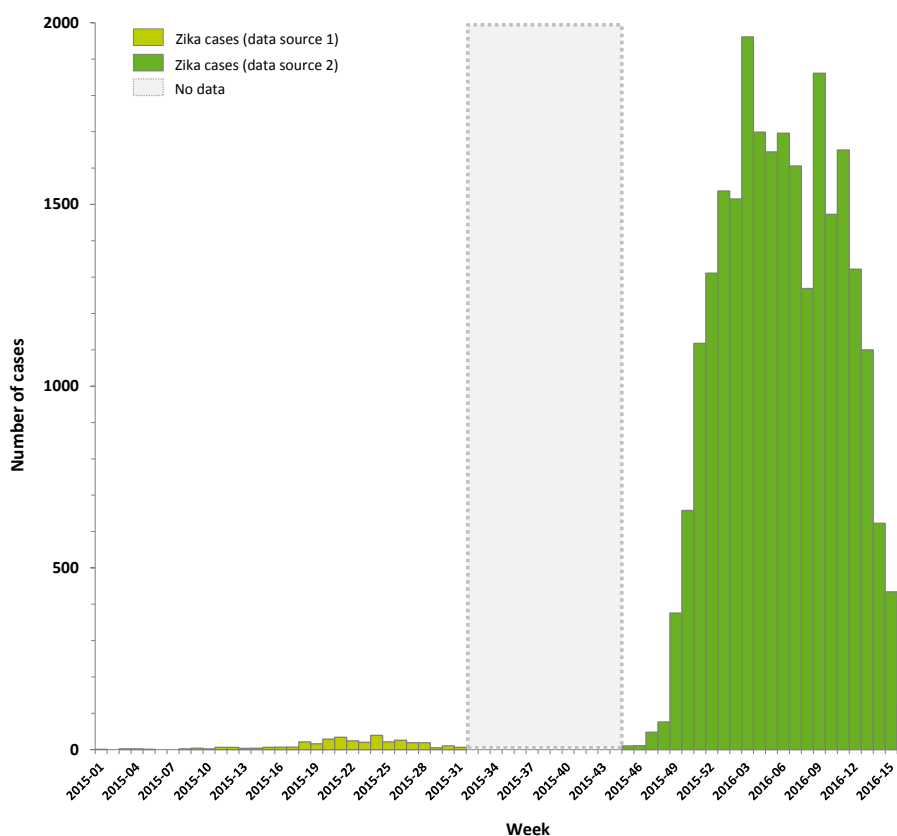
In May 2015, autochthonous transmission of Zika virus was confirmed in the states of Bahia and Rio Grande do Norte in Brazil. However, it is likely that Zika virus had been circulating earlier [26]. Since February 2015, Brazilian states and the Federal District have reported autochthonous cases of Zika virus and the virus is currently a major public health concern in Brazil. The Brazilian Ministry of Health has estimated that between 0.5 million and 1.5 million people were infected by Zika during 2015 [26].

Since January 2016 and as of week 16 of 2016, 120 161 probable cases (incidence rate 58.8 cases/100 000 inhabitants) of Zika virus infection have been reported in 1 605 municipalities across 26 federal states and the federal district (Brasília), of which 39 993 were confirmed cases [28]. The mid-west region has had the highest cumulative incidence rates since 2016 with 130.2 cases/100 000 inhabitants. The most affected states were Mato Grosso (532.6 cases/100 000 inhabitants), Tocantins (238.4 cases/100 000 inhabitants), Bahia (227 cases/100 000 inhabitants) and Rio de Janeiro (195.2 cases/100 000 inhabitants). Between epidemiological week 13 and 16 of 2016, 7 000 new cases were reported in the state of Rio de Janeiro [29].

Zika virus circulation in Rio de Janeiro is presumed to have started in early 2015 when an outbreak of exanthematic illness involving more than 350 cases was reported between January and July 2015 [30]. A recent publication using epidemiological surveillance data from the Brazilian Notifiable Diseases Information System (SINAN) presented the epidemiological curve of Zika infections in the city of Rio de Janeiro between week 45 of 2015 and week 16 of 2016 (Figure 2). Almost 26 000 cases of Zika virus disease were reported, with an average of 1 600 cases during the peak period between weeks 4 to 10, 2016 [31]. A steep increase in the number of cases was reported between week 44 and 52 of 2015, corresponding to the establishment of mandatory notification of ZIKV infection at the end of October 2015 in Rio de Janeiro. Less than 150 cases were reported in week 16 of 2016 and, according to the available information, a steady and constant decrease from week 11 to week 16 2016 was observed. There is uncertainty about the current evolution of the Zika virus outbreak in Rio de Janeiro because no regular information about cases of Zika virus infection is available after week 16 from the Brazilian Ministry of Health's epidemiological bulletin.

The Brazilian Ministry of Health provided an updated assessment of Zika virus risk during Olympics and Paralympics Games on 10 June 2016 [32]. The assessment provides weekly data about reported suspected cases in Brazil and in the Rio de Janeiro state until the first week of May 2016. Cases are reported to have been decreasing steadily since mid-February, with 2 053 cases reported for the first week of May nationwide and 200 reported in Rio de Janeiro [32]. The Brazilian Ministry of Health provided an updated assessment of the Zika virus risk during the Olympics and Paralympics Games on 10 June 2016 [32]. The assessment provides weekly data about reported suspected cases in Brazil and in the Rio de Janeiro state until the first week of May 2016. Cases are reported to have been decreasing steadily since mid-February, with 2 053 cases reported for the first week of May nationwide and 200 reported in Rio de Janeiro [32].

There is uncertainty about the more recent evolution of the Zika virus outbreak in Rio de Janeiro because no regular information on cases of Zika virus infection is available after the third week of April through the epidemiological bulletin from the Brazilian Ministry of Health.

Figure 2. Distribution of confirmed and suspected cases of Zika virus disease, week 01 of 2015 to 16 of 2016, Rio de Janeiro, Brazil

Note: Data digitalised for week 01 of 2015 to week 31, 2015 from data source (1, Brasil et al. [30]) and for period week 45 of 2015 to week 16, 2016 from data source (2, Bastos et al. [31]). The notification of Zika disease was made mandatory for reporting in the Brazilian Notifiable Diseases Information System (SINAN) by the end of October 2016.

Several countries in the Americas, including Brazil, have reported an increase in Guillain-Barré syndrome (GBS) during Zika virus outbreaks [33].

Since 1 February 2016, the clusters of microcephaly cases and other neurological disorders associated with Zika virus infection have constituted a Public Health Emergency of International Concern (PHEIC). WHO acknowledges a scientific consensus to consider Zika virus infection as a cause of microcephaly and Guillain-Barré syndrome [34]. The magnitude of the risk that Zika virus infection during pregnancy will result in malformations of the foetus is under investigation, but remains unknown at present [32-34].

Dengue fever

Dengue fever remains a major public health problem in Brazil. Disease incidence and severity have increased in the past two decades. Between 2000 and 2009, 3.5 million cases of dengue fever were reported [21]. Since the beginning of the year and as of week 16 of 2016, more than one million probable and confirmed dengue fever cases have been reported in Brazil [28]. Rio de Janeiro state reported 47 411 cases in 2016 [28] compared to 28 677 cases for the same period in 2015. Dengue transmission in 2016 seems to be above the normal range (interquartile range defined by the box in Figure 6 in Annex 2) for the three first months of the year, as compared to the period 2007–2015.

Dengue transmission in Brazil occurs all year round but is most intense from January to June. There is considerable variation in the dengue risk in Brazil, depending on the regions and climatic zone [35]. The seasonal pattern of dengue for the Brazilian states hosting Olympic Games venues is presented in terms of monthly incidence in Annex 2. The median incidence of dengue during August and September (2007–2015 period) is 0.4 cases per 10 000 inhabitants in Rio de Janeiro State, hence almost 12 times lower than during the peak transmission period from March to May. This is mainly attributed to decreased vector abundance during the winter months in southern parts of Brazil. In Rio de Janeiro, *Aedes aegypti* showed a seasonal pattern, based on data from 2007–2008, with the highest adult density during the austral summer. Mosquito activity declined during winter but never stopped. The seasonality pattern and abundance varied in different areas of the city [36,37]. In northern areas such as Manaus, which experiences a tropical monsoon climate, *Aedes aegypti* was observed in more than 84% of houses throughout the year [40].

Chikungunya

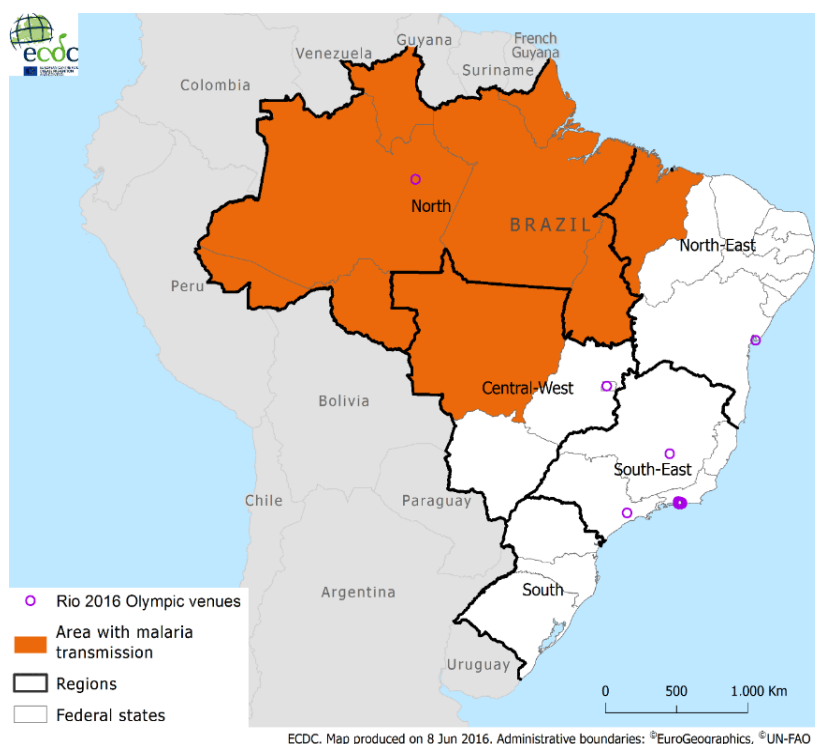
In December 2013, chikungunya emerged in the Caribbean and rapidly spread to North, Central and South America during 2014 and 2015. This was the first documented autochthonous transmission of chikungunya virus in the Americas. Since the beginning of the year and as of 1 April 2016, 64 349 cases of chikungunya virus infection and 15 deaths had been recorded in Brazil, compared to almost 10 000 cases for the same period in 2015 [28].

On 22 December 2015, local health authorities in Brazil confirmed the active circulation of chikungunya virus in the municipality of Rio de Janeiro following the detection of a locally-acquired case [41]. In 2016, from the beginning of the year to week 16, 1 050 cases were reported in Rio de Janeiro state which represents 1.2% of the total number of reported cases this year [28].

Malaria

Malaria is present in the Brazilian Amazon, northern and central-western regions, with less than 150 000 cases reported in 2014. *Plasmodium vivax* accounts for 83% and *Plasmodium falciparum* for 16% of all cases [20,40]. Although the city of Rio de Janeiro is malaria-free, the central part of Rio de Janeiro state, in the forested mountainous areas (see Figure 3), reports on average around six cases of locally-acquired malaria per year – four were reported in 2014 [43,44].

Figure 3. Malaria transmission in Brazil



Note: Data modified from CDC [43].

Yellow fever

Yellow fever is endemic in most parts of Brazil except along the south-eastern Atlantic coastline [43,44]. While Brazil reports a low number of yellow fever cases annually, cases do still occur despite the implementation of vaccination programmes. Brazil has not reported a case of urban yellow fever since 1942 [43,47] so vaccination is not recommended for travellers whose itineraries are limited to Rio De Janeiro, Salvador and Sao Paulo. Between 2015 and 2016, two fatal sylvatic autochthonous cases were notified to WHO [48].

Leishmaniasis

Cutaneous and mucosal leishmaniasis are endemic in 18 countries in the Americas, with 79% of the cases reported from Brazil. In 2013, 37 402 cases were registered in Brazil and the Andean sub-region. Visceral leishmaniasis is a growing problem, with an average of two cases per 100 000 population reported each year [22]. Between 2001 and 2013, 45 490 cases of visceral leishmaniasis were recorded in the Americas, with Brazil accounting for 96% of cases [49]. Leishmaniasis is not considered endemic in Rio de Janeiro or Rio de Janeiro state.

Chagas disease

The implementation of an intensive vector control programme in 2006 has eliminated the main vector of Chagas disease in Brazil and interrupted vector-borne transmission. Around 3.5 million people in Brazil still have the chronic form of the disease and congenital transmission continues because of Chagas disease's long latency period [21,48]. Although Chagas disease is not considered endemic in Rio de Janeiro or Rio de Janeiro state, autochthonous transmission of Chagas disease has been documented in rural areas of Rio de Janeiro state prior to the elimination of vector-borne transmission in the country in 2006. [51]

Schistosomiasis

An estimated four to six million individuals are infected with *Schistosoma mansoni* in Brazil [50], with highest endemicity found in the north-eastern region [50]. In recent decades, there has been an increasing incidence of schistosomiasis cases in urban and coastal areas [50].

Rabies

Human rabies in Brazil has been associated with transmission by dogs, cats, foxes, monkeys and vampire bats, with most human cases transmitted through wildlife exposures. PAHO recently issued an alert on rabies recommending prompt use of post-exposure prophylaxis to prevent human cases. Between early 2014 and June 2015, one case of human rabies was reported in Brazil and one case of canine rabies in the previously unaffected state of Mato Grosso do Sul [53].

Sexually transmitted and blood-borne infections

HIV/AIDS

In Brazil, HIV notifications have remained stable since 2000. The estimated mean national sero-prevalence is less than 0.6%, with approximately 600 000 people infected. Since 1996, Brazil has provided universal access to antiretroviral therapy free of charge. In large urban areas, the incidence of AIDS-related illnesses has declined remarkably. However, in small and medium municipalities, low-level transmission is still ongoing [22]. Between 1996 and 2006, the HIV incidence in the northern and north-eastern regions increased from 2.7 to 4.6 per 100 000 population, and from 3.0 to 3.3 per 100 000, respectively [52].

Prevalence of HIV among specific risk groups is higher, with reported rates of 6.2% among sex workers, 13.6% among men who have sex with men and 23.1 among people who inject drugs [55].

Other sexually transmitted infections

Notification of sexually transmitted infections (STIs) in Brazil is mandatory for AIDS, HIV in pregnant women and exposed children, syphilis, and urethral discharge syndrome in men. Despite the compulsory notification, there is considerable under-reporting of cases. A multi-centre sero-prevalence study from the Brazilian Ministry of Health estimated the prevalence of major bacterial STIs among pregnant women as 9.4% for chlamydia, 2.6% for syphilis and the prevalence of HPV as 40.4%. In the same study the prevalence of either syphilis, gonorrhoea or chlamydia was 6.2% among industry workers and 19.7 % among those attending STI clinics [56]. The GeoSentinel study identified three cases of syphilis, three cases of urethritis, one case of lymphogranuloma venereum and one undefined case of STI in travellers returning from Brazil [21].

Viral hepatitis

A hepatitis B survey conducted among a representative sample of the population in the north-eastern and central-western regions and in the Federal District of Brasília showed an HBsAg prevalence of less than 1%. There was no statistically significant difference in prevalence across geographical areas. Brazil is considered a low-endemicity country for hepatitis B [55]. Hepatitis B is most commonly spread from mother to child at birth (perinatal transmission), or through horizontal transmission (exposure to infected blood). Hepatitis B is also spread by percutaneous or mucosal exposure to infected blood and various body fluids, including through saliva, menstrual, vaginal and seminal fluids. Sexual transmission of hepatitis B may occur, particularly in unvaccinated men who have sex with men and heterosexual persons with multiple sex partners or through contact with sex workers [58].

A Brazilian nationwide hepatitis C (HCV) sero-prevalence study conducted in 2005–2009 in the state capitals of the five Brazilian regions showed a weighted prevalence of HCV antibodies of 1.4% (95% CI 1.12%–1.64%). Sero-positivity varied from 0.7% in the north-eastern region to 2.1% in the northern region. [57] The hepatitis C virus is a blood-borne virus. It is most commonly transmitted as a result of injecting drug use through the sharing of injection equipment, in healthcare settings due to the reuse or inadequate sterilisation of medical equipment, especially syringes and needles, or through the transfusion of unscreened blood and blood products. Less frequently, HCV can be transmitted sexually and can be passed from an infected mother to her baby. Hepatitis C is not spread through breast milk, food or water or by casual contact such as hugging, kissing and sharing food or drinks with an infected person [60].

Vaccine-preventable diseases

Measles and rubella

Endemic transmission of measles in Brazil was interrupted in July 2015, and the transmission of rubella was eliminated in 2009. However, measles continues to circulate elsewhere in the world, and countries in the Americas have reported imported cases. Therefore, there is a risk that infected travellers may enter Brazil during the Olympic Games.

In November 2015, WHO American Region's regional verification committee determined that the Region cannot be declared measles-free because Brazil has had sustained transmission of a single measles virus strain for >1 year [61]. During the period 2013–2015, imported cases resulted in ongoing measles transmission in several states, including in Pernambuco and Ceará, with 971 confirmed measles cases [62]. Measles transmission was reported to have ended in Brazil in July 2015, following a vaccination campaign [63].

Meningococcal disease

From 2000 to 2009, Brazil reported 1.5 to 2 cases of meningococcal disease per 100 000 population. Since 2002, a substantial increase has been observed in the proportion of cases attributed to meningococcus serogroup C, currently responsible for most cases of meningococcal disease in Brazil [64]. Several outbreaks of meningococcal disease have been reported in Brazil during recent decades, some of which have resulted in a very large number of cases [21,62]. In 2010, Brazil was the first country in Latin America to introduce the meningococcal C conjugate (MCC) vaccine routinely into its immunisation programme [65].

Influenza and other respiratory virus infections

Influenza cases occur throughout the year in Brazil. In the south-eastern region, higher numbers of influenza detections are reported from April to September, peaking in June and July [64]. Influenza A(H7N9), influenza A(H5N1) and Middle East Respiratory Syndrome coronavirus (MERS-CoV) cases have never been reported in Brazil.

Tuberculosis

WHO defines Brazil as a tuberculosis (TB) high-burden country, with an estimated 90 000 new cases of TB in 2014 (44 cases per 100 000 population). Higher TB rates have been reported in association with urban areas, population density, poor economic conditions and household crowding [67]. About 18% of the TB cases are estimated to be co-infected with HIV. Six percent of individuals with TB in Brazil are estimated to be infected with strains resistant to isoniazid and 1.4% with strains resistant to both isoniazid and rifampicin [68].

Antimicrobial resistance and healthcare-associated infections

In general, there is a paucity of data on antimicrobial resistance and healthcare-associated infections in Brazil. There are only a few publications on extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae and methicillin-resistant *Staphylococcus aureus* (MRSA) from Brazilian hospitals [21,67,68]. Carbapenem resistance is widespread in *Pseudomonas aeruginosa* isolates. Half of these carbapenem-resistant isolates harbour the Sao Paulo metallo-beta-lactamase (SPM) [70]. Infections due to antimicrobial-resistant bacteria represent an important problem in Brazil, particularly in hospitals.

Other health risks

Accidents and injuries, mostly caused by motor vehicle crashes, are the leading cause of death among travellers under the age of 55 years. Flash floods and landslides, especially in urban areas, have been a frequent cause of accidents. Travellers to Brazil frequently report sunburn. Information on the overall crime and safety situation in Brazil can be found in the Overseas Security Advisory Council report [71].

ECDC threat assessment

Almost all EU/EEA countries are participating in the Rio Summer Olympics 2016 and a large number of EU travellers will visit the country during the event.

The following health threats and their associated risks have been assessed (Annex 3, Table 1):

- An infection imported to Brazil by EU travellers
- An infection imported to Brazil from an ongoing event of international concern
- A disease affecting an EU traveller during their stay in Brazil
- An infection imported to the EU after a traveller's return to Europe.

Risks of infection importation to Brazil from EU travellers

The overall risk of food- or waterborne disease importation from Europe to Brazil is very low to low. There is a significant risk of importation for measles, through infectious EU travellers from countries where transmission is ongoing. The risk of importation is very low to low for other vaccine-preventable diseases. Finally, there is a very low risk of importation of antimicrobially-resistant bacterial strains to Brazil through infected EU travellers. The risk of importation increases slightly if those travellers are hospitalised.

Risk of infection importation to Brazil from events of international concern

Recently, five infectious disease-related events have raised concern at the international level: avian influenza A(H7N9) and A(H5N1), Ebola virus disease, Middle East respiratory syndrome coronavirus (MERS-CoV), wild poliovirus [72] and Zika virus infection [35].

Avian influenza

The A(H7N9) influenza outbreak in China started in February 2013. As of March 2016, more than 700 cases have been reported linked to China [73]. Temporal distribution of cases shows a seasonal pattern with few cases being reported between June and October. Between 2003 and March 2016, over 840 human cases of influenza A(H5N1) were reported to WHO. In 2015, Egypt reported 136 cases, China five cases and Indonesia two cases. The observed seasonal pattern since 2004 has shown few reported cases with onset between July and October [73].

So far, neither EU Member States nor Brazil have reported A(H7N9) or A(H5N1) cases. The risk of introduction to Brazil is therefore considered very low.

Other avian influenza subtypes have been detected in Asia in the past two years, including A(H5N6), A(H9N2), A(H10N8) and A(H9N2) in Egypt. However, the risk of introduction to Brazil is very low.

Most human cases of avian influenza report exposure to animals prior to infection and sustained human-to-human transmission has not been observed.

Ebola virus disease

In 2014–2015, a large outbreak of Ebola virus disease affected Guinea, Liberia and Sierra Leone. In 2016, only clusters of Ebola virus disease have been detected. The outbreak has been declared over in all three West African countries. The risk of exportation of Ebola virus disease to Brazil is considered very low.

Middle East respiratory syndrome coronavirus

Since 2012, Saudi Arabia, the United Arab Emirates, Jordan, Qatar, Oman, Iran and South Korea have reported non-travel related MERS-CoV cases. There is growing evidence that the dromedary camel serves as a host species for MERS-CoV [71,72]. Although most MERS-CoV cases have been reported from the Middle East, the outbreak in South Korea showed that importation of cases from the Middle East could cause significant outbreaks in previously unaffected countries. All the countries that are recent countries of infection or that have reported MERS-CoV cases with camel contact in 2015–2016 will participate in the Olympic Games and travellers from the region can be expected. The risk of importation of MERS-CoV to Brazil cannot be excluded but is assessed as low.

Polio

Two countries that are reporting wild poliovirus transmission, Afghanistan and Pakistan, are both participating in the Games. The risk of a visitor to Brazil from one of these two polio-affected countries introducing wild polio virus to Brazil is considered very low [22]. It is nonetheless important that people travelling to Brazil from polio-affected countries are vaccinated according to the recommendations made by WHO [72].

Zika virus infection

According to WHO, Zika virus continues to spread geographically to areas where competent vectors are present [33]. Although a decrease in the number of cases of Zika infection has been observed in some affected areas and countries, the Zika epidemic is still ongoing. Over the past three months, and as of end of May 2016, autochthonous cases of Zika virus infection have been reported from 51 countries or territories worldwide [76]. It is likely that transmission of Zika virus infections will still be possible in some parts of the Americas and beyond, and therefore, the risk of a viraemic traveller arriving in Brazil is substantial, but is not expected to change the transmission dynamic in Brazil.

The most recent Brazilian Ministry of Health assessment of the Zika virus risk during the Olympics shows a decreasing trend in the Zika epidemic [32]. The dynamic of the epidemic in Brazil needs to be further assessed on a systematic basis through the regular notification of Zika virus cases at state level (e.g. Ministry of Health

epidemiological bulletin). Availability of surveillance data would be critical to monitor the risk. To date, Brazil as a whole is considered to be experiencing widespread transmission.

A list of countries and territories with documented autochthonous transmission during the past three months is available on the [ECDC website](#) [76].

Yellow fever

There is an ongoing yellow fever epidemic in Angola, Democratic Republic of Congo and Uganda. In Peru 52 sylvatic cases have been reported from the beginning of the year to week 19 of 2016 [77]. According to a WHO statement from the meeting of the Emergency Committee under the International Health Regulations concerning yellow fever, Member States should consider yellow fever vaccination of all travellers, and especially migrant workers, to and from Angola and Democratic Republic of Congo, hence limiting the risk of importation into Brazil [78]. Therefore, the risk of cases being imported from Angola and DR Congo will be very low once this measure has been effectively implemented.

While the risk of the virus being introduced through viraemic travellers to Rio de Janeiro cannot be excluded, it will remain lower than the risk of introduction from endemic areas in Brazil.

Health risks for EU travellers during their stay in Brazil

Surveillance data of gastrointestinal infections in Brazil suggest that foodborne outbreaks may occur during the Olympic Games. EU travellers to Rio de Janeiro in 2016 may encounter locally endemic infections related to mass gatherings – e.g. salmonellosis, STEC infections, campylobacteriosis, giardiasis, and viral gastrointestinal illness [79].

The risk of being infected with *Salmonella* typhi in Brazil is very low and mostly related to unvaccinated travellers from the EU visiting the North and Northeast Regions [23,24,76]. There is practically no risk of cholera infection to travellers [25].

EU travellers to Rio in 2016 are at risk of hepatitis A infection. The majority of European countries are classified by WHO as very low or low-HAV-endemicity countries. Brazil is an intermediate endemicity country and prone to HAV infection outbreaks [21,22].

Using dengue as a proxy of the seasonal pattern of *Aedes*-borne disease transmission, the likelihood of acquiring dengue, chikungunya and Zika infection is moderate for EU travellers in the North and Northeast Regions of the country (See Annex 2). The risk will be low in the Southeast Region (including Rio de Janeiro), and around Sao Paulo due to colder climate (for Brazilian regions see Figure 4 in Annex 1 and for seasonal profile see Annex 2). This assessment does not take into account the possible impact of above-normal temperatures predicted by IRI in relation to the transmission dynamics for Zika, highlighting the need to closely monitor the evolution of the epidemic in Brazil [15].

Preliminary estimates from a modelling study showed that the maximum risk of Zika infection to tourists visiting during the three weeks of the Olympic Games is between 0.18 infections/100 000 tourists to 3.2 infections/100 000 tourists, which corresponds respectively to 9 and 160 expected Zika infections under a scenario of 500 000 visitors attending the Olympics for one full month in Rio de Janeiro, assuming that the probability of being bitten by a *Aedes* mosquito is the same for local inhabitants as for tourists [81].

The malaria risk is moderate for travellers to the North and Centre-West Region (Figure 3). Travellers who are considering attending the football matches in Manaus as part of Rio 2016 or travelling around Brazil should be advised on prophylaxis [82].

The risk of yellow fever is very low but sylvatic yellow fever is endemic in most parts of Brazil except along the south-eastern Atlantic coastline [43].

The risk of leishmaniasis (both cutaneous and visceral), schistosomiasis and lymphatic filariasis is mostly associated with rural and deprived areas of the Northeast Region. It is considered very low for travellers not visiting deprived urban areas.

The risk of being infected with rabies during the Olympic Games is low for EU travellers, but can be moderate for unvaccinated travellers visiting rural areas or deprived urban areas where canine vaccination is low [53].

There is a very low risk of TB transmission for EU travellers, unless they stay in overcrowded indoor spaces in deprived communities.

There is a low risk of HIV infection for EU travellers to Rio 2016, mostly limited to travellers exposed to risk behaviour (unprotected sex, particularly with sex workers and among men who have sex with men and injecting drug users) [55]. Unprotected sex also exposes travellers to the risk of other sexually transmitted infections, including gonorrhoea and syphilis.

There is a low risk of HBV transmission, mostly limited to travellers who engage in unprotected sex.

There is a low risk of meningococcal disease and other vaccine-preventable diseases for EU travellers to Brazil.

The risk of being infected with influenza will be moderate for travellers to the Southeast Region of the country.

For EU travellers requiring hospitalisation or medical care in Brazil the risk of acquiring healthcare-associated infections, including infections caused by antimicrobially-resistant bacteria, is low if standard precautions and other infection prevention and control measures are complied with in hospitals and other healthcare facilities. Visiting or staying in deprived urban areas may increase the risk of communicable disease transmission.

Risk of infection importation from Brazil to the EU after a traveller's return

A study based on the GeoSentinel information system identified dengue as the leading cause of febrile systemic infections among travellers returning from Brazil [21]. In this study, the number of dengue-infected travellers follows the seasonal transmission pattern in Brazil with the highest number between February and May and the lowest in August. Dengue and malaria were also among the most common reasons for hospitalisation in the same study population.

As the likelihood of visitors being infected by *Aedes*-borne viruses in Rio de Janeiro is considered to be low during the austral winter season, the subsequent and specific probability of importing these diseases to EU is considered low. This risk would not significantly change the overall rate of Zika-infected individuals entering the EU during the summer 2016, since the Zika outbreak is expected to continue in Central America and some countries/territories in the Caribbean region which are well-connected with the EU. Based on modelling, the number of Zika infections imported into Europe in 2016 from Brazil has been projected to range from 508 to 1 778 in 2016, of which between 116 and 355 are expected to be symptomatic Zika infections [83]. As of 7 June 2016, ECDC has recorded 778 imported cases in 20 EU/EEA countries (excluding EU's Outermost Regions and Territories). Zika transmission through sexual contact between travellers returning from areas with ongoing transmission and their partners in the EU/EEA has been reported from infected symptomatic men to female partners. Recently, one possible transmission event was reported from a non-symptomatic male to a female who did not present Zika virus symptoms [84,85].

Two recent studies found that 21% [86] and 31% [81] of travellers returning from South and Central America who had not sought healthcare while travelling had been colonised (digestive tract carriage) with multidrug-resistant Enterobacteriaceae. In the latter study, the proportion of carriers decreased to 5.7% one month after return, 2.9% after two months and 1.7% after three months [81]. Based on this observation, there is a moderate-to-high probability of importing antimicrobially-resistant bacteria from Brazil to the EU, including some which are novel to the EU (e.g. producing the Sao Paulo metallo-beta-lactamase) [88]. However, antimicrobially-resistant bacteria only becomes a threat to the colonised carrier in the rare event of developing an infection [81]. Hence, the impact is low and the risk for the EU is therefore considered low. This risk is higher for EU travellers who have been hospitalised while in Brazil.

In addition, travellers who have been hospitalised while in Brazil and are hospitalised in an EU Member State upon return or in the months following their return from Brazil, may represent a risk for transmission of antimicrobially-resistant bacteria to other hospitalised patients. This risk is similar to that posed by patients admitted from any foreign hospital (within or outside the EU to a hospital in an EU Member State). Such patients should be screened for carriage of antimicrobially-resistant bacteria, and implementation of appropriate infection prevention and control measures should be ensured.

The risk of importation of cases with respiratory infections to the EU, such as seasonal influenza, is deemed moderate.

There are a number of diseases and infections that are highly unlikely to occur during the Summer Olympics in Rio 2016 but are still important for monitoring because of their severity and high case-fatality ratio. These include viral haemorrhagic fevers and diseases that could result from intentional release, such as anthrax or plague. Outbreaks and spread of vaccine-preventable diseases are of particular concern during mass gatherings but there is no evidence that the risk is higher than usual.

ECDC's mass gathering surveillance support

During the 2014 FIFA World Cup in Brazil, ECDC activated enhanced epidemic intelligence activities by having a dedicated officer evaluating the information regarding events relevant to the World Cup. During the monitoring period close to 40 000 relevant events were detected through [MedISys](#), 76 of which were determined to have direct relevance for the 2014 FIFA World Cup. Of the 76 events, 33 occurred in Brazil and were related to respiratory infections (7), vaccine-preventable illnesses (5), sexually-transmitted diseases (1), vector-borne illnesses (15), zoonosis (2) and food-and water-borne illnesses (3).

The approach to surveillance during the Summer Olympics in Rio, 2016 will be enhanced, as for the monitoring of previous mass gatherings. It will cover the period from 1 August 2016 (one week before the beginning of the Games) until one week after the closing ceremony for the Paralympics. Routine epidemic intelligence activities will be enhanced by expanding the information sources, using a targeted and systematic screening approach, tailoring

tools (i.e. [MedISys](#)), determining validation sources, establishing a daily analysis and communication process with regular and specific public health partners and developing topical reports.

ECDC will issue daily epidemiological reports that will be shared with the European Commission, EU/EEA Member States, WHO headquarters, WHO's Regional Office for Europe, PAHO Regional Office for the Americas of the World Health Organization and the Brazilian Ministry of Health.

Conclusions and options for response

Conclusions

Visitors to the 2016 Olympics and Paralympics Summer Games in Rio de Janeiro, Brazil will be most at risk of gastrointestinal illness and vector-borne infections. Therefore, they should pay attention to standard hygiene measures to reduce the risk of gastrointestinal illness and protect themselves against mosquito/other insect bites using insect repellent and/or by wearing long-sleeved shirts and trousers in regions where vector-borne diseases are endemic.

The risk of colonisation (digestive tract carriage) of multidrug-resistant Enterobacteriaceae should be considered for all travellers, irrespective of whether they have contact with healthcare facilities while in Brazil, during the three months following their return from Brazil. Surveillance for communicable diseases should be sensitive enough to detect threats at a stage when interventions would be likely to prevent or reduce the impact of outbreaks.

The Olympic Games will take place during the winter season in Rio de Janeiro when the cooler and drier weather will reduce mosquito populations. This will significantly lower the risk of mosquito-borne infections – such as Zika virus, dengue and chikungunya – for visitors, except in Manaus where six football matches will be held. Although the probability of being bitten by an infected mosquito is expected to be low during the events [81], the risk cannot be excluded that travellers may become infected and return to regions of the EU where competent vectors are active.

This assessment is limited by the absence of regular notification of cases of Zika virus diseases at state level and uncertainty about the possible impact on vector-borne transmission dynamics of above-normal temperatures predicted by the International Research Institute for Climate and Society (IRI). Because of these limitations, there is a continued need for close monitoring of the evolution of the Zika epidemic in Brazil in the weeks ahead of the Games.

In recent years, Brazil has eliminated rubella transmission and, since July 2015, measles transmission has been interrupted. However, these are diseases which are still endemic in many other countries and could be imported to Brazil by international visitors [22].

Options for response

Visitors to Brazil should consult the advice for vaccinations issued by the Brazilian health authorities and the Pan American Health Organization (PAHO) [89] and follow their own country's recommendations [90].

All travellers are advised to arrange comprehensive healthcare insurance before travelling to Brazil. If healthcare is needed, travellers should contact Brazil's healthcare system (Sistema Único de Saúde – SUS) through local hospitals or make use of their private health insurance through any healthcare provider [19].

The information for travellers in ECDC's [latest risk assessment on Zika virus](#) (published on 20 May 2016 and updated with a [public health development](#) on the ECDC website on 7 June 2016) remains valid [1]. Pregnant women and women who are planning to become pregnant should postpone non-essential travel to areas with widespread transmission until after delivery [1]. Brazil is currently considered to be experiencing widespread Zika transmission and, in the absence of regular updated information on the trend of the epidemic in the various states, this situation is likely to continue on a nationwide basis during the Olympic Games.

The list of countries and territories with active Zika virus transmission (sporadic and widespread transmission) during the past three months is available on the [ECDC website](#). An update of this information for travellers returning from areas with active transmission of Zika virus is also available on the [ECDC website](#).

Based on the epidemiological profile for infectious diseases in Brazil and the profile of the visiting populations, ECDC will conduct enhanced epidemic intelligence surveillance for communicable diseases from 1 August to 25 September 2016.

The proposed options for response related to communicable diseases at the Olympics and Paralympics Games in Rio de Janeiro, Brazil, 2016 are summarised below.

Prior to travelling, visitors to Rio de Janeiro, Brazil in 2016:

- Should have checked the status of and, where necessary, updated their vaccinations according to the schedule in their EU country of residence including: poliomyelitis, diphtheria, tetanus, pertussis, measles, mumps and rubella.
- Be aware that there is an increased risk of hepatitis A in Brazil compared to the EU and ensure that their

- vaccination status against hepatitis A is up-to-date.
- Be aware that there is sylvatic yellow fever in parts of Brazil, and follow the vaccination recommendations for these areas [44,45,85], especially if planning to attend football matches in Belo Horizonte, Brasilia, or Manaus.
- Be aware that there is rabies in Brazil and avoid all contact with stray dogs and cats, consult a doctor regarding the need for post-exposure prophylaxis if bitten by an animal; and consider vaccination against rabies before travelling if planning to stay longer than one month and/or in rural areas.
- Be aware that malaria exists in parts of Brazil outside of Rio de Janeiro, and consider malaria chemoprophylaxis if appropriate [82].
- Consider the need for other vaccinations based on lifestyle, activities or underlying health problems. This includes vaccination against influenza (preferably with the 2016 southern hemisphere seasonal vaccine) because the event takes place at the end of the influenza season in the southern and south-eastern regions.

While in Brazil, travellers should:

- Ensure standard hygiene measures to decrease the risk of gastrointestinal illness: consume only bottled drinks, mineral water and factory-produced ice cubes, ensure that meat and fish are thoroughly cooked, that mixed meals such as feijoada (a typical Brazilian dish) or lasagne are served at temperatures above 60°C, and salads below 5°C, and that fruits and vegetables are properly washed before consumption.
- Consider general hygiene conditions when consuming local products, such as freshly made fruit juices, coconut water, drinks and cocktails [19].
- Avoid sexual risk behaviours and practice safe sex, including the use of condoms, for preventing sexually transmitted infections.
- Take measures to prevent mosquito bites indoors and outdoors, especially during the daytime when the *Aedes* mosquito vectors of dengue, chikungunya and Zika are most active and biting [1]. These measures include:
 - Use of mosquito repellent in accordance with the instructions indicated on the product label.
 - Wearing long-sleeved shirts and long trousers, especially during the period when the *Aedes* mosquitoes are most active.
 - Sleeping or resting in screened or air-conditioned rooms or otherwise using mosquito nets, at night and during the day.

Travellers with immune disorders or severe chronic illnesses should consult their doctor or seek advice from a travel clinic - particularly with regard to effective prevention measures - before travelling to countries with active transmission.

Upon returning from Brazil:

- If requiring hospitalisation in the EU within one year after having been hospitalised in Brazil, travellers should report their previous hospital care in Brazil in order to ascertain a possible acquisition of antimicrobially-resistant bacteria and the implementation of appropriate prevention and control measures to prevent spread in the EU.
- Follow current recommendations for prevention of sexual transmission of Zika upon return from affected areas [92].
- Use insecticide repellents for three weeks if returning to an area with active *Aedes aegypti* and/or *Aedes albopictus* mosquitoes.

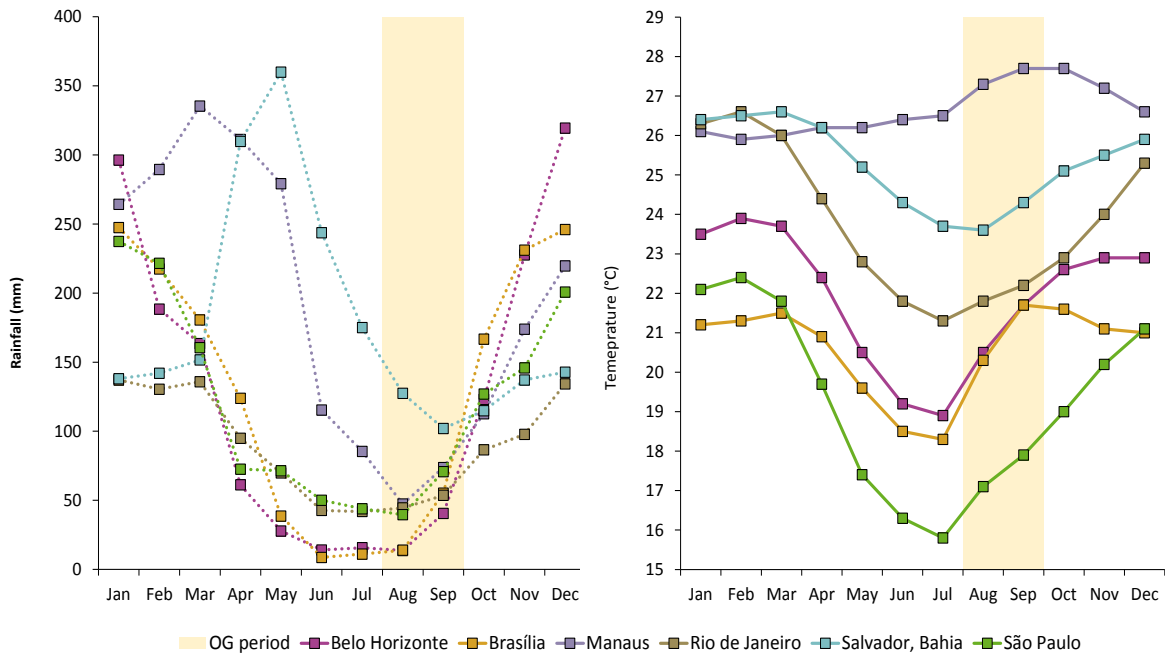
Annex 1

Figure 4. Regions and states in Brazil



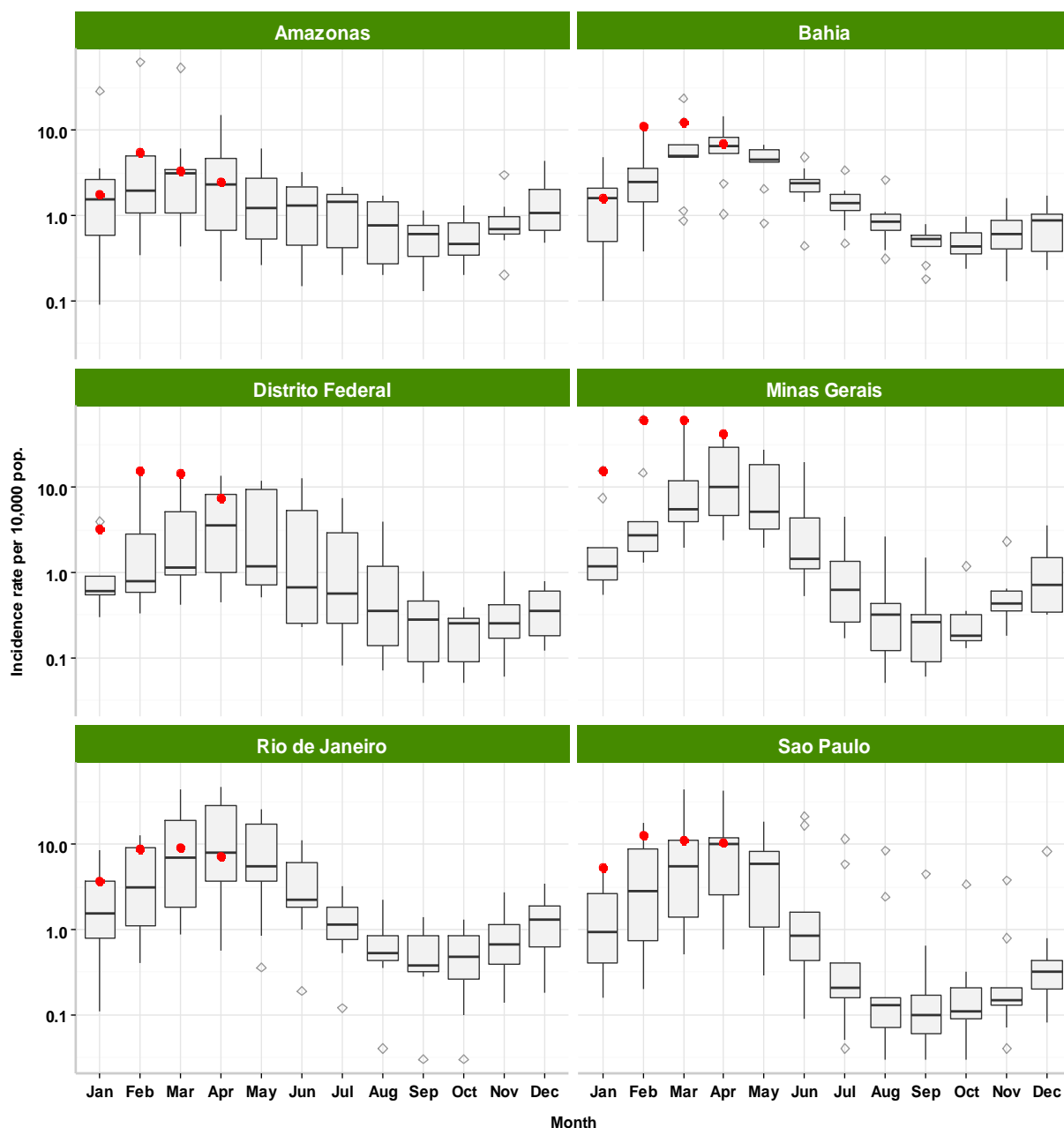
Annex 2

Figure 5. Climate profile for Brazilian states hosting Olympic Games venues



Note: Left panel, monthly rainfall average (mm) and right panel monthly daily temperature average during the period 1961–1990. Data source: [93]

Figure 6. Distribution of monthly dengue incidence rates by state in Brazil for the period 2007–2015 (box plots) and between January and April 2016 (red dots)



Note: Box plots represent the distribution of the monthly dengue incidence rates by state in Brazil for the period 2007–2015 (black line corresponds to the median and the box to the inter-quartile range (lower and upper 'hinges' at 25th and 75th percentiles). The upper whisker extends from the hinge to the highest value that is within 1.5* IQR of the hinge. Outliers are plotted as light grey diamonds. The red dots represent the dengue incidence for the months of 2016.

Data source: Jan 2007 to Dec 2012, [94]; missing data January to March 2013; April 2013 to April 2016, monthly aggregated number of dengue cases were derived and estimated from weekly cumulative number of cases after interpolation [95].

Annex 3

Table 1. Focus of ECDC surveillance activities during the period 5–21 August and 7–18 September 2016 and one week before/after the event

| Diseases | Risk | | | Enhanced surveillance required. | Remarks |
|---|-----------------------|------------------------|-------------------|---------------------------------|--|
| | Importation to Brazil | Transmission during OG | Exportation to EU | | |
| | + to ++++ | + to ++++ | + to ++++ | (Yes/No) | |
| Antimicrobial resistance and healthcare-associated infections | | | | | |
| Multidrug-resistant <i>Pseudomonas aeruginosa</i> # | + | ++ | ++ | Yes | All visitors, irrespective of having received hospital care or not while in Brazil, requiring hospitalisation in the months following their return should report travel to Brazil and be considered for testing to see if they carry antimicrobial-resistant bacteria. |
| Multidrug-resistant-resistant and carbapenem-resistant <i>Klebsiella pneumoniae</i> # | + | ++ | ++ | Yes | |
| Meticillin-resistant <i>Staphylococcus aureus</i> (MRSA)# | + | ++ | ++ | Yes | |
| Extended-spectrum beta-lactamase-producing Enterobacteriaceae# | + | ++ | ++ | Yes | |
| Food- and waterborne diseases | | | | | |
| Salmonellosis [£] | + | +++ | ++ | Yes | |
| <i>Campylobacter</i> infections [£] | + | +++ | ++ | Yes | |
| Hepatitis A | ++ | ++ | ++ | Yes | |
| Norovirus [£] | ++ | +++ | ++ | Yes | Frequent cause of outbreaks during mass gatherings |
| VTEC/STEC/ <i>E. coli</i> infections [£] | ++ | +++ | ++ | Yes | |
| Food poisoning, unspecified | - | +++ | + | Yes | Frequent cause of outbreaks during mass gatherings |
| Yersiniosis [£] | + | + | + | Yes | |
| Dysentery/bloody diarrhoea | + | ++ | + | Yes | |
| Shigellosis | + | ++ | + | Yes | |
| Botulism [#] | + | + | + | Yes | |
| Legionnaires' disease [#] | + | ++ | + | Yes | |
| Zoonoses | | | | | |
| Rabies | + | ++ | + | Yes | Rabies endemic, therefore risk moderate for unvaccinated travellers. |
| Leptospirosis | + | + | + | Yes | |
| Trichinosis | + | + | + | No | Low risk of local transmission, no human-to-human transmission. |
| Avian influenza (A(H7N9), A(H5N1), others) | + | + | + | No | |
| Vector-borne diseases | | | | | |
| Malaria | + | + | + | No | Very low except in areas in Figure 3 (i.e. moderate for travellers to the North and Centre-West Region) |
| Dengue | ++ | ++ | ++ | Yes | Moderate in North and Northeast Regions; low in the Southeast Region. |
| Yellow fever | + | + | + | Yes | Yellow fever is endemic in parts of Brazil |
| Chagas disease (American trypanosomiasis) | + | + | + | No | |
| Leishmaniasis | + | + | + | No | |
| Schistosomiasis (<i>Schistosoma mansoni</i>) | + | + | + | No | |
| Lymphatic filariasis | + | + | + | No | |
| Chikungunya | ++ | ++ | ++ | Yes | Moderate in North and |

| Diseases | Risk | | | Enhanced surveillance required. | Remarks |
|--------------------------------|-----------------------|------------------------|-------------------|---------------------------------|---|
| | Importation to Brazil | Transmission during OG | Exportation to EU | | |
| | + to +++++ | + to +++++ | + to +++++ | (Yes/No) | |
| Zika | ++ | ++ | ++ | Yes | Northeast Regions; low in the Southeast Region. |
| Ebola | + | + | No risk | No | |
| Sexually transmitted diseases | | | | | |
| HIV | + | ++ | ++ | No | Long incubation, event surveillance not useful |
| Syphilis | + | ++ | ++ | No | Long incubation, no use of event surveillance |
| Gonorrhoea | + | ++ | ++ | No | |
| Chlamydia | ++ | ++ | ++ | No | Very common STI across EU, limited benefit of monitoring. |
| Hepatitis B | + | ++ | ++ | Yes | |
| Hepatitis C | + | + | + | Yes | |
| Vaccine-preventable diseases | | | | | |
| Polio | + | + | + | Yes | |
| Rubella | + | ++ | + | Yes | |
| Measles | ++++ | + | + | Yes | |
| Mumps | + | + | + | Yes | |
| Pertussis | ++ | ++ | ++ | Yes | |
| Invasive meningococcal disease | + | ++ | ++ | Yes | |
| Typhoid fever | + | + | + | Yes | |
| Respiratory diseases | | | | | |
| Influenza | ++ | +++ | +++ | No | |
| MERS-CoV | ++ | + | + | Yes | |
| Tuberculosis | + | + | + | Yes | |
| Leprosy | + | + | + | No | |

+ Very low or no risk, ++ low risk, +++ moderate risk, +++++ high risk

Surveillance due to implications of severity, but low risk

£ Higher risk than indicated incidence rate, takes into consideration increased probability of temporary food providers and increased risk due to season.

Low risk, but enhanced surveillance recommended due to implications of severity and possible spread in hospitals and other healthcare facilities.

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